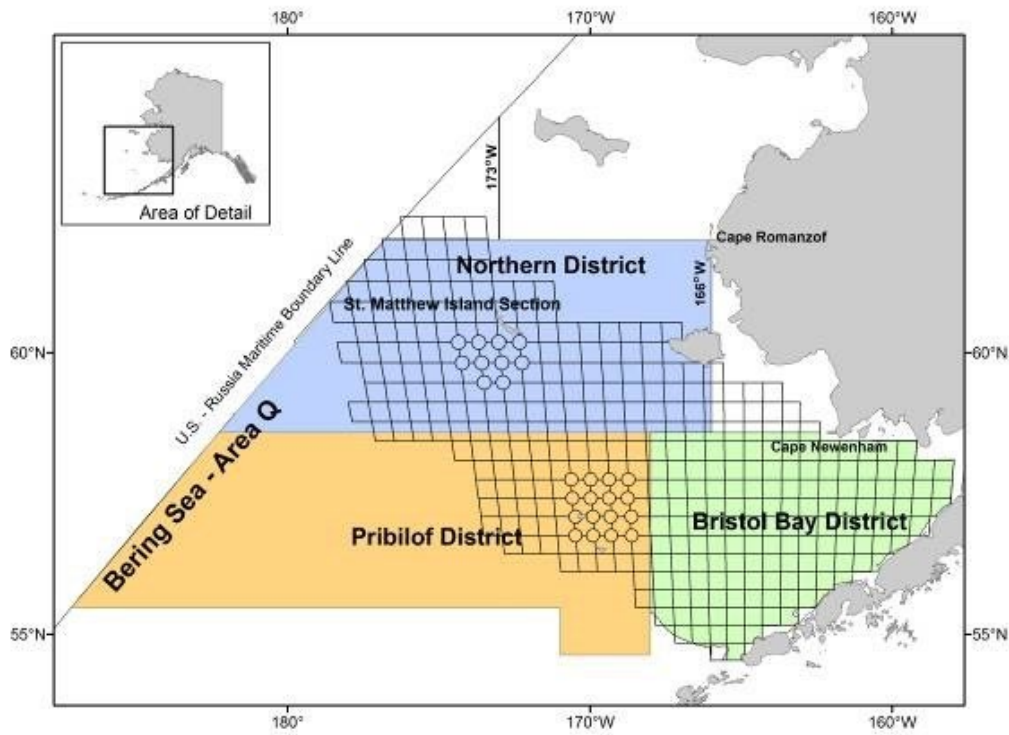


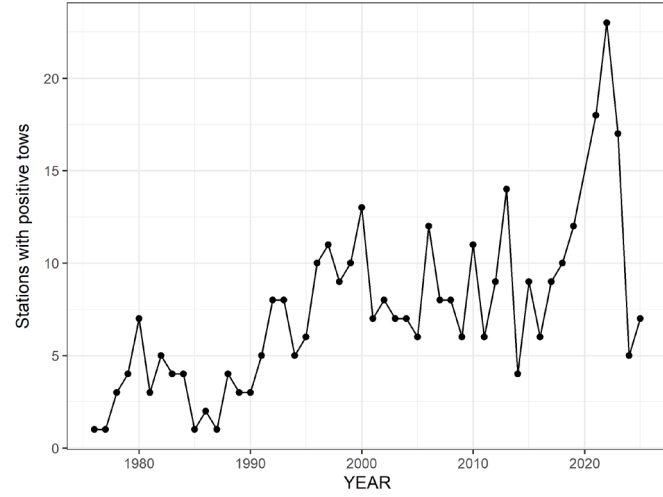
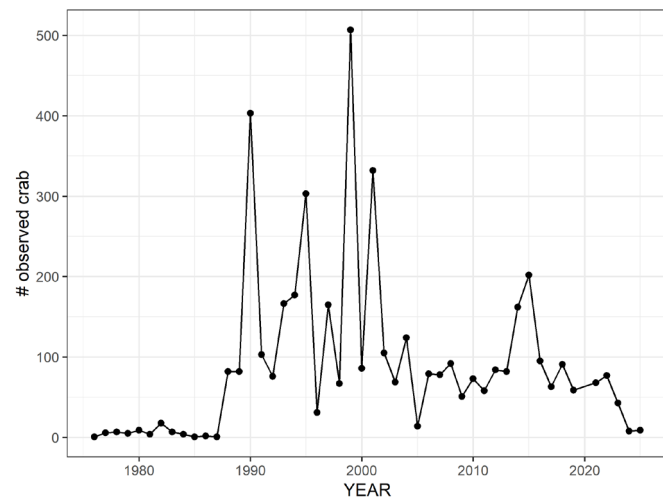
2025 assessment for Pribilof Islands red king crab

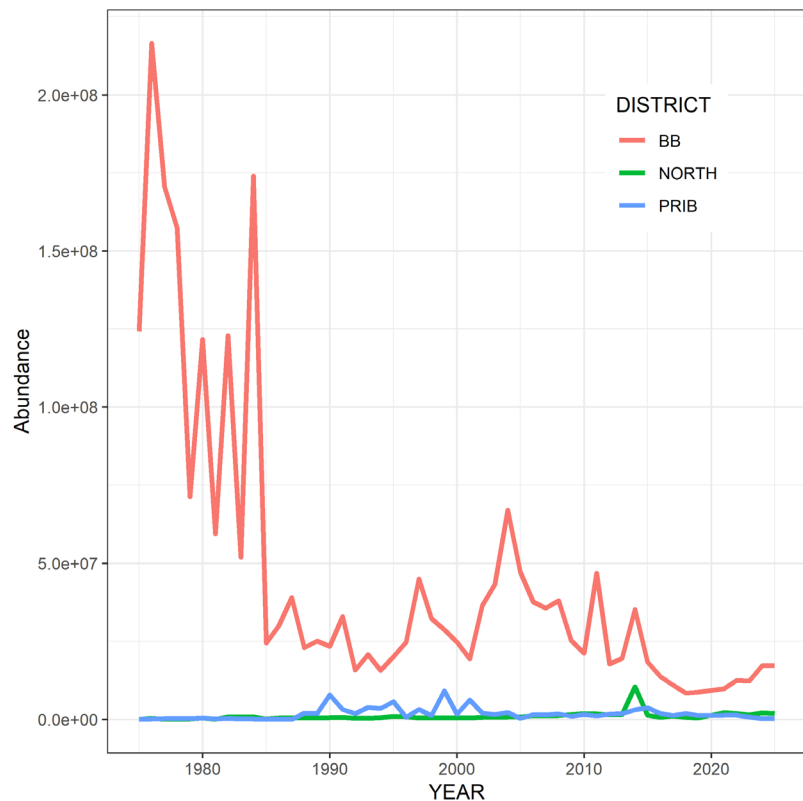
Cody Szuwalski

(updated version fixing typos, units, etc. available online)

