

2026 Stock Assessment and Fishery Evaluation Report for the Tanner Crab Fisheries of the Bering Sea and Aleutian Islands Regions

William T. Stockhausen

2026-09-21

THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF
PREDISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY
GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY NOAA
FISHERIES/ALASKA FISHERIES SCIENCE CENTER AND SHOULD NOT BE
CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY

1 Executive Summary

1.1 Stock: species/area

Southern Tanner crab, *Chionoecetes bairdi*, in the eastern Bering Sea (EBS).

1.2 Catches: trends and current levels

Legal-sized male Tanner crab are caught and retained in the directed (male-only) Tanner crab fishery in the eastern Bering Sea (EBS). The North Pacific Fishery Management Council (NPFMC) annually determines the overfishing limit (OFL) and acceptable biological catch (ABC) levels for Tanner crab in the EBS. The Alaska Department of Fish and Game (ADF&G) sets the total allowable catch (TAC) separately for areas east and west of 166°W longitude in the Eastern Subdistrict of the Bering Sea District Tanner crab Registration Area J based on the State's harvest strategy, which is determined by its Board of Fisheries. The OFL and ABC apply to "total catch mortality", which includes estimated bycatch mortality on discarded males and females from all fisheries that capture Tanner crab, as well as retained catch. The TAC applies only to retained catch, but is constrained by the ABC.

In addition to legal-sized males, females and sub-legal males are caught in the directed fishery as bycatch and must be discarded. Discarding of legal-sized males also occurs, primarily because the minimum size preferred by processors is larger than the minimum legal size, but also because "old shell" crab can be less desirable than "new shell" males. Tanner crab are also taken as bycatch in the snow crab and Bristol Bay red king crab fisheries, the groundfish fisheries, and, to a very minor extent, the scallop fishery. In order to account for mortality of discarded crab, handling mortality

rates for Tanner crab are assumed to be 0.321 for crab discarded in the crab fisheries, 0.5 for crab discarded in the groundfish fisheries that use fixed gear, and 0.8 for crab discarded in the groundfish fisheries that use trawl gear (CPT 2014, 2021). Bycatch in the groundfish fisheries is aggregated across gear types in the assessment model and the rate for trawl gear is applied to the aggregated bycatch to estimate discard mortality. These values are intended to account for differences in gear and handling procedures used in the various fisheries.

Following rationalization of the Bering Sea and Aleutian Islands (BSAI) crab fisheries in 2005/06, the directed fishery for Tanner crab was prosecuted through 2009/10, after which ADF&G set TACs to 0 in both management areas (thus closing the directed fishery) because stock biomass failed to meet required thresholds in the State’s harvest strategy. Prior to the 2010/11 closure, the retained catch averaged 766.6 t per year between 2005/06-2009/10 and total catch mortality averaged 1,877 t. In early 2012, the National Marine Fisheries Service (NMFS) declared the stock overfished because the estimated mature male biomass fell below the federal Minimum Stock Size Threshold ($MSST = \frac{1}{2}B_{MSY}$, where B_{MSY} is the equilibrium biomass associated with fishing at maximum sustainable yield, MSY), which was based at the time on a Tier 4 harvest control rule, with B_{MSY} determined by average mature male biomass over a specified time period; (Rugolo and Turnock 2011b).

Subsequently, NMFS determined that the stock was no longer overfished based on a new Tier 3 assessment model with $B_{35\%}$ as a proxy for B_{MSY} , where $B_{35\%}$ is 35% of unfished stock biomass. The OFL for 2012/13 was determined to be 19,020 t while the ABC was set to 8,170 t based on a “stair-step approach” adopted to re-open the fishery (SSC 2012; CPT 2015). ADF&G, however, set the TAC to 0 in both management areas in accordance with the State of Alaska’s harvest strategy at the time. The OFL for the following year (2013/14) was determined to be 25,350 t, with an ABC of 17,820 t following the stair-step approach (CPT 2013). ADF&G subsequently set the TACs at 746 t for the western area and at 664 t for the eastern area and the directed fishery was prosecuted for the first season since 2009/10. On closing, 80% (594 t) of the TAC was taken in the western area while 99% (654 t) was taken in the eastern area. Total catch mortality was 2,270 t. Since then, the stock has remained above its Tier 3 MSST and has not been considered overfished by federal standards. OFLs have ranged from ~21,000 t to ~51,000 t while ABCs have ranged from ~17,000 t to ~41,000 t; none have constrained fishery TACs set by ADF&G. ADF&G closed the directed fishery in the eastern area each year from 2016/17 to 2021/22 and 2 times (2016/17 and 2019/20) in the western region based on its own harvest strategies with criteria that incorporated area-specific stock size thresholds for females as well as males. Since ADF&G adopted a new harvest policy in 2022 (Daly et al. 2020), both areas have remained open to directed fishing although the TACs continue to remain well below federal OFLs and ABCs.

Since the elevation to Tier 3 in 2012/13, directed harvests reached a maximum of ~8,900 t in 2015/16, but subsequently dropped to less than 1,200 t until 2024/25 when the area-combined TAC was set at 2,840 t and directed harvests reached 3,000 t. During this period total catch mortality peaked in 2015/16 as well (~11,000 t) but was subsequently less than (~3,000 t).

For 2025/26, the OFL was 51,020 t and the ABC was 40,810 t. The TAC in the eastern region was 513.0 t and 4,590 t in the western region. Total retained catch was 5,109 t and total fishing mortality was estimated directly from observer data by applying gear-specific handling mortality rates to be 5,702 t.

1.3 Stock biomass: trends and current levels relative to virgin or historic levels

The annual NMFS EBS shelf summer bottom trawl survey has been conducted since 1975. It is the principal source of fishery-independent data on the size of the Tanner crab stock. In 2026, survey biomass was 130.7 thousand t for males, 27.22 thousand t for females, and 55.83 thousand t for industry-preferred males (males ≥ 125 mm carapace width [CW]). Average survey biomass over the past 5 years was 77.84 thousand t for males, 27.42 thousand t for females, and 19.08 thousand t for industry-preferred males. Since the survey gear was standardized in 1982, maximum survey biomass for males occurred in 1991 at 145.8 thousand t, for females in 1982 at 65.86 thousand t, and for industry-preferred males in 1992 at 73.98 thousand t. In general, the stock has fluctuated on a decadal scale imposed on a declining trend since the beginning of the survey. Since 2010, maximum survey biomass for males occurred in 2026 at 130.7 thousand t, for females in 2024 at 43.76 thousand t, and for industry-preferred males in 2026 at 55.83 thousand t.

For EBS Tanner crab, spawning stock biomass is expressed as mature male biomass (MMB) at the time of mating (mid-February), which is a model-estimated quantity. From the author's preferred model (22.03d5 (2026)), estimated MMB for 2025/26 was 116.9 thousand t. The most recent peak in MMB occurred in 2025/26 at 116.9 thousand t. MMB approached very low levels last seen in the mid-1990s to early 2000s (1993 to 2003 average: 51.76 thousand t) in 2020/21 at 51.85 thousand t but has increased over the past five years to its highest since 2009.

