

# 2022 draft assessment for Pribilof Islands red king crab

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Front matter table need revising

# PIRKC brief

- 1. Management:** This is the first assessment since PIRKC shifted to a triennial management cycle in 2019.
- 2. Input data:** Survey and bycatch data were updated with the most recent data in this draft. Some small adjustments were made to the recent years of bycatch data after a new download from AKFIN. One model uses size composition data from bycatch.
- 3. Assessment methodology:** GMACS was adopted in 2019 as the assessment methodology for this stock.  $B_{MSY}$  was redefined in 2019 as 35% of the average MMB observed from 2000-present, which was a period of no fishing. One model estimates a constant (rather than linear) growth increment.
- 4. Assessment results:** Overfishing did not occur from 2019-2021 and the stock was not overfished as of the summer of 2022.

Year	Tier	BMSY	MMB	Status	FOFL	Years	M
2022/2023	4	1709	3879	2.27	0.21	2000-2021	0.21

# CPT and SSC comments/requests

*The CPT supported bringing Model 22.1 forward for SSC review in October but did not support models 22.1a or 22.1b. Instead, the CPT recommended three new models for consideration:*

- Model 22.1c - Model 22.1 + ADF&G pot data
- Model 22.1d – Model 22.1 + trawl survey size composition
- Model 22.1e – Model 22.1 with both ADF&G pot data and trawl survey size composition.

Three models presented this cycle:

- 22.1 : Model 19.1 updated with new data
- 22.1a : 22.1 + bycatch size composition data
- 22.1b : 22.1a + estimated constant growth increment

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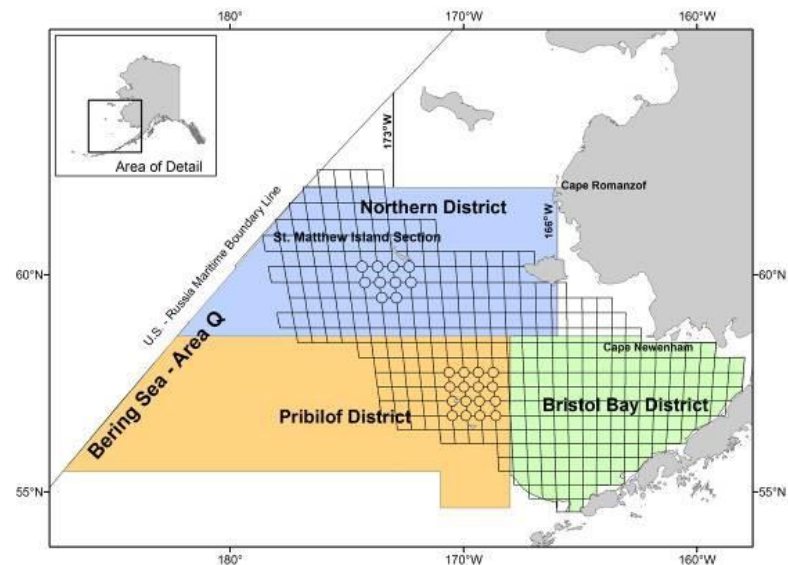
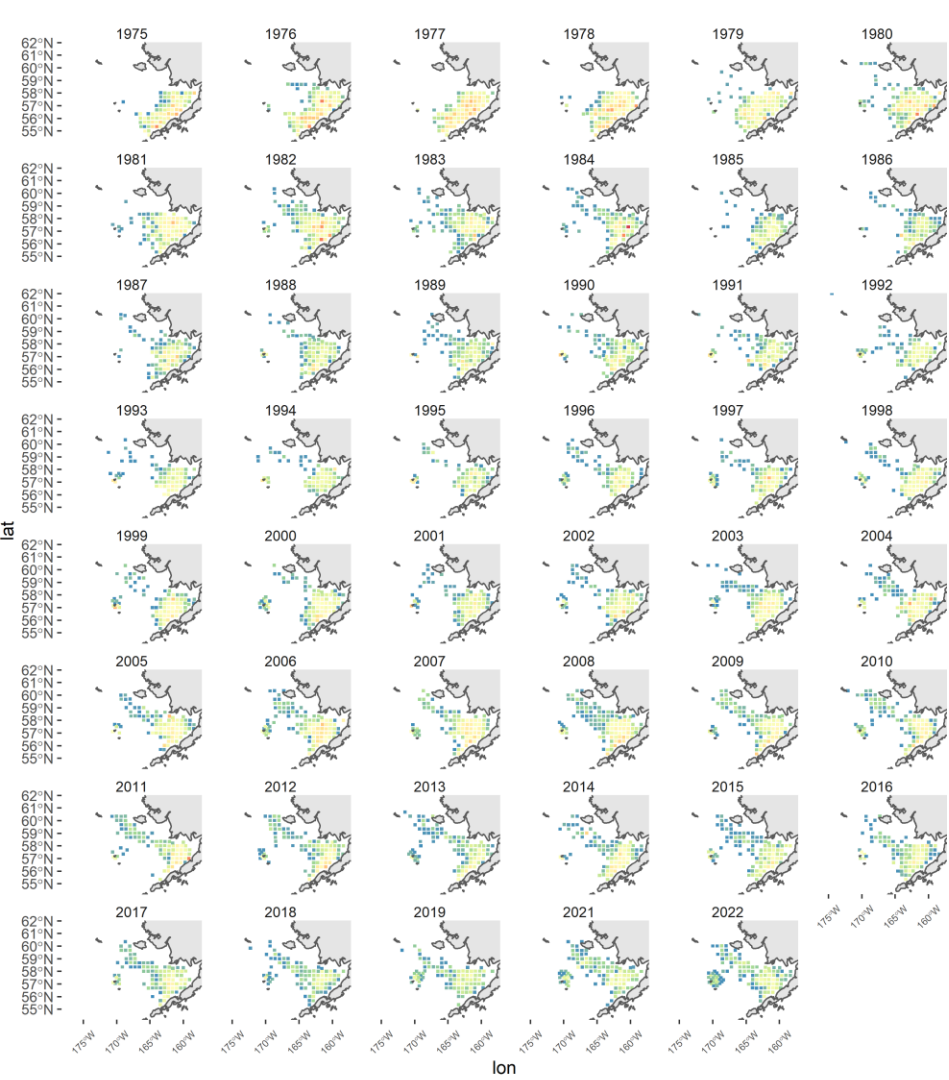
## Tier 4 control rule

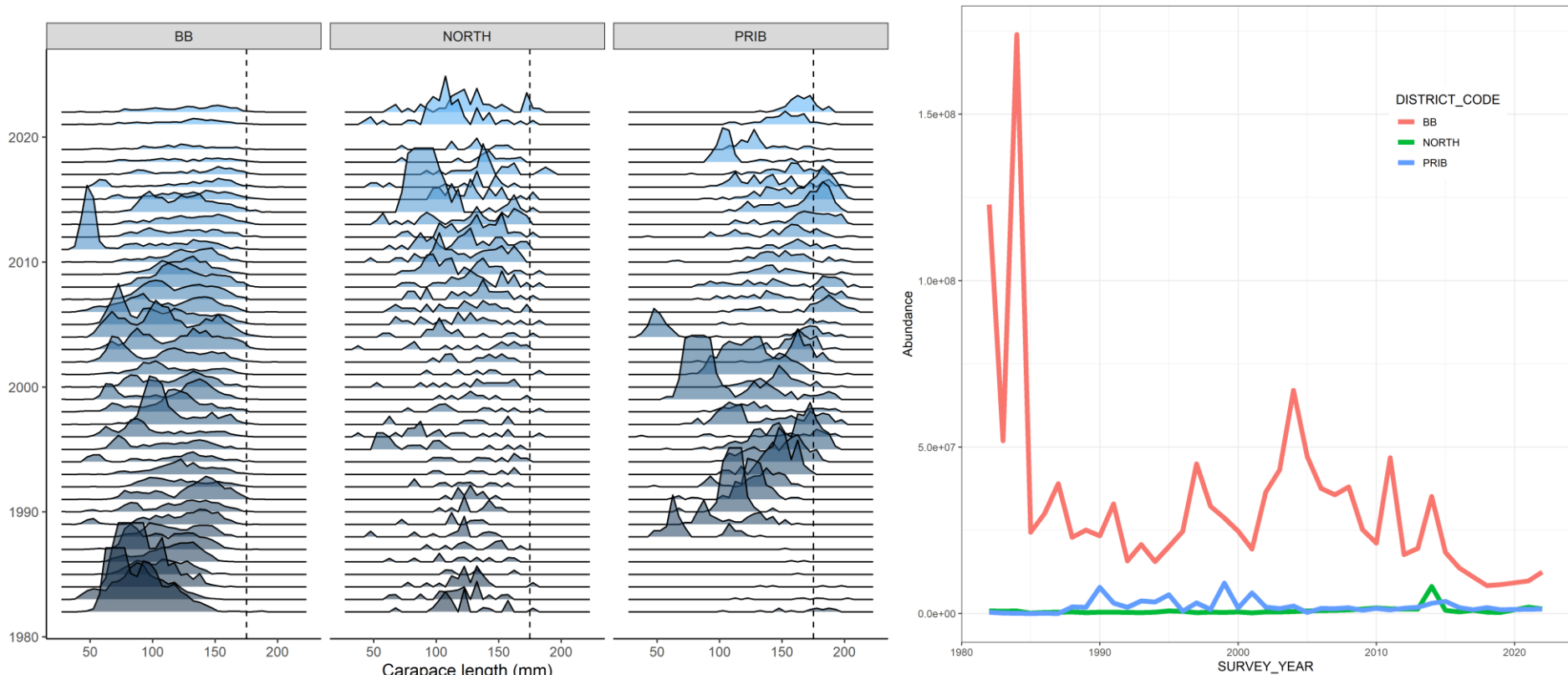
MMB is  $>120$  mm carapace length estimated from an integrated assessment

