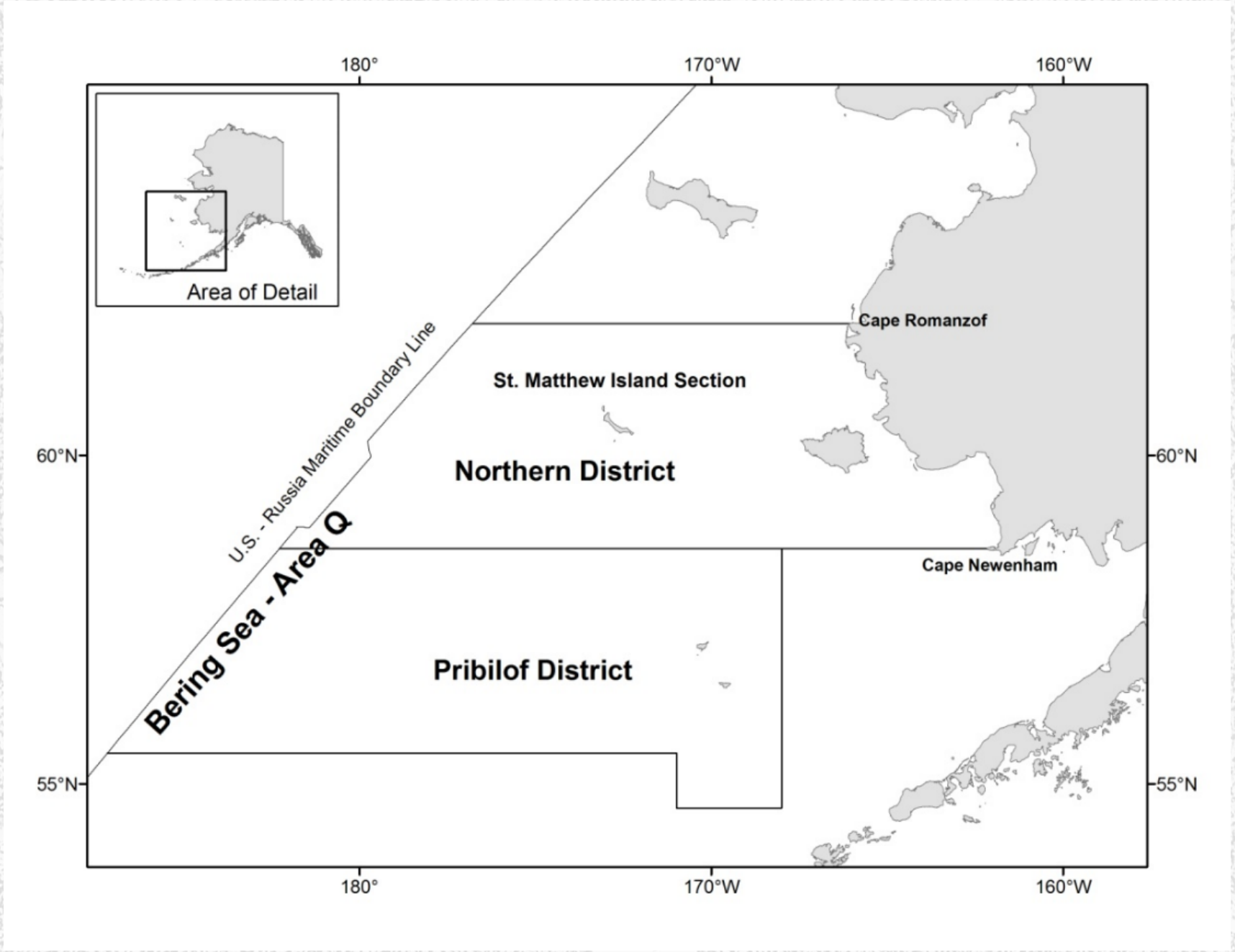
St. Matthew Blue King Crab

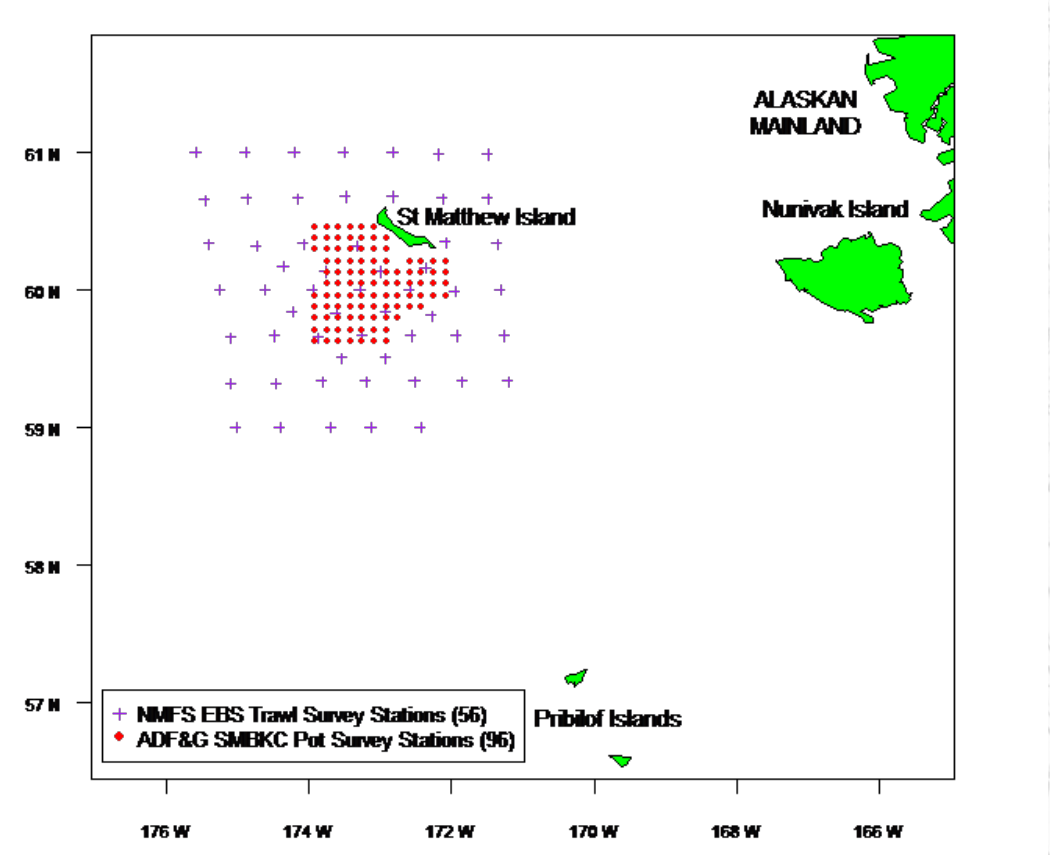
Final SAFE – September 2022

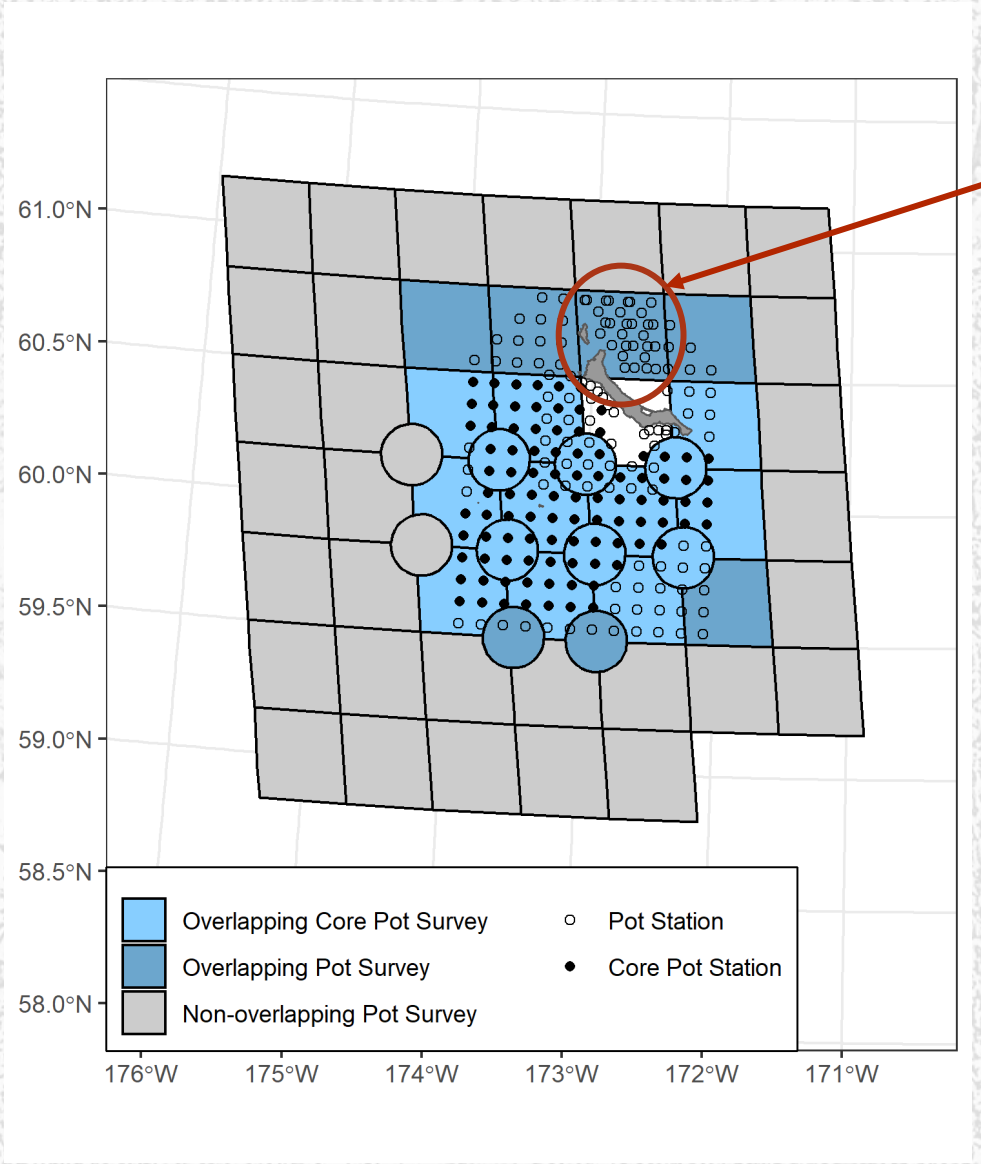
Katie Palof

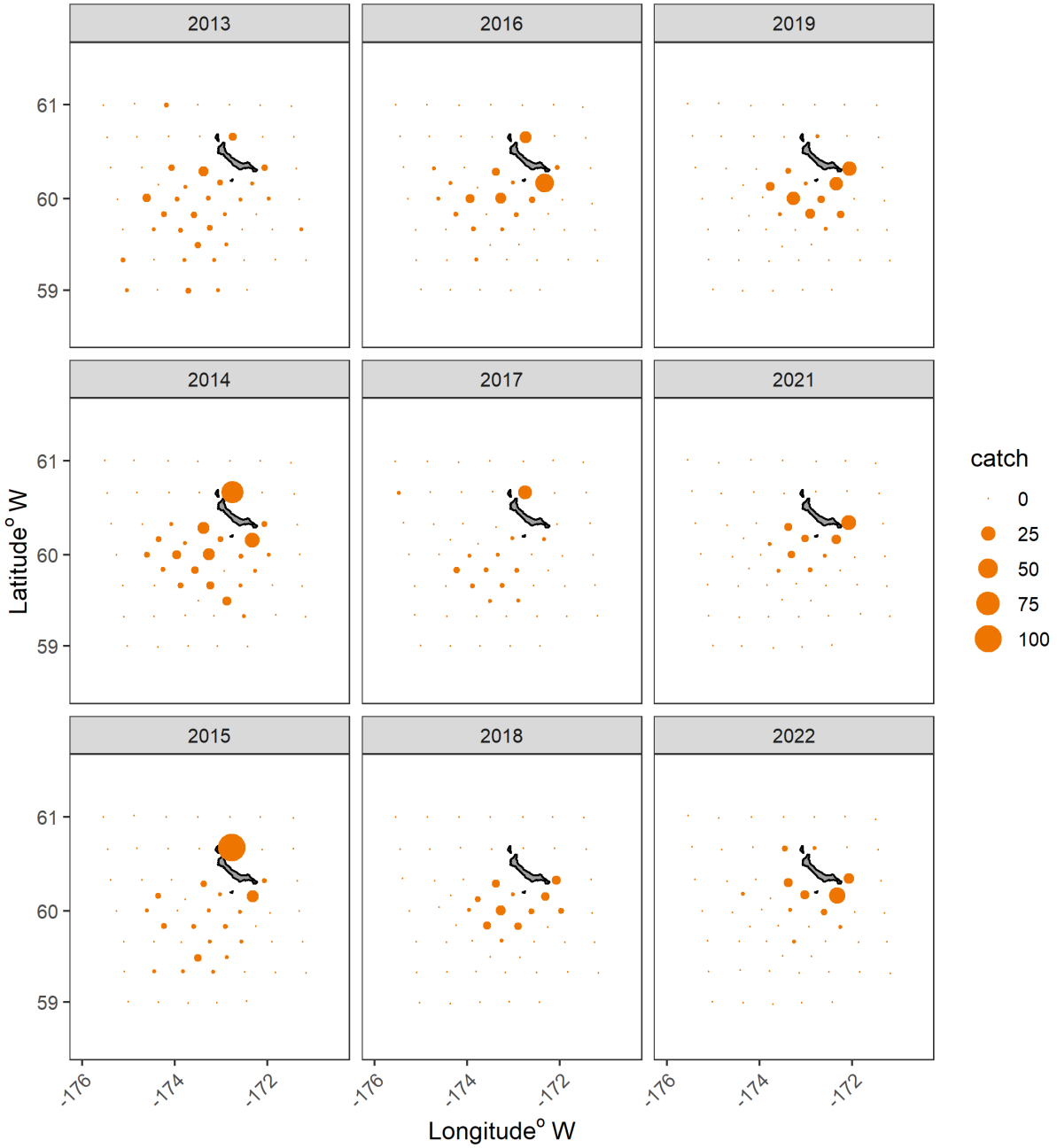
Current Status

- Last full assessment Sept. 2020 (moved to biennial cycle)
- Overfished
- Under rebuilding plan to be updated at this meeting (2022)
  - No changes to fishing regulations
  - No further bycatch restrictions
  - Focused on recruitment expectations
- Core model issues
  - Discrepancies in trends between pot survey and trawl survey
  - Spatial hot spots in surveys
  - Poor fit of models to recent years survey data (2010+)
  - SSC/CPT comments concerning these were addressed in May 2022
    - May/June 2022 recommendations – reference model for Sept. 2022


180°
170°W
160°W
Area of Detail
Cape Romanzof
St. Matthew Island Section
U.S. - Russia Maritime Boundary Line
60°N
Northern District
Bering Sea - Area Q
Cape Newenham
Pribilof District
55°N
180°
170°W
160°W


ALASKAN MAINLAND
Nunivak Island
St Matthew Island
Pribilof Islands
61 N
60 N
59 N
58 N
57 N
176 W
174 W
172 W
170 W
168 W
166 W
NMFS EBS Trawl Survey Stations (56)
ADF&G SMBKC Pot Survey Stations (96)


R-24
61.0°N
60.5°N
60.0°N
59.5°N
59.0°N
58.5°N
58.0°N
176°W
175°W
174°W
173°W
172°W
171°W
Overlapping Core Pot Survey
Overlapping Pot Survey
Non-overlapping Pot Survey
Pot Station
Core Pot Station



