

2026-05 Tanner Crab Report

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AFSC/NMFS/NOAA

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Topics

- SSC/CPT Comments
- New Analyses
 - “new” maturity workflow
 - *Chionoecetes* hybrids: discussed separately
- GMACS Tanner model development



CPT/SSC Comments

Chionoecetes stock assessment authors were asked to present a comparison of results from models using the legacy versus new maturity workflow data sets at the May 2026 CPT meeting.

- *Results discussed in document and here*

Tanner and snow crab stock authors were asked to complete three model sensitivity runs (including size composition and abundance data) with hybrids: 1) included in survey data; 2) included in catch data; 3) included in both survey and catch data.

- *Results discussed in document and during “Hybrids” topic*

The SSC recommends that authors and CPT provide a justification if catches are set to the OFL in projections, or use a more realistic estimate of future catches as is done in groundfish assessments.

- *The Tanner crab assessment results provide projection results from a range of fishing mortality rates (fractions of F_{OFL})*



CPT/SSC Comments

The SSC thanks the assessment author for their extensive work documenting and addressing previous SSC and CPT requests. While the SSC appreciates the author's attention to detail, the SSC highlights that the SAFE and the included appendices are over 400 pages long. The SSC suggests additional streamlining of the material included in future assessment documents.

- 2025 assessment doc was reduced from 800 pages in 2024. Concrete suggestions for how/where to reduce the document further are welcome. Recent requested additions (ESPs, risk tables, likelihood profiles, Tier 4 alternative models) necessarily increase the size of the document, as does the requirement to document the sequential addition of new data and model changes from the base model to the candidate model(s).*

The SSC agrees (with the CPT) that focus should remain on transitioning this assessment into the GMACs framework...The CPT suggested starting from inputting parameters via a .PIN file in the bridging analyses and then work towards estimating parameter values

- Sept 2025: G25.05 was not brought forward due to unexpected (and currently unresolved) problems encountered with optimizing the model (the optimization failed after ~150 steps after generating an invalid gradient vector required to update the parameter values).*
- May 2026: A number of issues have been resolved including: adding Tanner-like features to GMACS (maturity ogives as data and likelihood components; selectivity curves, comparable output); initial parameter values, R code to directly compare GMACS and TCSAM02 model results. Results are discussed in the document and here.*



Assessment Model Results with “New” Maturity Workflow



Male Maturity Ogives

type
new
old

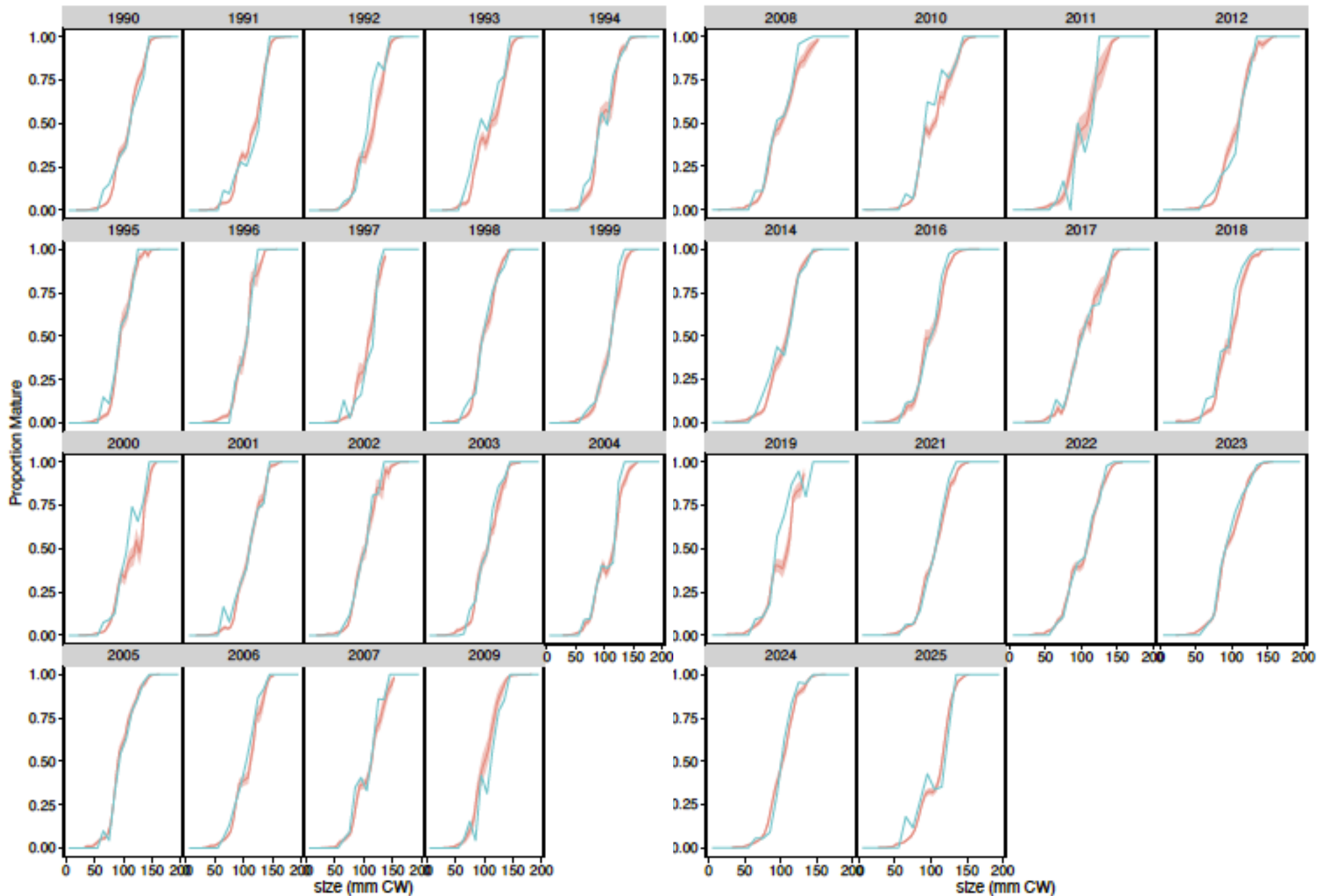
- based on CH, CW measurements

Old

- no accounting for spatial structure or sampling
- 10 mm bin sizes
- no estimates of uncertainty

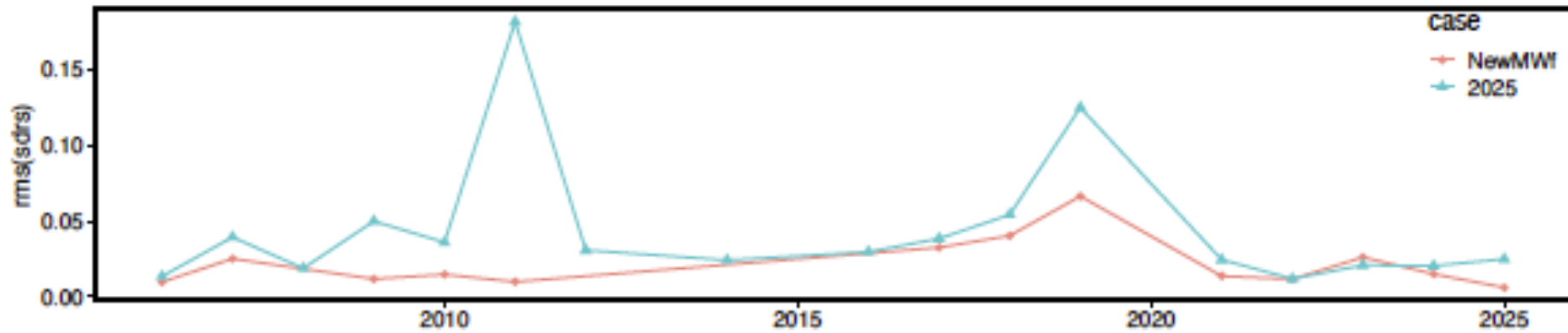
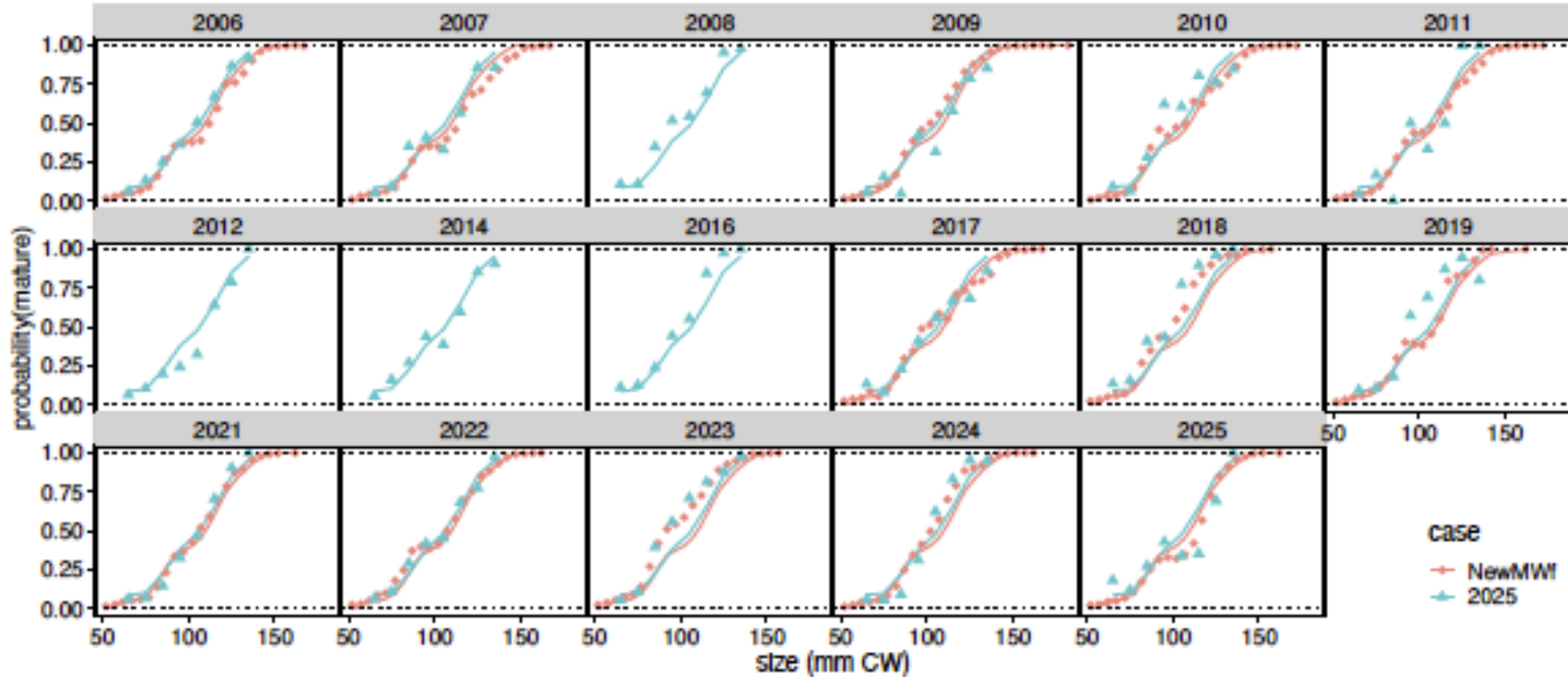
New

- uses sdmTMB to account for spatial structure and sampling
- 5 mm bin sizes
- estimates uncertainty