Fmsy proxy = natural mortality (0.21)

Bmsy proxy = 35% of mature male biomass projected to the time of mating from 2000-present

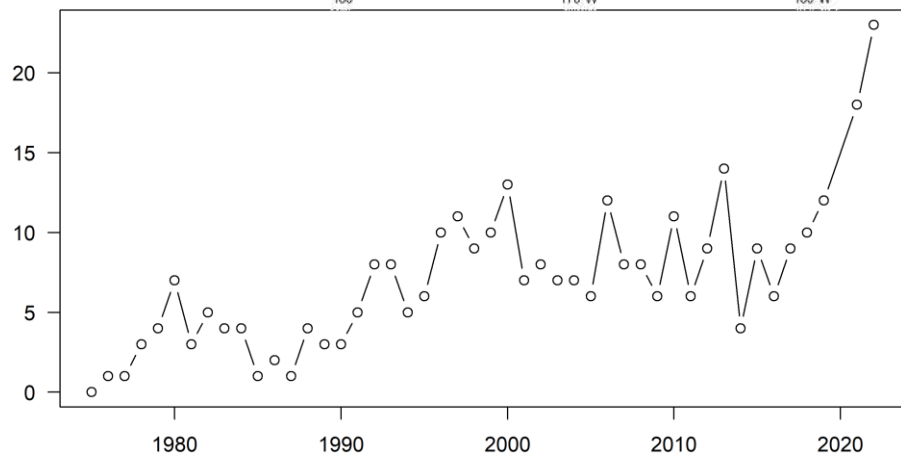
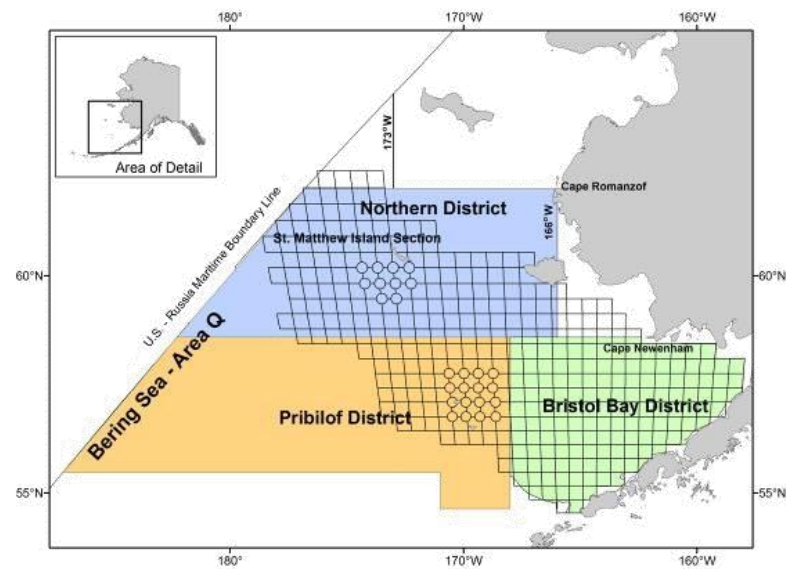
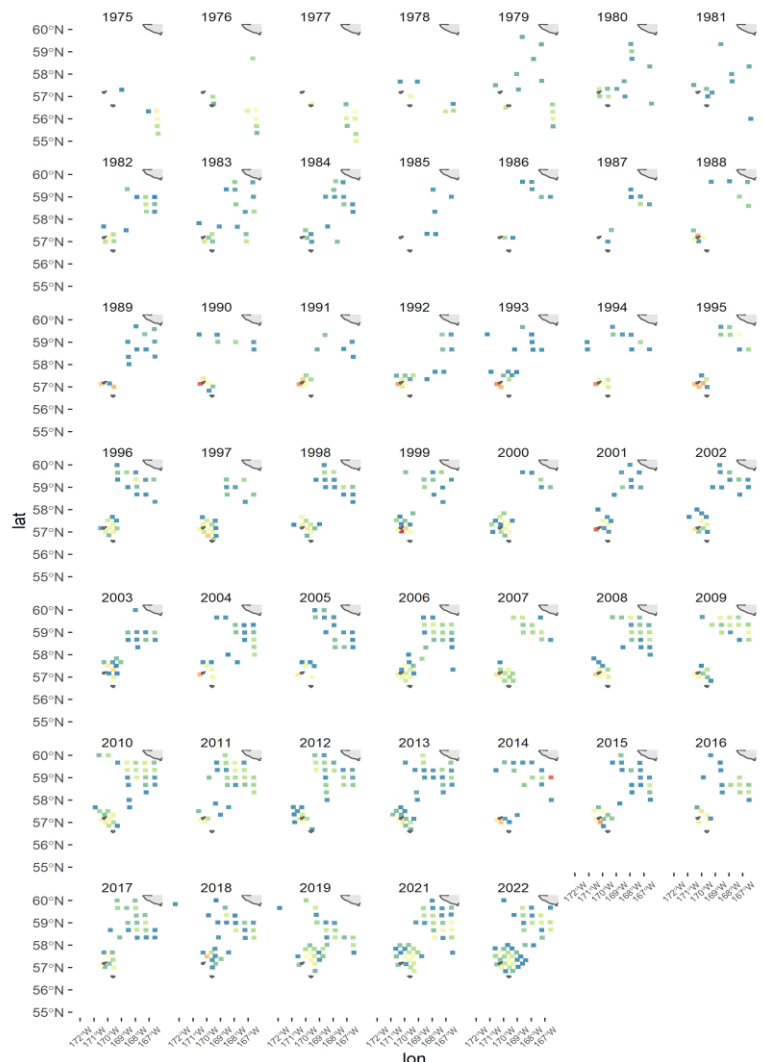
ABCs calculated by applying a 25% buffer to the OFL

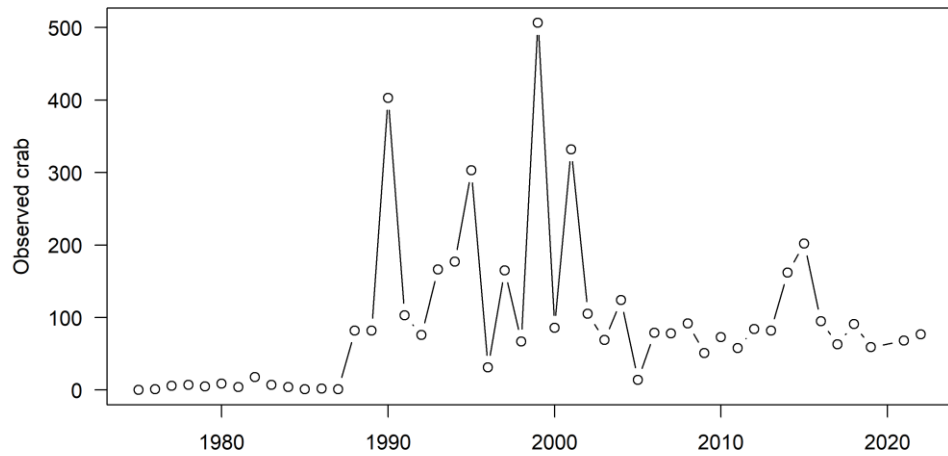
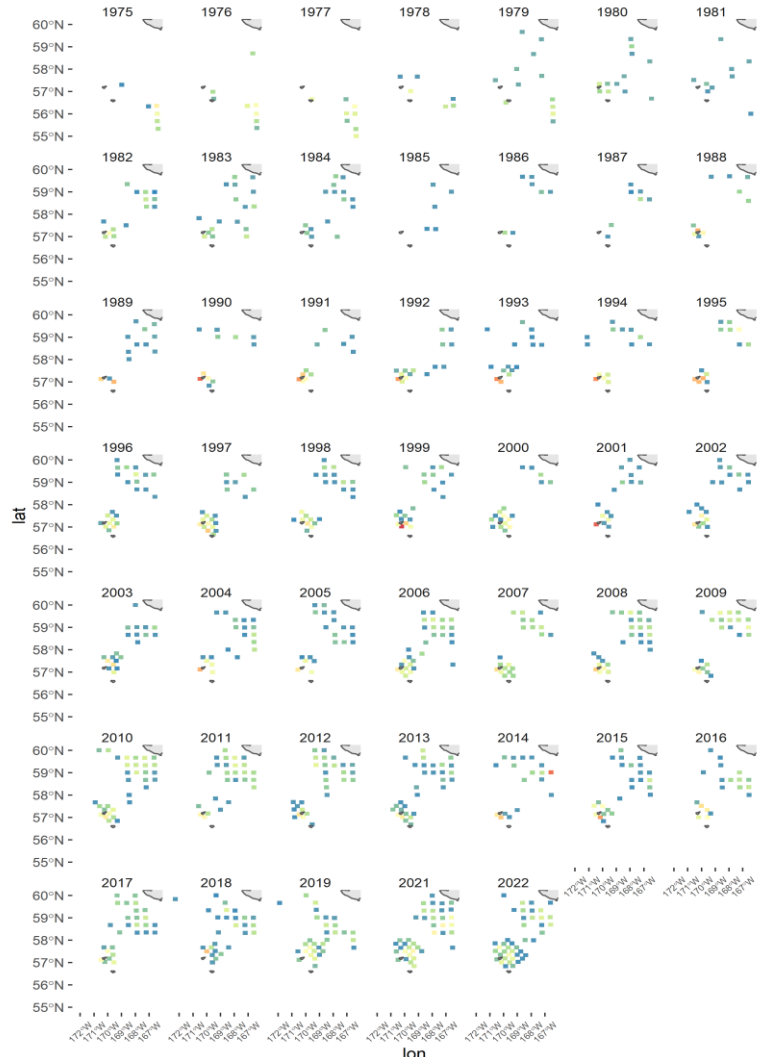