Trawl survey (area-swept) spatial breakdown in catch

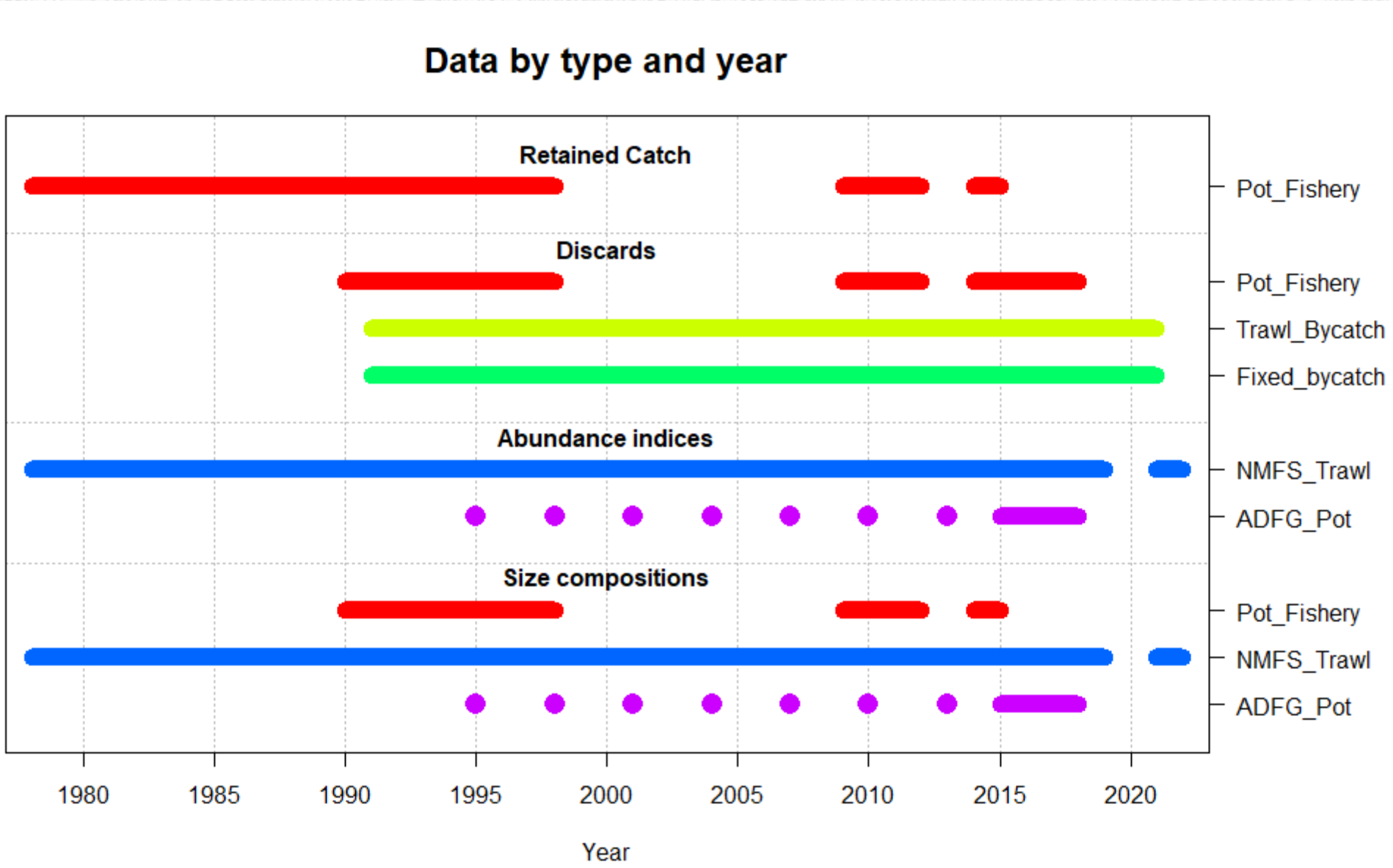
Models

16.0 - 2021 Reference Model (reviewed May 2022):

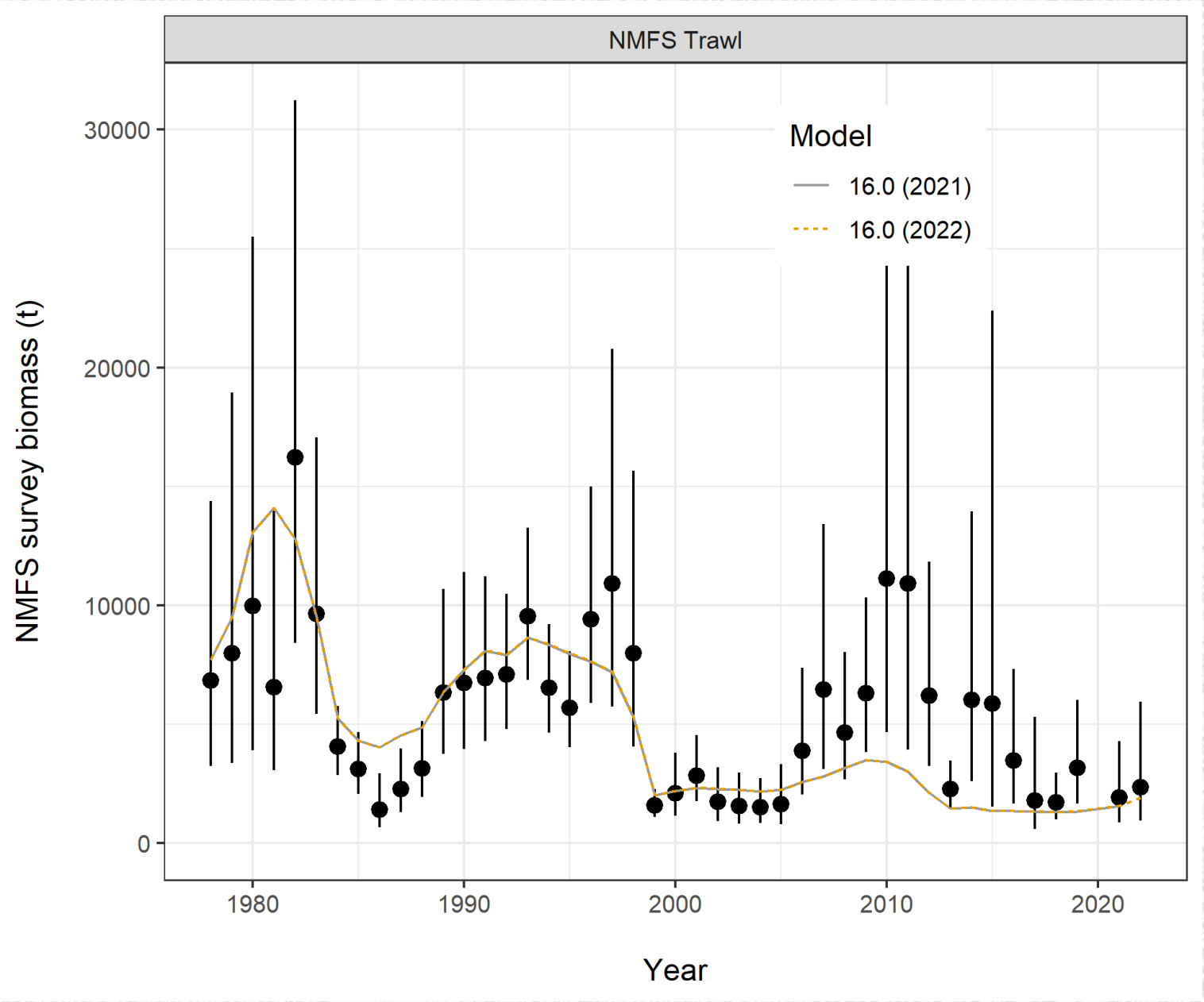
- Base model accepted in Sept. 2020 with updated 2021 survey data, and updated bycatch data through crab year 2020/21 (seen in May 2022)
- Updated GMACS version

16.0 - 2022 Reference Model:

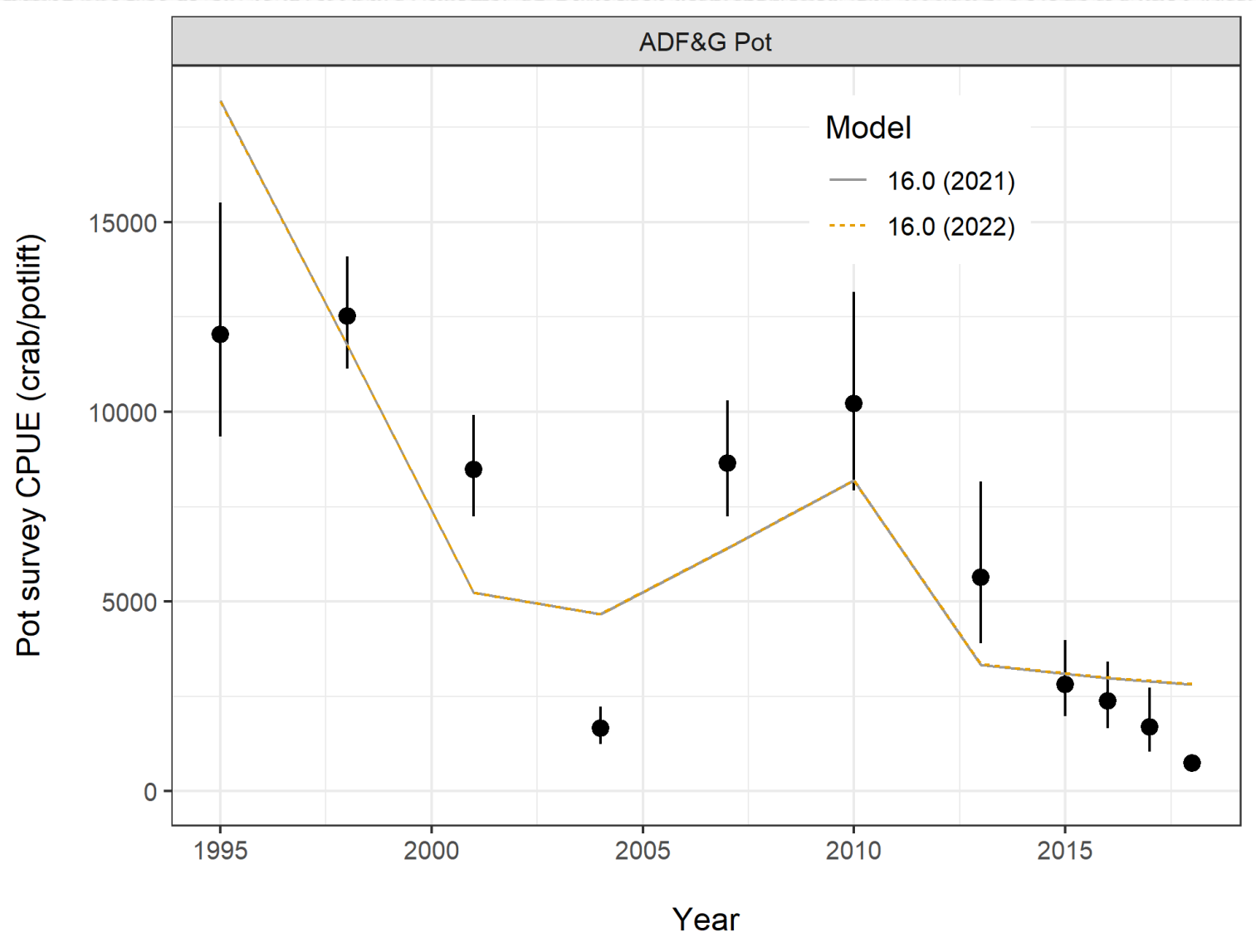
- model 16.0 with updated 2022 NMFS trawl data (biomass and size comps) and groundfish and crab bycatch data up to 2021/22 (removals)


Data by type and year
Retained Catch
Discards
Abundance indices
Size compositions
Pot_Fishery
Pot_Fishery
Trawl_Bycatch
Fixed_bycatch
NMFS_Trawl
ADFG_Pot
Pot_Fishery
NMFS_Trawl
ADFG_Pot
1980
1985
1990
1995
2000
2005
2010
2015
2020
Year