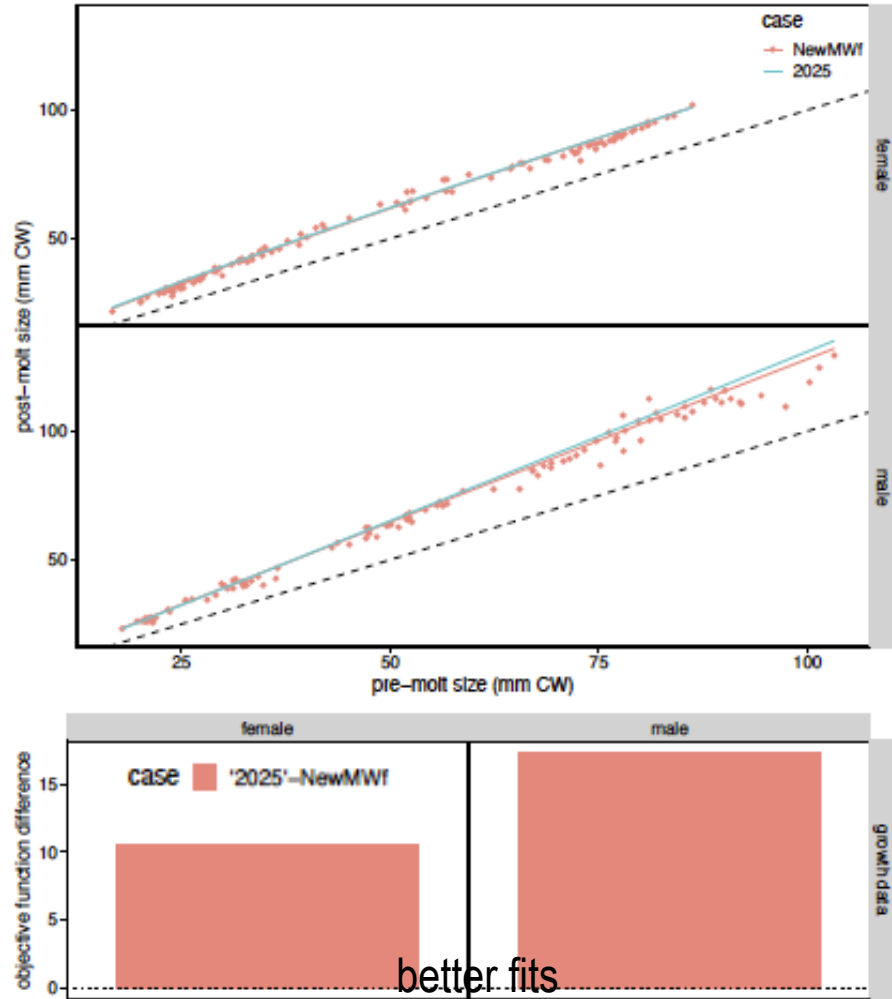
Model fits

Ogives

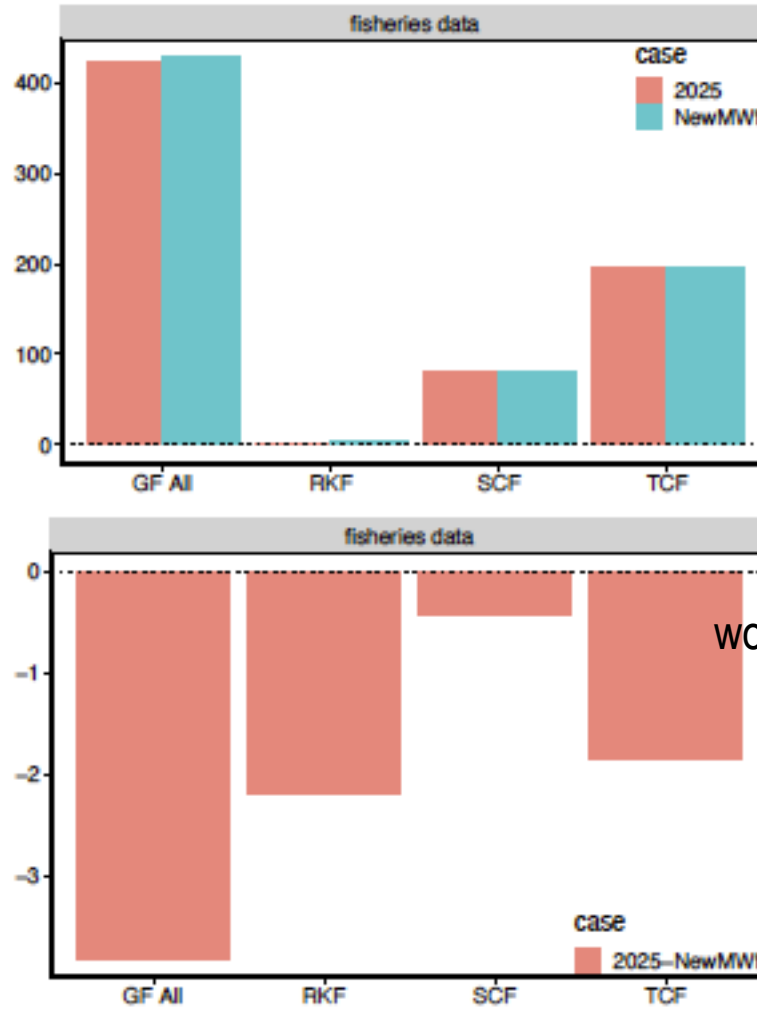


Fits to data

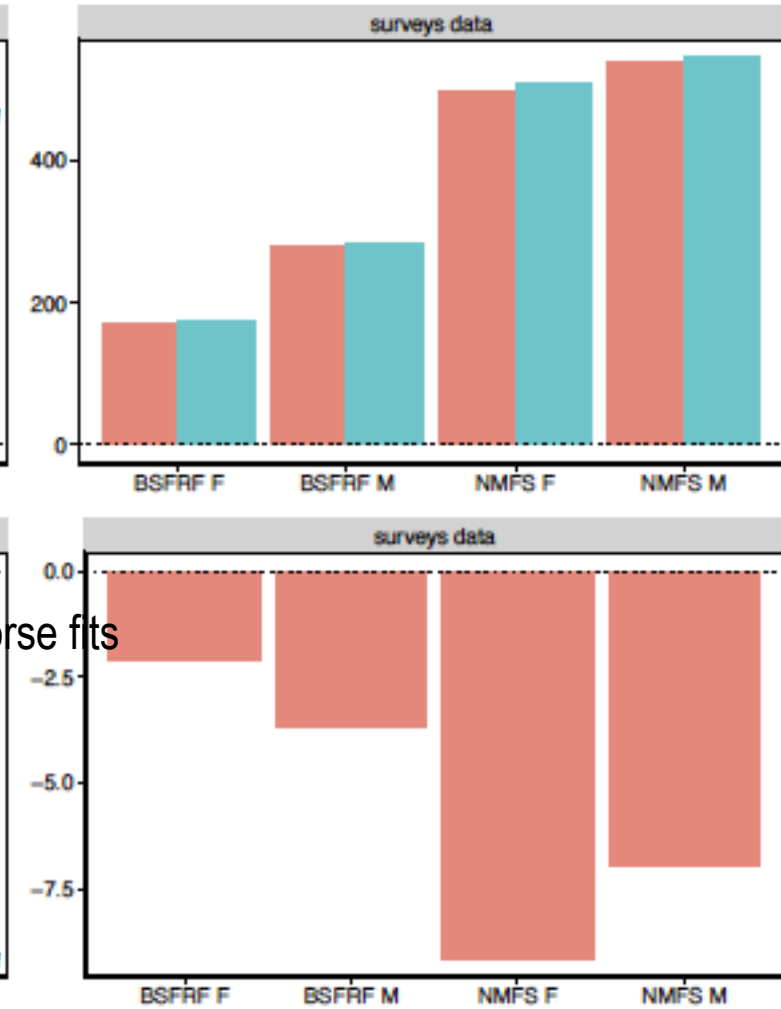
Growth data



Fisheries data

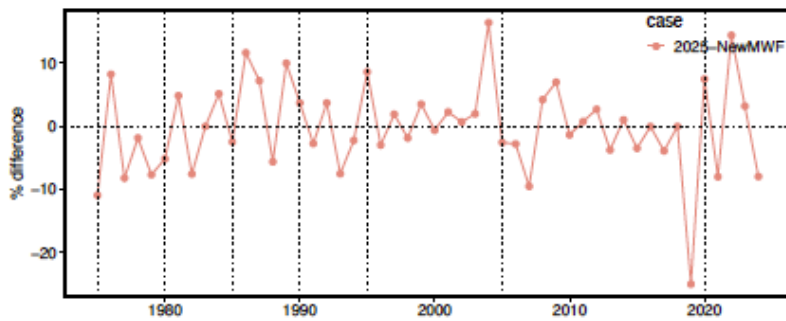
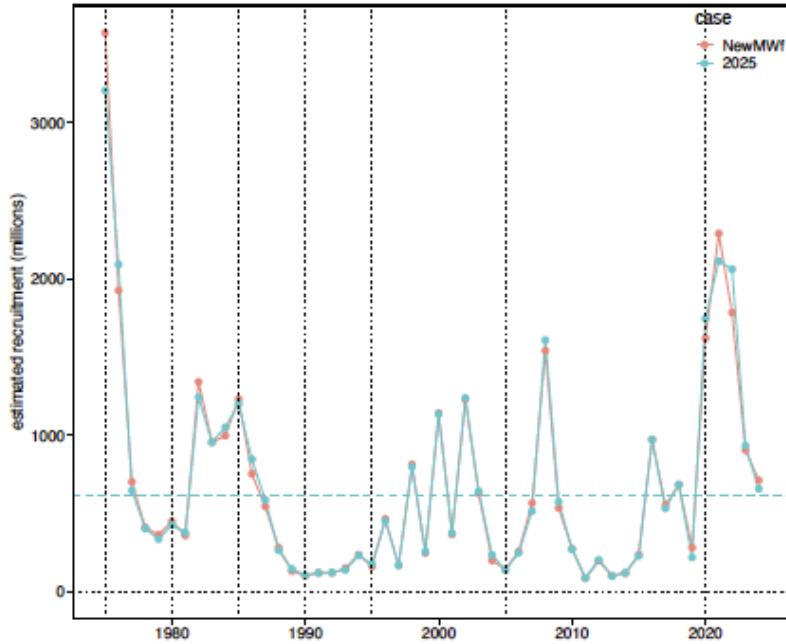


Survey data

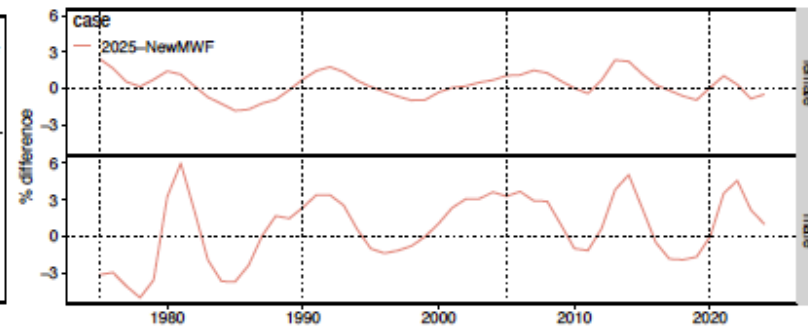
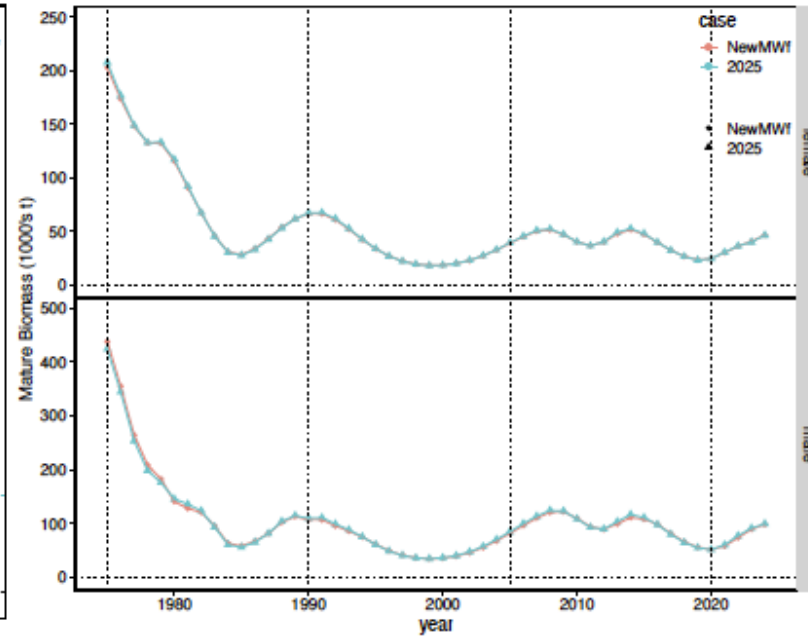


Estimated quantities

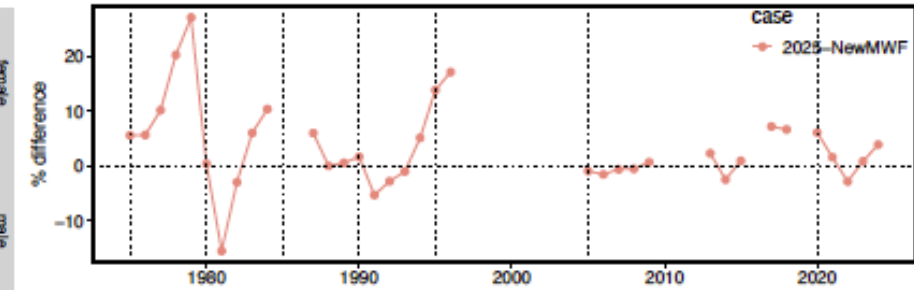
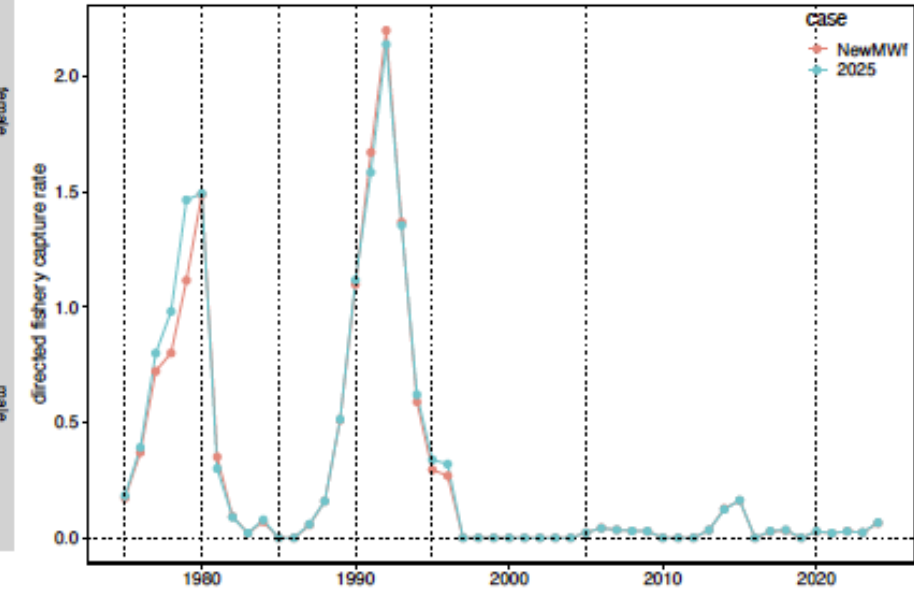
Recruitment



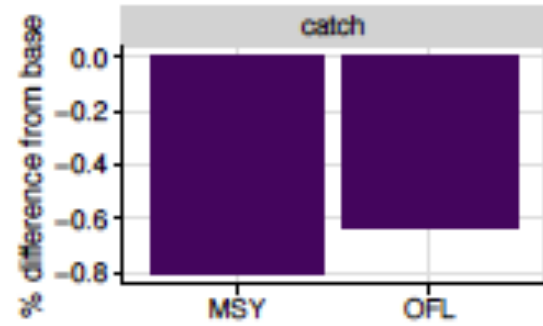
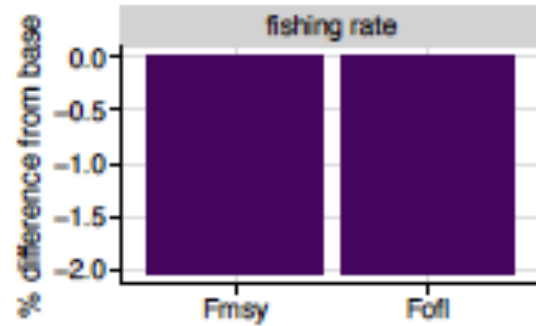
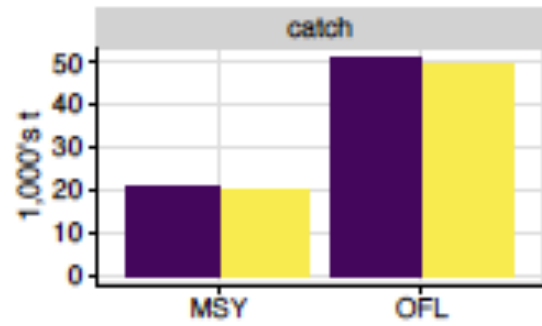
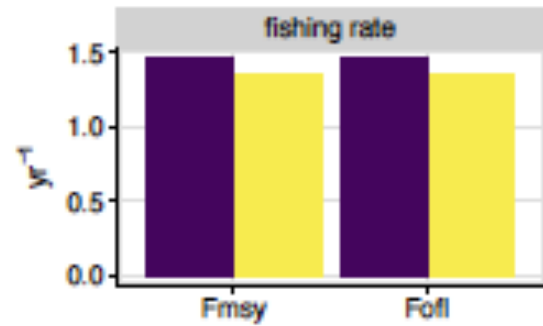
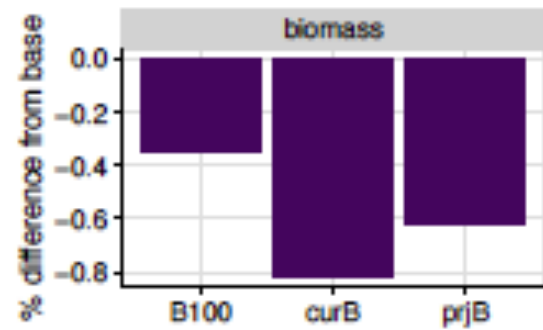
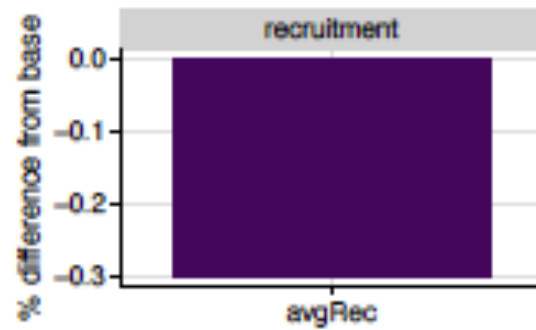
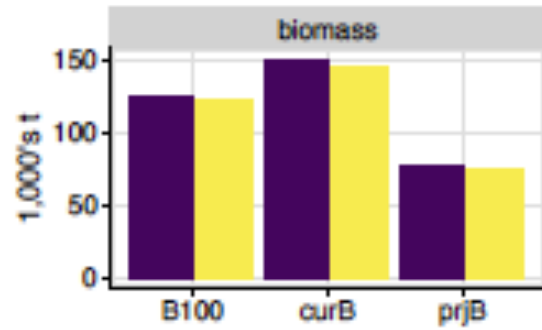
Mature Biomass