1.4 Recruitment: trends and current levels relative to virgin or historic levels.

Annual recruitment, the number of small crab (≥ 25 mm CW) entering the population at the beginning of the crab year (July 1), is a model-estimated quantity. From the author's preferred model (22.03d5 (2026)), estimated total recruitment has increased since 2016, when recruitment reached its lowest level (234 million) since 2011. Average recruitment over the previous 10 years (2016-2025) was 871 million crab, which is ~46% more than the long-term (1982-2025) mean of 596 million crab. For 2026, estimated recruitment is 515 million crab, which is substantially less than the estimate for the previous year (673 million) and less than the longterm average. However, estimates of recruitment in the final model year are generally not well-estimated.

1.5 Management performance

Historical status and catch specifications for eastern Bering Sea Tanner crab, with 2026/27 values based on the maximum likelihood estimate (MLE) from the author's recommended model, 22.03d5 (2026), and additional models that might be selected for determining management quantities, are given in the following tables:

Table A. Management quantities (in 1,000's t) from the author's preferred model, 22.03d5 (2026), and additional candidate models, as well as the recommended ABC buffer (20%). Biomass (MMB) is for the crab year the assessment was performed. TACs are summed across ADF&G management areas. Total catch is total catch *mortality*. M's are listed in the order: immature crab, mature female, mature male.

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC	model
2021/22	17.37	62.05	0.50	0.49	0.78	27.17	21.74	NA
2022/23	18.19	74.17	0.91	0.91	1.19	32.81	26.25	NA
2023/24	20.00	88.21	0.94	0.94	1.09	36.20	27.15	NA
2024/25	21.61	99.53	2.84	2.85	3.09	41.29	33.03	NA
2025/26	23.78	129.04	5.10	5.11	5.70	51.02	40.81	‘22.03d5 (GMACS)’
2026/27	NA	108.19	NA	NA	NA	72.10	57.68	‘22.03d5 (GMACS)’
2025/26	24.90	127.49	5.10	5.11	5.70	51.02	40.81	‘26.02 (GMACS)’
2026/27	NA	111.30	NA	NA	NA	53.73	42.98	‘26.02 (GMACS)’
2025/26	21.33	116.89	5.10	5.11	5.70	51.02	40.81	‘22.03d5 (2026)’
2026/27	NA	97.85	NA	NA	NA	67.39	53.91	‘22.03d5 (2026)’

Table B. Management quantities (in millions of pounds) from the author’s preferred model, 22.03d5 (2026), and additional candidate models, as well as the recommended ABC buffer (20%). Biomass (MMB) is for the crab year the assessment was performed. TACs are summed across ADF&G management areas. Total catch is total catch *mortality*. M’s are listed in the order: immature crab, mature female, mature male.

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC	model
2021/22	38.29	136.80	1.10	1.08	1.72	59.90	47.93	NA
2022/23	40.10	163.52	2.01	2.01	2.62	72.33	57.87	NA
2023/24	44.09	194.47	2.08	2.07	2.40	79.81	59.86	NA
2024/25	47.64	219.43	6.27	6.29	6.81	91.03	72.82	NA
2025/26	52.42	284.49	11.25	11.26	12.57	112.48	89.97	‘22.03d5 (GMACS)’
2026/27	NA	238.51	NA	NA	NA	158.96	127.17	‘22.03d5 (GMACS)’
2025/26	54.89	281.06	11.25	11.26	12.57	112.48	89.97	‘26.02 (GMACS)’
2026/27	NA	245.36	NA	NA	NA	118.45	94.76	‘26.02 (GMACS)’
2025/26	47.02	257.70	11.25	11.26	12.57	112.48	89.97	‘22.03d5 (2026)’
2026/27	NA	215.72	NA	NA	NA	148.57	118.85	‘22.03d5 (2026)’

Notes: MSST and MMB are based on data available to the Crab Plan Team at the time of the assessment for the previous crab fishing year.

1.6 Probability density function for the OFL

The probability density function assumed for the Tier 3 OFL to determine the p^* ABC (see Section 8 for details) is a normal function with mean 67,388 t and standard deviation 4,148 t. The standard deviation for the OFL was estimated using AD Model Builder’s “delta” method.

1.7 Basis for the 2026/27 OFL

Table C. Basis for the OFL from the author’s preferred model, 22.03d5 (2026), and additional candidate models. Biomass units are in 1,000’s t. ‘Projected MMB’ is projected for the fishing year following the assessment under the assumption the OFL is taken.

Year	Tier	Bmsy	Projected MMB	B/Bmsy	Fofl	Years to Define Bmsy	Natural Mortality	model
2021/22	3a	35.94	42.57	1.18	1.17	1982-2020	0.23	NA
2022/23	3a	34.70	47.58	1.37	1.17	1982-2021	0.23	NA
2023/24	3a	36.39	48.77	1.34	1.16	1982-2022	0.23	NA
2024/25	3a	40.01	56.06	1.40	1.23	1982-2023	0.23	NA
2025/26	3a	43.22	75.96	1.78	1.47	1982-2024	0.23	NA
2026/27	3a	47.56	108.19	2.27	1.31	1982-2025	0.3; 0.31; 0.27	‘22.03d5 (GMACS)’
2026/27	3a	49.79	111.30	2.24	1.02	1982-2025	0.35; 0.32; 0.2	‘26.02 (GMACS)’
2026/27	3a	42.66	97.85	2.29	1.42	1982-2025	0.25; 0.31; 0.32	‘22.03d5 (2026)’

Table D. Basis for the OFL from the author’s preferred model, 22.03d5 (2026), and additional candidate models. Biomass units are in millions of pounds. ‘Projected MMB’ is projected for the fishing year following the assessment under the assumption the OFL is taken.

Year	Tier	Bmsy	Projected MMB	B/Bmsy	Fofl	Years to Define Bmsy	Natural Mortality	model
2021/22	3a	79.23	93.85	1.18	1.17	1982-2020	0.23	NA
2022/23	3a	76.50	104.90	1.37	1.17	1982-2021	0.23	NA
2023/24	3a	80.23	107.52	1.34	1.16	1982-2022	0.23	NA
2024/25	3a	88.21	123.59	1.40	1.23	1982-2023	0.23	NA
2025/26	3a	95.28	167.46	1.78	1.47	1982-2024	0.23	NA
2026/27	3a	104.84	238.51	2.27	1.31	1982-2025	0.3; 0.31; 0.27	‘22.03d5 (GMACS)’
2026/27	3a	109.77	245.36	2.24	1.02	1982-2025	0.35; 0.32; 0.2	‘26.02 (GMACS)’
2026/27	3a	94.05	215.72	2.29	1.42	1982-2025	0.25; 0.31; 0.32	‘22.03d5 (2026)’

Estimated total catch mortality (retained + discard mortality in all fisheries, using discard mortality rates of 0.321 for crab pot gear, 0.5 for fixed gear in the groundfish fisheries, and 0.8 for trawl gear) in 2025/26 was 5.702 thousand t, which was less than the OFL (51.02 thousand t); consequently, **overfishing did not occur**. B_{MSY} for this stock was calculated to be 42.66 thousand t, so the MSST is 21.33 thousand t. Because 2025/26 MMB (116.9 thousand t) > MSST, **the stock is not overfished**.