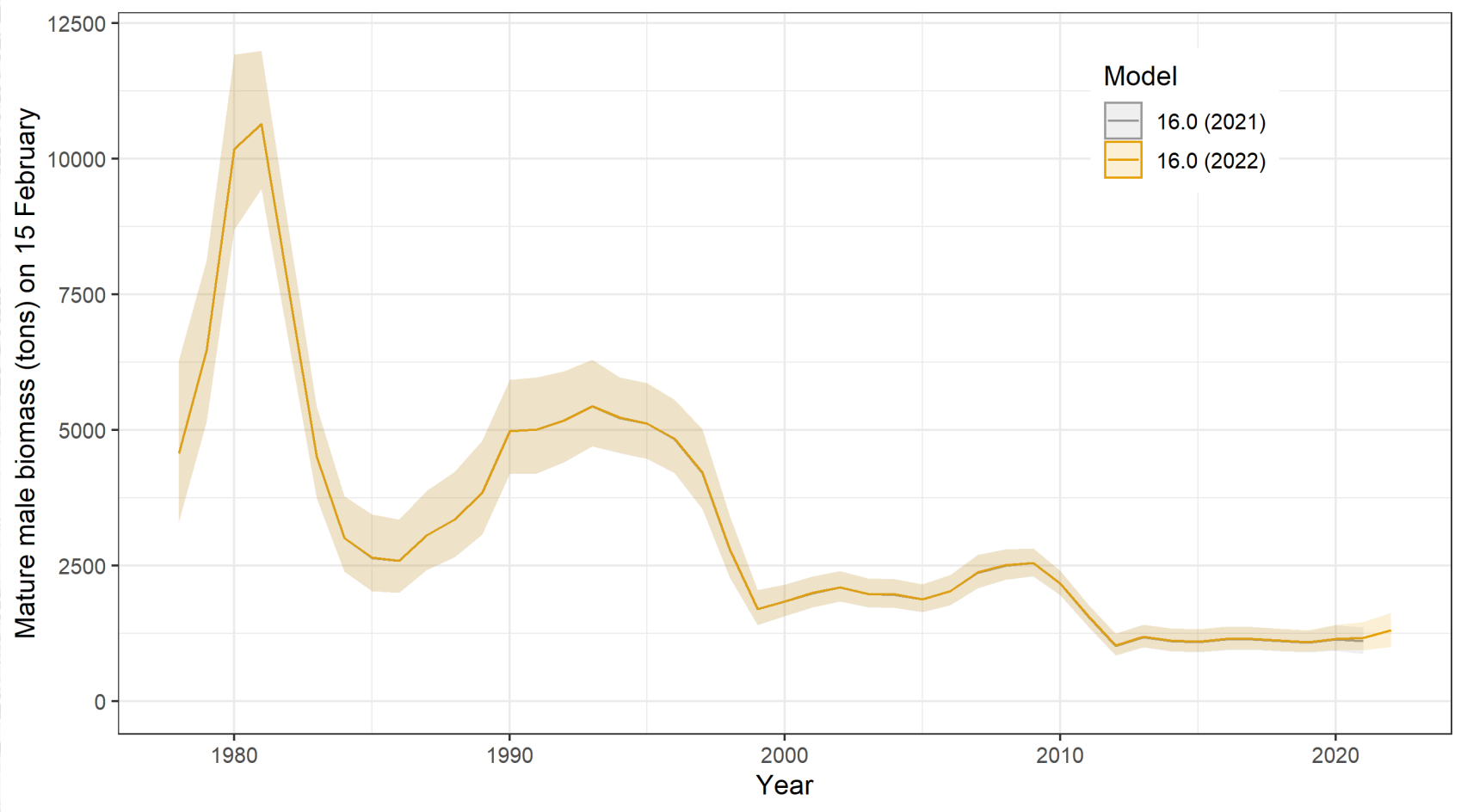
NMFS survey fit



ADF&G pot survey fit

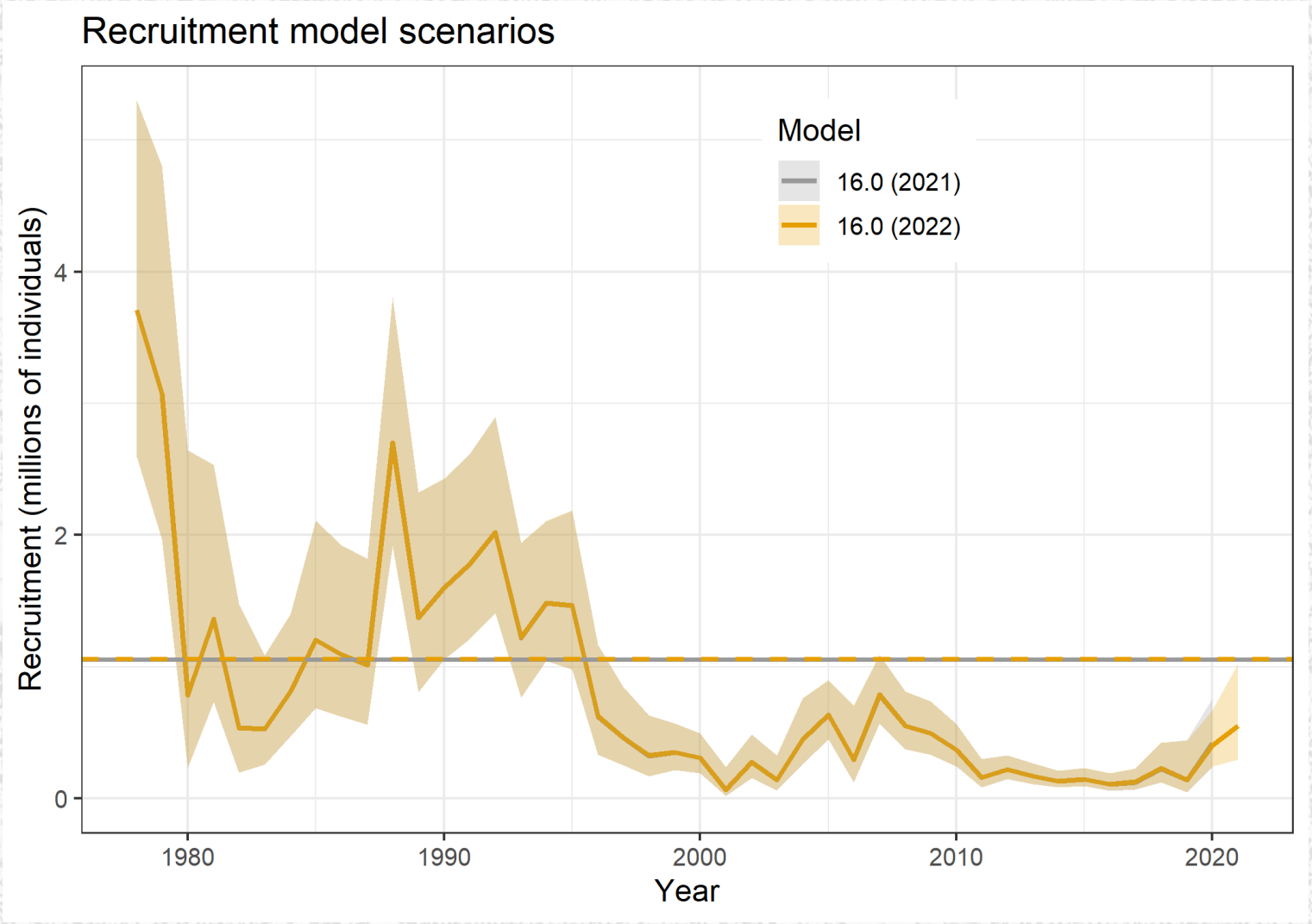


No discernable difference with updated reference model

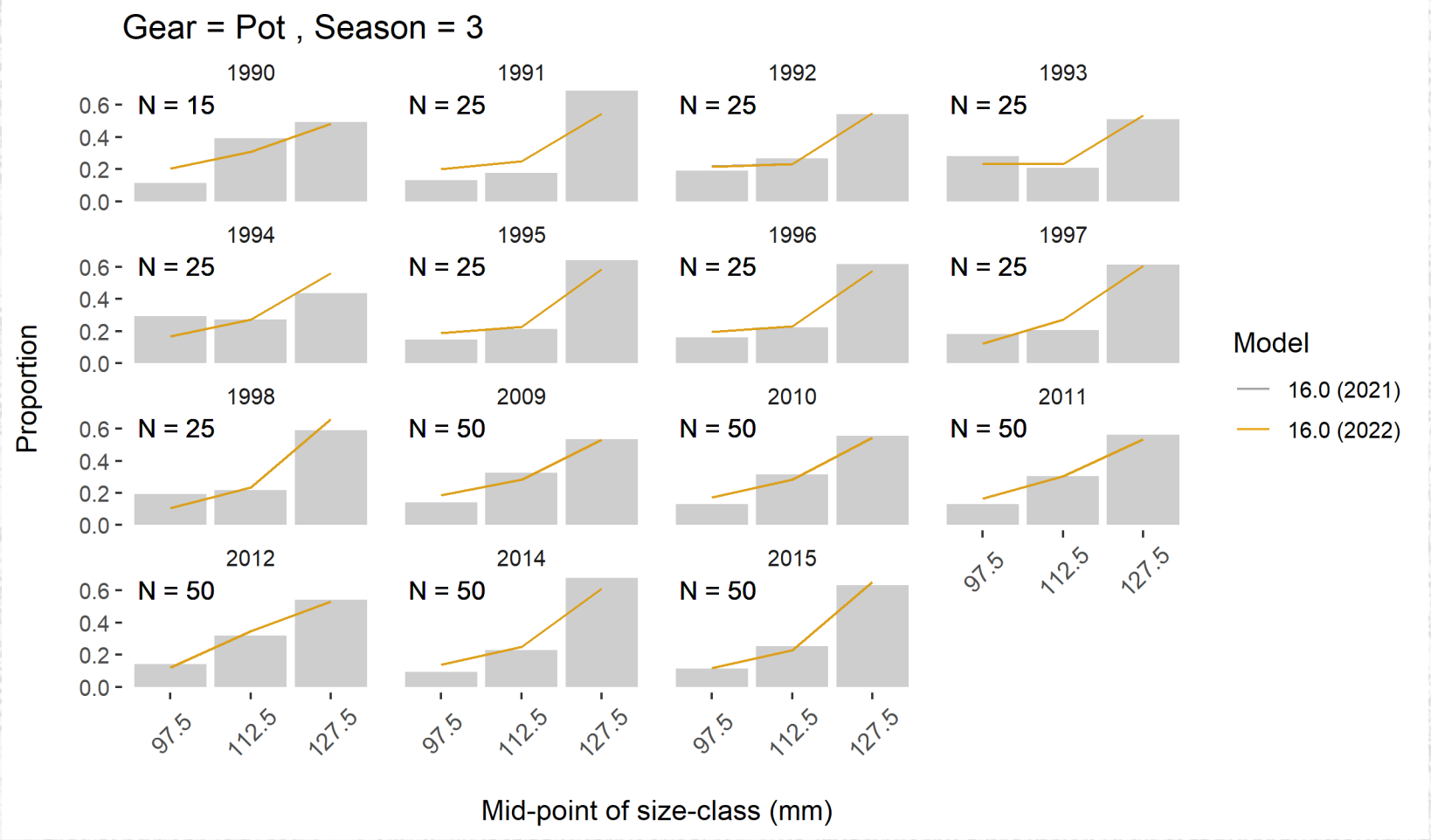


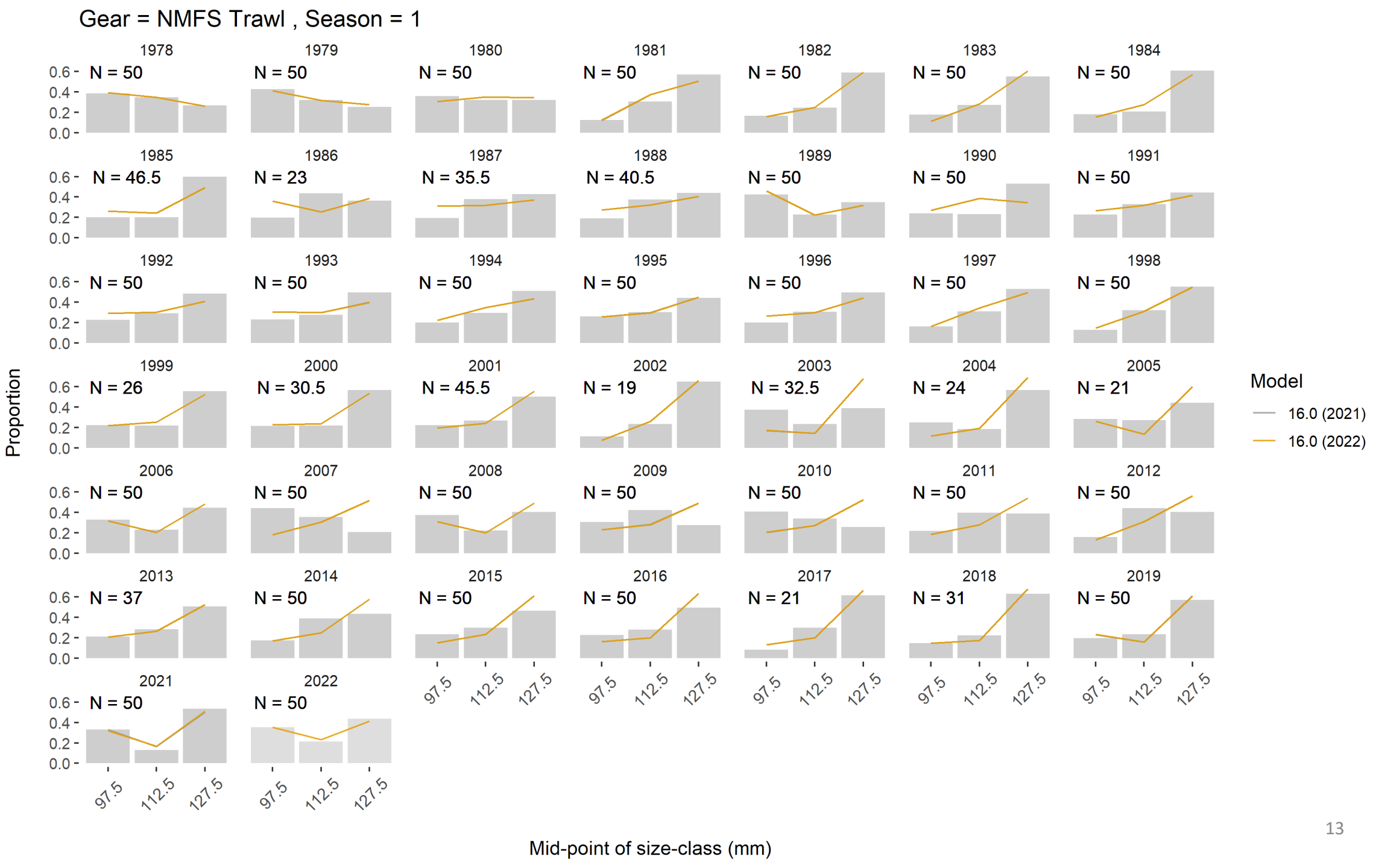
Recruitment

- Increase in 2021 & 2022
- Trending up



Size composition fit – directed fishery




Gear = NMFS Trawl , Season = 1
1978 N = 50
1979 N = 50
1980 N = 50
1981 N = 50
1982 N = 50
1983 N = 50
1984 N = 50
1985 N = 46.5
1986 N = 23
1987 N = 35.5
1988 N = 40.5
1989 N = 50
1990 N = 50
1991 N = 50
1992 N = 50
1993 N = 50
1994 N = 50
1995 N = 50
1996 N = 50
1997 N = 50