Directed Fishery Capture Rates



Management Quantities



case
■ 2025
■ NewMWT

case
■ NewMWT

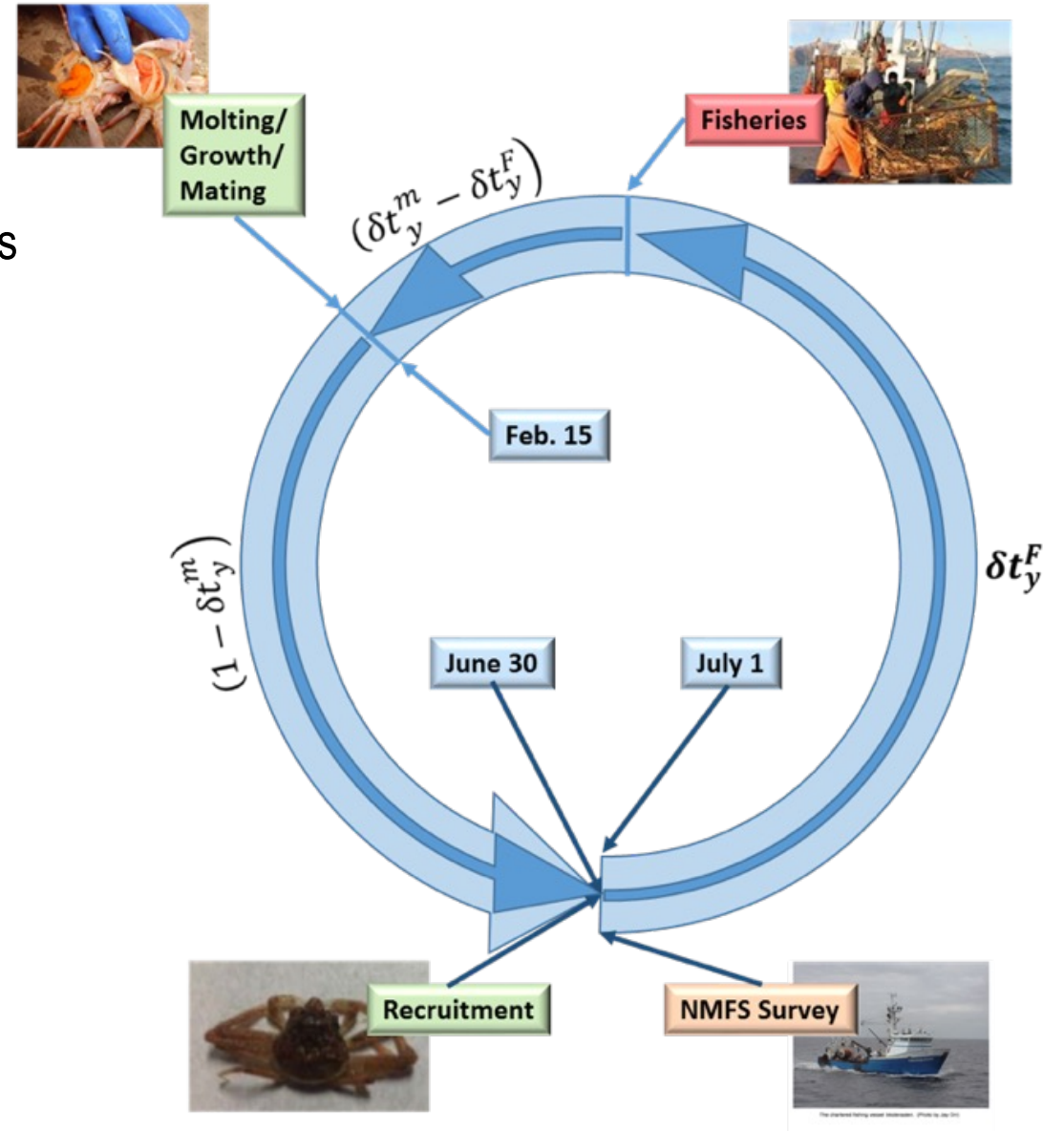


Progress toward a GMACS model for Tanner crab



Tier 3 Assessment Model

- Tier 3 size-structured model
 - Survey data
 - NMFS EBS shelf survey: 1975-present
 - BSFRF 2013-2018 side-by-side haul studies
 - Fishery data
 - directed fishery (areas combined)
 - retained catch
 - total catch
 - bycatch in
 - snow crab fishery
 - BBRKC fishery
 - groundfish fisheries
 - Estimates:
 - Annual recruitment
 - Annual numbers-at-size (M,F)
 - mature biomass (MMB, MFB)
 - Determines:
 - F_{MSY} , B_{MSY} , F_{OFL} , OFL



Population dynamics

process	time blocks	time blocks	22.03d5 description
Population rates and quantities			
Population built from annual recruitment			
Recruitment	1949+	1949-1974	In-scale mean + annual devs constrained as AR1 process
		1975+	In-scale mean + annual devs
Growth	1949+	1949+	sigma-R fixed, sex ratio fixed at 1:1
	1949+	1949+	sex-specific
			mean post-molt size: power function of pre-molt size post-molt size: gamma distribution conditioned on pre-molt size
Maturity	1949+	1949+	sex-specific
			size-specific probability of terminal molt
			logit-scale parameterization
Natural mortality	1949-1979,	1949-1979,	estimated sex/maturity state-specific multipliers on base rate
	1985+	1985+	priors on multipliers based on uncertainty in max age
	1980-1984	1980-1984	estimated "enhanced mortality" period multipliers



Fisheries

Fishery/process	time blocks	22.03d5 description
RKF bycatch in BBRKC fishery		
capture rates	pre-1952	nominal rate on males
	1953-1991	extrapolated from effort
	1992+	male ln-scale mean + annual devs(*)
	1949+	ln-scale female offset
male selectivity	1949-1996	ascending normal, asymptote fixed
	1997-2004	ascending normal, asymptote fixed
	2005+	ascending normal, asymptote fixed
female selectivity	1949-1996	ascending normal, asymptote fixed
	1997-2004	ascending normal
	2005+	ascending normal
GF All bycatch in groundfish fisheries		
capture rates	pre-1973	male ln-scale mean from 1973+
	1973+	male ln-scale mean + annual devs
	1973+	ln-scale female offset
male selectivity	1949-1986	ascending logistic
	1987-1996	ascending logistic
	1997+	ascending logistic
female selectivity	1949-1986	ascending logistic
	1987-1996	ascending logistic
	1997+	ascending logistic

Fishery/process	time blocks	22.03d5 description	
TCF directed Tanner crab fishery			
capture rates	pre-1965	male nominal rate	
	1965+	male ln-scale mean + annual devs	
	1949+	ln-scale female offset	
male selectivity	1949-1990	ascending logistic	
	1991-1996	annually-varying ascending logistic	
	2005+	annually-varying ascending logistic	
female selectivity	1949+	ascending logistic	
male retention	1949-1990; 1991-1996; 2005-2009; 2013+	ascending logistic	
	% retained	pre-1988	fixed at 100%
	1991-1996	fixed at 100%	
	2005-2009	fixed at 100%	
	2013+	fixed at 100%	
SCF bycatch in snow crab fishery			
capture rates	pre-1978	nominal rate on males	
	1979-1991	extrapolated from effort	
	1992+	male ln-scale mean + annual devs	
	1949+	ln-scale female offset	
male selectivity	1949-1996	dome-shaped (double normal) --plateau width fixed to 0 --descending limb width fixed to 1	
	1997-2004	dome-shaped (double normal)	
	2005+	dome-shaped (double normal)	
female selectivity	1949-1996	ascending logistic	
	1997-2004	ascending logistic	
	2005+	ascending logistic	



Surveys

Survey/process	time blocks	22.03d5 description
NMFS EBS trawl survey		
male survey q	1975-1981	In-scale
	1982+	In-scale w/ prior based on Somerton's underbag experiment
female survey q	1975-1981	In-scale
	1982+	In-scale w/ prior based on Somerton's underbag experiment
male selectivity	1975-1981	ascending normal, fixed fully-selected size at 180
	1982+	ascending normal, fixed fully-selected size at 180
female selectivity	1975-1981	ascending normal, fixed fully-selected size at 130
	1982+	ascending normal, fixed fully-selected size at 130
BSFRF SBS trawl surveys		
male catchability	2013-2018	fixed at 1 for all sizes
male availability	2013-2018	empirically-determined outside the model
female catchability	2013-2018	fixed at 1 for all sizes
female availability	2013-2018	empirically-determined outside the model



Likelihoods

		22.03d5		
Component	Type	included in optimization	Fits	Likelihood distribution
TCF: retained catch	biomass	yes	males only	lognormal
	size comp.s	yes	males only	multinomial
TCF: total catch	biomass	yes	total	lognormal
	size comp.s	yes	by sex (extended)	multinomial
SCF: total catch	biomass	yes	total	lognormal
	size comp.s	yes	by sex (extended)	multinomial
RKF: total catch	biomass	yes	total	lognormal
	size comp.s	yes	by sex (extended)	multinomial
GF All: total catch	abundance	yes	total	lognormal
	biomass	yes	total	lognormal
	size comp.s	yes	by sex	multinomial
NMFS "M" survey (males only, no maturity)	biomass	yes	males only	lognormal
	size comp.s	yes	males only	multinomial
NMFS "F" survey (females only, w/ maturity)	biomass	yes	by maturity classification	lognormal
	size comp.s	yes	by maturity classification	multinomial
BSFRF "M" survey (males only, no maturity)	biomass	yes	males only	lognormal
	size comp.s	yes	males only	D-M
BSFRF "F" survey (females only, w/ maturity)	biomass	yes	by maturity classification	lognormal
	size comp.s	yes	by maturity classification	D-M
growth data	EBS only	yes	by sex	gamma
male maturity ogive data	EBS only	yes	males only	binomial



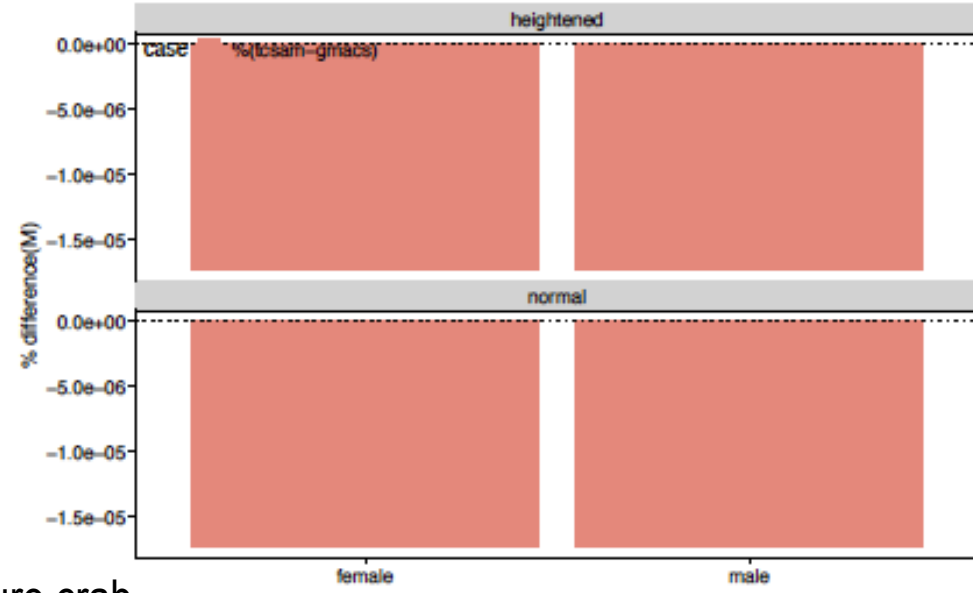
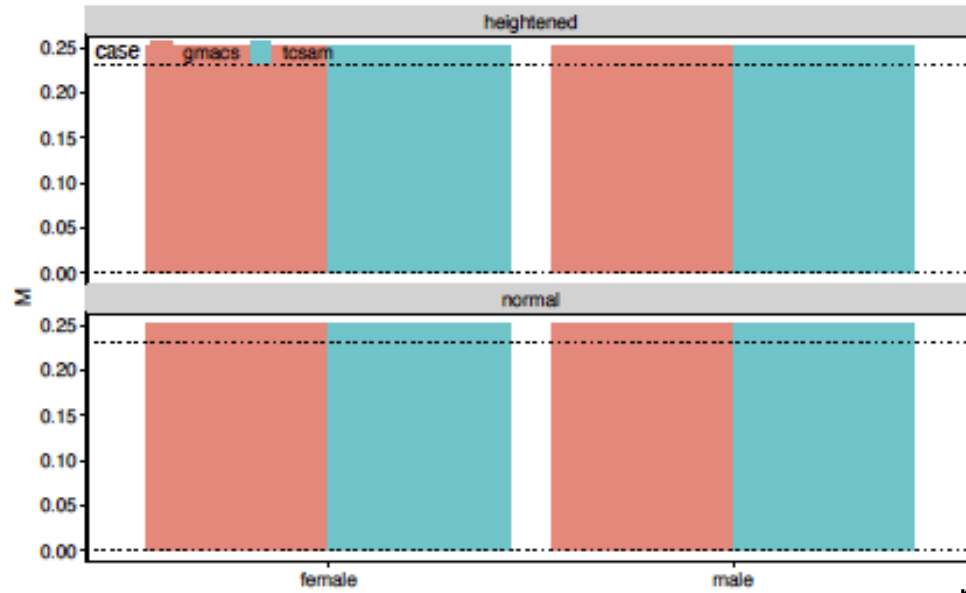
GMACS Modifications To Match TCSAM02

- *Added alternative multinomial likelihood as option to fit size comps (option 7) to match TCSAM02 calculation.*
- *Added male maturity data section to data file.*
- *Added "doTCSAM02EffExp" flag to data file (right after flag to read catch data in new format). If "on" (1), effort extrapolation for missing catch is based on average catch divided by average effort for years specified by new "avg_eff" column in new-format CatchDFs.*
- *Added growth transition options 9 and 10 to provide same functionality as TCSAM02*
- *Added alternative 4-parameter double normal selectivity option (SELEX_DOUBLENORM4a = 15) to match TCSAM02. The plateau is determined from a scale parameter and the distance between the max possible size and the size at the ascending limb.*
- *Added new options for calculating/extending size comps to provide sample size scaling/no scaling options for input size comps.*
- *The growth options TCSAM02A and TCSAM02B (=9 and 10) that provide similar functionality as TCSAM02 for the growth transition matrices were reassigned and additional options TCSAM02C and TCSAM02D (11 and 12) were added. A and B apply to the case where the molt increment is assumed to be gamma-distributed while C and D apply to the case where postmolt size is gamma-distributed. All of the options limit growth to a maximum number of size bins but treat probabilities from the "excluded" size bins differently: A and C drop them, then normalize the remaining probabilities to sum to 1 whereas B and D treat the max size bin as an accumulator for "raw" probabilities at larger size bins before dropping them.*
- *Fixed calculation of predicted fishery size comps in calc_predicted_composition by including fully-selected F's (ft(k,h,i,j)) in the calculations.*

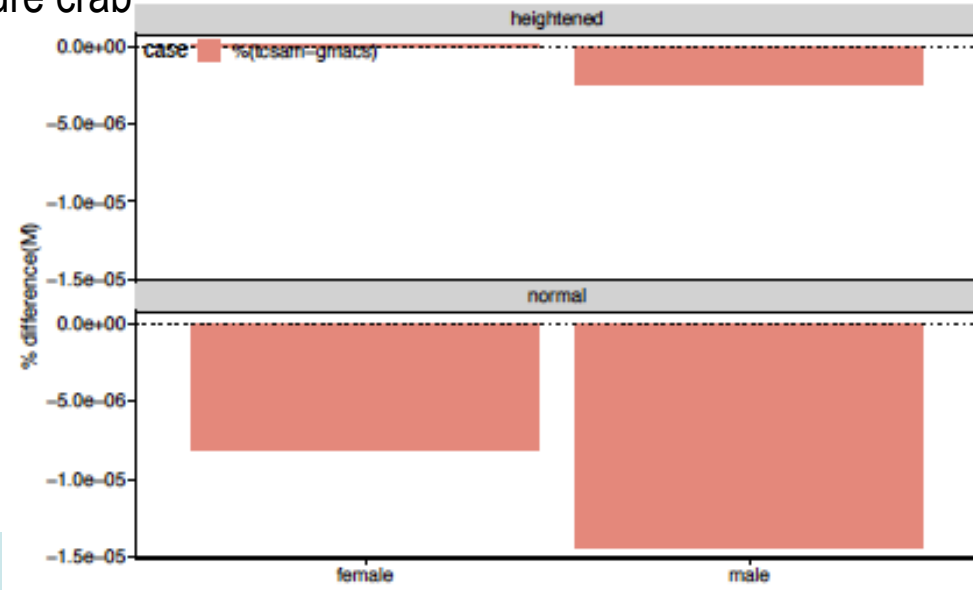
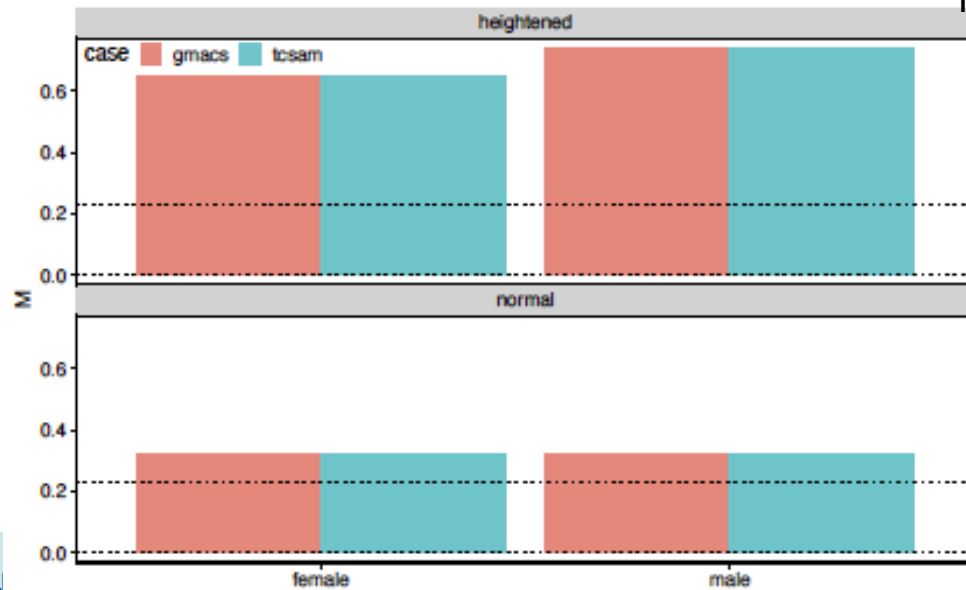