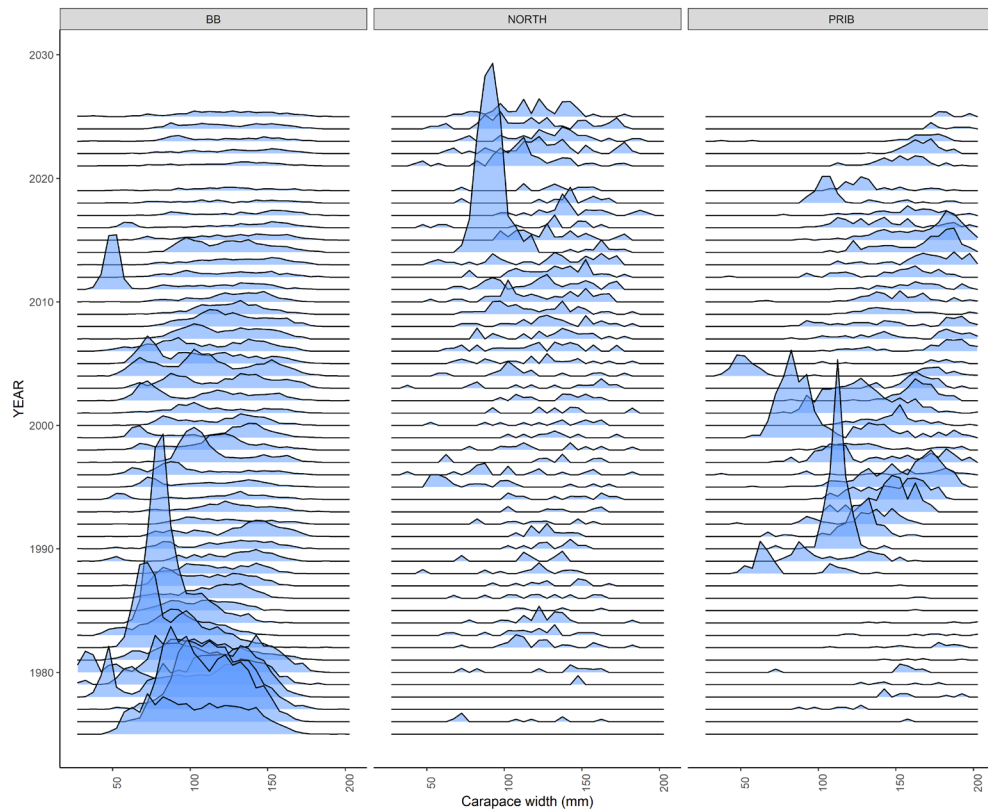


Management areas in the Bering Sea.

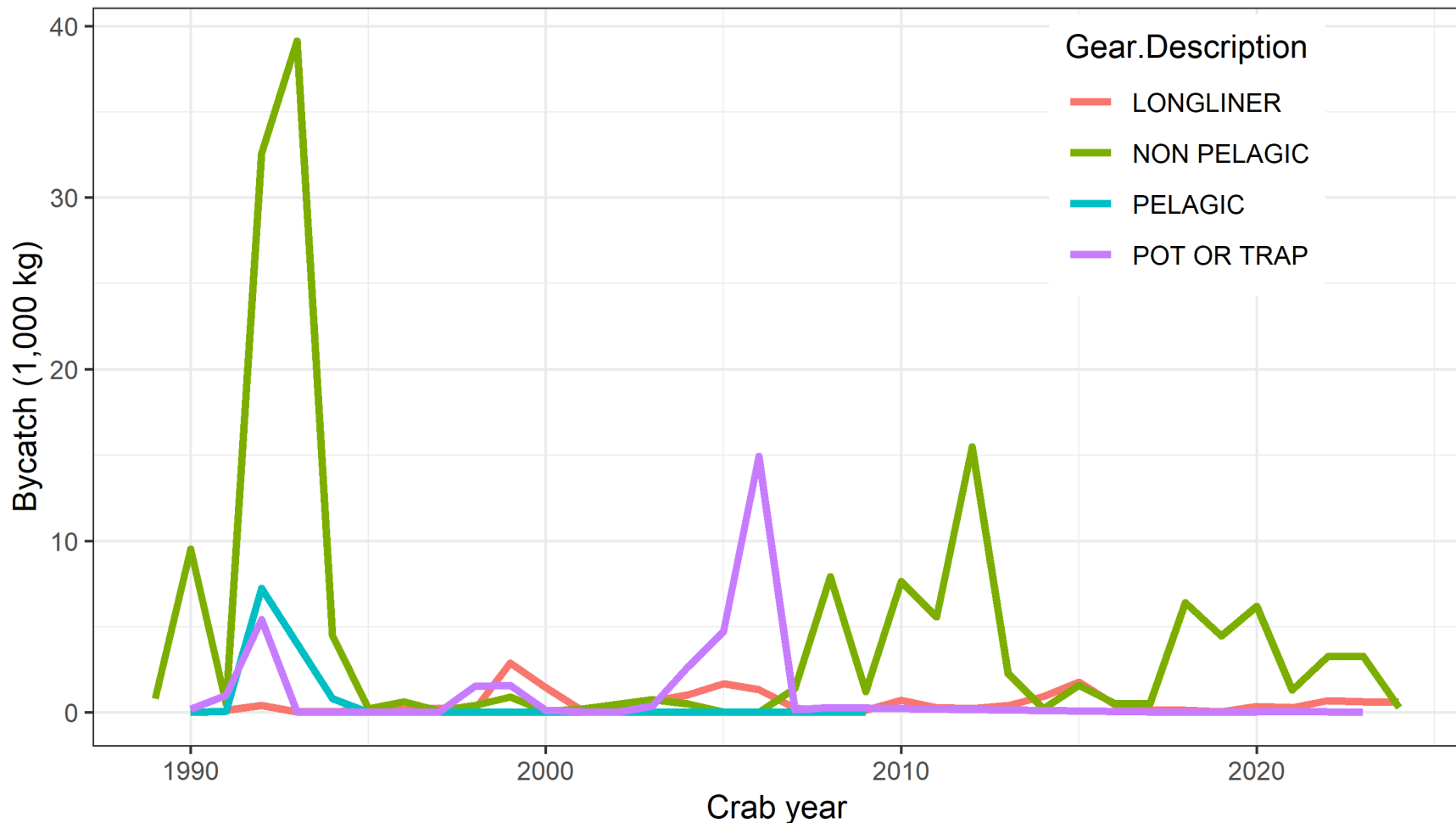




Survey estimates of abundance of male crab by district.



The number 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.



Groundfish fisheries bycatch by gear type.

A. Summary of major changes:

1. *Management*: No major changes.
2. *Input data*: Survey and catch data were updated with the most recent data in this draft.
3. *Assessment methodology*: ADFG pot survey data are included in this assessment. GMACS was updated.
4. *Assessment results*: Overfishing did not occur from 2022-2025 and the stock was not overfished as of the summer of 2025.

B. CPT and SSC comments/requests from June 2025:

The SSC request the author bring forward additional detail on the transition to the new GMACS version and diagnostics in the fall.

Given the large number of changes to GMACS over three years and the difficulty comparing across versions, little progress was made on this request.

The SSC recommends the CPT discuss and bring forward recommendation for revised time interval to align with PIBKC.

The SSC recommends this assessment remain in the GMACS framework.

C. Assessment scenarios

Models

Three assessment scenarios were considered this year:

- 22.1: accepted model from 2022
- 25.1: Same model configuration as 22.1, but updated GMACS model and survey/catch data
- 25.2: 25.1 + ADFG pot survey

Key assumptions of presented models include:

- only males are modeled, with size composition data representing all males observed and the index of abundance representing crab >120 mm carapace length (i.e. 'mature'),
- the probability of molting is a declining logistic function of size that is specified based on the BBRKC assessment,
- a single survey selectivity is estimated as a logistic function, but catchability is specified based on values estimated in the BBRKC assessment,
- growth increment is estimated with a prior based on BBRKC tagging data and is constant across size,
- natural mortality is specified as 0.21 based on an assumed longevity of ~25 years and Hamel's (2015) study relating longevity to natural mortality,
- total and retained fishery selectivity are logistic curves fixed at values estimated in the BBRKC assessment,
- all non-directed bycatch is lumped into a single 'fishery' for which a logistic selectivity is estimated,
- recruitment is estimated yearly and is allocated to the first 7 size bins