The OFL for 2026/27, based on the author’s preferred model (22.03d5 (2026)), is 67.39 thousand t, which results in a projected MMB of 97.85 thousand t. The maximum permissible ABC, ABC_{max} , for 2026/27 is 67.28 thousand t, based on the p^* ABC. In 2014, the NPFMC’s Scientific and Statistical Committee (SSC) adopted a 20% buffer to calculate ABC for Tanner crab to incorporate concerns regarding model and environmental uncertainty for this stock (SSC 2014). Because of uncertainty regarding environmental influences, the currency to describe reproductive potential, and the application of harvest control rules based on equilibrium considerations remain concerns for this stock and assessment, the author recommends continuing to use the 20% buffer to calculate the ABC. Based on this buffer, the ABC would be 53.91 thousand t.

1.8 Rebuilding analyses results summary

The Tanner crab stock was found to be above MSST (and B_{MSY}) in the 2012 assessment (Rugolo and Turnock 2012a) and was subsequently declared rebuilt. The stock remains not overfished. Consequently, no rebuilding analyses were conducted.

2 Summary of Major Changes

2.1 Changes to management of the fishery

The directed fishery was prosecuted in 2025/26 in both State management areas (i.e., east and west of 166°W longitude in the General Section of the Eastern Subdistrict of the Bering Sea District of the Tanner Crab Registration Area J; Figure 1) in the EBS. While this is the fourth year in a row the fishery have been open in both State management areas, it is also only the fourth since the 2015/16 season that the eastern area has been open to directed fishing. Bycatch of Tanner crab also occurred in the snow crab fishery, the Bristol Bay red king crab (BBRKC) fishery, and the groundfish fisheries.

2.2 Changes to input data

Table E summarizes the time frames of, and changes to, the input data for the 2026 assessment. Tyler Jackson (ADFG) provided revised estimates for the retained catch time series (catch abundance and biomass) and size compositions from the directed fishery and incidentally-retained catch from the snow crab and BBRKC fisheries from 1990/91-2024/25; he also provided new data from the directed Tanner crab fishery for 2025/26. In addition to retained catch data, Tyler also provided revised estimates for 1990/91 to 2024/25 of the time series for total catch abundance and biomass, as well as the associated size composition data, from fishery observer sampling in the directed fishery and for bycatch in the snow crab, BBRKC and new estimates from the 2025/26 season. Information on bycatch in the groundfish fisheries (abundance and biomass) based on observer sampling was pulled from the AKFIN Catch-In-Areas database for 2009-2026 on Aug. 10, 2026 and from AKFIN's norpack-length-report database from 1986-2006 on the same date.

Fishery-independent time series ("survey" biomass and abundance) and size compositions were updated with data from the 2026 NMFS EBS shelf bottom trawl survey using the R "crabpack" package developed by AFSC's Shellfish Assessment Program to pull survey abundance, biomass, and size composition data for the entire survey period (1975-2026) on Aug. 12, 2026. Emily Ryznar (NMFS) provided estimates for male maturity ogives from 1990 to 2026 using the new maturity workflow she developed (Ryznar 2026). No updates occurred to the Bering Sea Fisheries Research Foundation (BSFRF) survey data or to molt increment data included in the assessment.

Table E. Data used in this assessment, with new and updated data noted.

Description	Data types	Time frame	Notes	Source
NMFS EBS Bottom Trawl Survey	area-swept abundance, biomass	1975-2019, 2021-26	2026 added	NMFS
	size compositions	1975-2019, 2021-25	2026 added	
	male maturity data	2006+	2026 added	
NMFS/BSFRF	molt-increment data	2015-17, 2019	no new data	NMFS, BSFRF
BSFRF SBS Bottom Trawl Survey	area-swept abundance, biomass	2013-18	no new data	BSFRF
	size compositions	2013-18	no new data	
Directed fishery	historical retained catch (numbers, biomass)	1965/66-1996/97	not updated	2018 assessment
	historical retained catch size compositions	1980/81-1996/97	not updated	2018 assessment
	retained catch (numbers, biomass)	2005/06+	2025/26 added, remainder revised	ADFG
	retained catch size compositions	2005/06+	2025/26 added, remainder revised	ADFG
	total catch (abundance, biomass)	1991/92+	2025/26 added, remainder revised	ADFG
	total catch size compositions	1991/92+	2025/26 added, remainder revised	ADFG
Snow Crab Fishery	historical effort	1978/79/1989/90	not updated	2018 assessment
	effort	1990/91+	2025/26 added, remainder revised	ADFG
	total bycatch (abundance, biomass)	1990/91+	2025/26 added, remainder revised	ADFG
	total bycatch size compositions	1990/91+	2025/26 added, remainder revised	ADFG
Bristol Bay Red King Crab Fishery	historical effort	1953/54-1989/90	not updated	2018 assessment
	effort	1990/91+	2025/26 added, remainder revised	ADFG
	total bycatch (abundance, biomass)	1990/91+	2025/26 added, remainder revised	ADFG
	total bycatch size compositions	1990/91+	2025/26 added, remainder revised	ADFG
Groundfish Fisheries (all gear types)	historical total bycatch (abundance, biomass)	1973/74-1990/91	not updated	2018 assessment
	historical total bycatch size compositions	1973/74-1990/91	not updated	
	total bycatch (abundance, biomass)	1991/92+	2025/26 added, remainder revised	NMFS/AKFIN
	total bycatch size compositions	1991/92+	2025/26 added, remainder revised	

2.3 Changes to assessment methodology

As requested by the CPT and SSC, the standalone appendix Stockhausen (2026a) documents the equivalence of TCSAM02 and GMACS model results at initialization using a version of the model 22_03d5c with 2025 data that was modified slightly to minimize differences in model structure between the two frameworks with the expectation that results from the two frameworks should be almost identical. The standalone appendix Stockhausen (2026b) documents the results when parameters were estimated. Management quantities from the two models compared differed by less than 0.5% when the GMACS model was run with fixed parameters; when parameters were estimated, the management quantities differed by a maximum of 10%.

In addition to one Tier 3 model (“22_3d5c 2026”) developed using the bespoke modeling framework, TCSAM02, two models (“22_3d5c GMACS” and “26_02 GMACS”) developed using the GMACS framework were also evaluated for this assessment. The TCSAM02 modeling framework is described in detail in Stockhausen (2023a). A detailed description of the GMACS framework is in preparation (Veron, in prep.) but is not yet available. All three models were based on the accepted model from the 2025 assessment, model 22_03d5c, but the 2026 models include the new and revised fishery and survey data noted in the previous section. The “22_3d5c 2026” TCSAM02 model was identical in structure and parameterization to the 2025 assessment model. “22_3d5c GMACS” was intended to replicate the model structure of “22_3d5c 2026” as closely as possible in a GMACS model. To that end, equivalent population processes, selectivity curves, parameters, and likelihood components (including prior probability functions) were used to the extent possible but the two models could not be made identical in all respects. One important simplification that was implemented was to use the size-specific probability of maturing curves estimated using the TCSAM02 model as fixed inputs to the GMACS model. The TCSAM02-equivalent functionality to estimate these curves

has not been implemented yet in GMACS. As an alternative to this, the third model, “26_02 GMACS”, followed the Tier 3 snow crab model approach and used the results from Emily Ryznar’s updated male maturity ogive analysis (that included the 2026 NMFS EBS survey data) to directly determine the annual probability of maturing (i.e., undergoing terminal molt).