Natural Mortality

immature crab



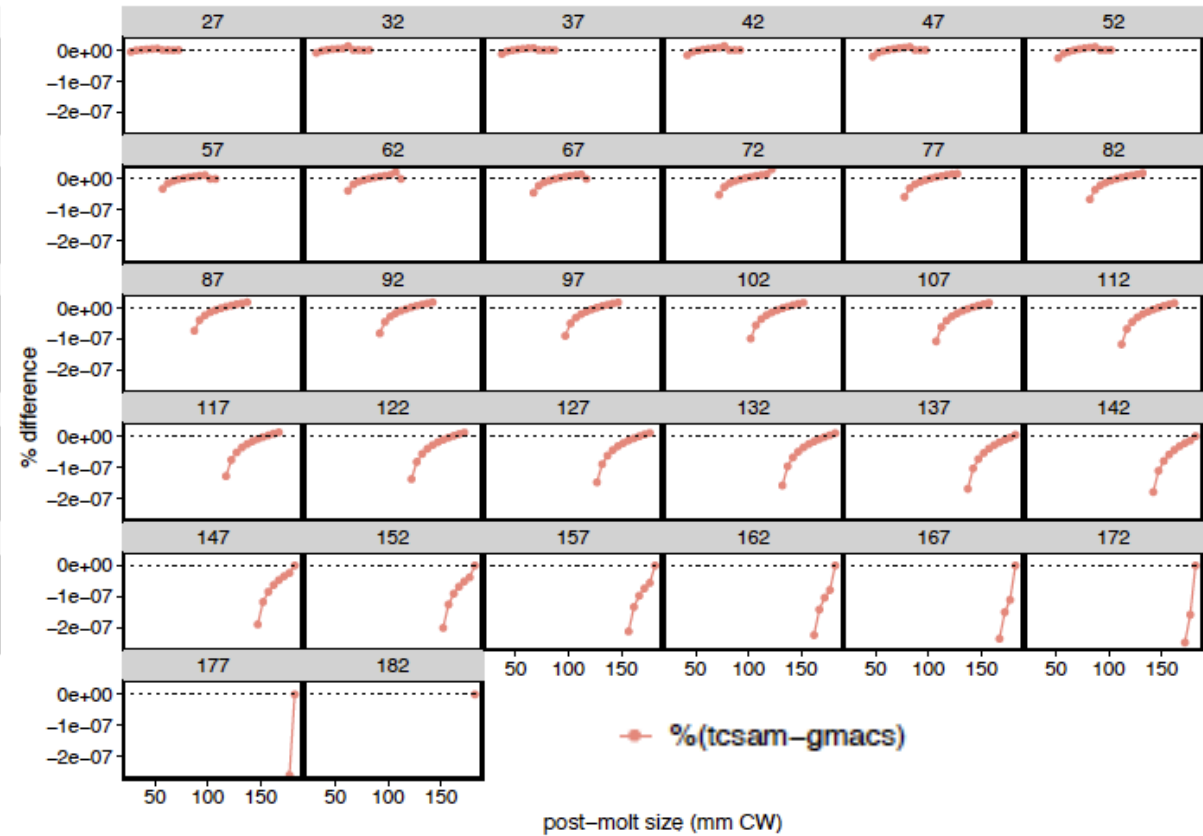
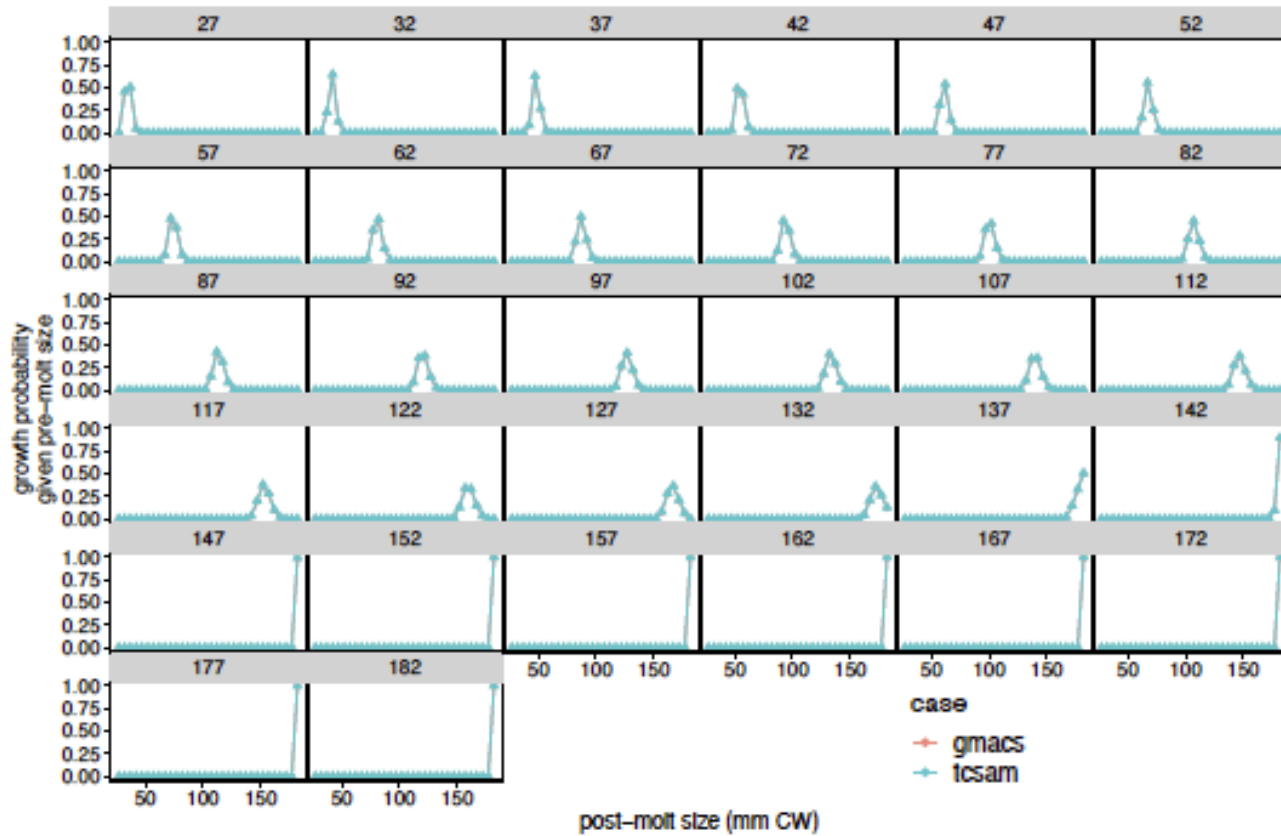
mature crab



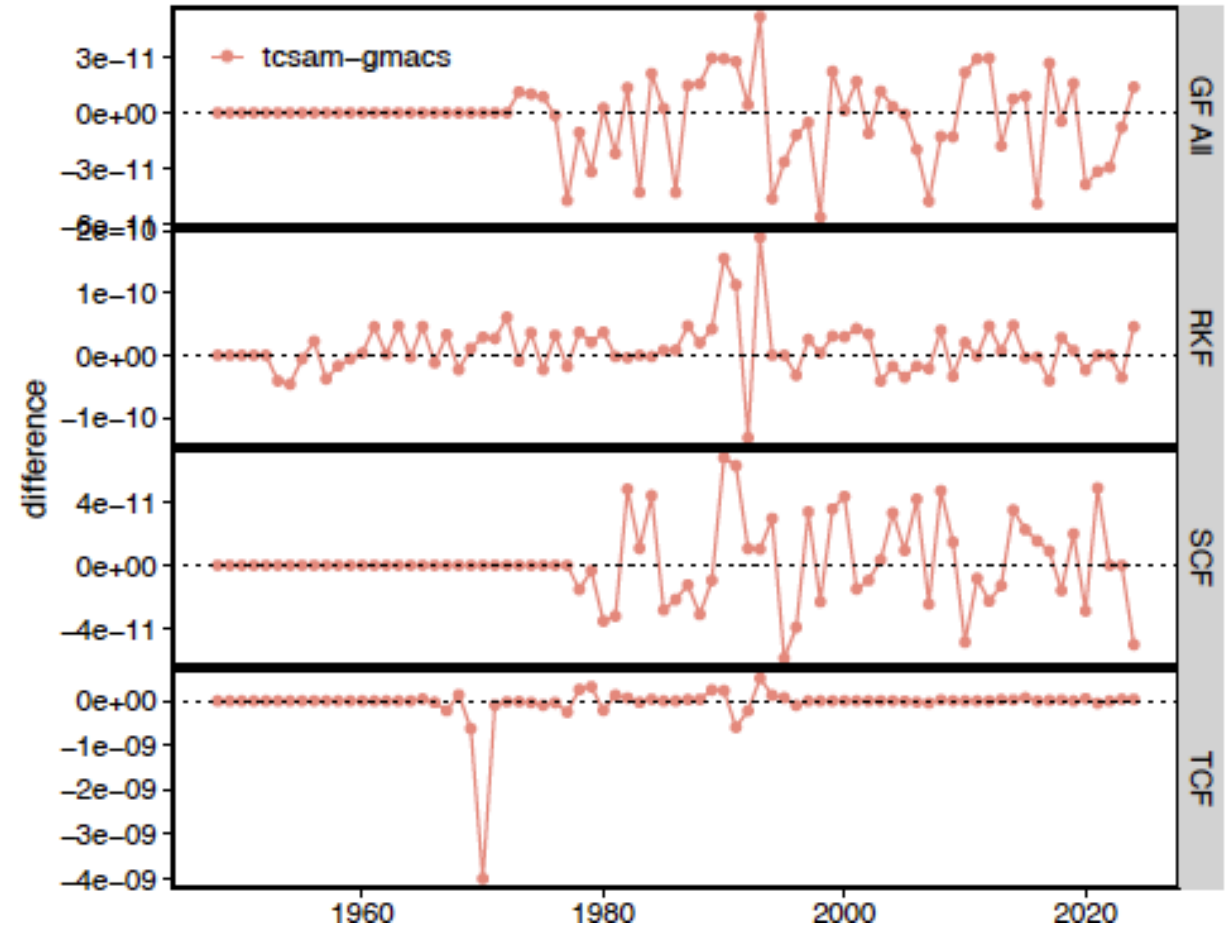
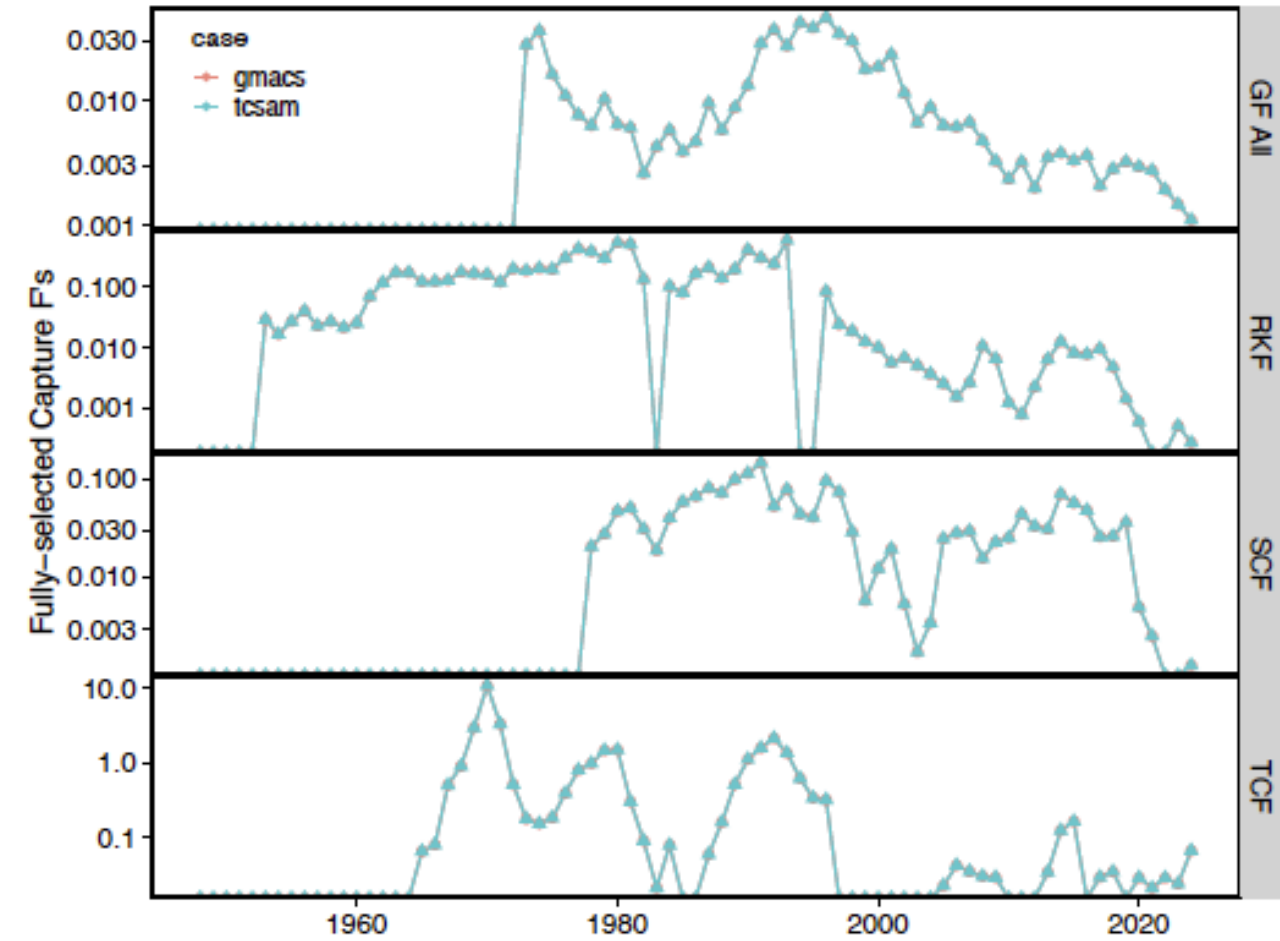
values