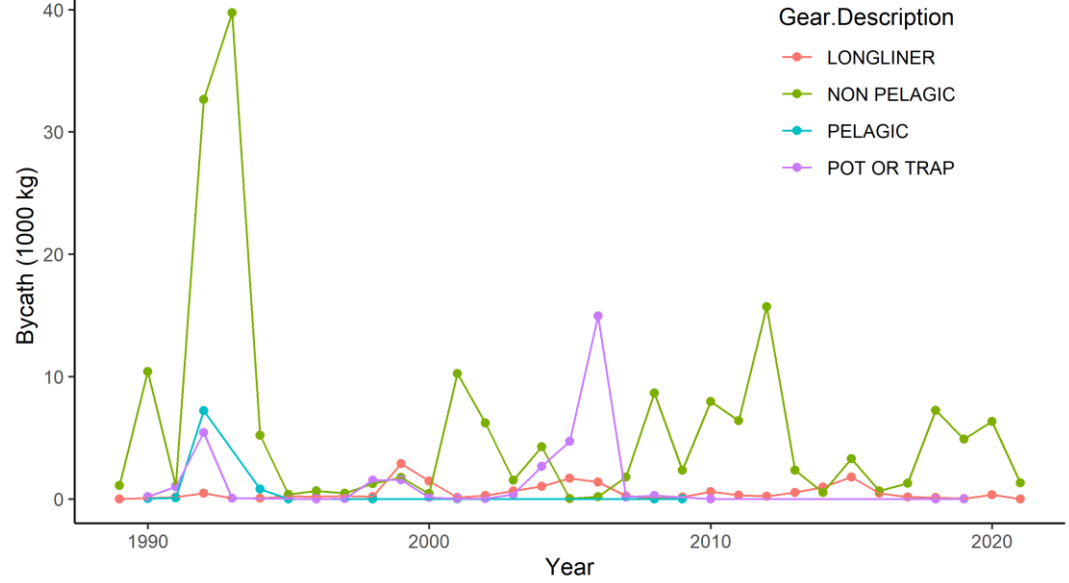
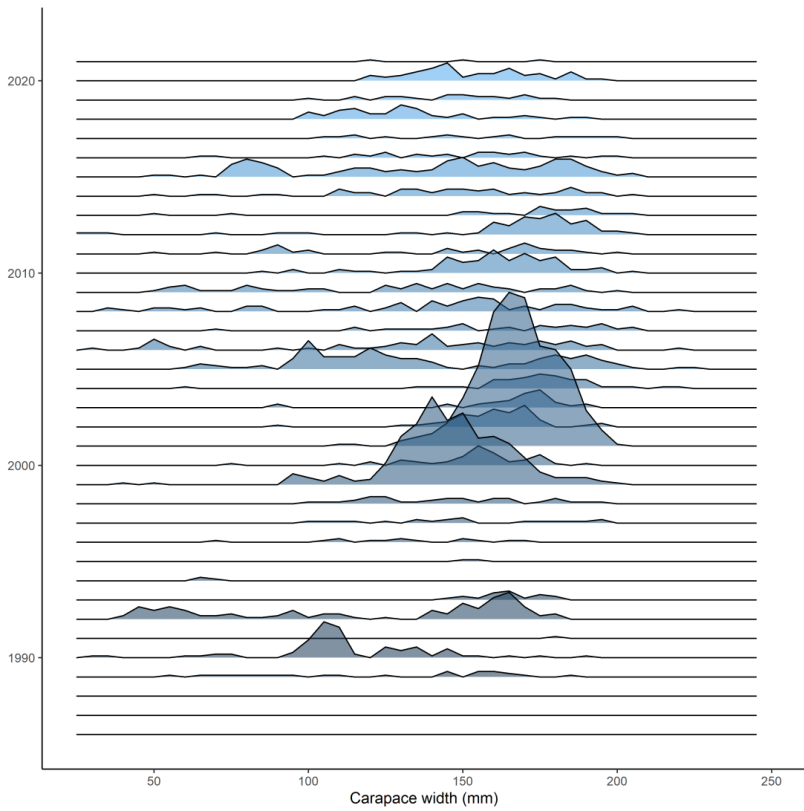


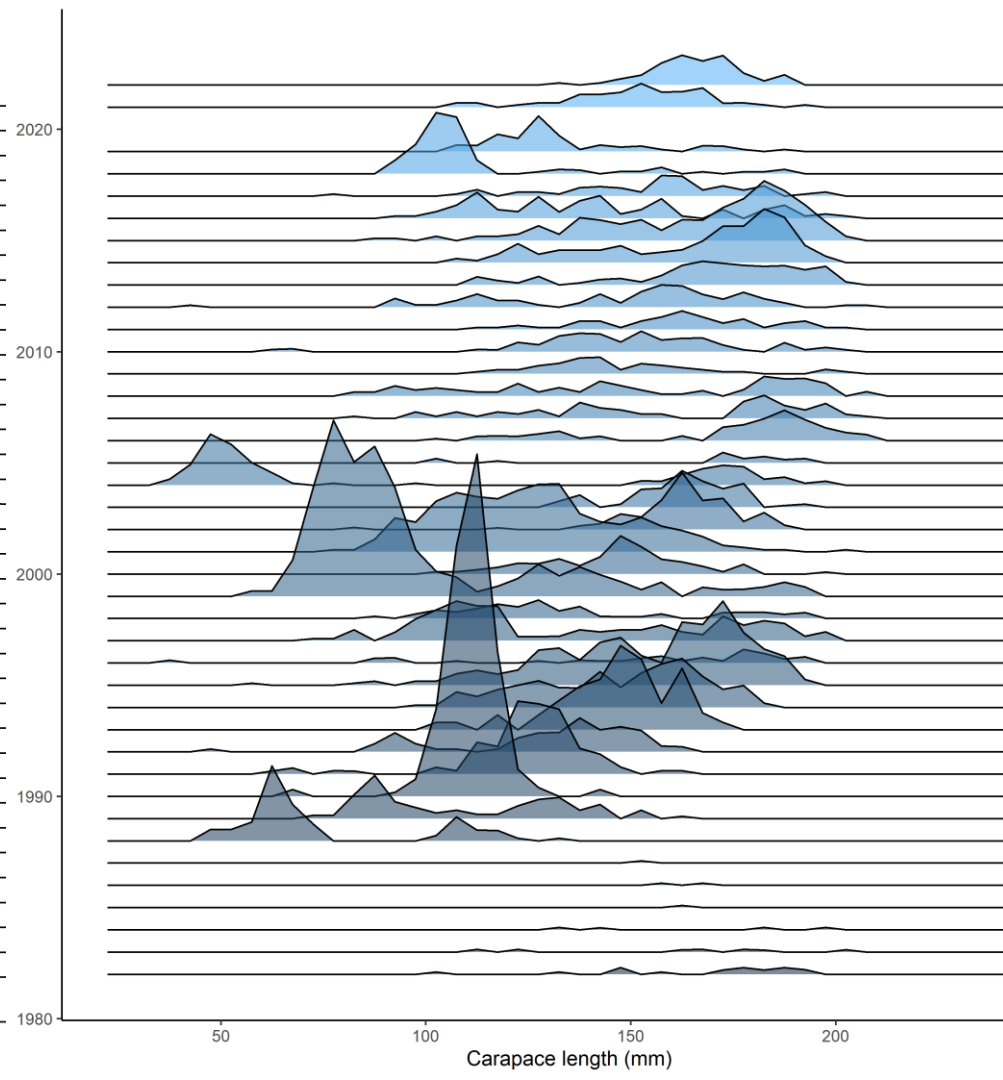
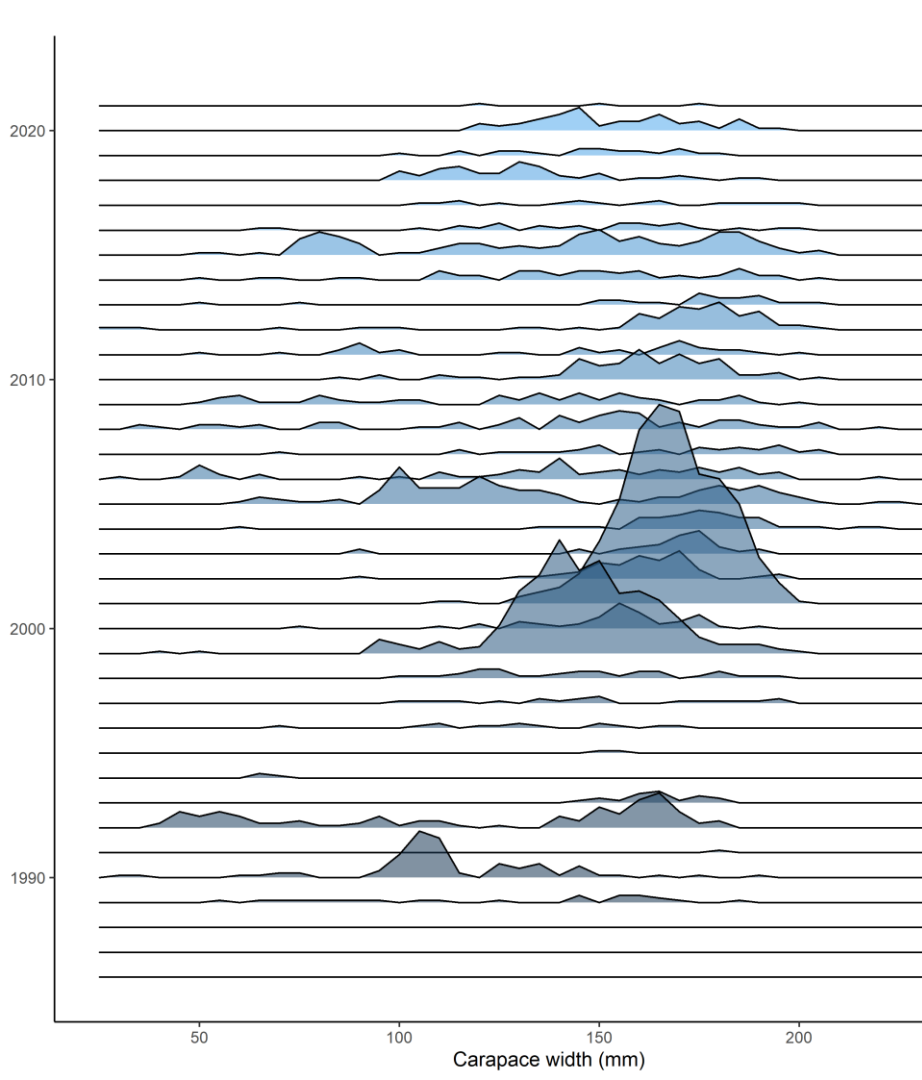
The number by size of male red king crab at carapace length by district. Each district is scaled to the maximum observed in a district, refer to above figure for relative differences. Data were capped in some years and size classes to allow for better resolution of cohorts (e.g. ~60-70 mm carapace length in 1982 for Bristol Bay).