ADFG pot surveys

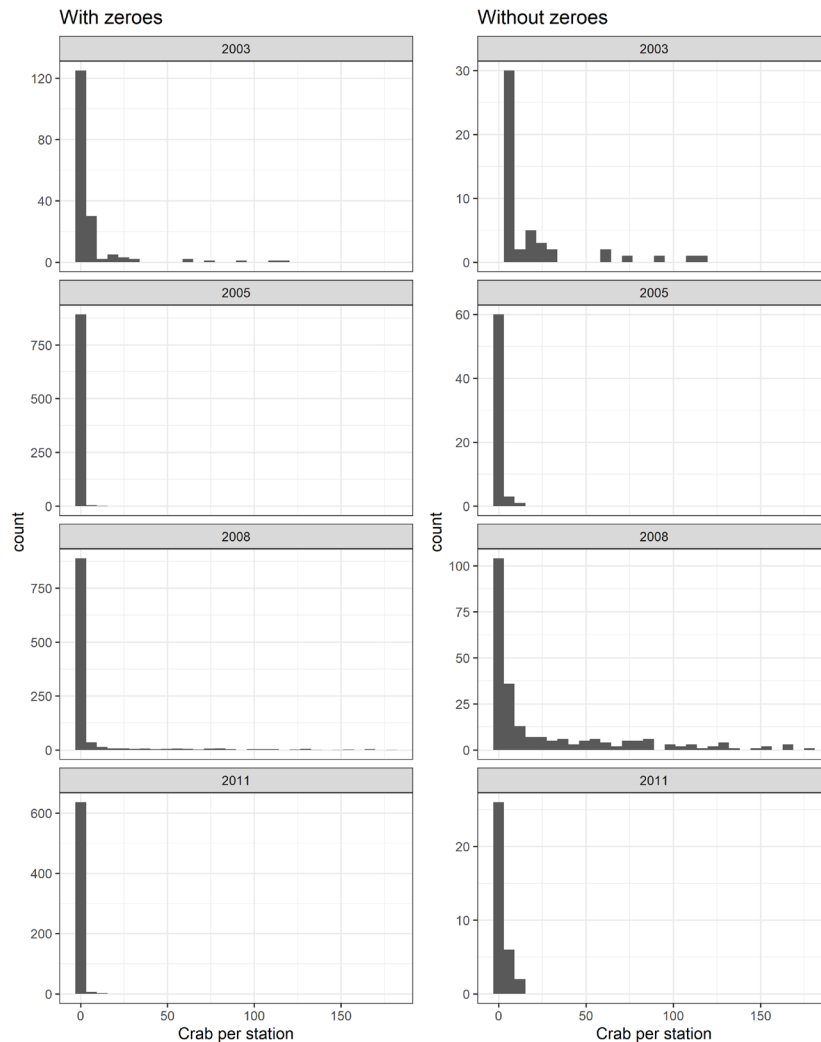
- 4 years
 - 2003, 2005, 2008, 2011



Locations of stations of ADFG pot surveys around the Pribilof Islands by year.

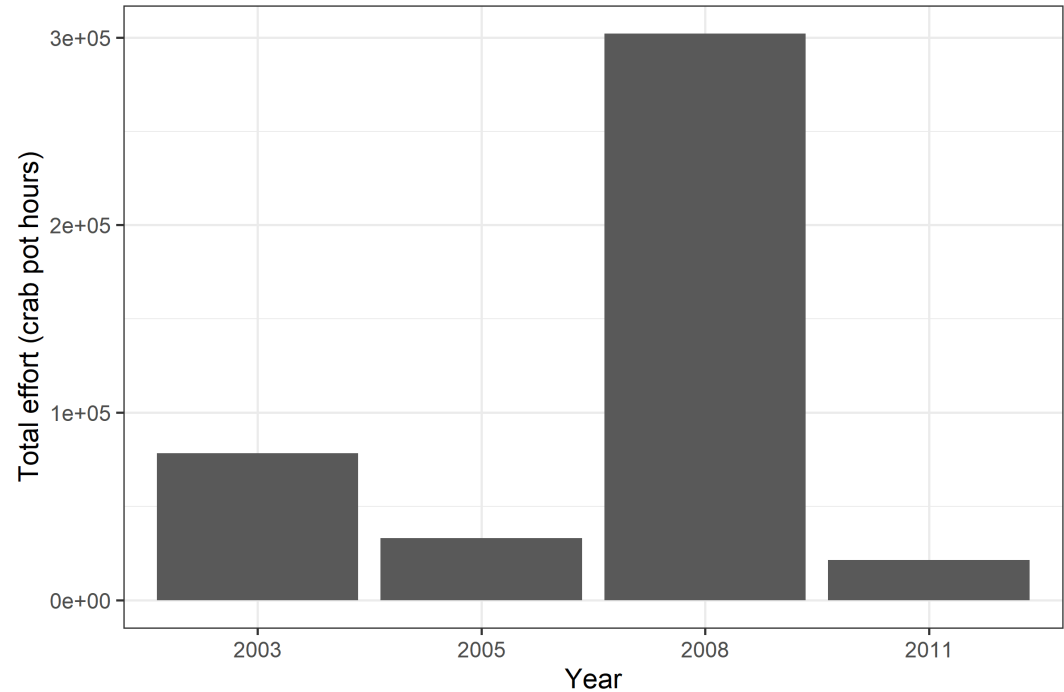
ADFG pot surveys

- 4 years
 - 2003, 2005, 2008, 2011
- Generally relatively few crab per station

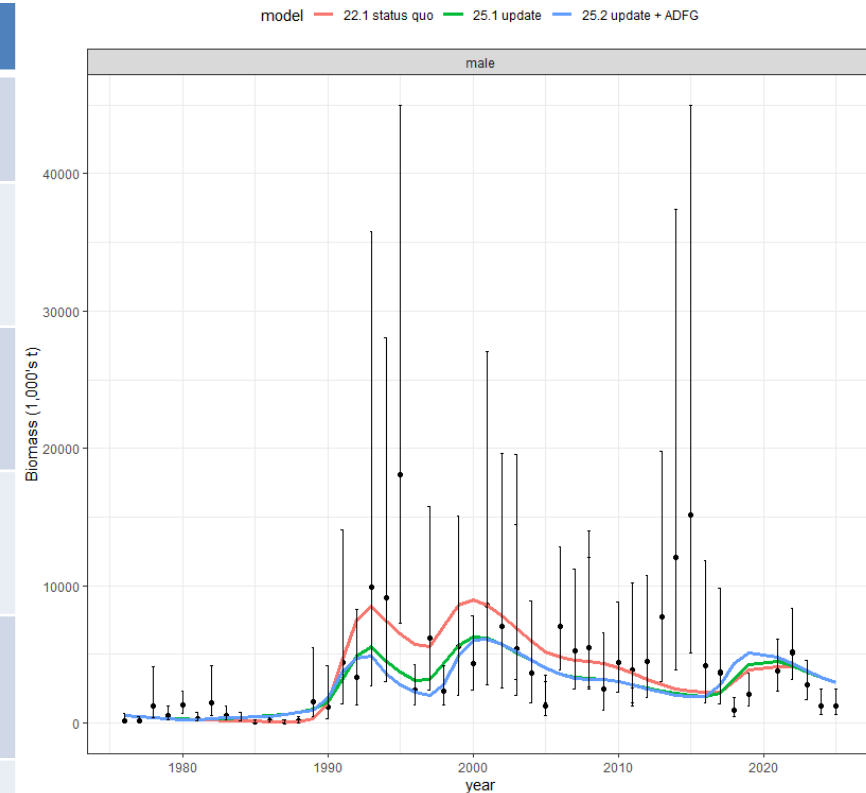


ADFG pot surveys

- 4 years
 - 2003, 2005, 2008, 2011
- Generally relatively few crab per station
- Highest sampling effort in 2008