% differences

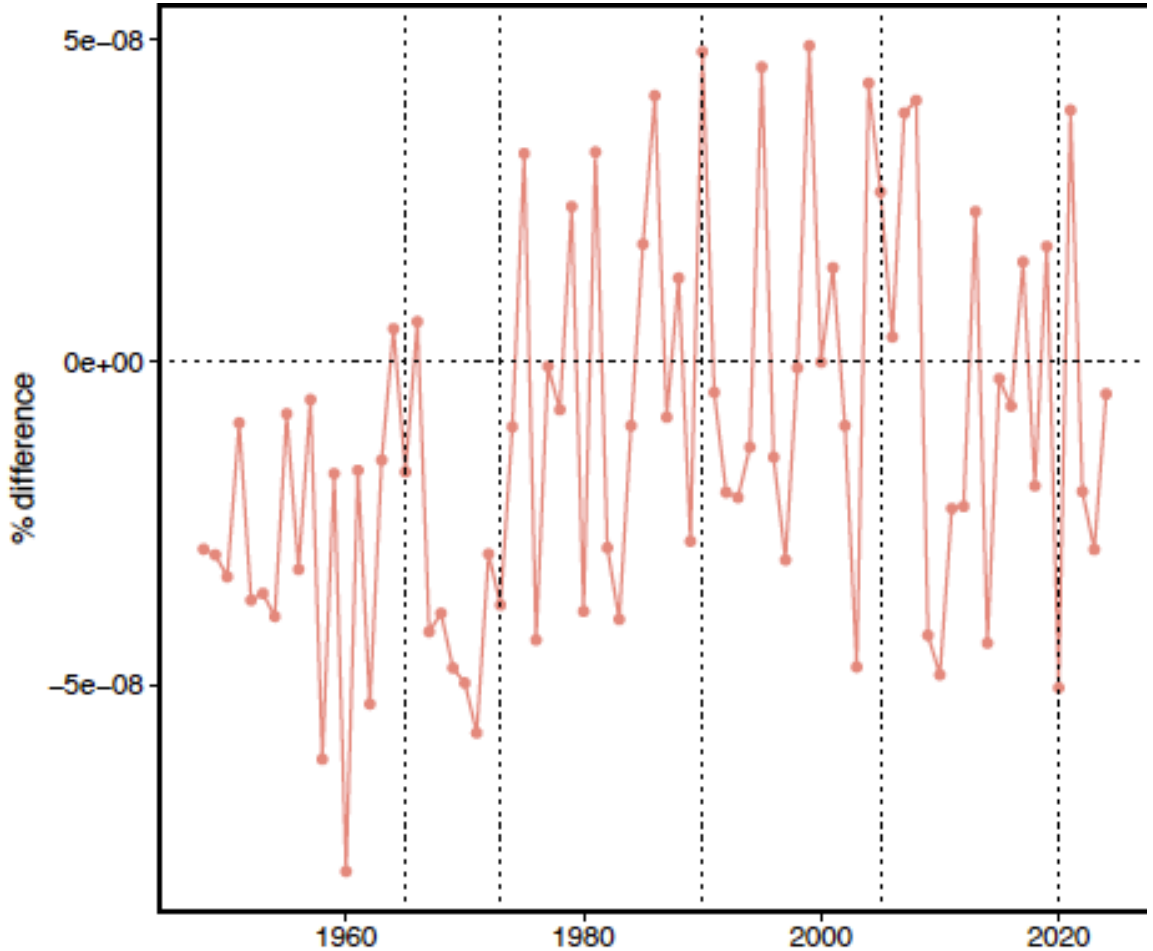
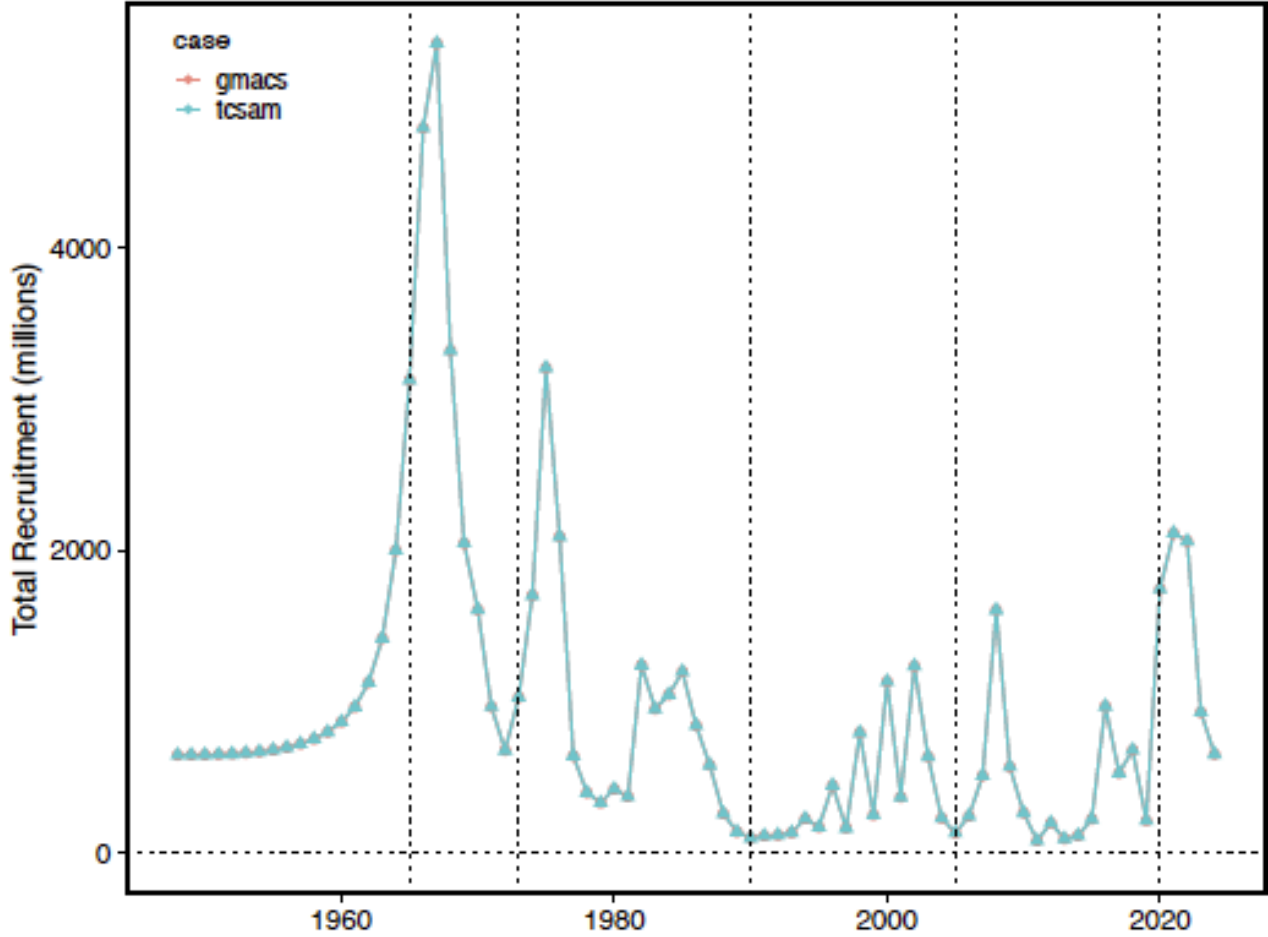
Male growth