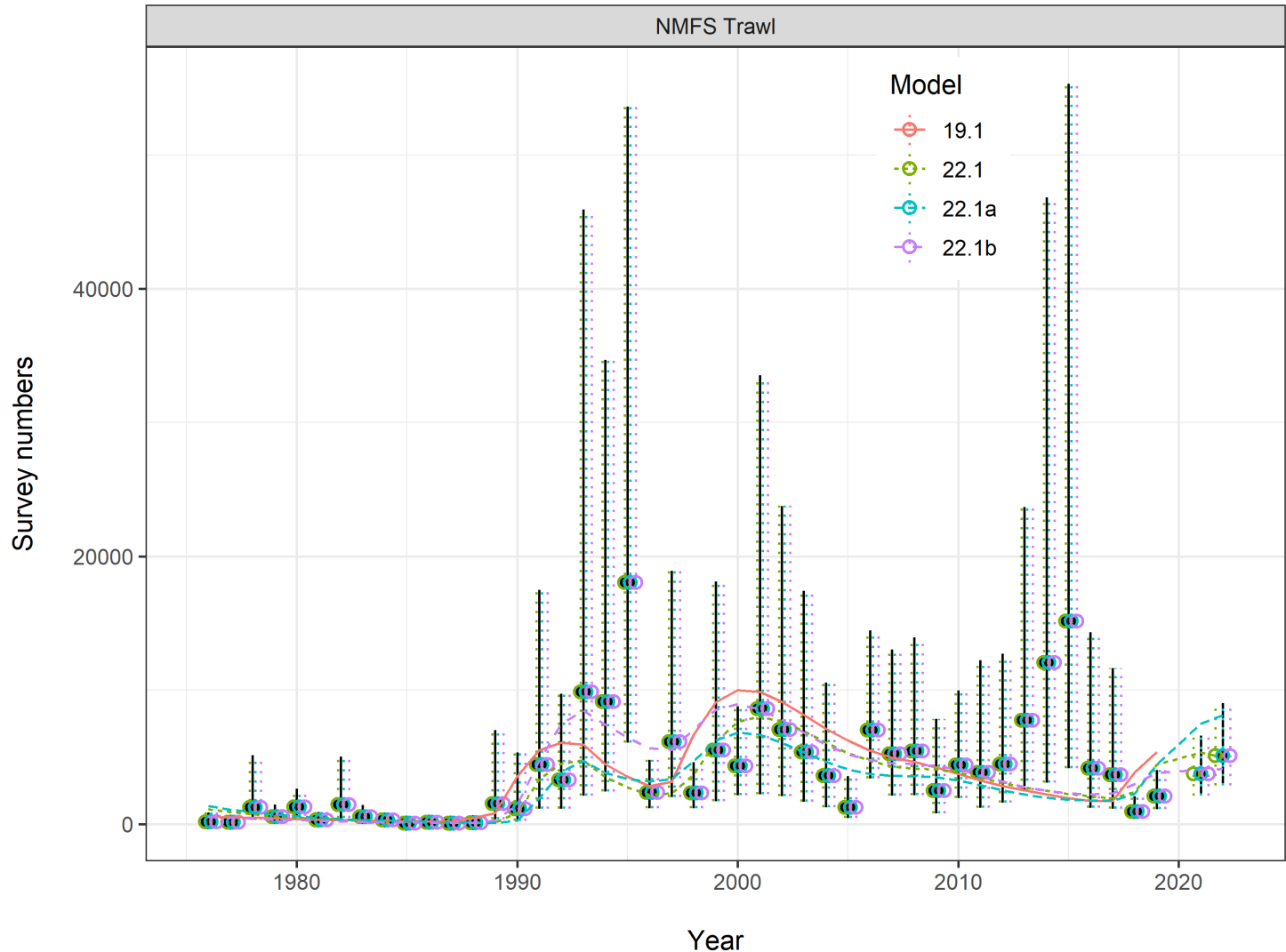






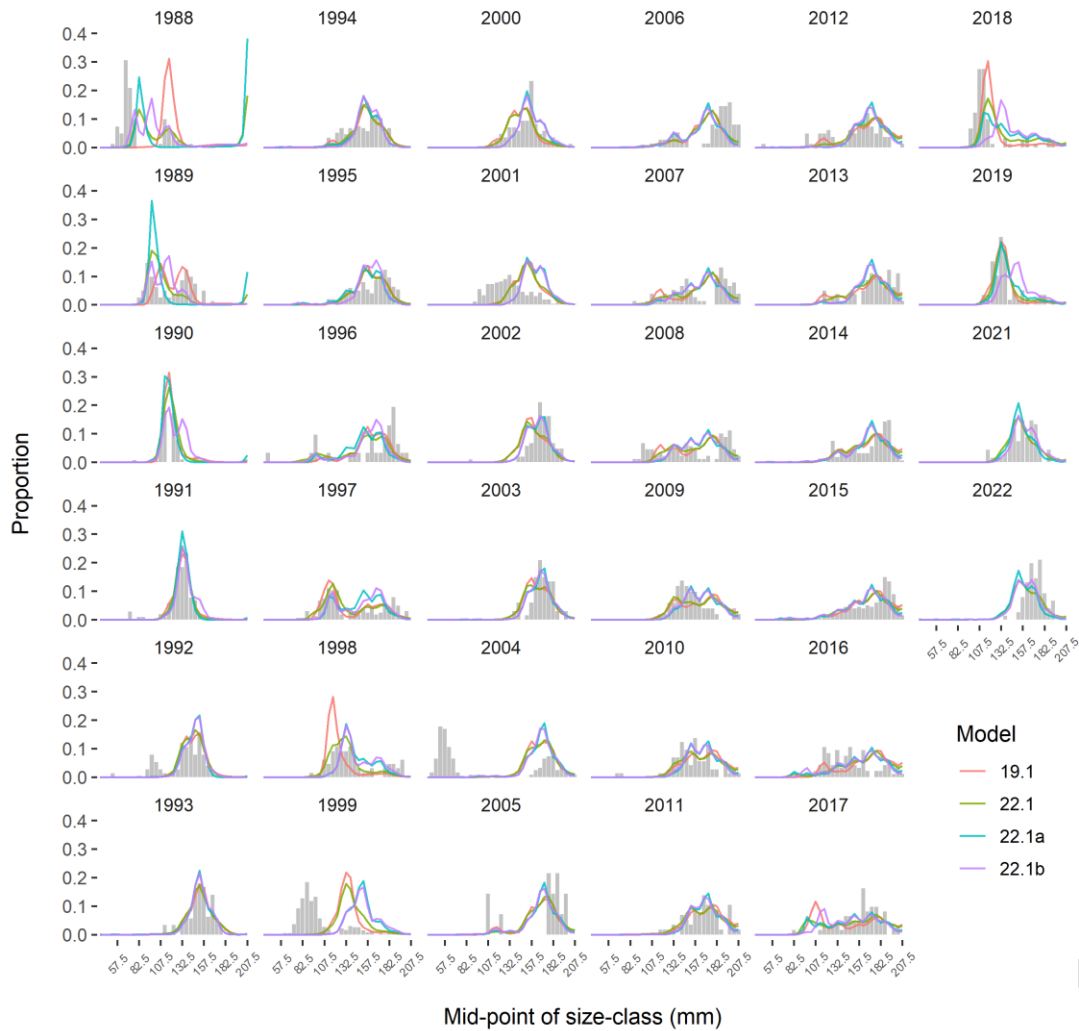




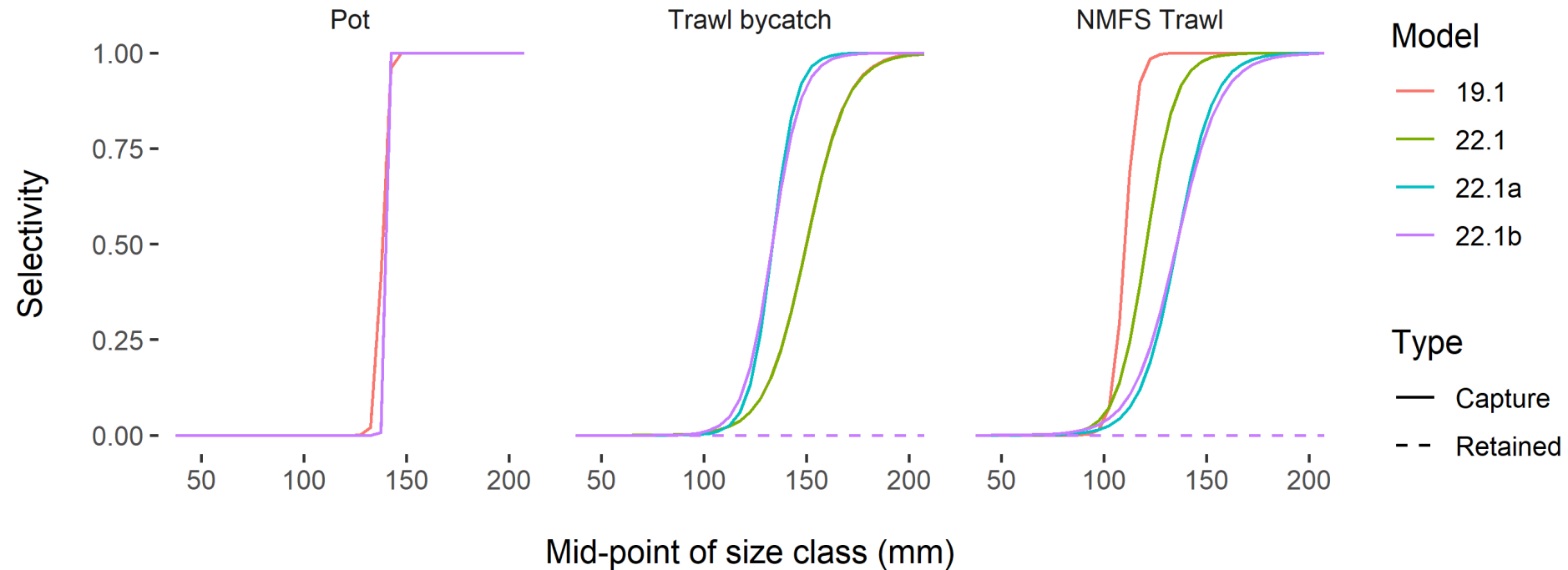


Model fits to  
mature male  
biomass from the  
NMFS summer  
trawl survey.