3 Responses to the most recent two sets of SSC and CPT Comments

3.1 May/June 2026

3.1.1 CPT/SSC Comment (general)

Proposed Crab Risk Table SOP adopted for implementation in September 2026, endorsed by both CPT and SSC: (1) Assessment authors identify a historical buffer based on long-term, persistent considerations (Tier 1, top row, carried over annually); (2) Second row evaluates current-year uncertainties not already captured in the model, tier level, or HCRs (Tier 2, used only in rare circumstances where additional buffer is needed); (3) No prescriptive formula links risk table scores to ABC buffer changes; (4) Authors collaborate with ESP authors (and ESR authors when no ESP exists); (5) Full risk table provided as appendix in each SAFE chapter for all annual assessments (snow crab, Tanner crab, BBRKC, NSRKC, AIGKC); (6) CPT will develop a summary buffer history table in the full SAFE Introduction to track buffers for each stock.

3.1.1.1 Response

Sept. 2026: The two-row format has been implemented in the Risk Table appendix (Appendix B in the SAFE report). Assessments already contain justifications for existing buffers that would populate Tier 1. Appendix A provides a table documenting the recent history of ABC buffers for this stock.

3.1.2 CPT/SSC Comment (specific to assessment)

Bring forward the following for the September 2026 final assessment: (1) an updated TCSAM02 model using the new maturity workflow and updated survey and fishery data; (2) a matching GMACS model configured as closely as possible to the updated TCSAM02 — the CPT anticipates adopting the GMACS version for harvest specifications; (3) a Tier 4 fallback/context calculation. Both the updated maturity workflow and resolution of data-handling issues identified by the CPT must be completed and documented before the final assessment. Confirm the updated fishery catch time series is being used. Also provide a concise summary of relevant CIE recommendations and author responses from the June 2026 CIE review, if available in time for the September CPT and October SSC review.

3.1.2.1 Response

Sept. 2026: (1) TCSAM02-based model 22.03d5c (2026) is the 2025 assessment model updated with male maturity ogive results from the new maturity workflow, 2026 NMFS EBS trawl survey data (pulling all years 1975-2026 from the database), 2025/26 crab fishery data, revised 1990/91-2025/26 crab fishery data, and updated groundfish fisheries bycatch data from the Catch-In-Areas database via AKFIN for all years. The most recent, full time series for both fishery and survey data (as opposed to simply adding the last year of data to the previous assessment's data files) have always been used to update data for this assessment. (2) Results from a "matching" GMACS model, 22.03d5c (GMACS), are also provided (but not recommended for harvest specifications). (3) A Tier 4 fallback/context calculation is provided. Only a draft document of the CIE Review recommendations was available before this document was written. The recommendations immediately relevant to the assessment essentially endorse the transition to GMACS.

3.1.3 CPT/SSC Comment (specific to assessment)

Both the CPT and SSC recommend that differences in how maturity ogives are used in the snow crab and Tanner crab assessments be discussed at a future January Modeling Workshop. The new maturity workflow (using Bernoulli likelihood per data point and bootstrapping for subsampling uncertainty) is endorsed by both the CPT and SSC and should be used for both snow crab and Tanner crab assessments going forward.

3.1.3.1 Response

Sept. 2026: Noted. The GMACS model 26.02 (GMACS) discussed in this document includes the male maturity "data" from the new maturity workflow in a manner similar to how the snow crab model has treated similar data for snow crab in previous assessments.

3.1.4 SSC Comment (specific to assessment)

Provide a concise TCSAM02–GMACS bridge table comparing: convergence diagnostics; likelihood components; priors and penalties; derived biomass and abundance estimates; reference points; and OFL calculations. Also provide a technical reconciliation of the TCSAM02 and GMACS Tier 3 OFL calculations, including: side-by-side documentation of the algorithms; decomposition of the ~7% OFL difference; and identification of the recommended OFL calculation if GMACS is brought forward for October 2026 management specifications. Develop this reconciliation in coordination with GMACS developers and other crab assessment authors as appropriate.

3.1.4.1 Response

Sept. 2026: The tabular comparisons requested are provided in several tables; a single "concise" table is beyond the abilities of the assessment author. As demonstrated in the "run 1" appendix, the TCSAM02 and GMACS Tier 3 OFL calculations result in the same values when fully-equivalent parameters are used in the models. The 7% OFL discrepancy between the models presented in May resulted because the two parameter sets used were not completely equivalent: while both models were driven with identical recruitment "devs" parameters, the TCSAM02 model included mean recruitment parameters for two time periods (pre-1975, post-1974) while GMACS only accommodates

a single mean recruitment parameter. When the GMACS recruitment parameters were revised to duplicate the TCSAM02 time recruitment time series, the resulting OFLs were essentially identical ($< 0.1\%$ difference). Both frameworks use the same approach to determining F_{OFL} based on finding $F_{35\%}$ using an iterative, steepest descent algorithm to determine the directed fishery F that results in $B = B_{35\%}$, followed by application of the harvest control rule to determine F_{OFL} . The OFL is then calculated by projecting the current population forward one year under directed fishing at F_{OFL} (and bycatch fishery F 's consistent with bycatch in recent years).

3.1.5 CPT/SSC Comment (specific to assessment)

Do not include hybrid catch or survey data in the snow crab or Tanner crab assessment models at this time — including hybrids in removals for parent populations (primarily snow crab) creates internal inconsistencies in assessment models. Hybrid model runs are not requested for September 2026, but may be requested in a future cycle depending on hybrid abundance, stakeholder interest, and other factors. Continue formally tracking hybrid abundance and distribution trends in the NOAA survey technical memo (potentially using a REMA model as a monitoring tool). Hybrid-related uncertainty should be handled through the existing FMP flexibility in the ABC buffer setting process, the risk table, or the TAC-setting process as appropriate; caution against a predetermined direction in modifying any buffer, as this uncertainty could go in either direction.

3.1.5.1 Response

Sept. 2026: No hybrid catch or survey data was included in the models run for this assessment. Trends in hybrid abundance are considered in the Risk Table and recommendations for a reducing the ABC below its maximum permissible value.

3.1.6 CPT/SSC Comment (specific to assessment)

Modernized genetic identification of hybrid crab is a high-priority research item to move beyond semi-subjective morphometric classifications and to better understand the long-term implications of hybridization in a warming Bering Sea. Continued research into hybrid-specific population dynamics, genetics, life history information, and habitat characterization or preferences is needed to inform a long-term approach. Alignment of how hybrids are classified is needed across the ADF&G observer program, EBS bottom trawl survey, and federal fishery data streams so that data sources can be linked for analyses. Continued communication is needed among partner agencies (ADF&G, NOAA) to make data streams more consistent and improve their potential future utility.

3.1.6.1 Response

Sept. 2026: Noted. The AFSC EBS trawl survey team is conducting a pilot study to improve morphological classification using genetically confirmed identifications.

3.2 CPT Comments January 2026

3.2.1 CPT Comment (specific to assessment)

The CPT requested that Chionoecetes stock assessment authors present a comparison of results from models using the legacy versus new workflow data sets at the May 2026 CPT meeting.