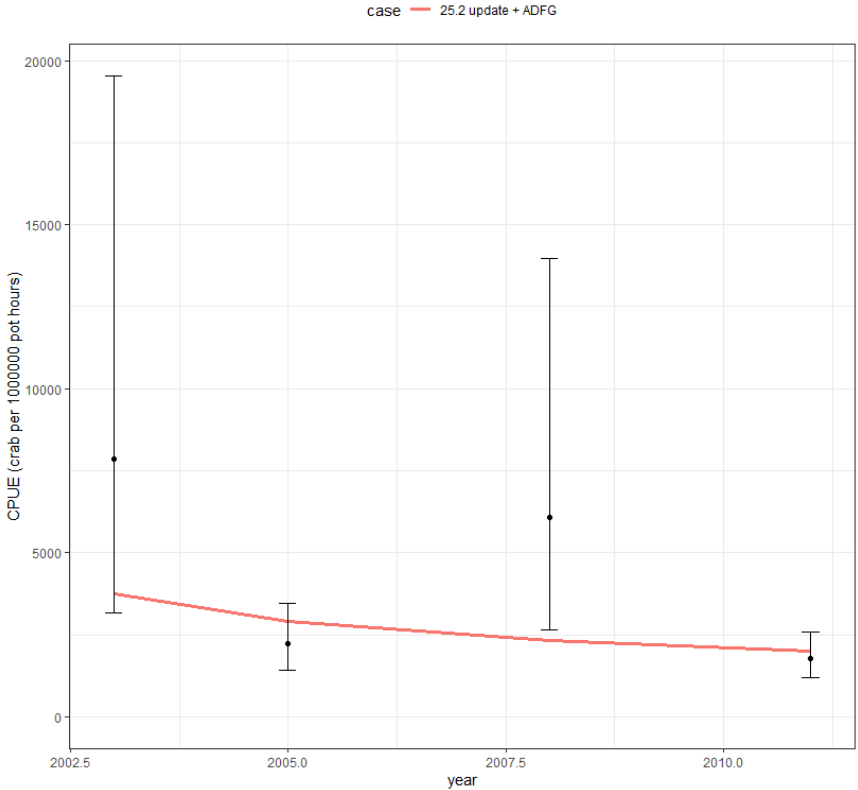


Data source	Comments
NMFS survey	Poor fits to last two years; change in fit to early years



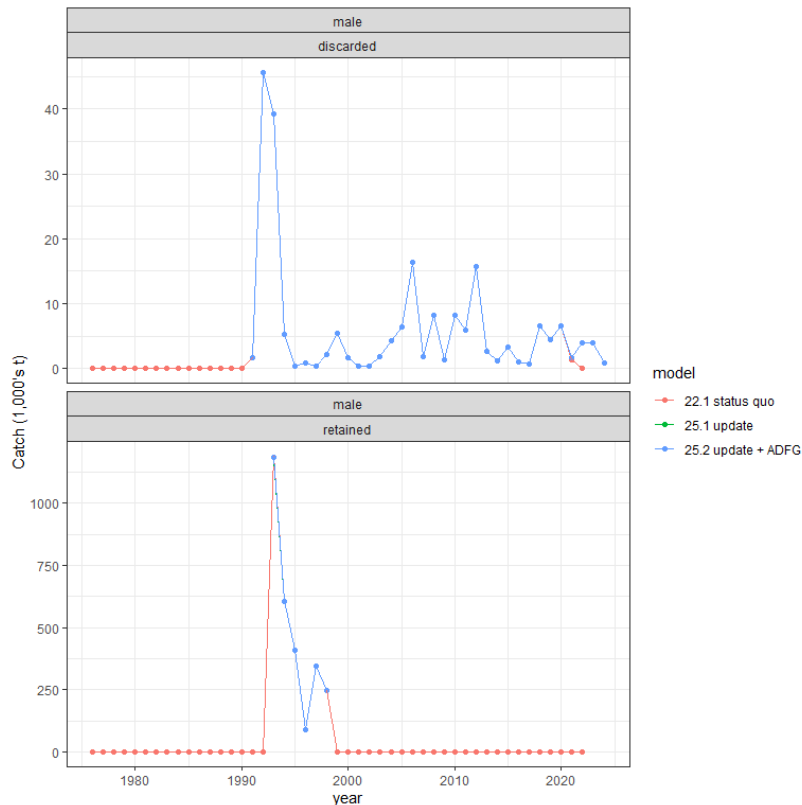
Model fits to the observed mature male biomass at survey in *tonnes.

Data source	Comments
NMFS survey	Poor fits to last two years; change in fit to early years
ADFG pot	Large CVs; one missed



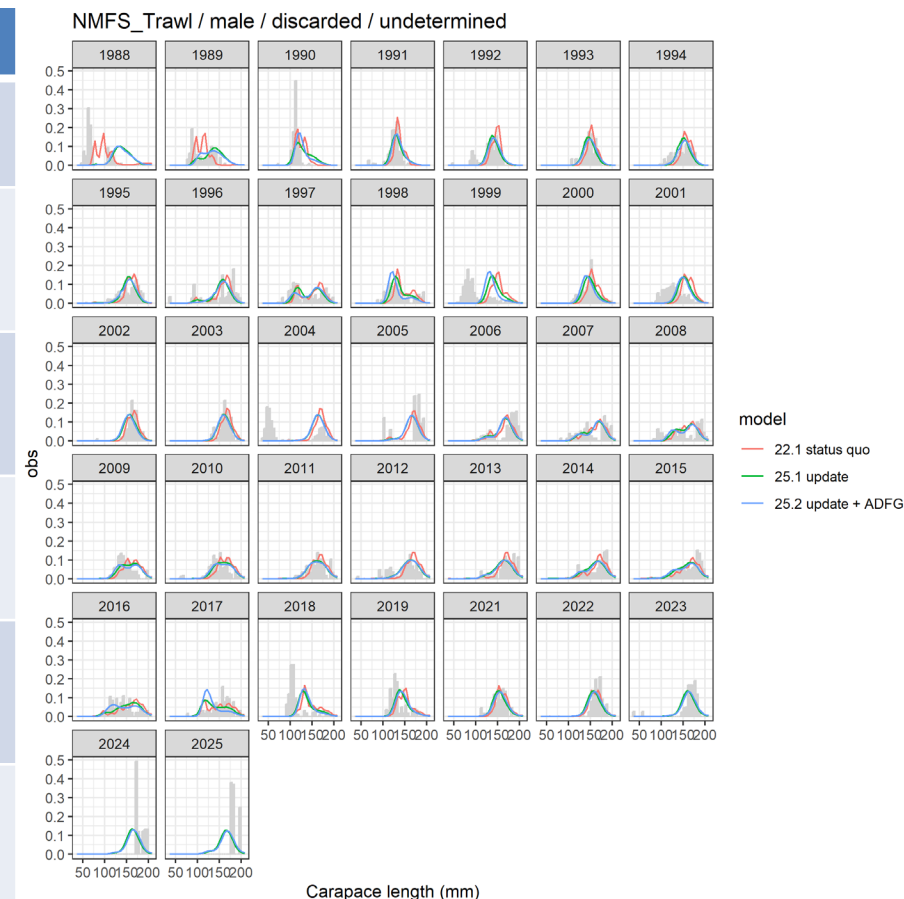
Model fits to the ADFG pot survey data.