# Gear = NMFS Trawl , Season = Annual

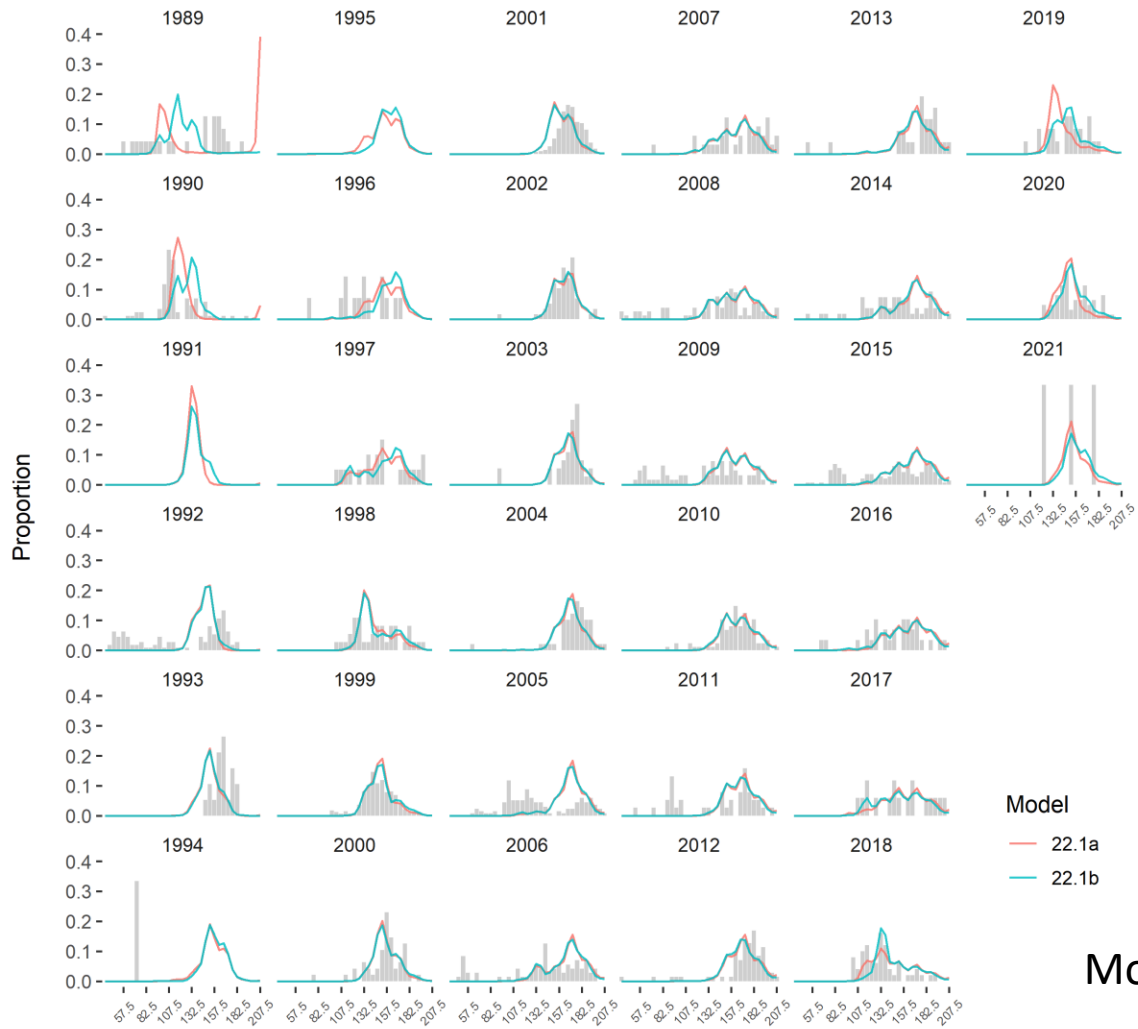


Model fits to survey size composition data.



Estimated survey selectivity, assumed directed pot fishery selectivity, assumed and estimated bycatch selectivity.