3.2.1.1 Response

May 2026: Results from this modeling exercise for Tanner crab are presented in May 2026 Tanner crab report.

3.2.2 CPT Comment (specific to assessment)

Tanner and snow crab stock authors complete three model sensitivity runs (including size composition and abundance data):

- With hybrids included in survey data;
- With hybrids included in catch data;
- With hybrids included in both survey and catch data

3.2.2.1 Response

May 2026: Results from this modeling exercise for Tanner crab are presented in May 2026 Tanner crab report.

3.3 SSC Comments October 2025

3.3.1 SSC Comment (general)

The SSC notes that crab stock assessment authors currently use the OFL for catch projections. The SSC recommends that the 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.

3.3.1.1 Response

May 2026: It's a bit unclear what this comment is referring to. The Tanner crab assessment results provide projection results from a range of fishing mortality rates (fractions of F_{OFL}) for the directed fishery.

3.3.2 SSC Comment (specific to assessment)

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, which makes review a daunting task. The SSC suggests additional streamlining of the material included in future assessment documents.

3.3.2.1 Response

May 2026: Noted. However, recent requests by the SSC to include results from a Tier 4 modeling approach, likelihood profiles on important parameters, retrospective assessment results, more information on jittering, and risk tables only increases the amount of material that needs to be included in the document. Specific suggestions as to what to remove, or how to reorganize the results into appendices, would be highly appreciated.

Sept. 2026: The current document is even longer than the 2025 version to document the continuing transition from TCSAM02 to GMACS in the level of detail requested by the CPT and SSC, as well as additional requirements (e.g., squid plots for recruitment estimates in retrospective analyses) added to the SAFE Guidelines checklist.

3.3.3 SSC Comment (specific to assessment)

The main recommendation from the SSC is to continue prioritizing the transition of the Tanner crab assessment into the GMACS framework. If a CIE review of this assessment is scheduled for 2026, the SSC strongly recommends that both the current and GMACS results are presented to the CIE, even if the GMACS conversion is still in progress

3.3.3.1 Response

May 2026: The transition of the Tanner crab assessment into the GMACS framework continues to be prioritized. A GMACS version of the Tanner crab model now achieves almost identical results to the bespoke model for population-level quantities, fishery quantities, survey quantities, and likelihood values when initialized at parameter values equivalent to those from the bespoke model and compared with the bespoke model results after a single iteration step (see Stockhausen (2026d)). The only quantities substantially different are fits to “extended” size compositions and the OFL (~7.4% difference). The discrepancy in fitting “extended” size compositions (i.e., size compositions formed by appending the corresponding female size composition to a male composition) is caused by differences in how the two component compositions are weighted when forming the “extended” composition, but a path to resolving it has not yet been determined. The cause of the difference in the OFL has not yet been identified, but it is likely to be due to differences in the way the bycatch fisheries are treated in the two modeling frameworks. Current attention is also focused on reconciling the priors and likelihood penalties used in the two frameworks to achieve converged models yielding essentially the “same” values.

Sept. 2026: The transition of the Tanner crab assessment into the GMACS framework continues to be the highest priority for this assessment. However, it is time that other issues (e.g., maturity definition) with the assessment start to be addressed again and that is only possible if the transition

to GMACS is completed. Although the author does not recommend using a GMACS model for harvest specifications this cycle, he does recommend fully adopting GMACS for future assessments at this time and discontinuing further use of TCSAM02 models other than as potential diagnostic tools.

3.3.4 SSC Comment (specific to assessment)

An analysis of different inclusions/exclusions of hybrid data into the Tanner crab assessment (i.e., in survey and catch data) to evaluate sensitivity to these options and ensure an internally consistent approach. This is a lower priority for Tanner crab (see snow crab recommendations), but it may be helpful for the Tanner and snow crab assessment authors to work collaboratively on this topic.

3.3.4.1 Response

May 2026: Model runs similar to those for snow crab were made including/excluding hybrid survey and fishery data in the 2025 assessment model (see Stockhausen (2026d)). Differences in management parameters under the different scenarios were relatively small (~10%) compared with the assessment results without hybrids.

3.3.5 SSC Comment (specific to assessment)

Continue reviewing pertinent literature for any new information on the maturity and reproductive biology of Tanner crab and other crab species with determinate growth (i.e., have a terminal molt) and re-examining the appropriateness of estimating maturity within the model or using an alternative (e.g., cut-line, size at 95% maturity) to better inform Tanner crab management decisions as new information becomes available. The SSC suggests that this could also be a high-priority topic for the upcoming CIE review.

3.3.5.1 Response

May 2026:

- “Continue reviewing pertinent literature”: any suggestions? There are several fairly recent publications which focus on snow crab maturity and reproductive biology, but the only one I’m aware of that also considers Tanner crab is Slater et al. (2024).
- “the appropriateness of estimating maturity within the model”: characterizing the size-specific transition of immature crab through terminal molt to “maturity” is necessary to accurately reflect the post-recruitment dynamics of individual cohorts within the model for both males and females. For females, of course, the transition from immature through terminal molt to maturity is morphologically unambiguous and maturity ogives do not need to be explicitly derived (maturity state-explicit survey size compositions provide this information) for the model to estimate the size-specific transition probabilities from immature to mature state. For males, the male maturity workflows (see Stockhausen (2026d)) developed by the SAP provide the estimates of size-specific post-growth fractions of newly-morphometrically mature males on an (almost) annual basis (since 2008) that the model uses as “data” to determine the size-specific probabilities of terminal molt for males. Unlike the snow crab model, which uses the

ogives as “truth” to annually categorize post-growth new shell males into those that remain immature and those that underwent terminal molt and became mature, the current Tanner crab assessment model estimates time-invariant size-specific probabilities of terminal molt using the ogive data, although the modeling framework allows for estimating time variation across blocks of years.

- “estimating maturity within the model or using an alternative (e.g., cut-line, size at 95% maturity)”: Whether it is better to use the estimated probabilities of terminal molt or alternatives such as a cut-line to determine proxies ($F_{35\%}$, $B_{35\%}$) for management reference points (F_{MSY} , B_{MSY}) is not strictly a biological issue and depends on the goals of management (e.g., using size-at-95% mature as the minimum size for “mature” males when calculating $B_{35\%}$ would protect a larger size range of males from exploitation than use of the maturity ogive, but might result in a greatly-reduced OFL).

3.4 SSC Comment (specific to assessment)

The SSC supports further exploration of an index of how changing environmental conditions might affect size at maturity of Tanner crab and considers this a research priority for both Tanner and snow crab.

3.4.0.1 Response

May 2026: Noted. Current snow crab research, which suggests this may be a complex problem involving both exogenous environmental conditions (e.g., temperature) and “endogenous” population conditions (e.g., size-specific density dependence) (C. Szuwalski, pers. comm.), may provide a template for future research.

3.5 CPT Comments September 2025

3.5.1 CPT Comment (general)

The CPT recommended that, when the CPT requests that only one model, essentially the last accepted model with updated data, be brought forward for a final SAFE, the final SAFE should be a complete document, but the associated presentation to the CPT need not provide a detailed description and evaluation of the model.

3.5.1.1 Response

May 2026: Noted.