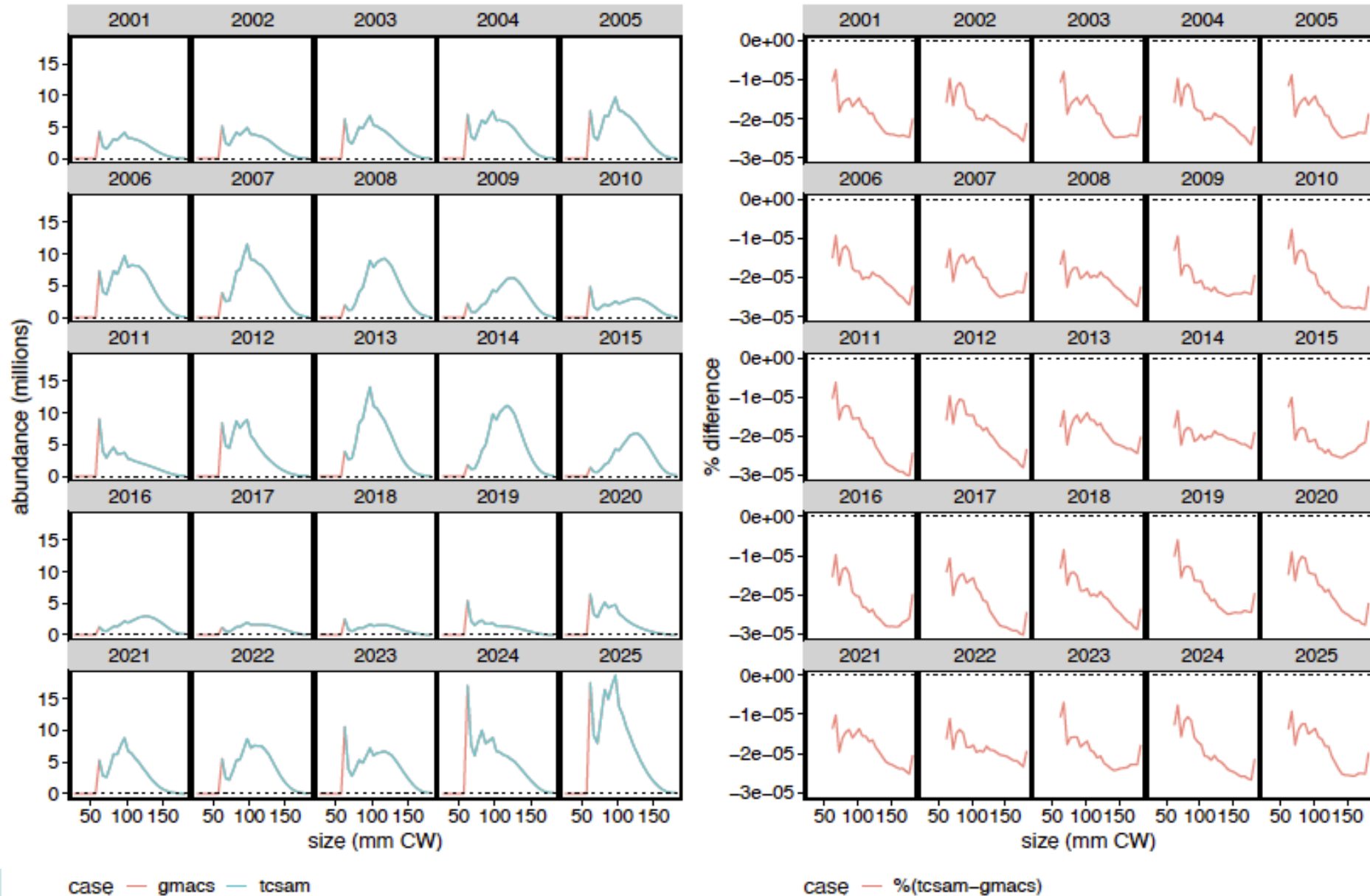
Fully-selected Male Capture F's



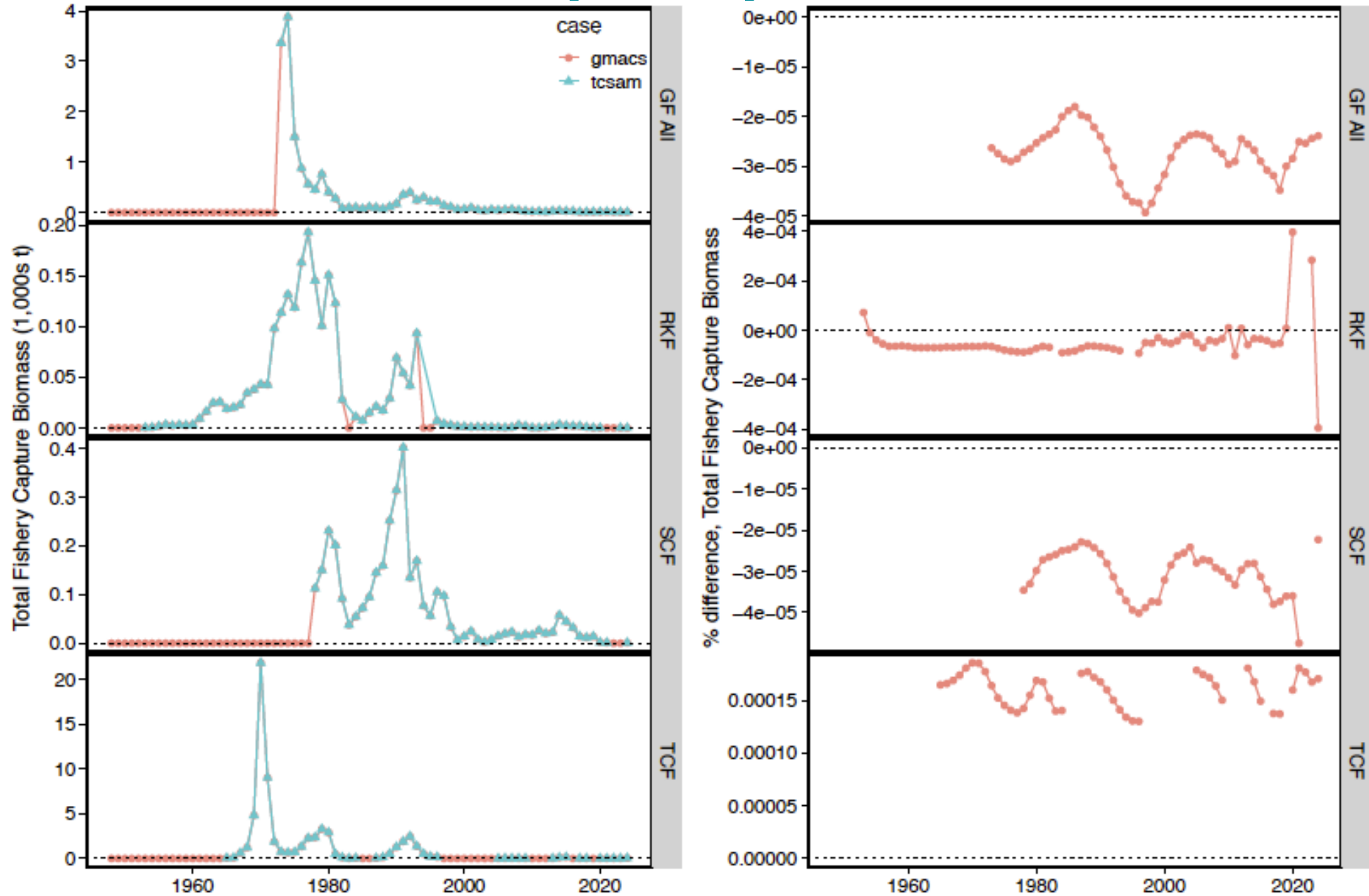
Recruitment



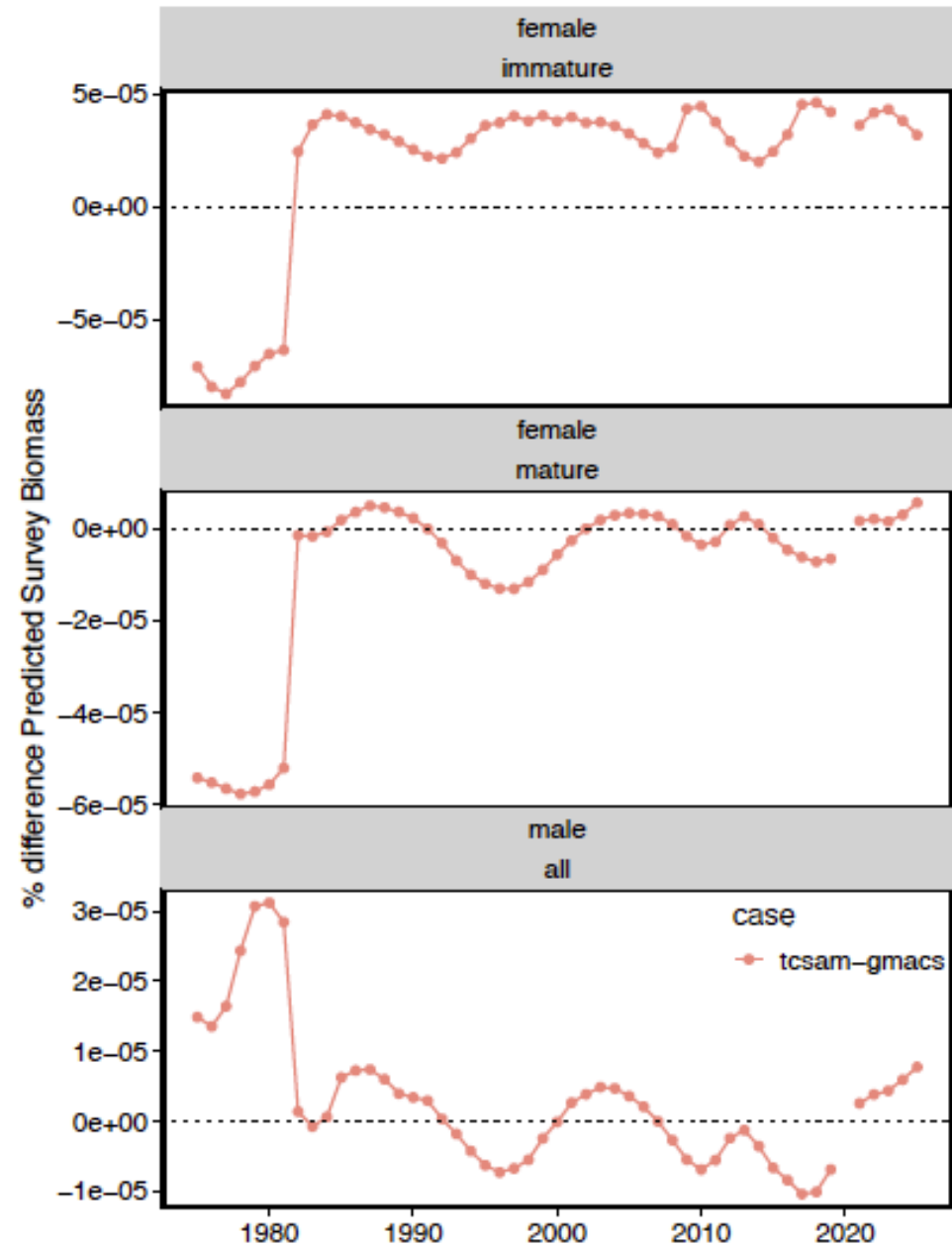
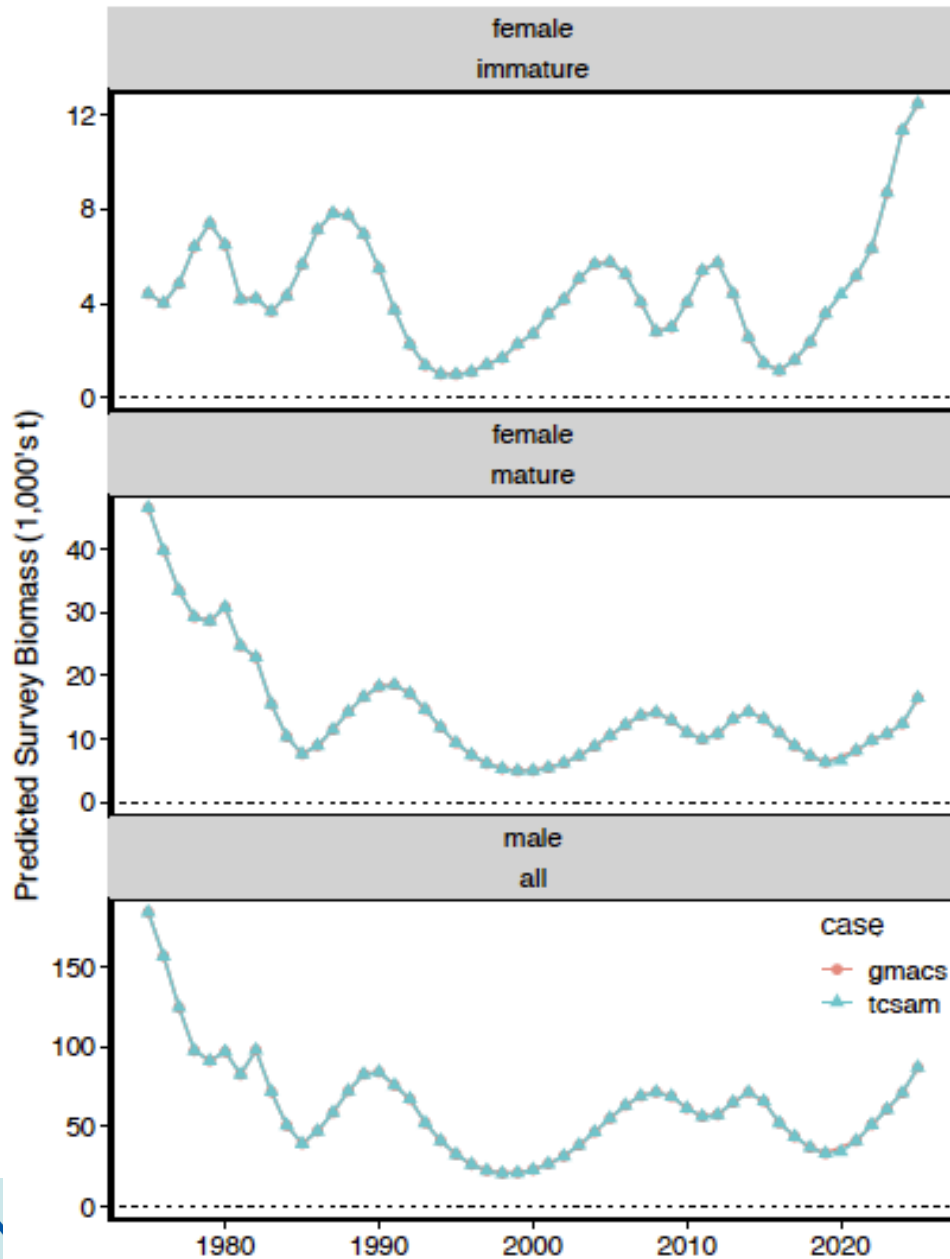
Population abundance-at-size for mature males