# Gear = Trawl bycatch , Season = NA

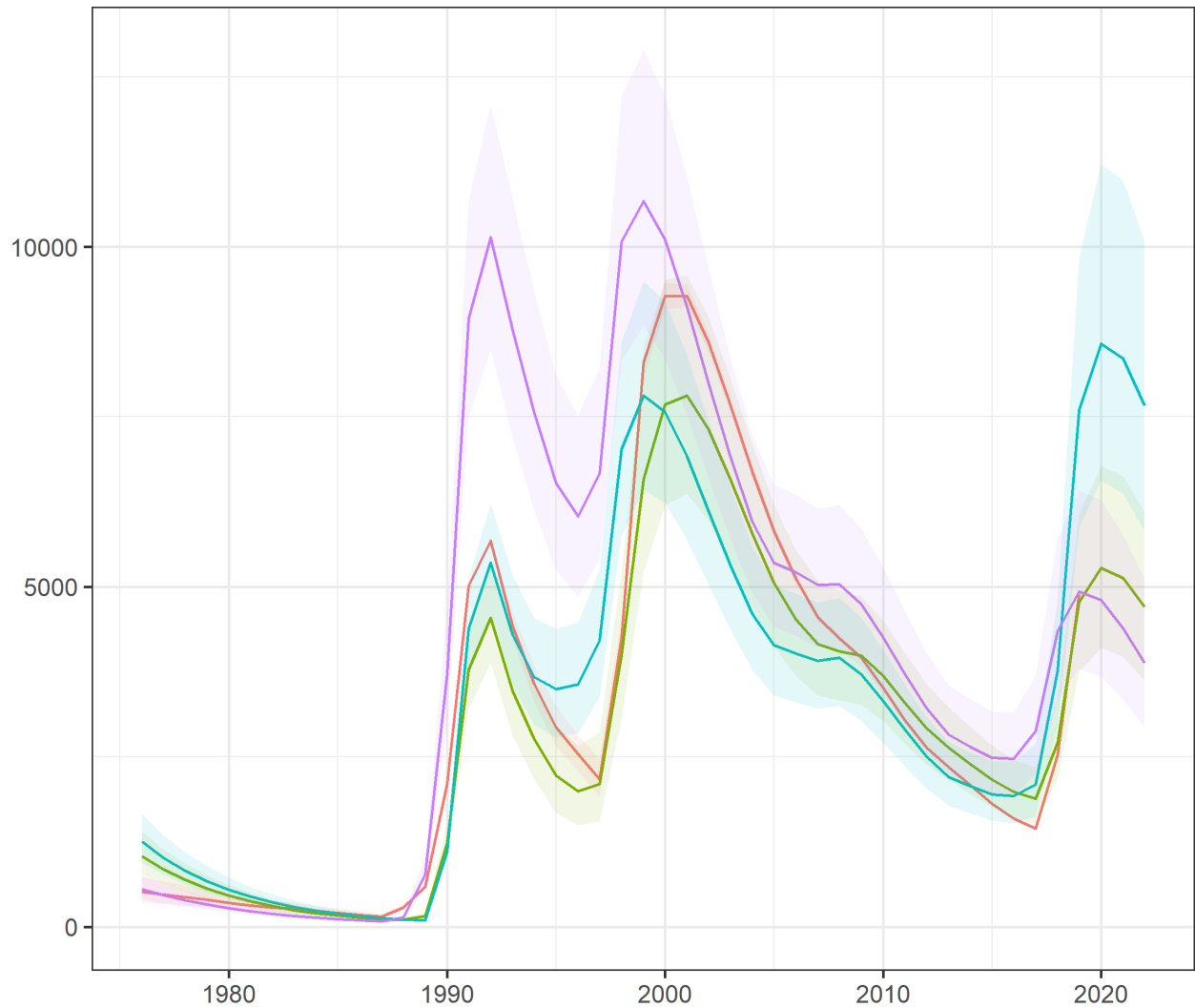


Model  
— 22.1a  
— 22.1b

Model fits to bycatch composition data.



SSB (tonnes)



Model

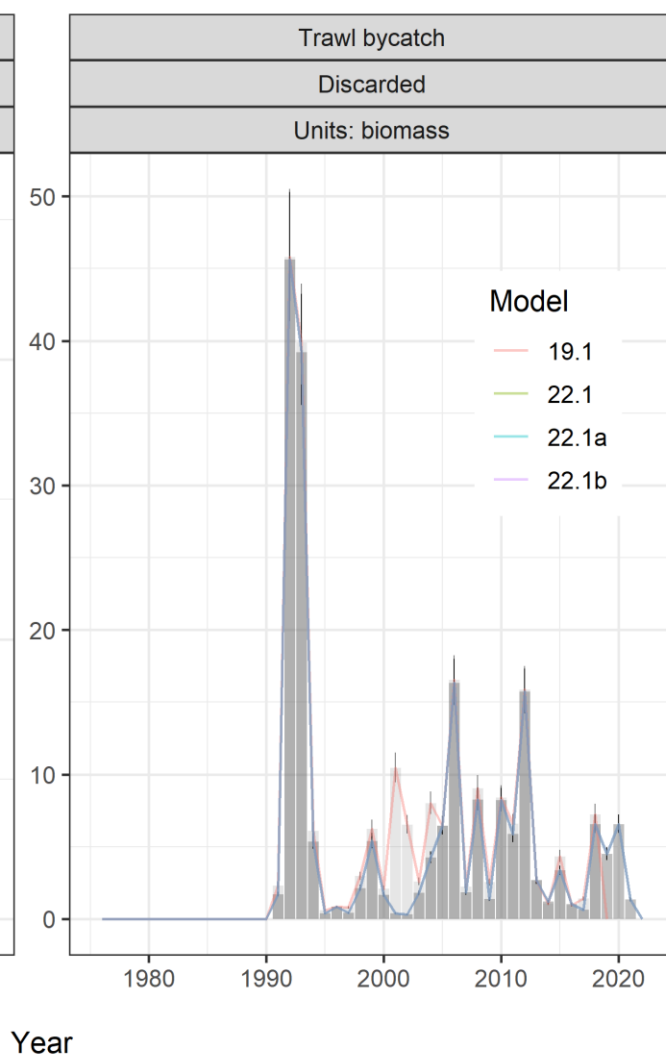
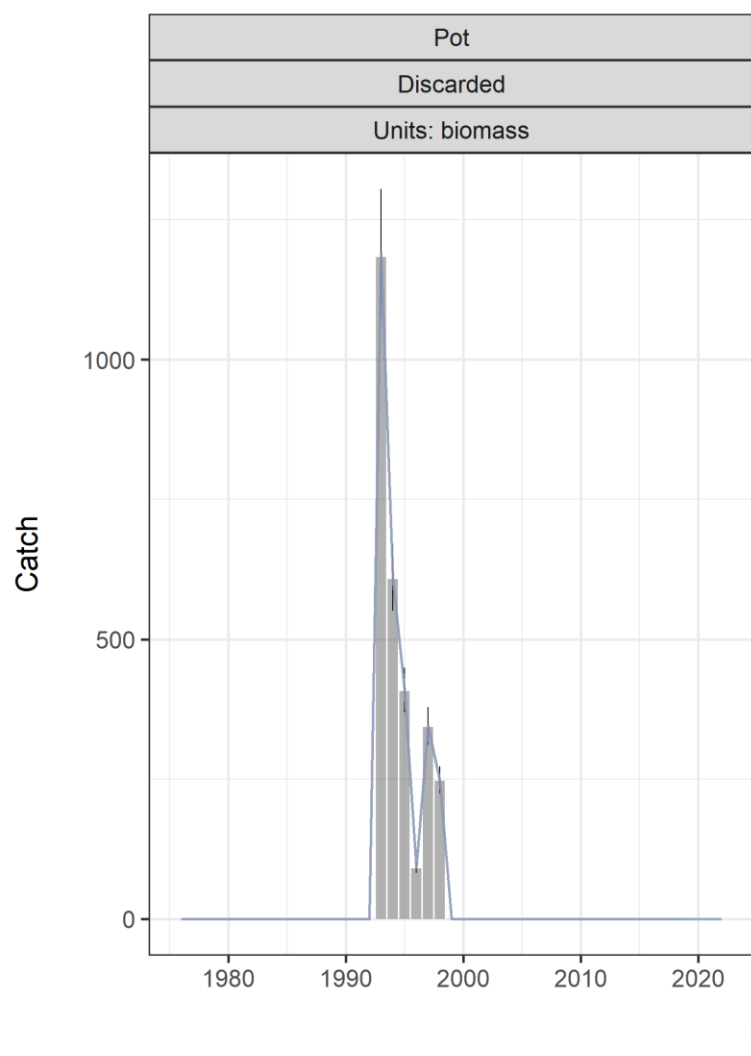
19.1

22.1

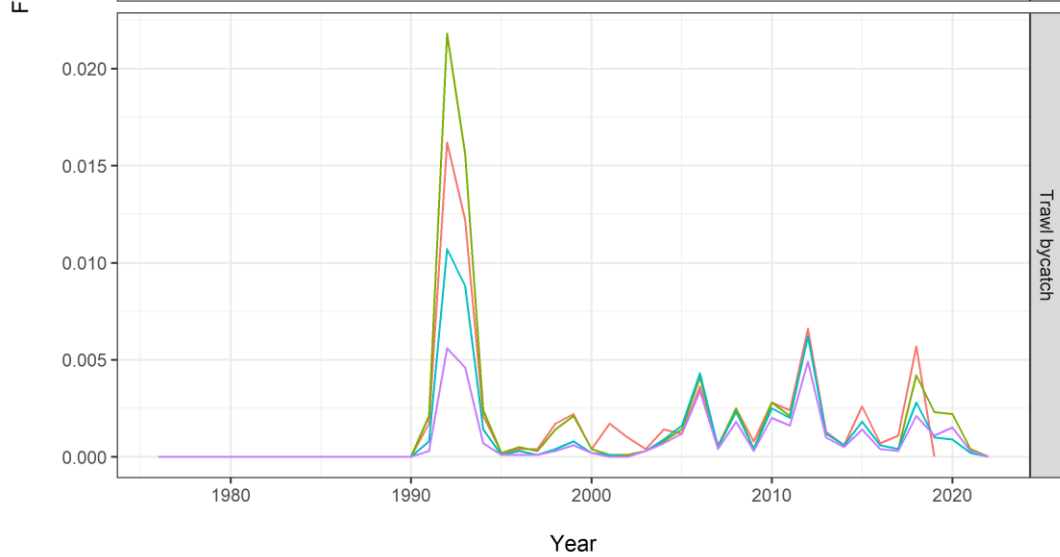
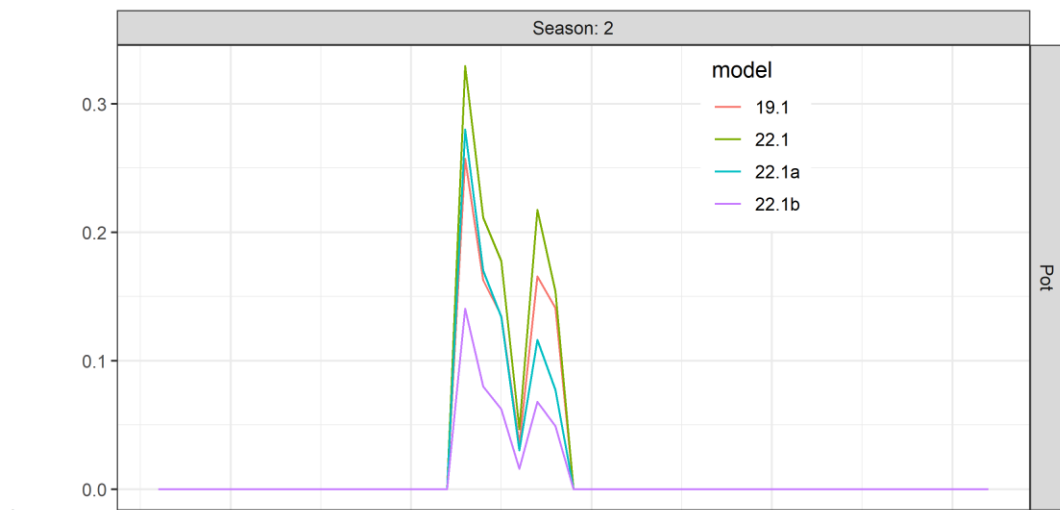
22.1a