Data source	Comments
NMFS survey	Poor fits to last two years; change in fit to early years
ADFG pot	Large CVs; one missed
Catches	Both well fit



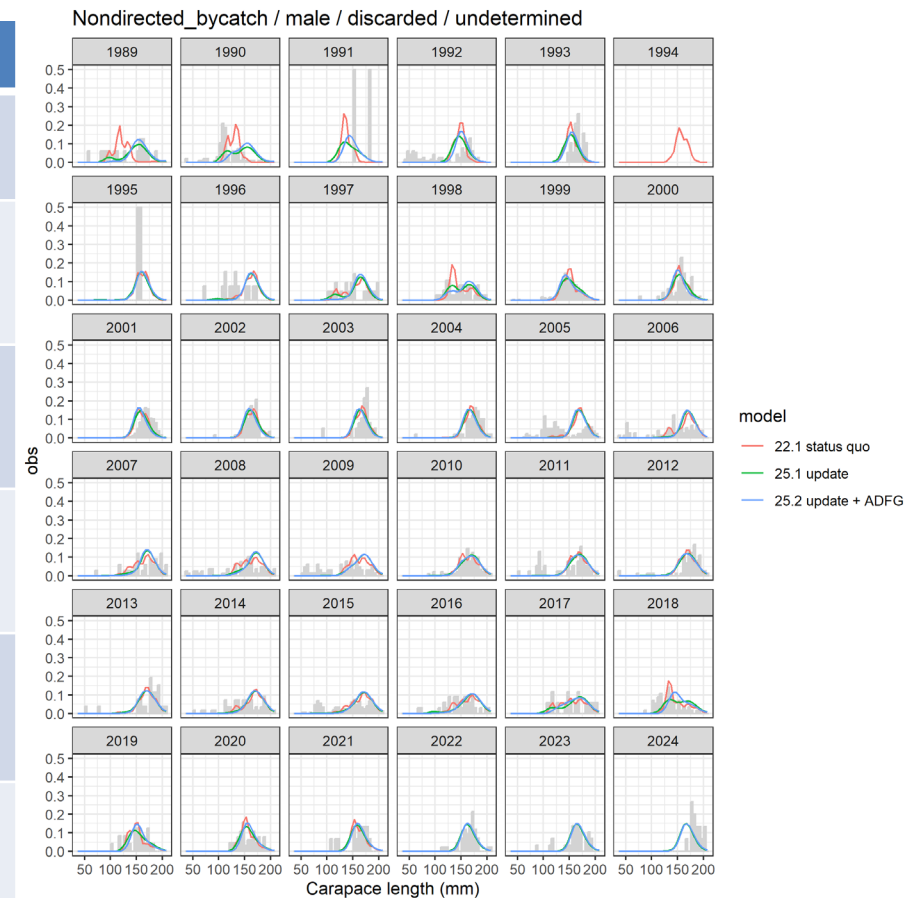
Model fits to non-directed bycatch data (top) and retained catch data (bottom) in *tonnes.

Data source	Comments
NMFS survey	Poor fits to last two years; change in fit to early years
ADFG pot	Large CVs; one missed
Catches	Both well fit
Survey size comps	Acceptable fits, particularly when samples sizes were larger



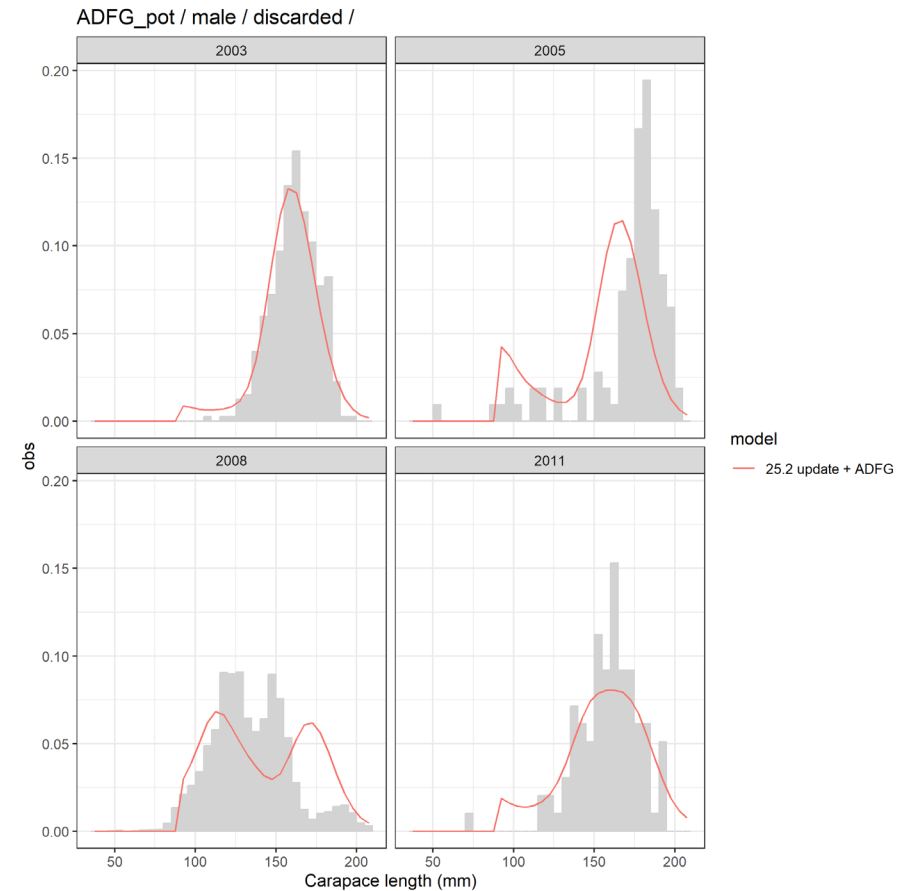
Model fits (lines) to the NMFS bottom trawl survey size composition data (grey bars).

Data source	Comments
NMFS survey	Poor fits to last two years; change in fit to early years
ADFG pot	Large CVs; one missed
Catches	Both well fit
Survey size comps	Acceptable fits, particularly when samples sizes were larger
Nondirected bycatch size comps	Well fit in some years; others had a lack of fit in smaller size bins



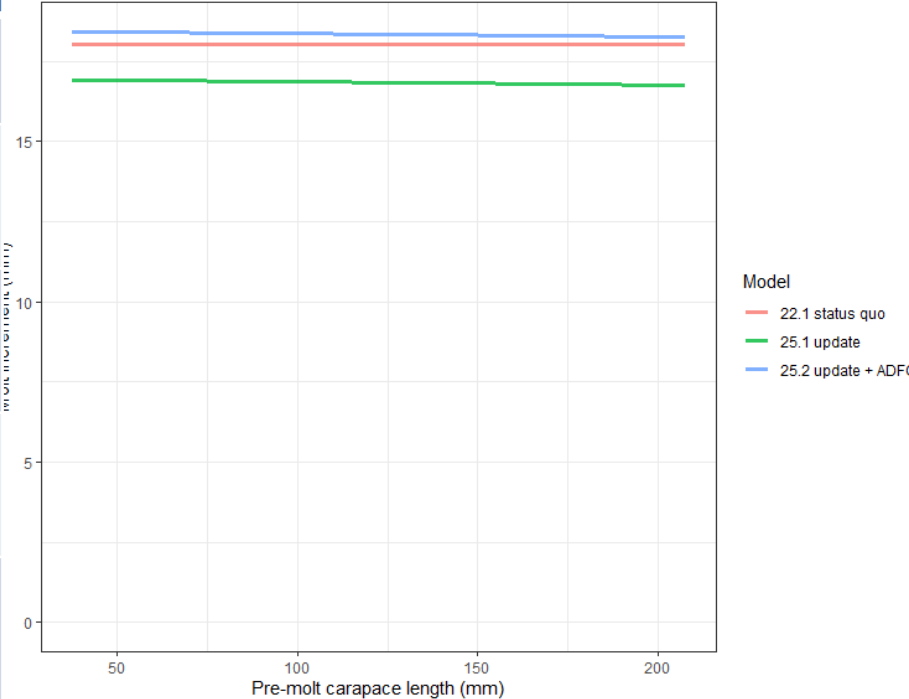
Model fits (lines) to the nondirected bycatch size composition data (grey bars).