3.6 SSC Comments June 2025

3.6.1 SSC Comment (general)

The SSC notes that a historical retrospective is different from a within model retrospective and requests that crab assessments include a plot comparing the model-estimated time series of mature male biomass from the current assessment with the time series from the ten previous assessments (i.e., historical retrospective).

3.6.1.1 Response

Sept. 2025: The requested plot is given in Figures 164 and 165 of the 2025 SAFE chapter ([Stockhausen 2025a](#)).

3.6.2 SSC Comment (general)

The SSC recommends that each crab SAFE chapter include a clear description of the buffers used in harvest specification over the most recent five years, as a basis for comparing the current year's buffer recommendations.

3.6.2.1 Response

Sept. 2025: The buffer on Tanner crab has consistently been set at 20% by the SSC in recent years, despite occasional recommendations by the author (if not the CPT) for a larger value. This is repeated several times in the text.

3.6.3 SSC Comment (specific to assessment)

The SSC concurs with the CPT and recommends bringing forward the base model (22.03d5) and the GMACS model (G25.05) in October.

3.6.3.1 Response

Sept. 2025: 22.03d5 has been brought forward. 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). Time constraints did not allow a solution to this to be found in time for model results to be included in the SAFE.

3.6.4 SSC Comment (specific to assessment)

The SSC also recommends bringing forward a Tier 4 calculation similar to 2024 and consistent with methods used for BBRKC and EBS snow crab.

3.6.4.1 Response

Sept. 2025: Done.

3.6.5 SSC Comment (specific to assessment)

The SSC agrees that focus should remain on transitioning this assessment into the GMACS framework and recommends developing a list of clear milestones for the transition for the October meeting.

3.6.5.1 Response

Sept. 2025: See GMACS-relevant responses below. A list of milestones would include: 1) agreement between GMACS and the bespoke model when the former is started in 1975 with a pin file derived from the bespoke model that includes the bespoke model's estimates of population structure in 1975; 2) successful optimization of the GMACS model (a current point of failure, as noted in responses above); 3) comparison of all likelihood components between the two models; 4) adjustment of priors and penalties to achieve model configurations that are as close as possible; 5) evaluation of the final comparison.

May 2026: 1) is almost completed, and will be complete pending resolution of discrepancies in how "extended" size compositions are formed. 2) the model now converges, but not to values equivalent to the assessment model due to the issues noted in 1). 3) all data-related likelihood components except "extended" size compositions are in agreement between the two models. 4) and 5) are TBD.

Sept. 2026: A version of 1) has been completed: running the same model constructed in each framework results in identical results when run with equivalent (not necessarily equal) parameter values (see the "run 1" appendix). 2) Tanner crab GMACS models have been successfully optimized, although attempts to conduct retrospective analyses and projections failed for currently unknown reasons. 3) data-derived likelihood components in 1) were identical between the two models. 4) and 5) "as close as possible" is not good enough to yield "identical" optimized solutions—while the results are similar, they are not identical because, in particular: a) M is parameterized differently in the two frameworks and assigning priors to these parameters contributes different weights to the total objective function; b) selectivity parameters are estimated on different scales in the two frameworks (TCSAM02: arithmetic scale; GMACS: ln-scale), leading to different gradient structures even when the objective functions are identical; c) some equivalent functions are parameterized differently (e.g., logistic selectivity parameterized by slope or width), again contributing to different gradient structures

3.7 CPT Comments May 2025

3.7.1 CPT Comment (general)

With regard to Risk Tables:

- Given that baseline buffers or buffer ranges are not specified by tier level for crab stocks, buffers should consider uncertainty associated with tier level if warranted.

- The risk table should also be used to evaluate additional uncertainty, on a stock-by-stock basis, that is not already incorporated in the assessment model, tier level, or harvest control rules.
- No prescriptive formula will be used to adjust risk table scores or buffers across stocks.
- ...assessment authors should coordinate with ESP authors (and ESR authors when an ESP is not available) to discuss ecosystem considerations prior to completion of a risk table.
- Risk tables should be conducted for all annual crab stock assessments (Snow crab, Tanner crab, BBRKC, NSRKC, and AIGKC). A full risk table will be contained as an appendix in each individual SAFE chapter with rationale given for risk table scoring. Brief risk table summaries will be included in the SAFE introduction (i.e., general description and risk table template, CPT-recommended risk table scores, and buffer for each stock).

3.7.1.1 Response

Sept. 2025: The risk table for the 2025 Tanner crab stock assessment is provided as an appendix ([Stockhausen 2025b](#)). It was created as a joint effort by the assessment author and the ESP and ESR authors. It does not use a prescriptive formula to adjust the risk table scores.

3.7.2 CPT Comment (specific to assessment)

The CPT agreed with using the high-precision carapace width data but recommended using the full set of 1979 stations provided in `crabpack`.

3.7.2.1 Response

Sept. 2025: Done.

3.7.3 CPT Comment (specific to assessment)

With regards to GMACS:

- The CPT suggested starting from inputting parameters via a .PIN file in the bridging analyses and then work towards estimating parameter values
- it might also be useful to consider how selectivity is being estimated. A closer look at how priors were placed on the NMFS survey selectivity seems warranted given large differences between estimates from each model.

3.7.3.1 Response

Sept. 2025: Since May, several Tanner-specific features have been added to GMACS (e.g., additional selectivity options, growth options, etc.) to better match the bespoke model configuration and to facilitate the comparison using a directly-comparable pin file. One major stumbling block to this approach is the difference in how recruitment is handled in each model. In the bespoke model, recruitment is modeled differently in the time periods before and after 1975, the first year that survey data is incorporated into the model: recruitment prior to 1975 (the first year that survey data is available) is modeled as a first-order autoregressive (AR1) process while after 1975 it is modeled as a random walk. This two-period strategy was found to be the best way of building up the population using recruitment during a “spin-up” period from zero in 1948 (an approach that ensures the population structure is consistent with modeled growth and mortality when the survey data become available in 1975). In GMACS, recruitment cannot be defined for different time periods: a single set of recruitment parameters is applied to the entire model time period. A work-around may be to start the GMACS model in 1975 but initialized with the population structure from the bespoke model for 1975, as well as other bespoke model-equivalent parameters and processes, but this has not been implemented yet. Another issue is that the GMACS model, when run from a pin file that is thought to provide the best match to the bespoke model, generates an invalid gradient structure (i.e., a vector of NaNs) after ~150 optimization steps and the reason for this has not yet been identified. As a consequence, no GMACS models are discussed in this document.

May 2026: A GMACS version of the 2025 Tanner crab assessment model run with one function call now yields values “exactly equivalent” to the assessment model when initialized with an equivalent pin file, except for the OFL and fits to extended size compositions (i.e., all fishery size compositions),. The model also converges now, although not to values equivalent to the assessment because of issues with fitting the extended size compositions.

Sept. 2026: The “Run 1” appendix to this report documents that, given equivalent (not necessarily identical) values for parameters, models constructed using the TCSAM02 and GMACS frameworks yield essentially identical results, including the OFL. After further examination, the pin file referenced in the May 2026 comment did not provide a set of completely equivalent parameter values.

3.7.4 CPT Comment (specific to assessment)

The CPT recommended bringing forward only the base model (22.03d5) and the GMACS model (G25.05) so that more effort can be placed on bridging to GMACS.