22.1b

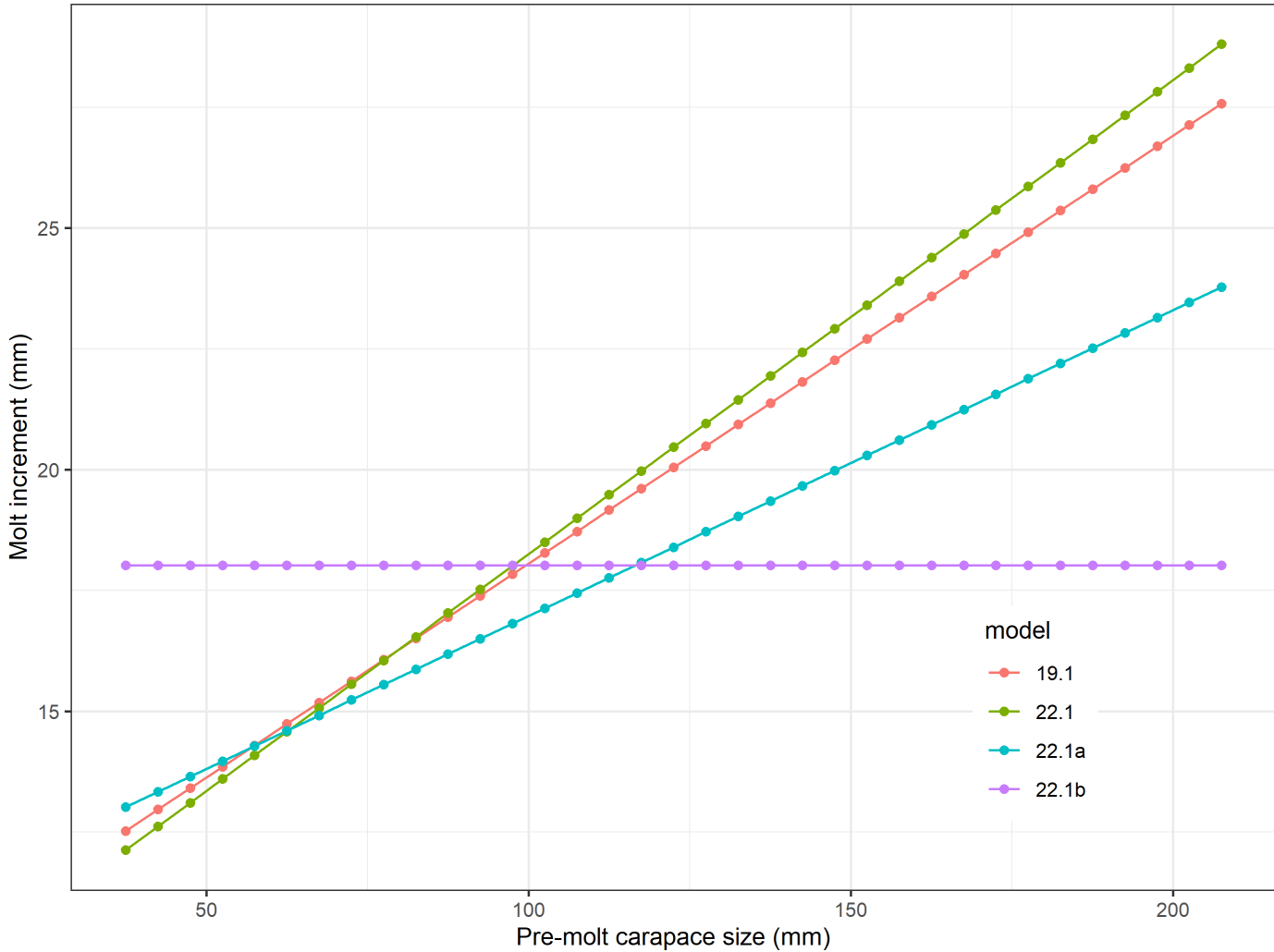
Model predicted mature  
male biomass at mating  
time

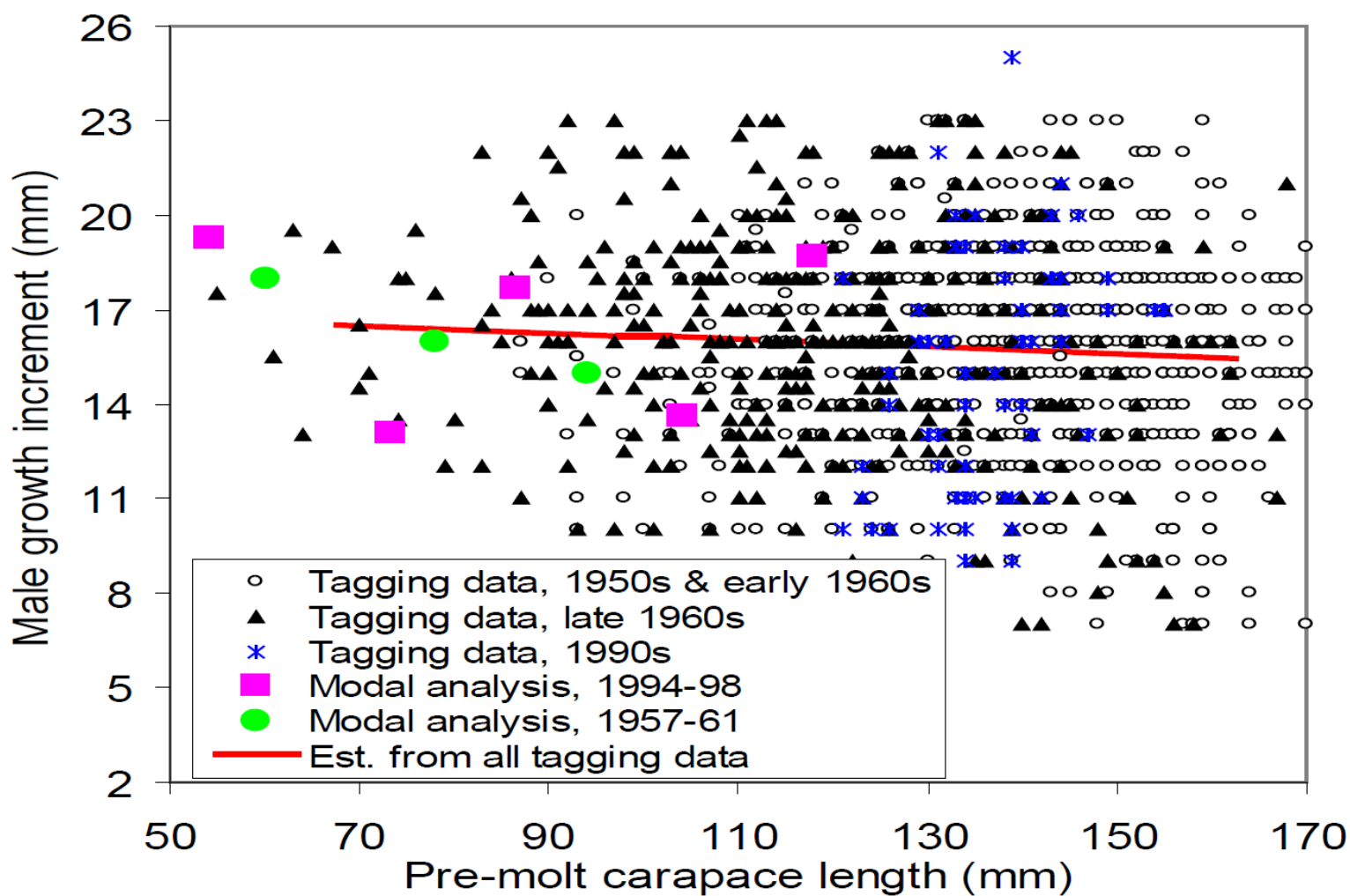


Model fits to catch data. note a difference in scales between figures (in tons)