1998 N = 50
1999 N = 26
2000 N = 30.5
2001 N = 45.5
2002 N = 19
2003 N = 32.5
2004 N = 24
2005 N = 21
2006 N = 50
2007 N = 50
2008 N = 50
2009 N = 50
2010 N = 50
2011 N = 50
2012 N = 50
2013 N = 37
2014 N = 50
2015 N = 50
2016 N = 50
2017 N = 21
2018 N = 31
2019 N = 50
2021 N = 50
2022 N = 50
0.0
0.2
0.4
0.6
97.5
112.5
127.5
Proportion
Mid-point of size-class (mm)
Model
16.0 (2021)
16.0 (2022)

Size composition fit – ADF&G pot survey

Reference model (16.0 -2022)

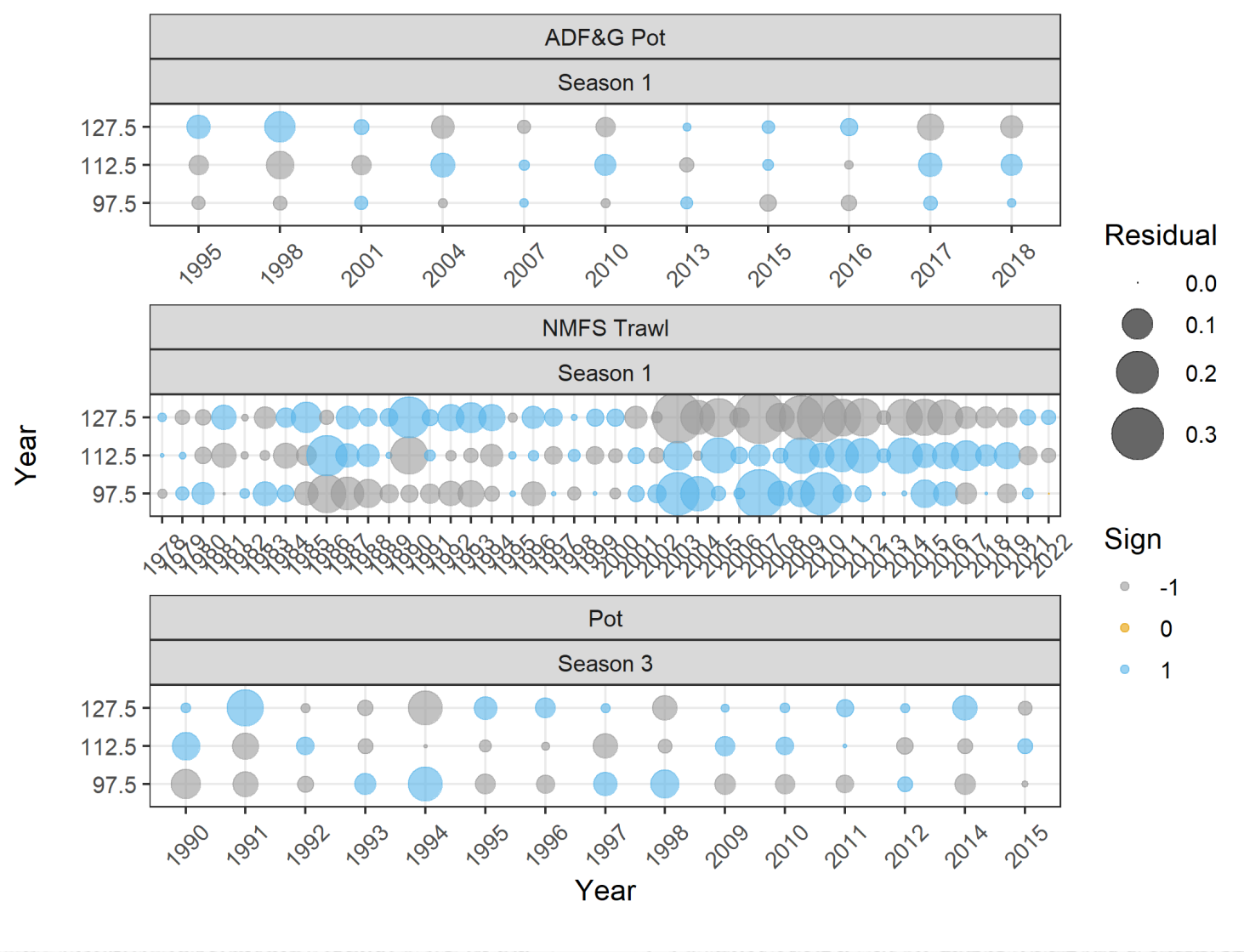


Table 12: Model parameter estimates, selected derived quantities, and their standard deviations (SD) for the base (16.0) model 2022.