3.7.4.1 Response

Sept. 2025: The base model, 22.03d5, has been updated with 2024/25 data and provides the basis for this assessment. It was not possible to bring a GMACS model forward at this point (see comment/response above).

3.7.5 CPT Comment (specific to assessment)

likelihood profiles over the OFL would be an interesting addition to the currently presented analyses.

3.7.5.1 Response

Sept. 2025: Time constraints did not allow this suggestion to be pursued, although the dependence of the OFL on several parameters which were themselves profiled is illustrated in an appendix to this document ([Stockhausen 2025c](#)). If time allows, the suggestion will be followed up on for the January Modeling workshop.

May 2026: No work has been done to address this. A likelihood component with a very large weight will need to be added to the overall likelihood to allow the model to be evaluated at a series of OFL values during the profiling.

3.8 SSC Comments October 2024

3.8.1 SSC Comment (general)

The SSC would like to see additional residual diagnostics other than raw residuals for length composition data from GMACS models. The SSC encourages crab authors to collaborate with groundfish assessment authors regarding the use of One-Step-Ahead and Pearson residuals.

3.8.1.1 Response

May 2025: One-Step-Ahead (OSA) residuals and DHARMA residual statistics are provided for most of the models discussed herein ([Stockhausen 2025d](#)).

Sept. 2025: “Raw” residuals have almost never been presented in the Tanner crab assessments; Pearson’s residuals have been presented. For this assessment, OSAs and DHARMA statistics are additionally presented for fits to size composition data.

3.8.2 SSC Comment (general)

The SSC requests that the CPT consider whether distinguishing between full and update assessments, as in the protocol recently adopted for groundfish assessments, would be useful for crab assessments.

3.8.2.1 Response

May 2025: As an author or reviewer, this distinction might be useful if the requirements for update assessments were reduced from those for full assessments.

3.8.3 SSC Comment (general)

The SSC suggests the CPT live link assessments and other documents in their report to facilitate review.

3.8.3.1 Response

May 2025: If the SSC is requesting that links to figures and tables be provided in the text, that has been done in the Tanner crab assessment and other reports for several assessment cycles now (just tap the figure/table number). Otherwise, it is unclear to what the request refers.

3.8.4 SSC Comment (general)

CPT develop a process for ensuring that authors have provided a response to all previous (including at least, the last assessment) SSC recommendations.

3.8.4.1 Response

May 2025: It would be helpful if SSC requests were extracted into a table. In particular, SSC comments that pertain to multiple stocks may only occur in the review for a single stock.

3.8.5 SSC Comment (specific to assessment)

While the SSC appreciates the author’s attention to detail, the SSC highlights that the SAFE and the included Appendices are over 700 pages long, which makes review a daunting task. The SSC suggests that consideration should be given to streamlining the material included in future assessment documents.

3.8.5.1 Response

May 2025: Specific suggestions for streamlining the assessment would be welcome. The SAFE guidelines prescribe a substantial number of topics to be addressed in an assessment, and this has grown in recent years with incorporation of risk tables and ESPs. The Appendices generally provide supplementary information related to, but not necessarily critical to, understanding and evaluating the assessment (e.g., exhaustive residuals plots) or they provide results from requested analyses. They should be regarded the same as “Supplementary Material” in a published paper.

3.8.6 SSC Comment (specific to assessment)

While this [fixing Dirichlet-Multinomial parameters] addresses the immediate issue [of the parameters hitting an upper bound], fixing parameters is not a long-term solution, and evaluation of whether these parameters can be reliably estimated should continue.

3.8.6.1 Response

May 2025: Agreed, although a D-M parameter hitting an upper bound simply implies that the size composition and associated sample size being evaluated are consistent with a multinomial distribution. The input sample sizes for most size compositions fit in the Tanner crab model have already been substantially down-weighted from the number of crab sampled, so an associated D-M parameter hitting its upper bound is not surprising.

3.8.7 SSC Comment (specific to assessment)

The draft risk table noted increased concern for population dynamics in part due to uncertainty in the quantification of reproductive output. The SSC suggests this uncertainty is more associated with the stock assessment, rather than population dynamics.

3.8.7.1 Response

May 2025: Noted. The concern will be moved to the “stock assessment” column of the table.

3.8.8 SSC Comment (specific to assessment)

Directly incorporate annual molt to maturity data, as implemented in the EBS snow crab assessment, if sufficient data are available.

3.8.8.1 Response

May 2025: As has been noted previously (see below), this would require substantial development work to implement in TCSAM02. A GMACS model implementing *annual* molt to maturity data has been developed but time did not allow re-running the model for this report after issues with the GMACS code were identified (and subsequently corrected). The GMACS model discussed in this report ([Stockhausen 2025d](#)) uses the mean molt to maturity curve based on the annual data.

3.8.9 SSC Comment (specific to assessment)

Explore differences in the spatial distribution of small male crab in the NMFS survey, to identify if the distribution of small crab encountered in 2003-2005 and 2008-2010, which successfully propagated to larger sizes, showed differences in habitat use compared with the cohort first observed in 2017-2019, which did not propagate to larger sizes. Likewise, the SSC recommends that a comparison of environmental conditions experienced by small crabs during these periods may help to elucidate why some cohorts appear to propagate and others do not.

3.8.9.1 Response

May 2025: A preliminary analysis ([Stockhausen 2025d](#)) suggests differences in temperatures experienced by the “successful” and “unsuccessful” cohorts.

3.8.10 SSC Comment (specific to assessment)

[...] the SSC notes that for a number of years, the author and CPT have expressed concerns that the recommended models are overly optimistic. The SSC recommends exploring the reason for this characterization through exploring likelihood profiles and other diagnostics and sensitivities of important scale related parameters (e.g., natural mortality, catchability and mean recruitment).

3.8.10.1 Response

May 2025: Likelihood profiles were run for log-scale mean recruitment, male survey catchability, and base natural mortality. Preliminary results suggest that the three are substantially correlated (see [Stockhausen 2025d](#)). Further analysis will be presented in September.

Sept 2025: A limited set of likelihood profile results are presented in an appendix to this SAFE ([Stockhausen 2025c](#)).

4 Introduction

4.1 Stock

Tanner crab, *Chionoecetes bairdi*. Tanner crab is one of five species in the genus *Chionoecetes* ([Rathbun 1924](#)). The common name “Tanner crab” for *C. bairdi* ([Williams et al. 1989](#)) was modified to “southern Tanner crab” in 2005 ([McLaughlin and Co-authors 2005](#)). Prior to this change, the term “Tanner crab” had also been used to refer to other members of the genus, or the genus as a whole. Hereafter, the common name “Tanner crab” will be used in reference to “southern Tanner crab”.

4.2 Distribution

Tanner crabs are found in continental shelf waters of the north Pacific. In the east, their range extends as far south as Oregon ([Hosie and Gaumer 1974](#)) and in the west as far south as Hokkaido, Japan ([Kon 1996](#)). The northern extent of their range is in the Bering Sea ([Somerton 1981a](#)), where they are found along the Kamchatka peninsula ([Slizkin 1990](#)) to the west and in Bristol Bay to the east.