Data source	Comments
NMFS survey	Poor fits to last two years; change in fit to early years
ADFG pot	Large CVs; one missed
Catches	Both well fit
Survey size comps	Acceptable fits, particularly when samples sizes were larger
Nondirected bycatch size comps	Well fit in some years; others had a lack of fit in smaller size bins
ADFG pot size comps	2003 and 2011 well fit; 2005 and 2008 less so



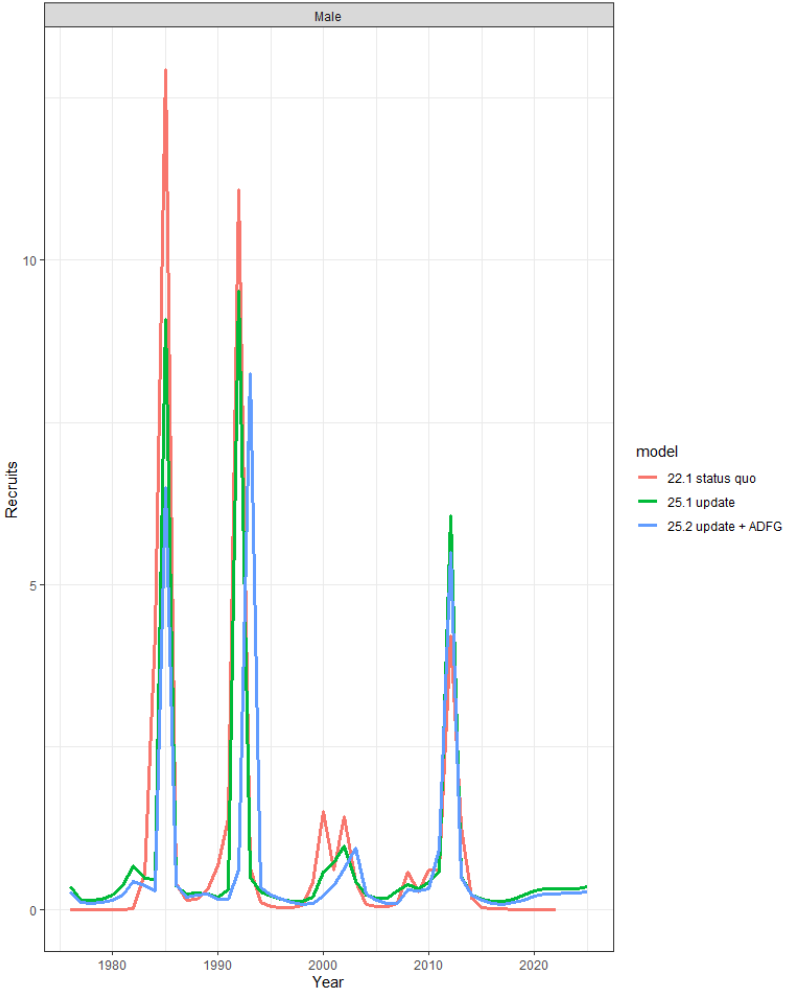
Model fits (lines) to the ADFG pot survey size composition data (grey bars).

Population process	Comments
Growth	Similar estimates, but subject to strong prior



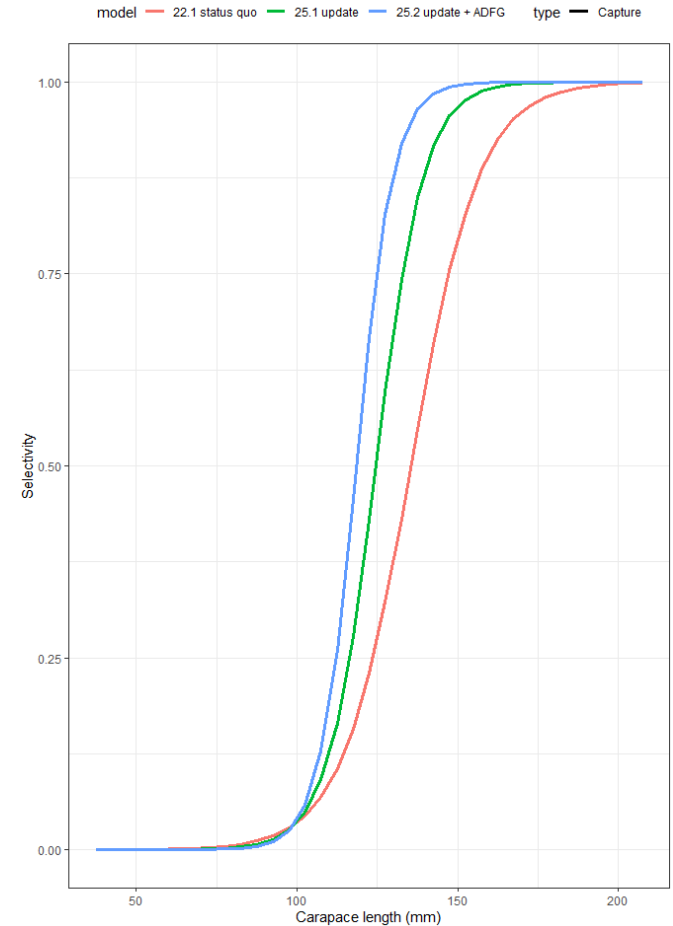
Model estimates of molt increment at size.

Population process	Comments
Growth	Similar estimates, but subject to strong prior
Recruitment	Similar patterns across models; slight disagreement on timing



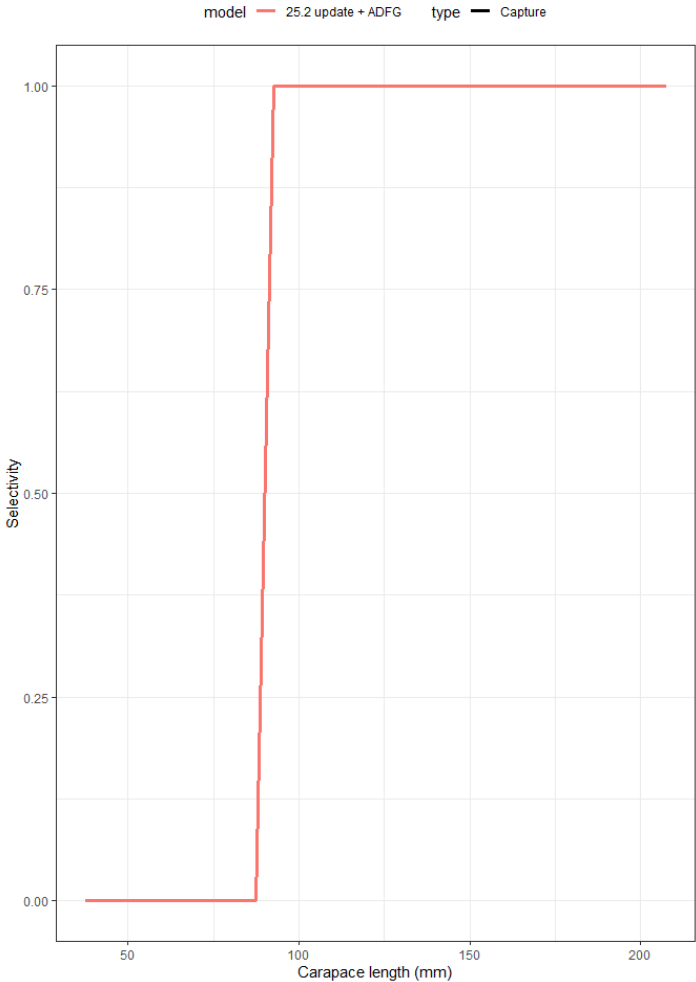
Estimated recruitment by model.