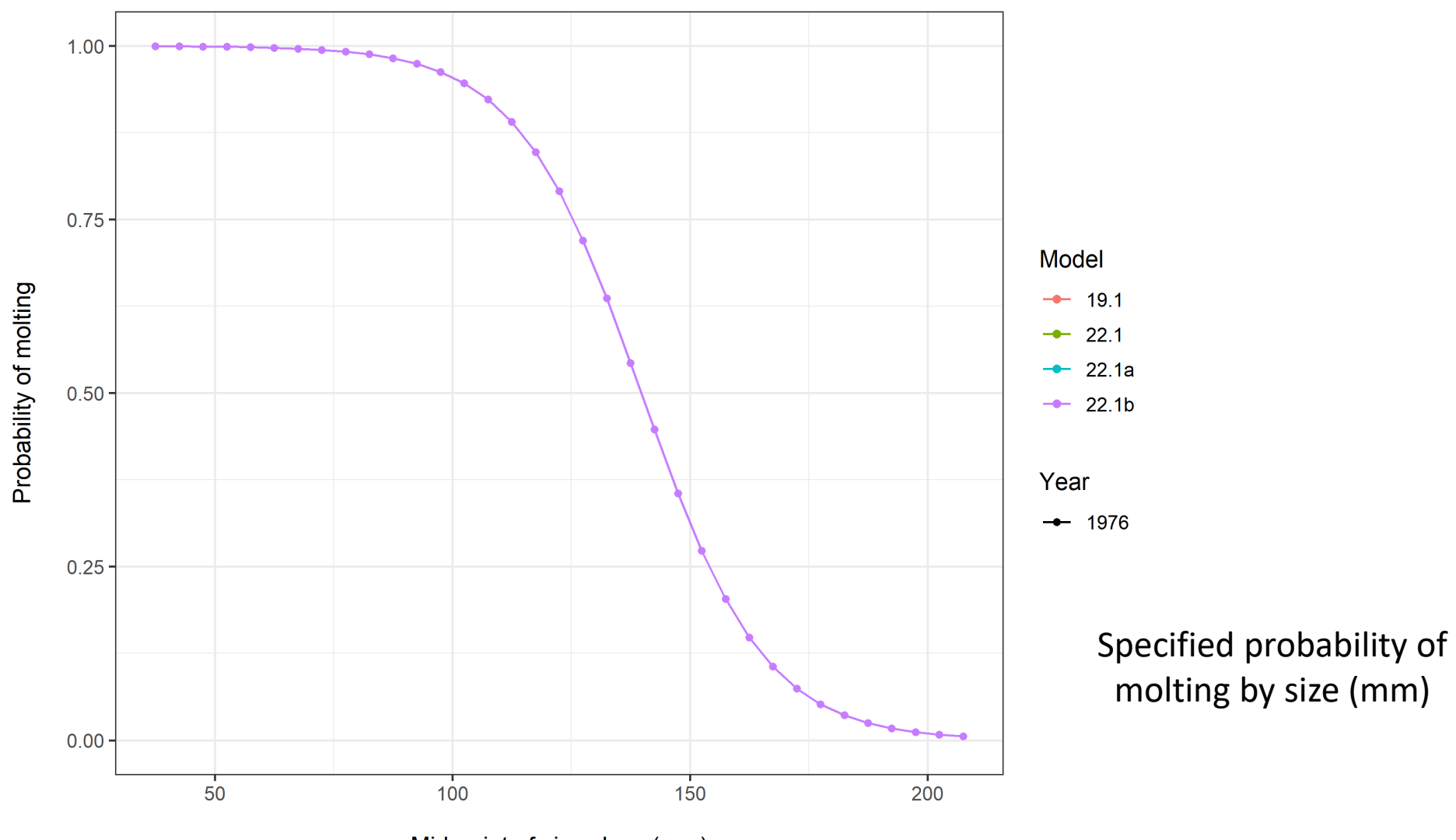


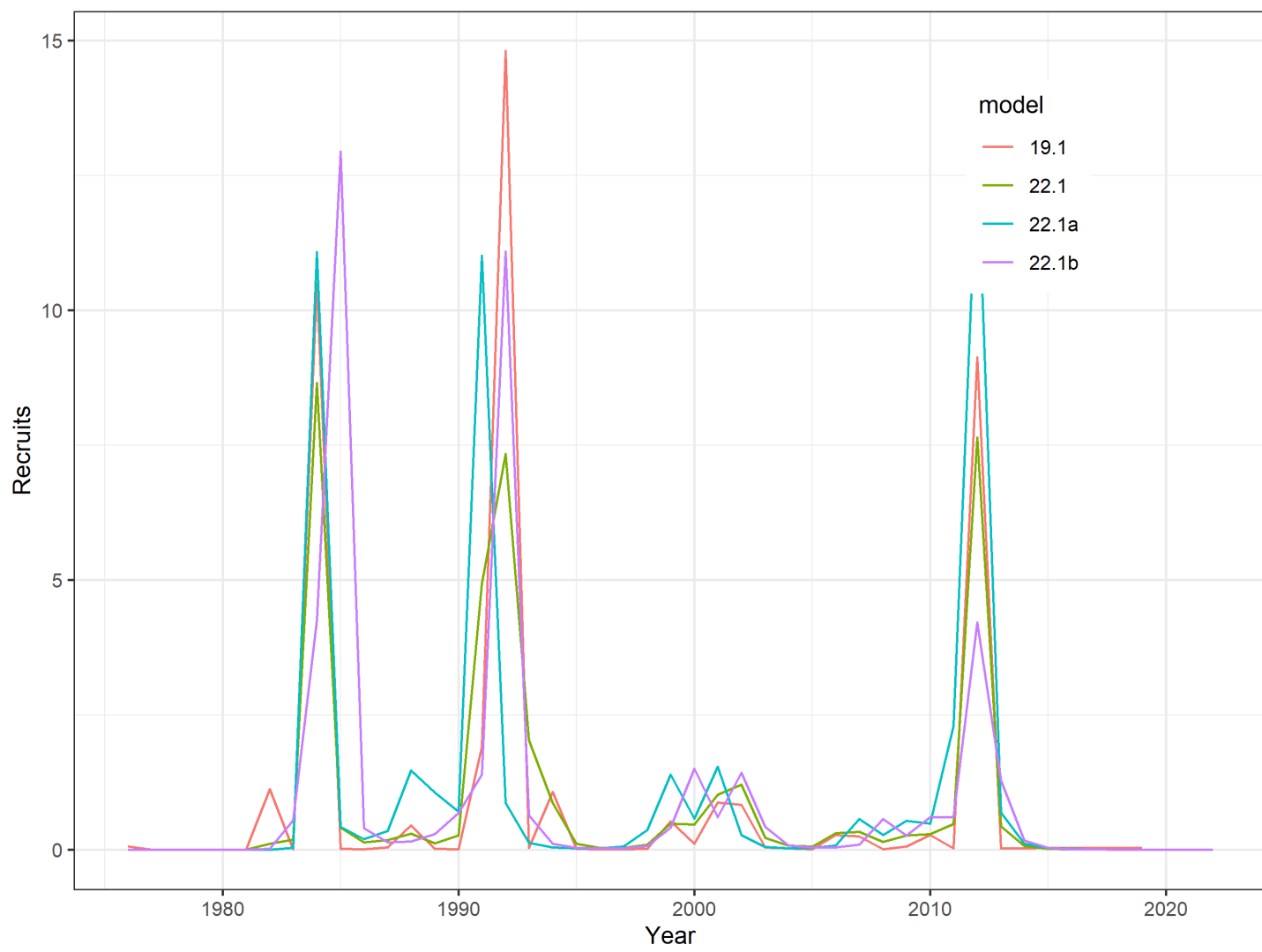
Model predicted fishing mortalities





Tagging data  
 used to  
 inform molt  
 increment  
 for Bristol  
 Bay red king  
 crab.  
 Reproduced  
 figure A2  
 from 2021  
 BBRKC  
 assessment.





Likelihood	Model.22.1	Model.22.1a	Model.22.1b
Directed fishery	-12.43	-12.45	-12.45
Bycatch	-64.40	-64.40	-64.40
Survey	24.94	33.11	31.42
Size comp survey	-4305.89	-4256.10	-4213.59
Size comp bycatch	NA	-4072.22	-4055.58

Contributions to the objective function by likelihood component.



# Author Recommendation

The **author's preferred model is 22.1b** based on the incorporation of new data source to estimate PIRKC specific bycatch mortality and modifications in assumptions about growth that are more consistent with the best available information about the biology of red king crab in the Bering Sea. Model 22.1a fits the data better, but does so by employing assumptions that do not reflect the tagging data for BBRKC.

Model	MMB	B35	F35	FOFL	OFL	M	avg_rec	Status
19.1	4893.79	1594	0.21	0.21	864.29	0.21	0.97	3.07
22.1	4703.93	1529	0.21	0.21	830.76	0.21	0.84	3.08
22.1a	7661.25	1601	0.21	0.21	1353.05	0.21	1.06	4.79
22.1b	3878.98	1709	0.21	0.21	685.07	0.21	0.96	2.27

Changes in management quantities for each scenario considered. Reported management quantities are derived from maximum likelihood estimates. Reported natural mortality is for mature males, average recruitment is for males, and status and MMB were estimates for February 15 of the completed crab year.