Parameter	Estimate	SD
Natural mortality deviation in 1998/99 (δ^M_{1998})	1.582	0.136
$\log(\bar{R})$	13.872	0.194
$\log(n^0_1)$	14.954	0.174
$\log(n^0_2)$	14.513	0.210
$\log(n^0_3)$	14.328	0.207
q_{pot}	3.775	0.244
$\log(\bar{F}^{\mathrm{df}})$	-2.132	0.052
$\log(\bar{F}^{\mathrm{tb}})$	-9.892	36.302
$\log(\bar{F}^{\mathrm{fb}})$	-8.098	0.072
log Stage-1 directed pot selectivity 1978-2008	-0.920	0.180
log Stage-2 directed pot selectivity 1978-2008	-0.560	0.132
log Stage-1 directed pot selectivity 2009-2017	-0.542	0.163
log Stage-2 directed pot selectivity 2009-2017	-0.000	0.000
log Stage-1 NMFS trawl selectivity	-0.314	0.065
log Stage-2 NMFS trawl selectivity	-0.000	0.000
log Stage-1 ADF&G pot selectivity	-0.721	0.125
log Stage-2 ADF&G pot selectivity	-0.000	0.000
F_{OFL}	0.061	0.007
OFL	66.333	11.990

Table 14: Comparisons of negative log-likelihood values for the selected model scenarios.

Component	Ref
Pot Retained Catch	-68.46
Pot Discarded Catch	6.69
Trawl bycatch Discarded Catch	-8.54
Fixed bycatch Discarded Catch	-8.50
NMFS Trawl Survey	5.58
ADF&G Pot Survey CPUE	85.59
Directed Pot LF	-104.67
NMFS Trawl LF	-267.94
ADF&G Pot LF	-91.24
Recruitment deviations	62.93
F penalty	9.66
M penalty	6.46
Prior	13.71
Total	-358.73
Total estimated parameters	153.00

Retrospective - 10 year peel - recent few years are consistent

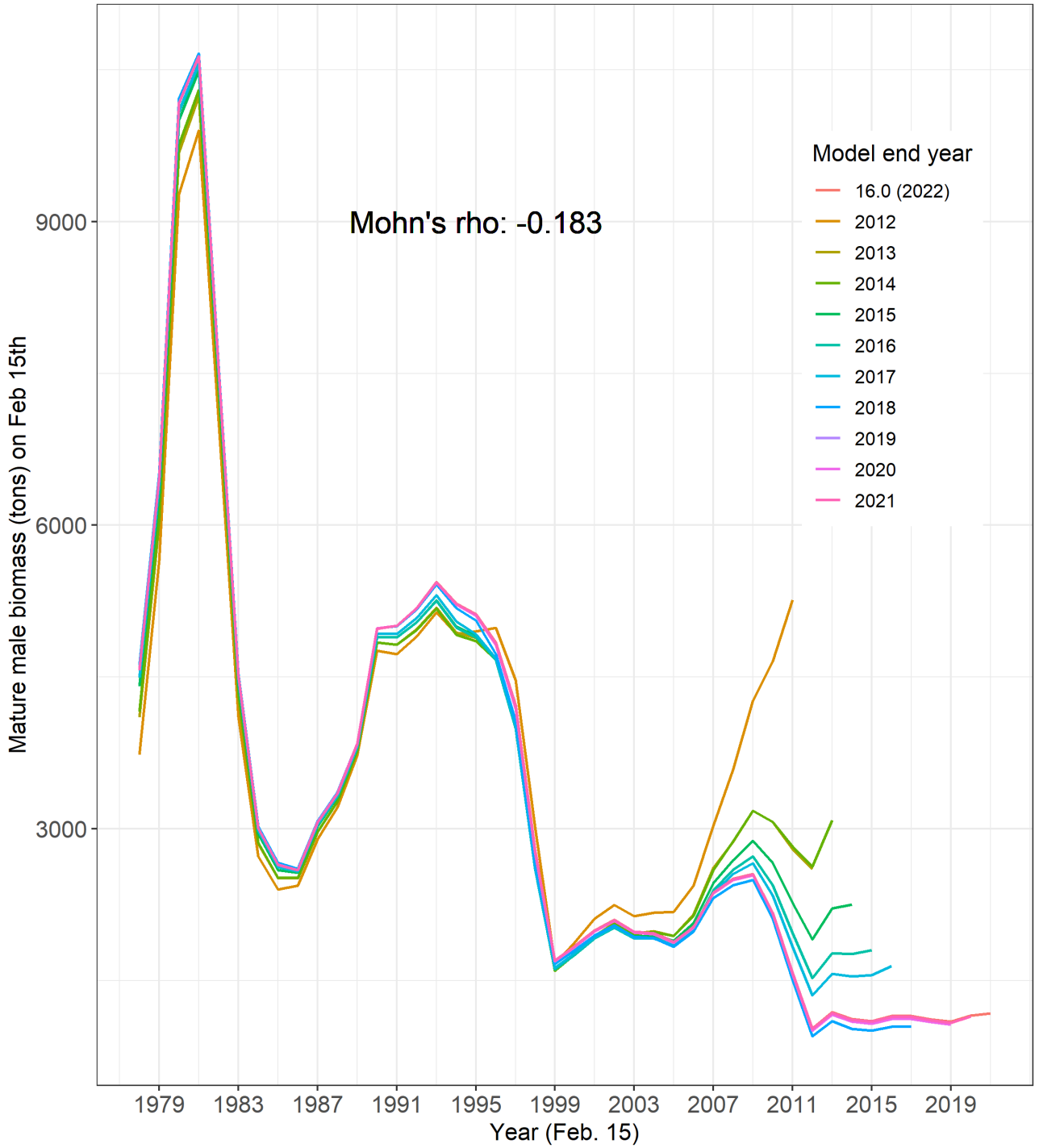


Table 1: Status and catch specifications (1000 t) for the base model.

Year	MSST	Biomass (MMB_{mating})	TAC	Retained catch	Total male catch	OFL	ABC
2018/19	1.74	1.15	0.00	0.00	0.001	0.04	0.03
2019/20	1.67	1.06	0.00	0.00	0.001	0.04	0.03
2020/21	1.65	1.14	0.00	0.00	0.001	0.05	0.04
2021/22	1.63	1.18	0.00	0.00	0.001	0.05	0.04
2022/23		1.31				0.07	0.05

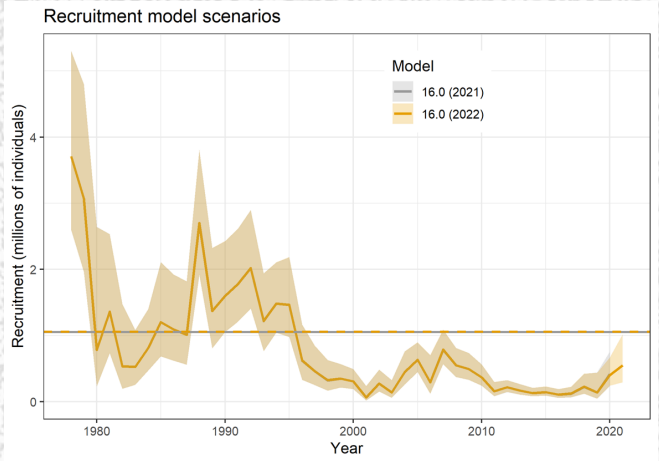
Table 4: Comparisons of management measures for the base model. Biomass and OFL are in tons.