Population process	Comments
Growth	Similar estimates, but subject to strong prior
Recruitment	Similar patterns across models; slight disagreement on timing
Survey selectivity	Fairly large differences among models



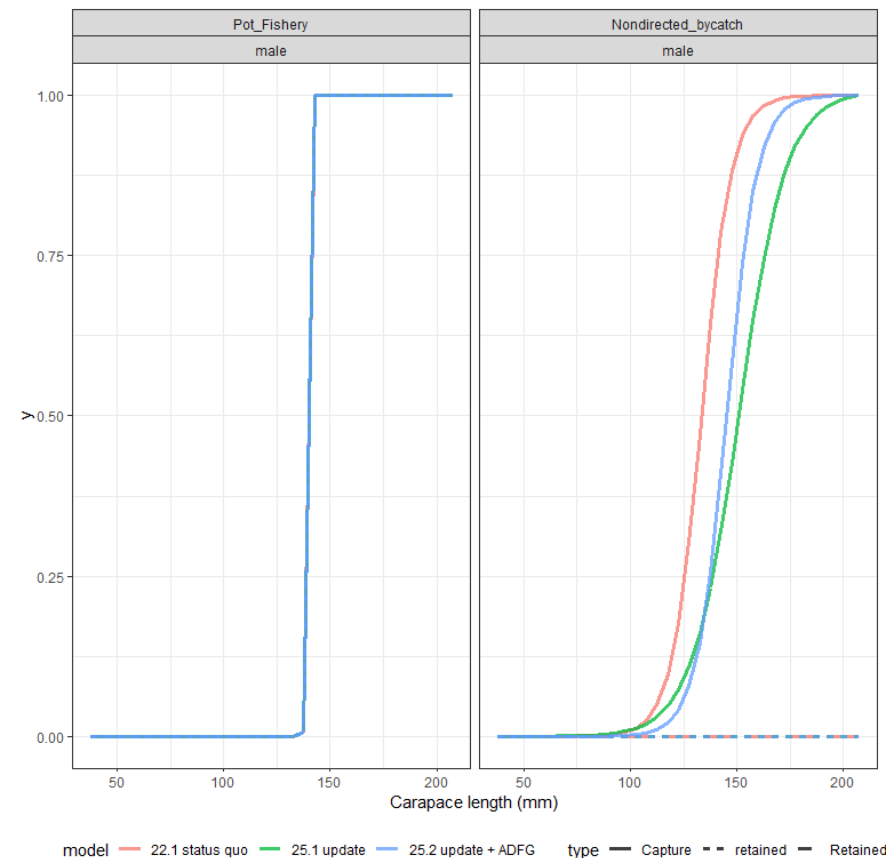
Estimated NMFS bottom trawl survey selectivity at size (x-axis)

Population process	Comments
Growth	Similar estimates, but subject to strong prior
Recruitment	Similar patterns across models; slight disagreement on timing
Survey selectivity	Fairly large differences among models
ADFG selectivity	Essentially knife-edged



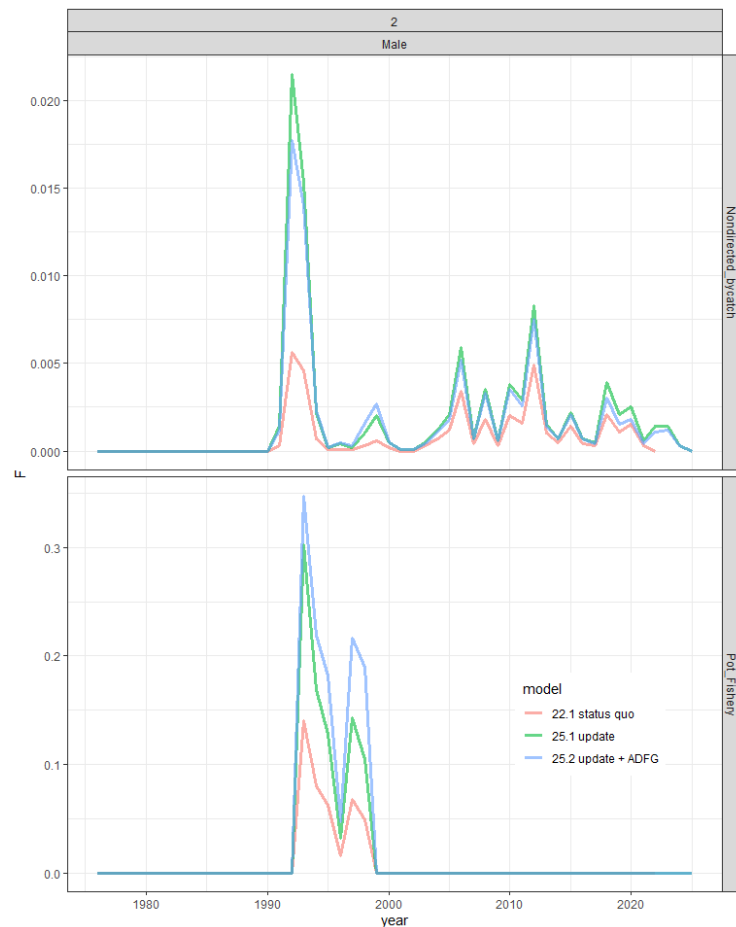
Estimated ADFG pot survey selectivity

Population process	Comments
Growth	Similar estimates, but subject to strong prior
Recruitment	Similar patterns across models; slight disagreement on timing
Survey selectivity	Fairly large differences among models
ADFG selectivity	Essentially knife-edged
Fishery selectivity	Directed fixed; Fairly large differences for bycatch estimates



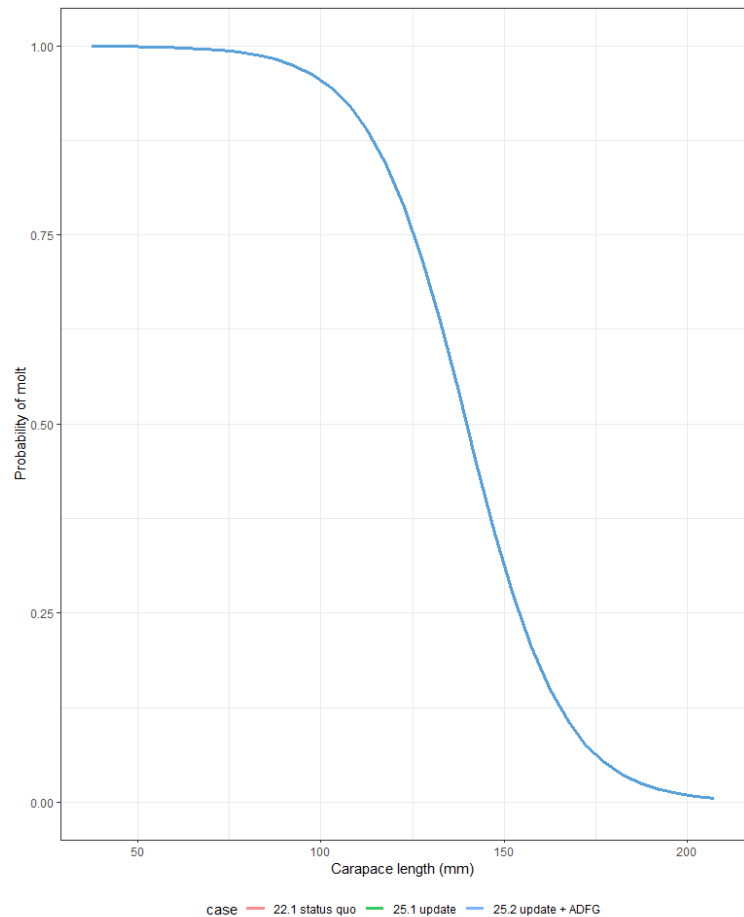
Estimated selectivities by fishing fleet for capture and retained catches.

Population process	Comments
Growth	Similar estimates, but subject to strong prior
Recruitment	Similar patterns across models; slight disagreement on timing
Survey selectivity	Fairly large differences among models
ADFG selectivity	Essentially knife-edged
Fishery selectivity	Directed fixed; Fairly large differences for bycatch estimates
Fishing mortality	Large differences for directed fishery, smaller for non-directed



Estimated fishing mortalities for male crab in the directed and non-directed fisheries.