Predicted total catch biomass, by fishery

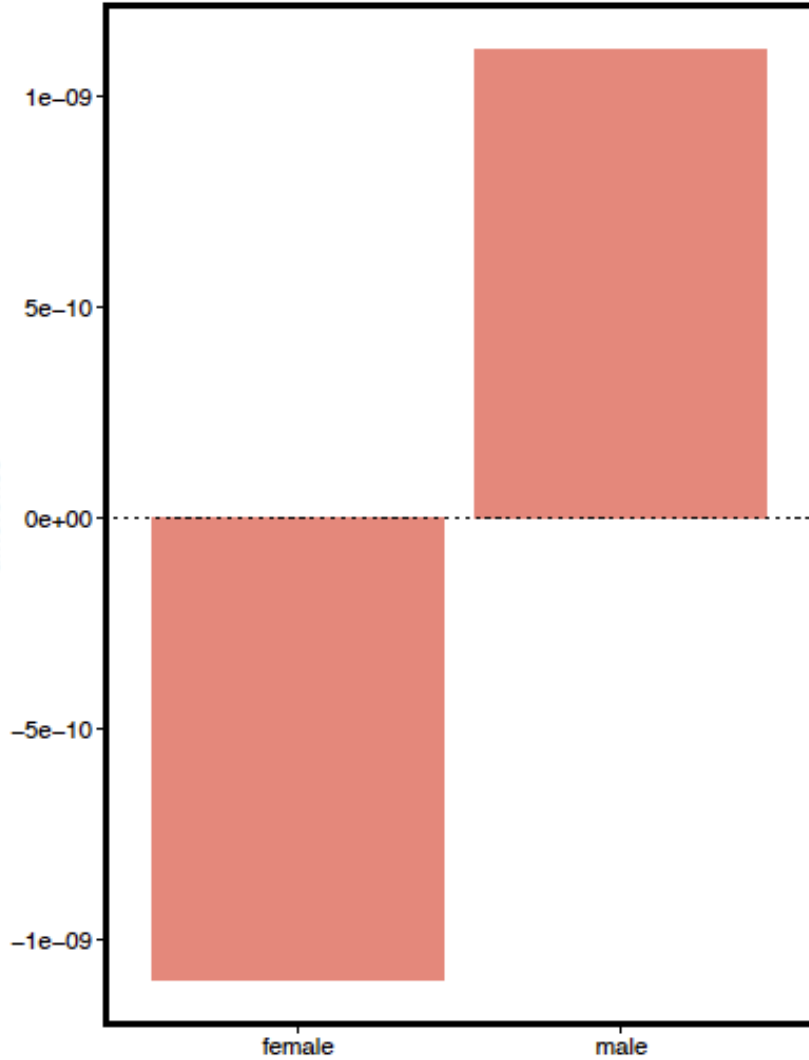


Predicted NMFS Survey Biomass

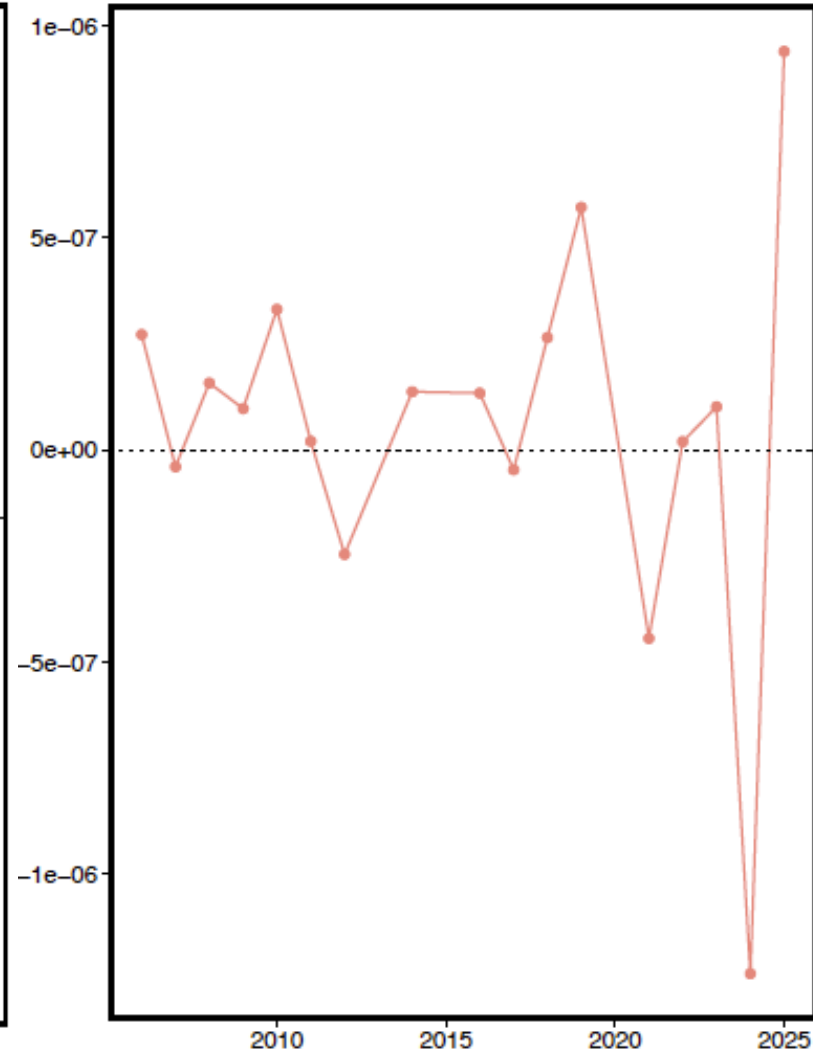


Likelihood differences

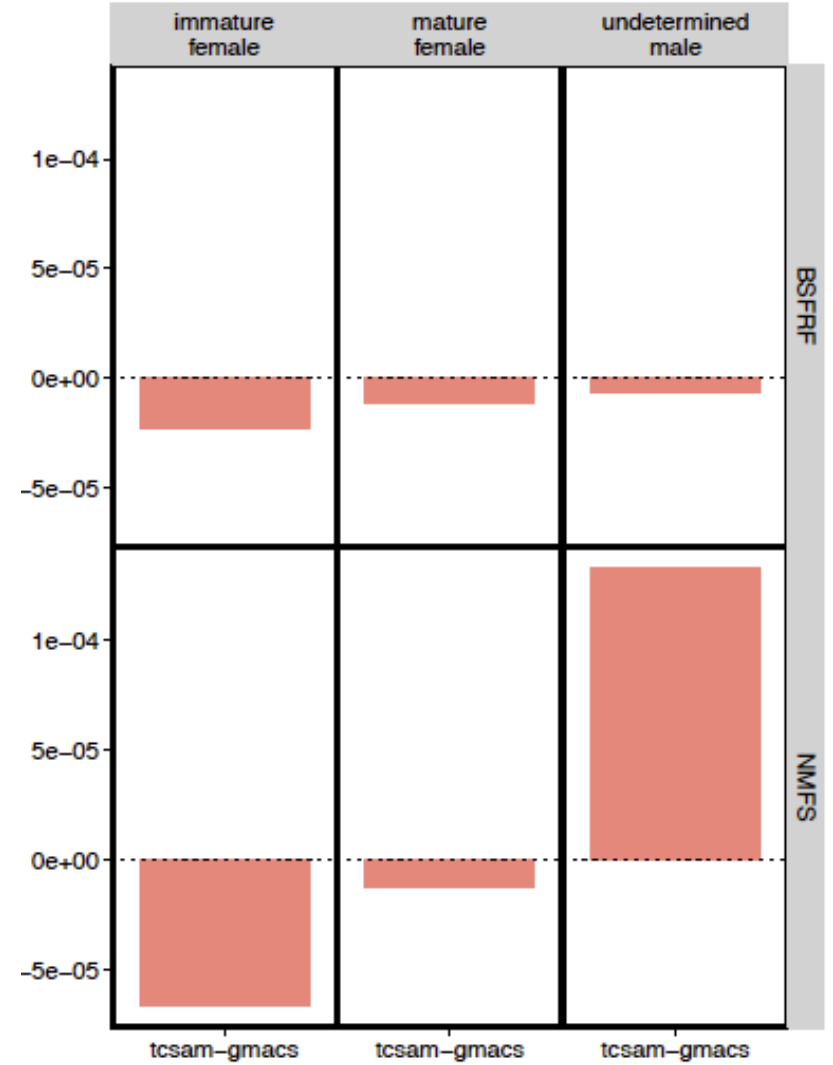
growth



male maturity ogives

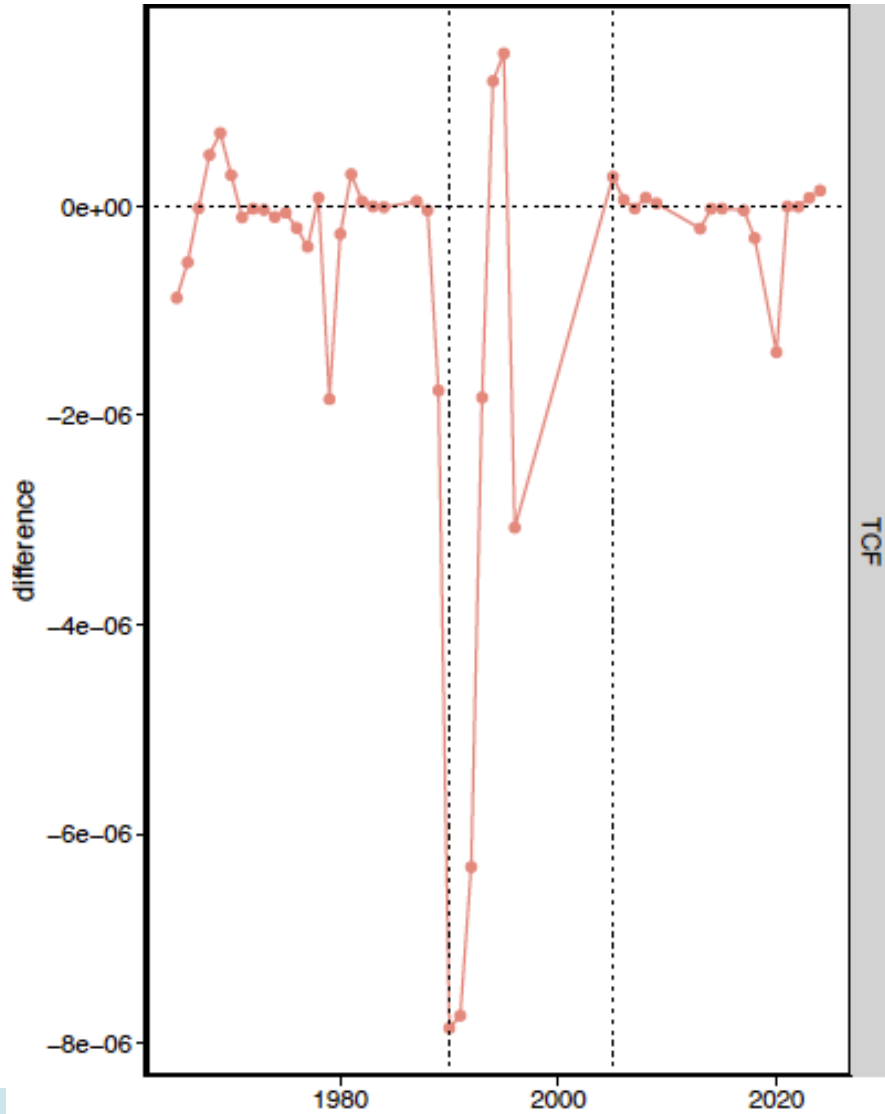


survey biomass

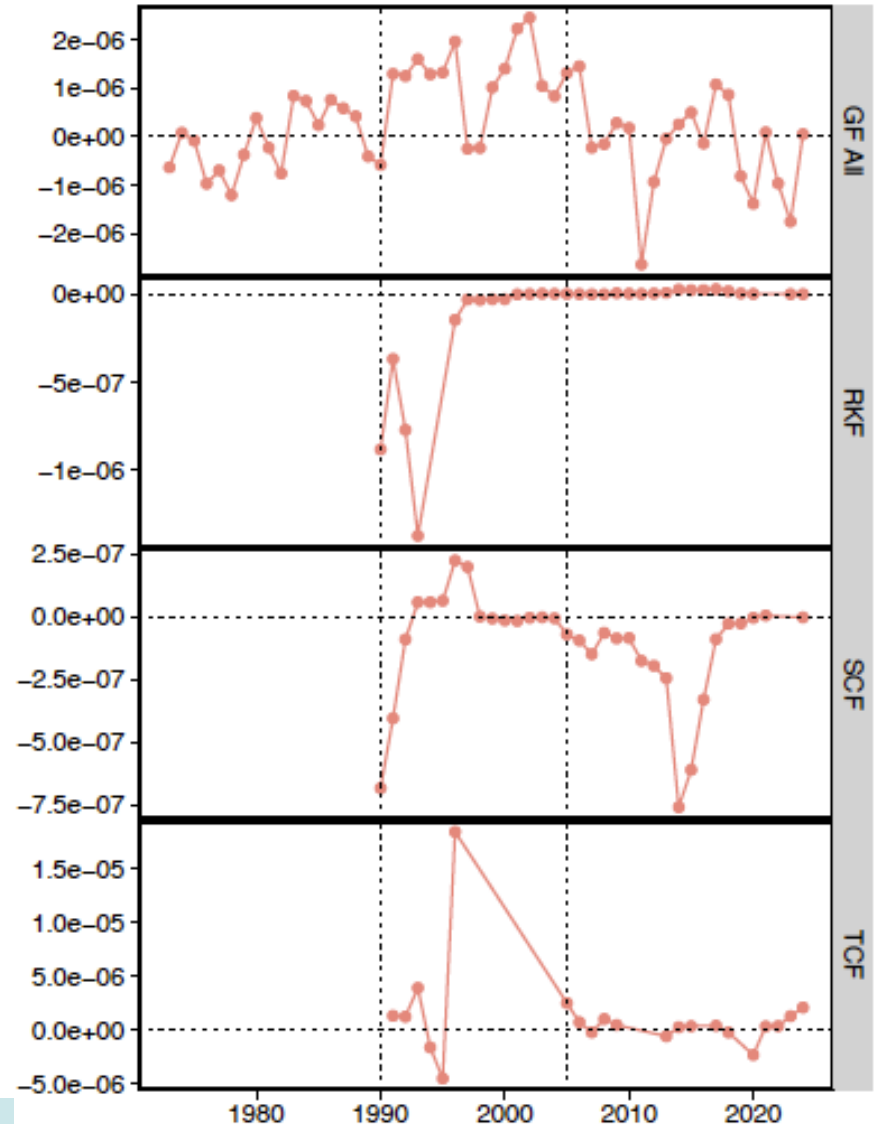


Likelihood differences

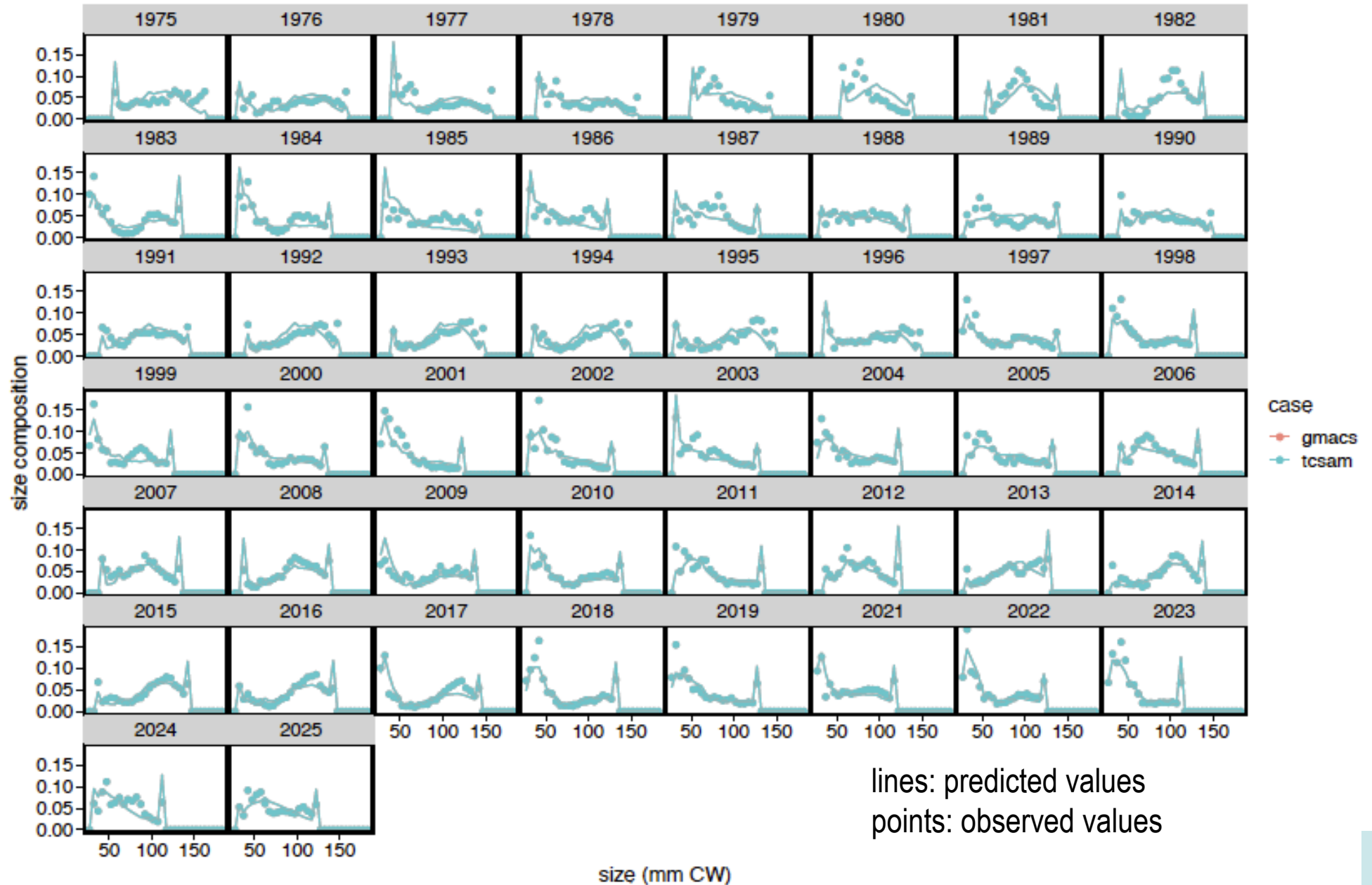
retained catch biomass



total catch biomass



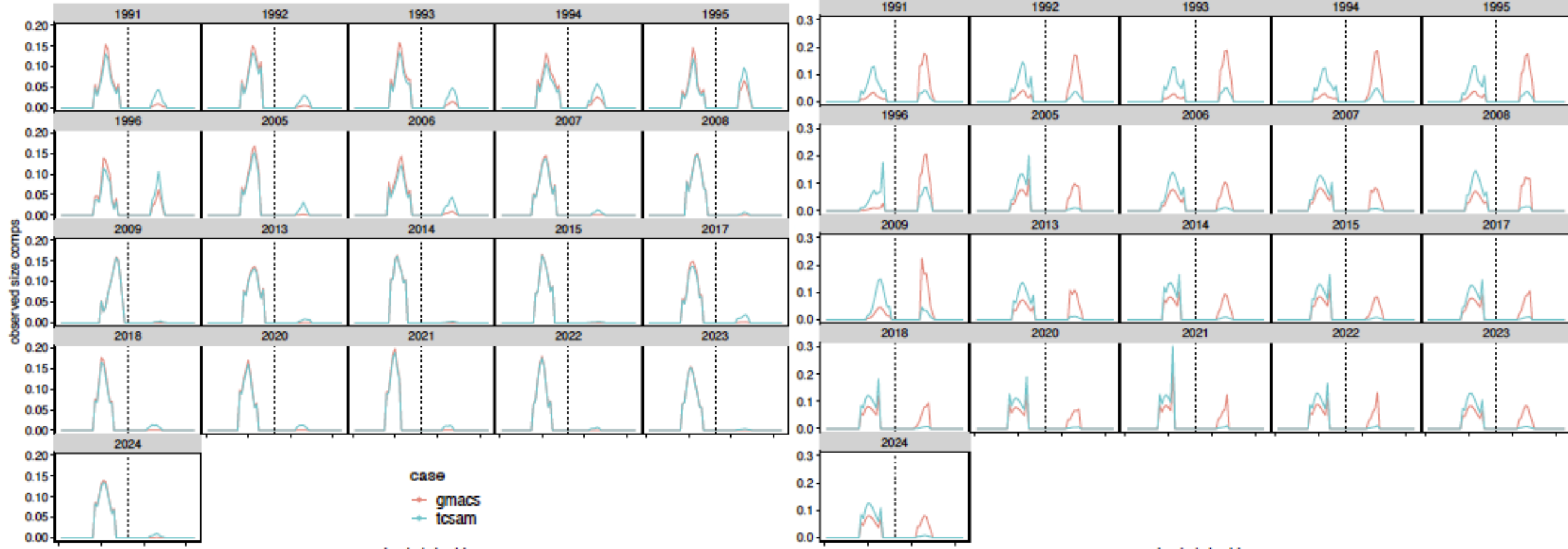
Fits to NMFS survey male size comps



Directed fishery “extended” total catch size comps

observed size comps

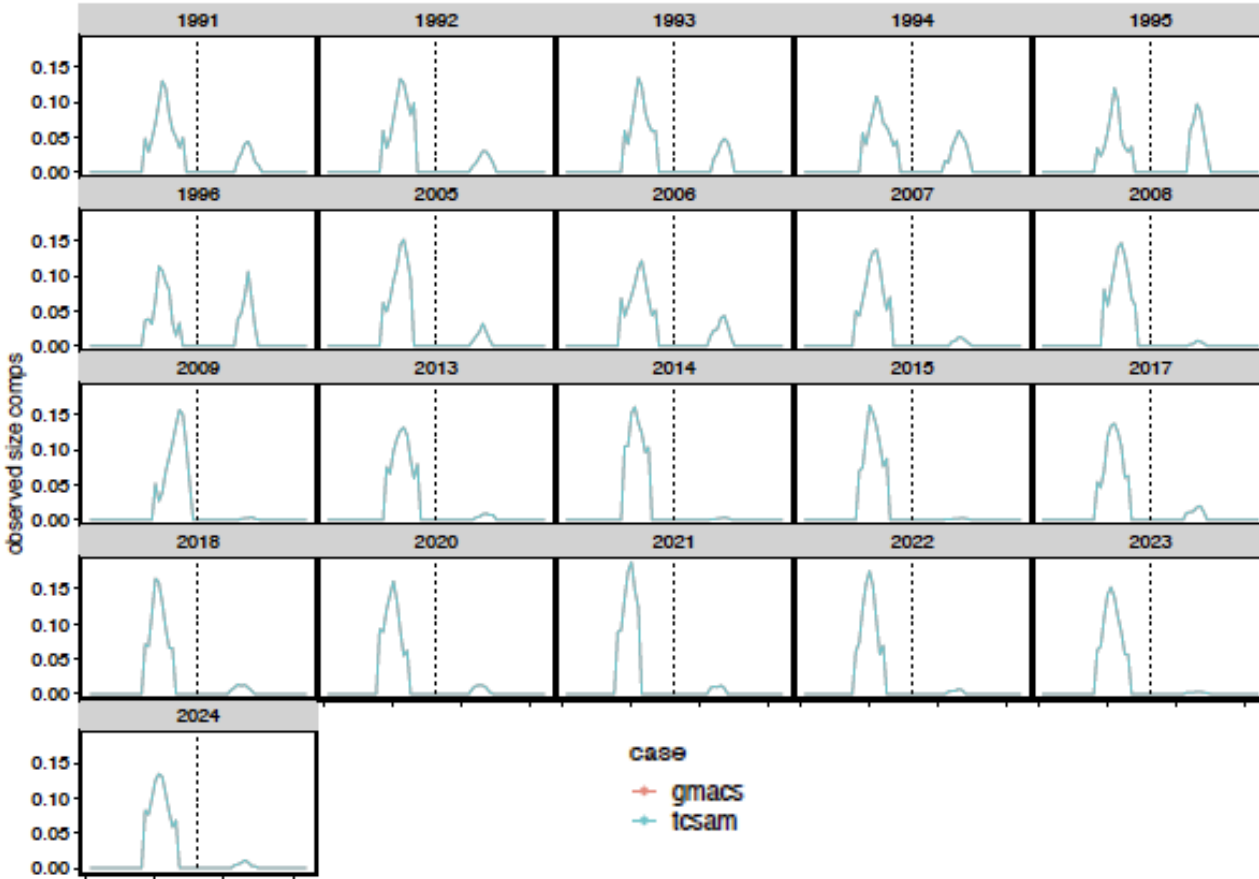
predicted size comps



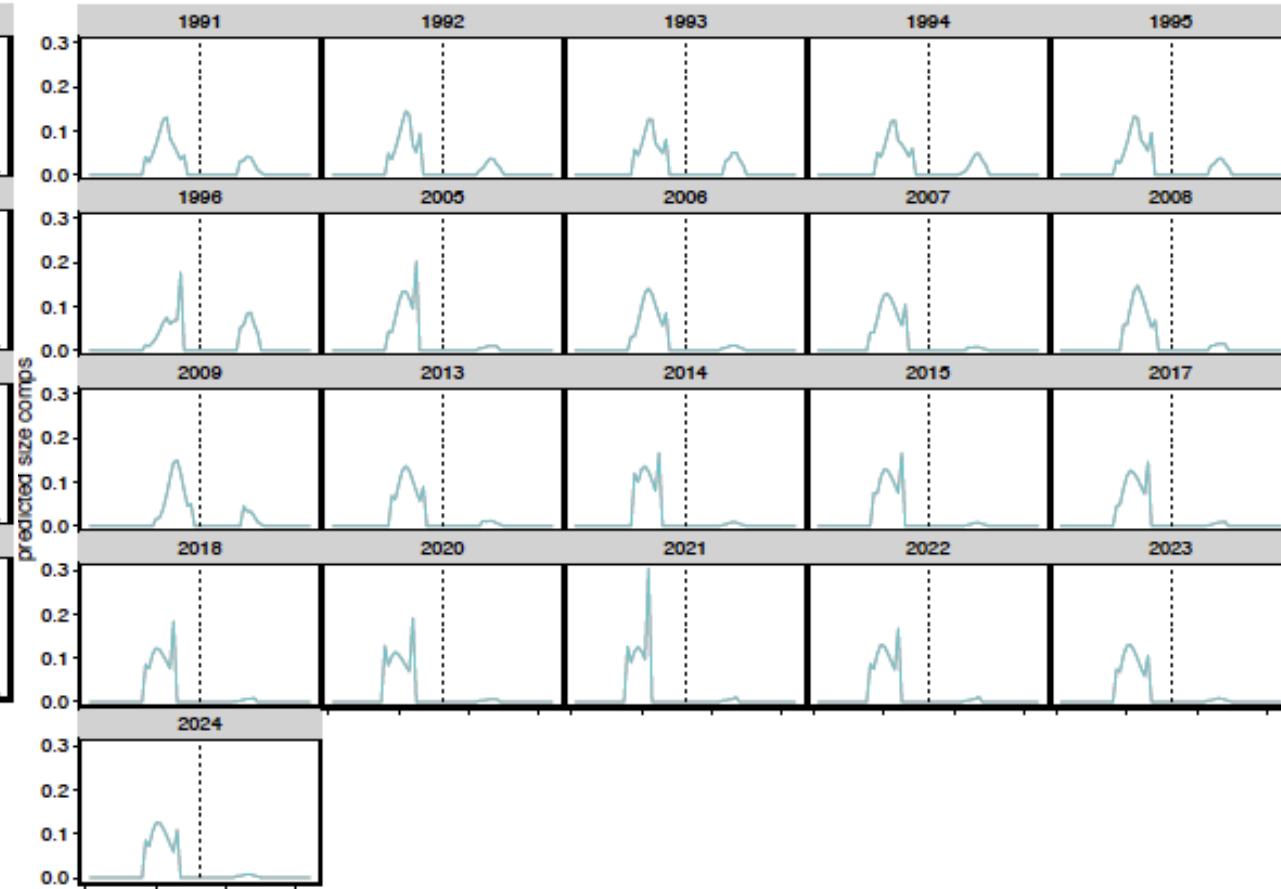
- without scaling by sex-specific fishery capture rates