Component	Ref
MMB_{2022}	1175.056
B_{MSY}	3255.221
MMB/B_{MSY}	0.404
F_{OFL}	0.061
OFL_{2022}	66.333
ABC_{2022}	49.749

Summary

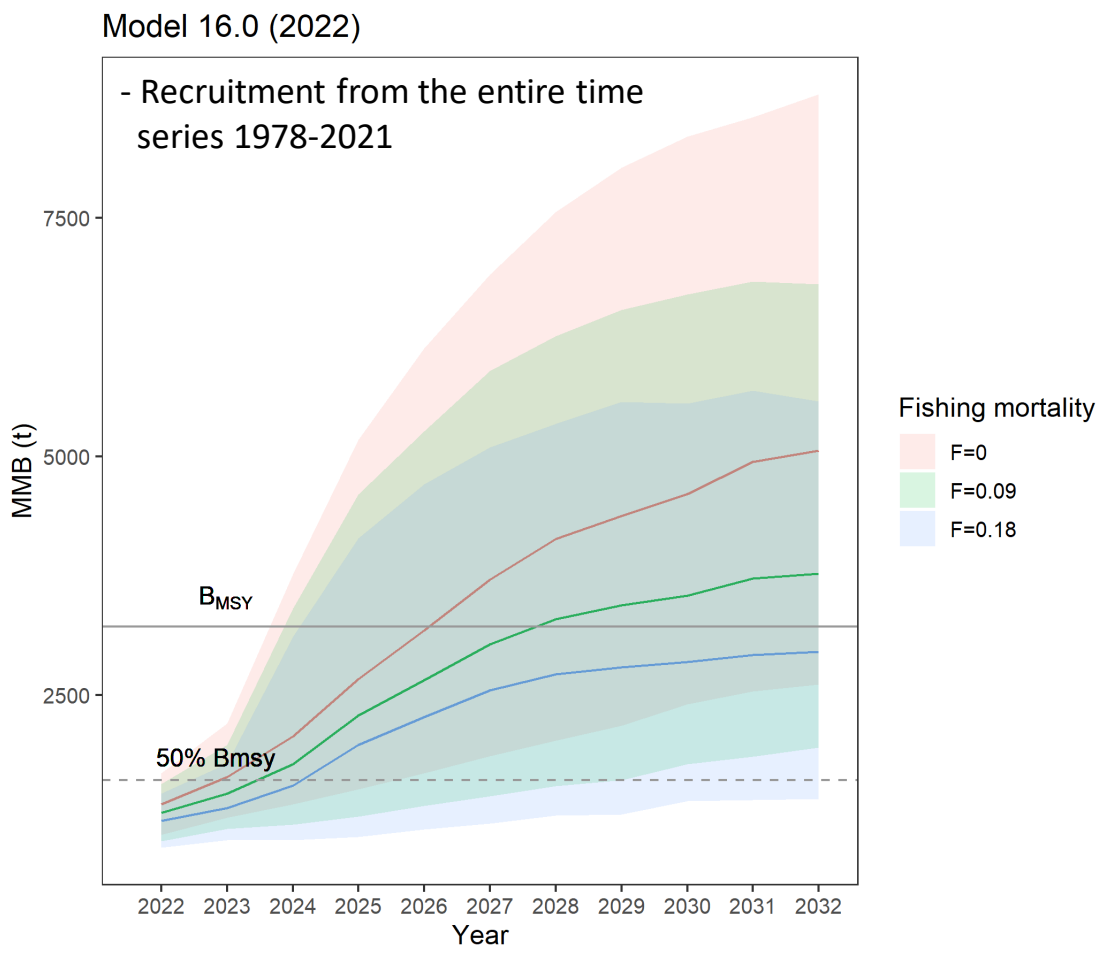
- Reference model fit as expected
- Increased recruitment in last two survey data points, reflected in recruitment estimations
- Future work
  - Further work on the two survey comparisons
  - Sensitivity/review of life history parameters in the model
  - Focus on Q – random walk or time blocks or alternative ways to address survey differences

Progress towards rebuilding

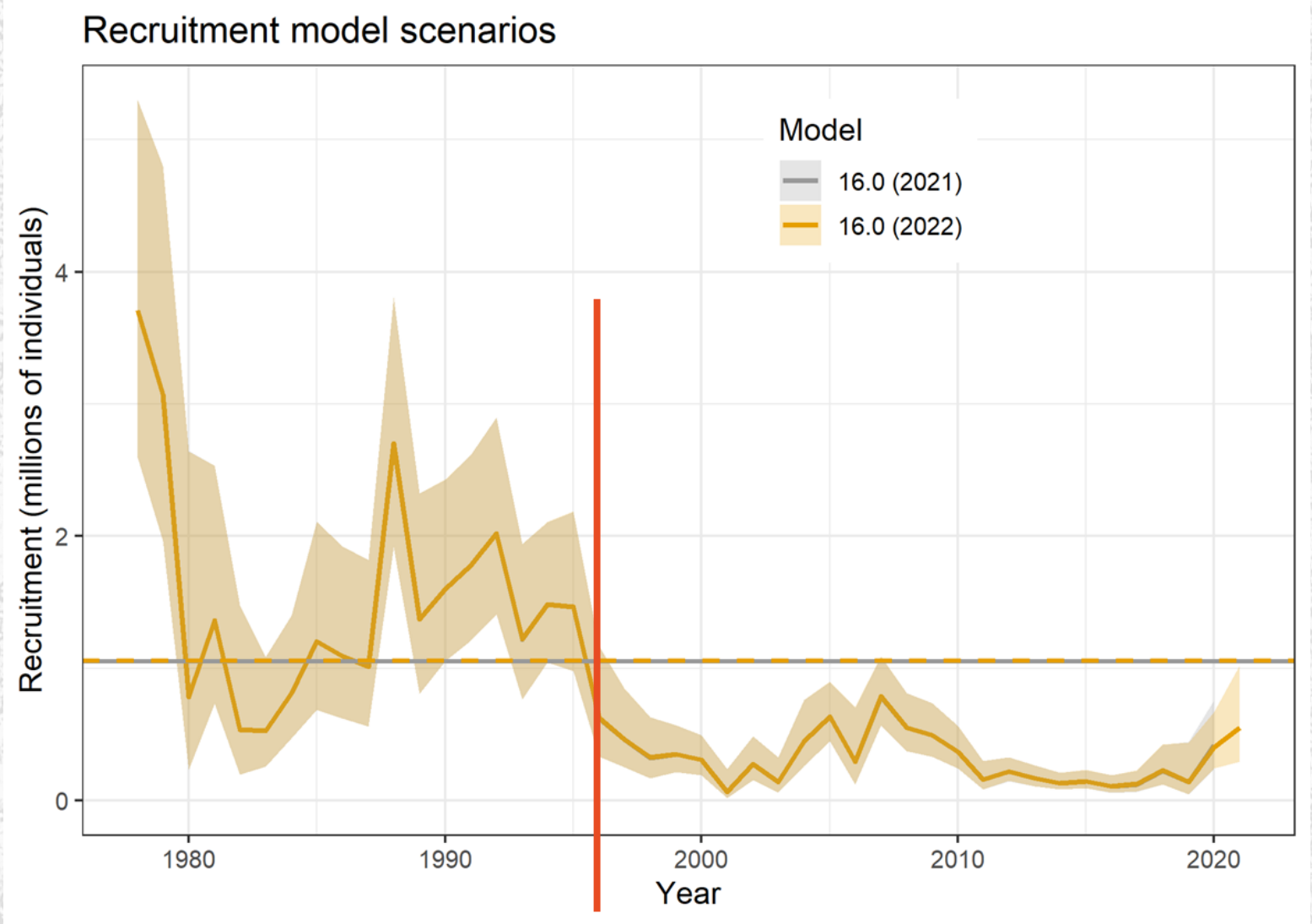


- Recruitment increase from very low levels
- Rebuilding progress highly dependent on successful recruitment
- 2022 ADF&G survey will help in understanding the stock and its current status
- Projections using average recruitment and recent recruitment both show likely increases in the stock, although they have much variability.

Projections



Recruitment periods



Thanks – Questions?

Thanks to ADF&G staff and plan team members for review.