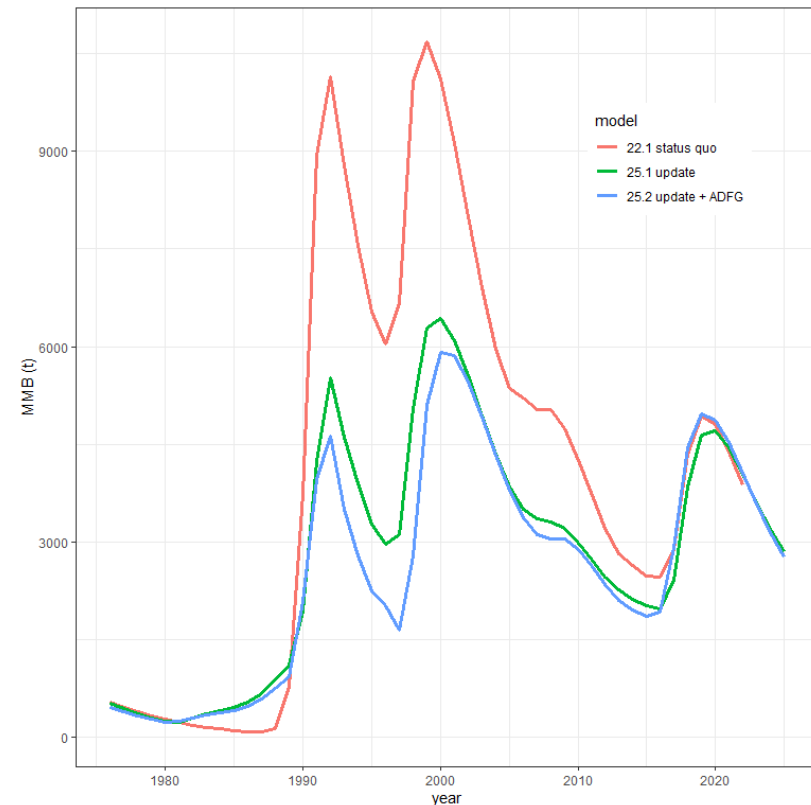
Population process	Comments
Growth	Similar estimates, but subject to strong prior
Recruitment	Similar patterns across models; slight disagreement on timing
Survey selectivity	Fairly large differences among models
ADFG selectivity	Essentially knife-edged
Fishery selectivity	Directed fixed; Fairly large differences for bycatch estimates
Fishing mortality	Large differences for directed fishery, smaller for non-directed
Maturity	Specified based on BBRKC



Probability of molting. Probability of molting at size was specified based on BBRKC for all models, so only one line appears.

Recommendations

- Use model 25.2
 - Data are sparse; more data may fill holes
- Tier 4 OFL
 - 489 t
- Buffer
 - 25%: ABC = 367 t



Estimated mature male biomass at mating time in tonnes.

	MMB	BMSY	Status	OFL	FMSY
22.1	3616	1708	2.27	685	0.21
25.1 update	2657	1297	2.20	503	0.21
25.2 + ADFG	2586	1283	2.16	489	0.21

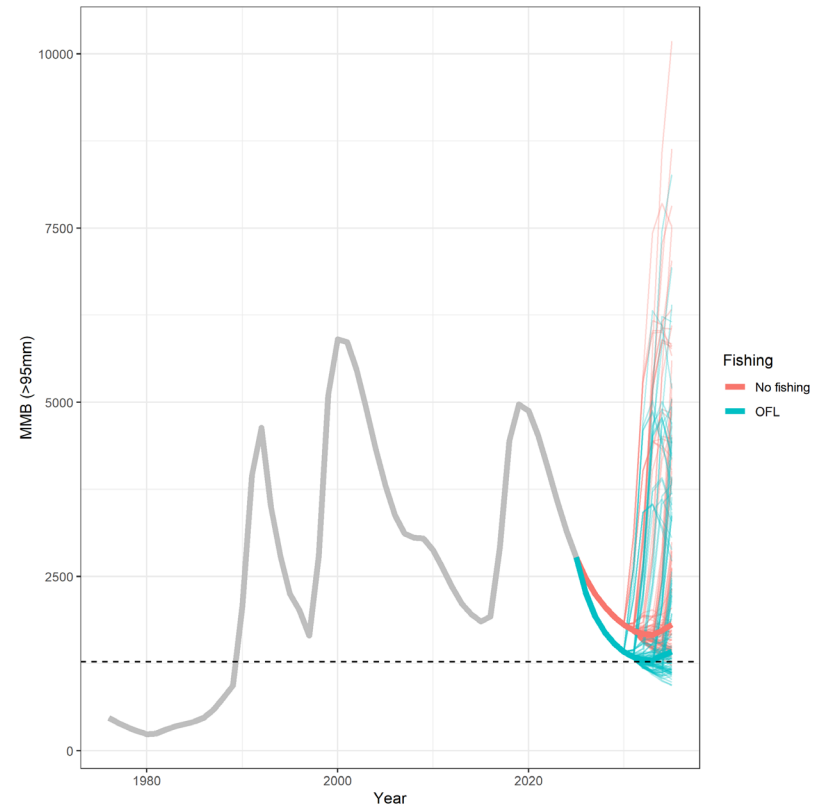
*table has been updated

Recommendations

- Use model 25.2
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 - 25%: ABC = 367 t
- Stock may come close to BMSY before next assessment

	MMB	BMSY	Status	OFL	FMSY
22.1	3616	1708	2.27	685	0.21
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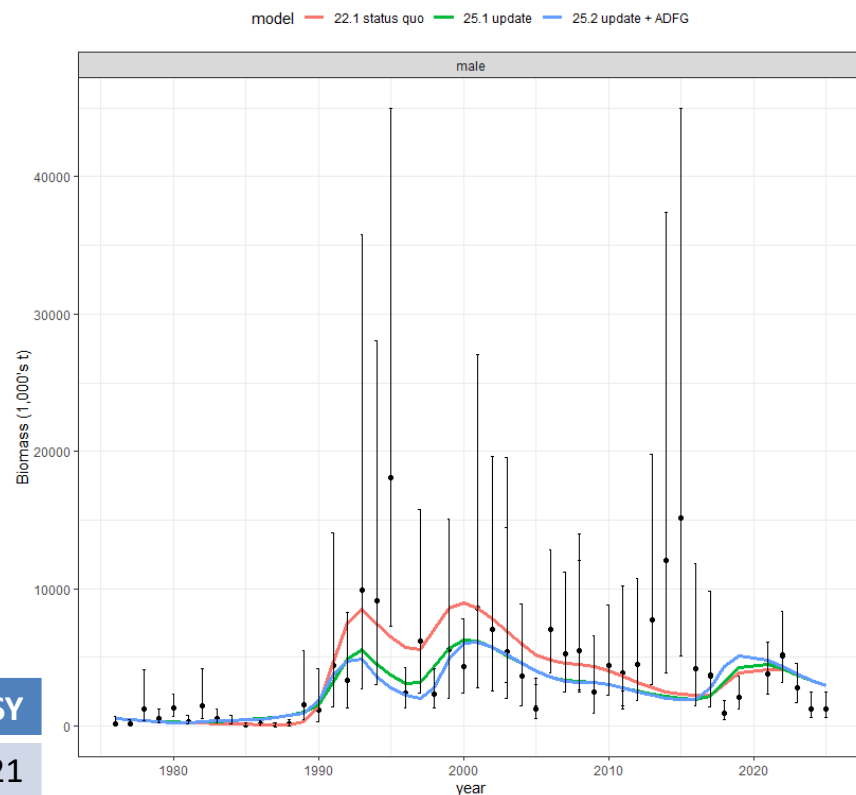
Projected MMB under no fishing and fishing at the OFL (10 years)

Recommendations

- Use model 25.2
 - Data are sparse; more data may fill holes
- Tier 4 OFL
 - 489 t
- Buffer
 - 25%: ABC = 367 t
- Stock may come close to BMSY before next assessment
- Status may be considerably worse if trend continues given lack of fit to terminal years (final year observation is just under BMSY)

	MMB	BMSY	Status	OFL	FMSY
22.1	3616	1708	2.27	685	0.21
25.1 update	2657	1297	2.20	503	0.21
25.2 + ADFG	2586	1283	2.16	489	0.21

*table has been updated



Estimated mature male biomass at survey time in *tonnes.