Directed fishery “extended” total catch size comps

observed size comps



predicted size comps

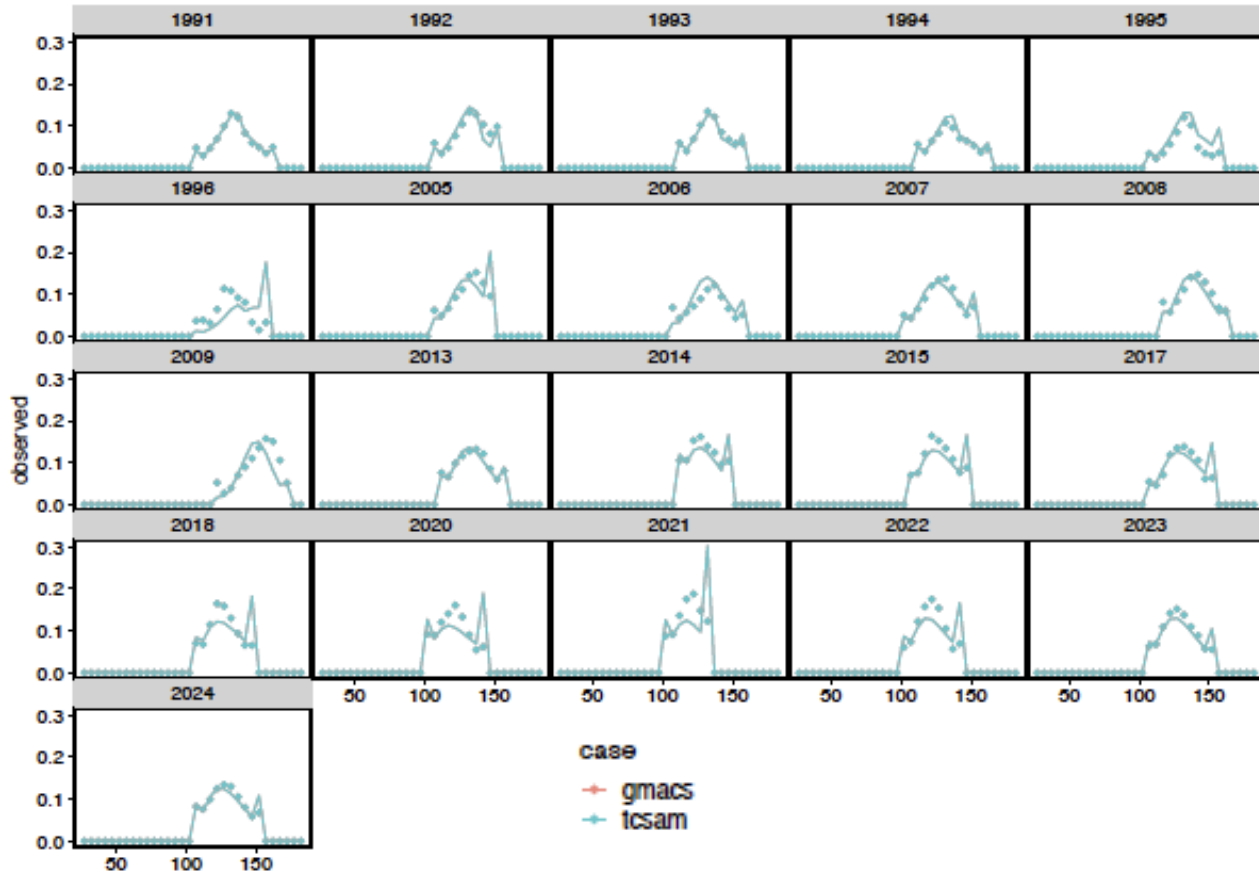


- with scaling by sex-specific fishery capture rates

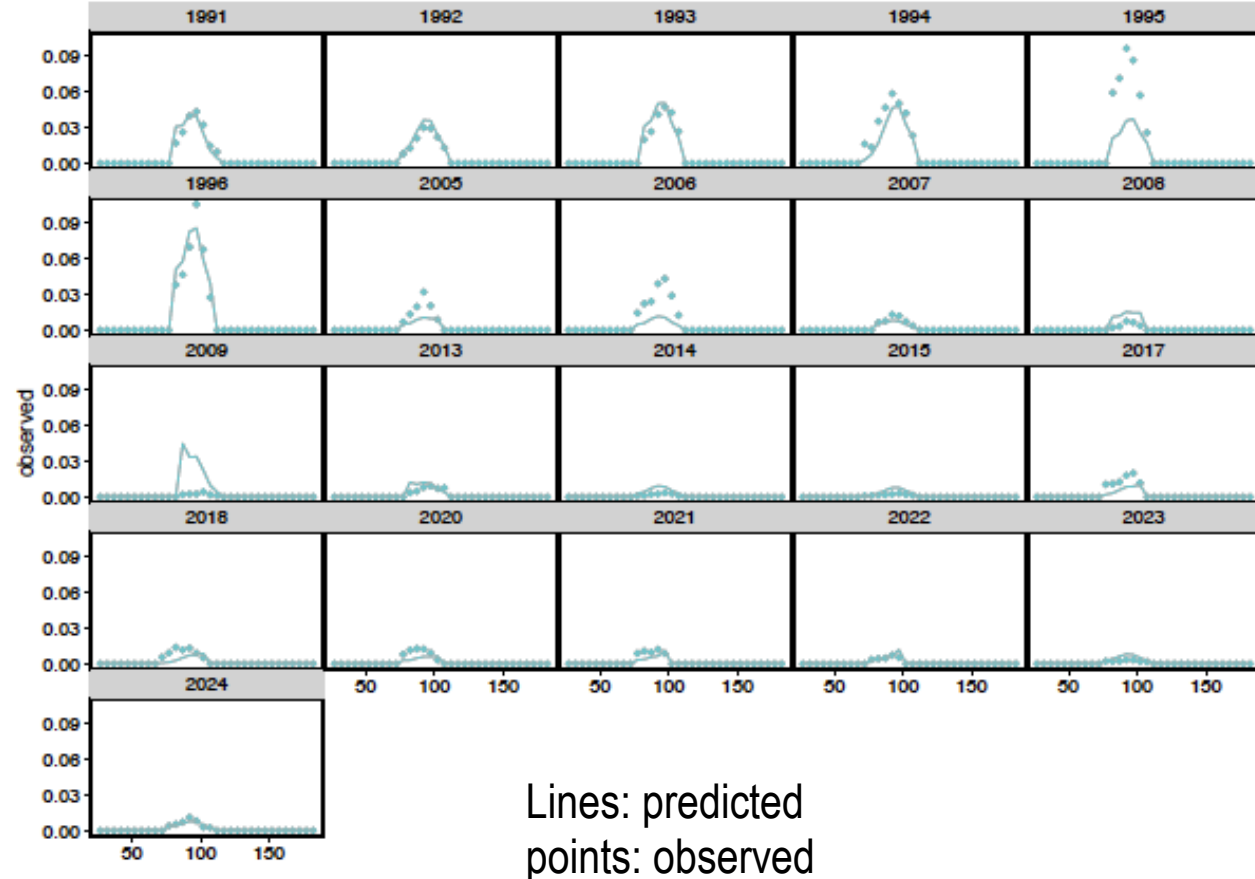


Fits to directed fishery total catch size comps

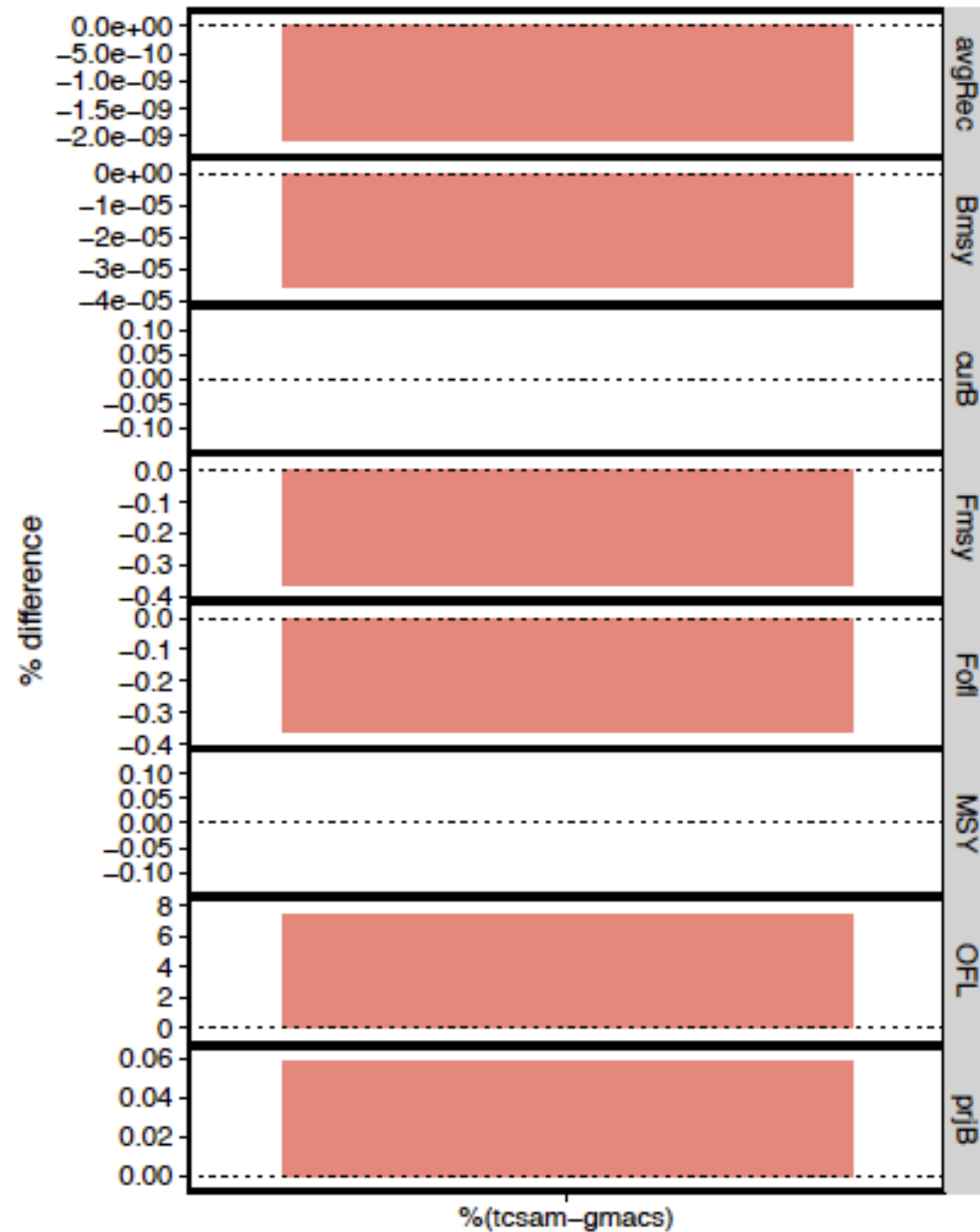
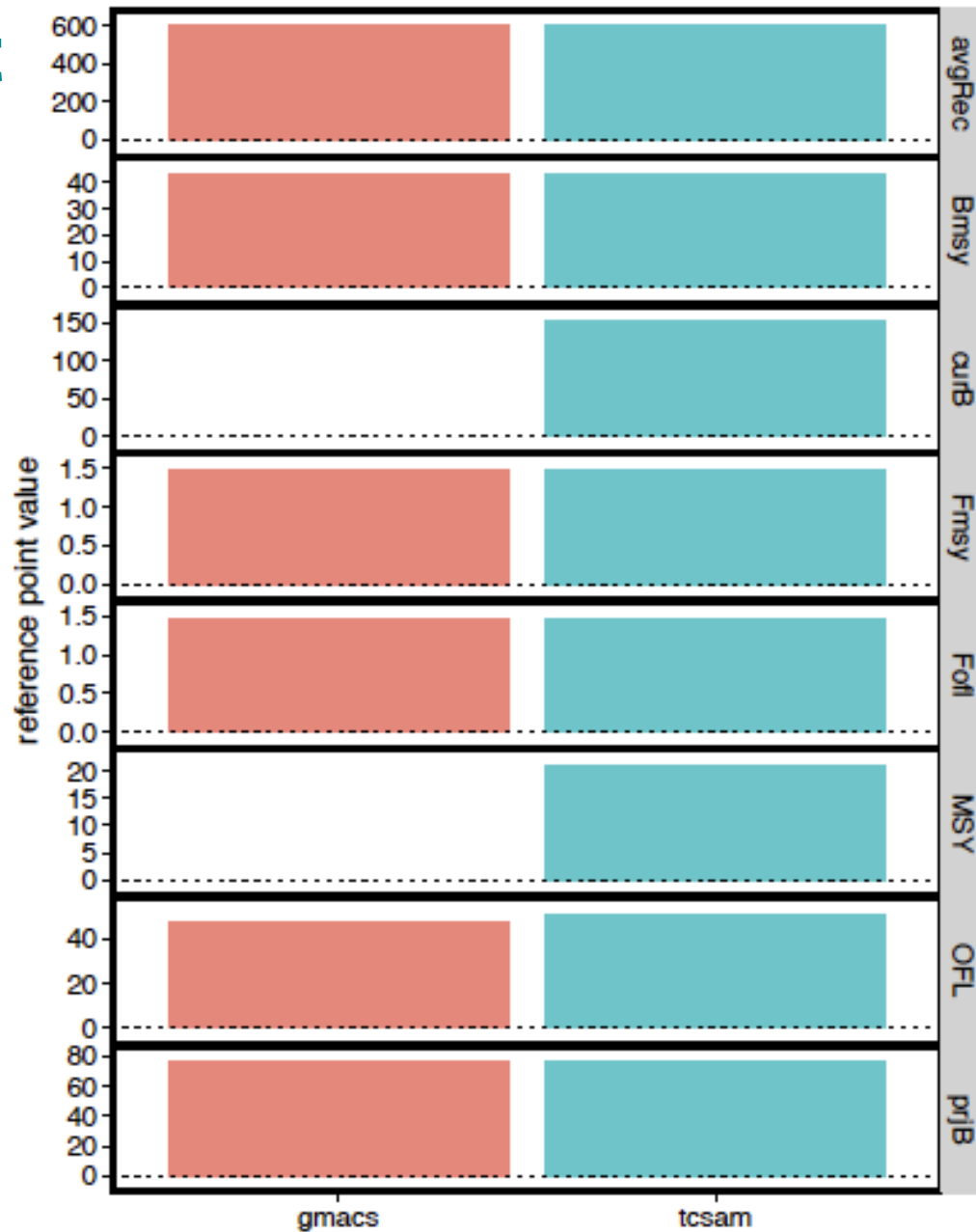
males



females



Management Quantities



Wrap-up

GMACS

Estimation

- GMACS model converges, but not to TCSAM02 MLE
- Need to ensure priors and penalties are equivalent between the frameworks

Further work (before September)

- reconcile OFL calculations

Proposed models

- use new maturity workflow
- bespoke TCSAM02 model updated with 2025/26 fishery and survey data
- matching GMACS model with 2025/26 fishery and survey data
 - priors, penalties to match TCSAM02 as closely as possible
 - use GMACS OFL calculations



TCSAM02

Models



Proposed Tier 3 models for September

- 2024 assessment model (TCSAM02 22.03d5) is “base” model
 - update with 2024/25 fishery/survey data
- TCSAM02 25_02 model
 - with SBS-derived NMFS survey capture probabilities
- GMACS G25_05
 - resolve scaling differences with TCSAM02 model
 - provide complete analysis
 - management quantities,
 - retrospective patterns, etc