In the EBS, the unit stock is defined as the geographic range of the EBS continental shelf. *C. bairdi* is common in the southern half of Bristol Bay, around the Pribilof Islands, and along the shelf break, although males less than the industry-preferred size (125 mm carapace width [CW]) and ovigerous and immature females of all sizes are distributed broadly from southern Bristol Bay northwest to St. Matthew Island ([Rugolo and Turnock 2011a](#)). Water temperature may limit the northern extent of the spatial distribution of Tanner crab ([Somerton 1981a](#); [Murphy 2020](#)). The southern range of snow crab, the cold water congener *C. opilio*, in the EBS is near the Pribilof Islands ([Turnock and Rugolo 2011](#)). The distributions of snow and Tanner crab overlap on the shelf from approximately 56° to 60°N, and in the two species hybridize in this area ([Karinen and Hoopes 1971](#)).

4.3 Stock structure

Tanner crab in the EBS are considered to be a separate stock distinct from Tanner crab in the eastern and western Aleutian Islands ([NPFMC 1998](#)). Clinal differences across the EBS shelf in some biological characteristics such as mean mature size exist across the range of the unit stock, leading some authors to argue for a division into eastern and western stocks in the EBS ([Somerton 1981b](#); [Zheng 2008](#); [Zheng and Pengilly 2011](#)). However, it was not generally recognized at the time

of these arguments that this species undergoes a terminal molt at maturity (Tamone et al. 2007), nor were the implications of ontogenetic movement considered. Thus, biological characteristics estimated using comparisons of length frequency distributions across the range of the stock, or on modal length analysis over time, may have been confounded as a result and do not provide definitive evidence of stock structure.

Simulated patterns of larval dispersal suggest that Tanner crab in Bristol Bay may be somewhat isolated from other areas on the shelf, and that this component of the stock relies heavily on local retention of larvae for recruitment, suggesting that Tanner crab on the shelf may exist as a metapopulation of weakly-connected sub-stocks (Richar et al. 2015). However, recent genetic analysis has failed to distinguish multiple non-intermixing, non-interbreeding sub-stocks on the EBS shelf (Johnson 2019), suggesting that Tanner crab in the EBS form a single unit stock.

4.4 Life History

4.4.1 Molting and shell condition

Tanner crab, like all crustaceans, normally exhibit a hard exoskeleton of chitin and calcium carbonate. This hard exoskeleton requires individuals to grow through a process referred to as molting, in which the individual sheds its current hard shell, revealing a new, larger exoskeleton that is initially soft but which hardens over several days. Newly-molted crab in this “soft shell” phase can be vulnerable to predators because they are generally torpid and have few defenses if discovered. Subsequent to hardening, an individual’s shell provides a settlement substrate for a variety of epifaunal “fouling” organisms such as barnacles and bryozoans. The degree of hard-shell fouling was once thought to correspond closely to post-molt age and led to a classification of Tanner crab by shell condition (SC) in survey and fishery data similar to that described in Table F.

Table F. Shell condition classification table.

Shell Condition Class	Description
0	pre-molt and molting crab
1	carapace soft and pliable
2	carapace firm to hard, clean
3	carapace hard; topside usually yellowish brown; thoracic sternum and underside of legs yellow with numerous scratches; pterygostomial and bronchial spines worn and polished; dactyli on meri and metabronchial region rounded; epifauna (barnacles and leech cases) usually present but not always.
4	carapace hard, topside yellowish-brown to dark brown; thoracic sternum and undersides of legs data yellow with many scratches and dark stains; pterygostomial and bronchial spines rounded with tips sometimes worn off; dactyli very worn, sometimes flattened on tips; spines on meri and metabronchial region worn smooth, sometimes completely gone; epifauna most always present (large barnacles and bryozoans).
5	conditions described in Shell Condition 4 above much advanced; large epifauna almost completely covers crab; carapace is worn through in metabronchial regions, pterygostomial bronchial spines, or on meri; dactyli flattened, sometimes worn through, mouth parts and eyes sometimes nearly immobilized by barnacles.

Although these shell classifications continue to be applied to crab in the field, it has been shown that there is little real correspondence between post-molt age and shell classifications SC 3 through 5, other than that they indicate that the individual has probably not molted within the previous year (Nevisi et al. 1996). In this assessment, crab classified into SCs 3-5 have been aggregated as “old-shell” crab, indicating that these are crab likely to have not molted within the previous year. In a similar fashion, crab classified in SCs 0-2 have been combined as “new shell” crab, indicating that these are crab that have certainly (SCs 0 and 1), or are likely to have (SC 2), molted within the previous year.

4.4.2 Growth

Work by Somerton (1981a) estimated growth for EBS Tanner crab based on modal size frequency analysis of Tanner crab in survey data assuming no terminal molt at maturity. Somerton’s approach did not directly measure molt increments and his findings are constrained by not considering that the progression of modal lengths between years was biased because crab ceased growing after their terminal molt to maturity.

Growth in immature Tanner crab larger than approximately 25 mm CW proceeds by a series of annual molts, up to a final (terminal) molt to maturity (Tamone et al. 2007). Rugolo and Turnock (2012b) derived growth relationships for male and female Tanner crab from data on observed growth in males to approximately 140 mm carapace width (CW) and in females to approximately 115 mm CW collected near Kodiak Island in the Gulf of Alaska [J. Munk, unpublished; Donaldson et al. (1981)]. These relationships were used as priors for estimated growth parameters in older (2012-2016) assessments (Rugolo and Turnock 2012a; Stockhausen 2013, 2014, 2015, 2016). Rugolo and Turnock (2010) compared the resulting growth per molt (gpm) relationships with those of Stone et al. (2003) for Tanner crab in southeast Alaska in terms of the overall pattern of gpm over the size range of crab and found that the pattern was characterized for both males and females by a higher rate of growth to an intermediate size (90-100 mm CW), followed by a decrease in growth rate from that size thereafter. Similarly-shaped growth curves were found by Somerton (1981a) and Donaldson et al. (1981), as well.

Molt increment data was collected for Tanner crab from the EBS during 2015, 2016, 2017 and 2019 in cooperative research between NMFS and BSFRF (R. Foy and E. Fedewa, NMFS, pers. comm.s). Previous analysis of the data suggests it is not substantially different from that obtained near Kodiak Island (Stockhausen 2017a). The EBS molt increment data is fit in the assessment model to inform inferred growth trajectories in all of the models evaluated in this assessment.

4.4.3 Weight at size

Weight-at-size relationships used in this assessment were revised in 2014 based on a comprehensive re-evaluation of data from the NMFS EBS shelf bottom trawl survey (Daly et al. 2014). Weight-at-size is described by a power-law model of the form $w = a \cdot z^b$, where w is weight in kg, z is the size in mm CW, and a and b are estimated coefficients (Daly et al. 2015). In 2021, Jon Richar (AFSC Kodiak) conducted a new analysis of the weight-at-size data for Tanner crab that incorporates shell condition as a factor. Other preliminary analyses suggest that temperature may be a factor, as well. The CPT, however, has not reviewed models based on these new relationships; thus, this

assessment uses the previously-established relationships. The parameter values for the relationships used in this assessment are presented in Table G.

Table G. Weight-at-size parameters ($w = a \cdot z^b$) for Tanner crab, in grams.

sex	maturity	a	b
males	all	0.000270	3.022134
females	immature (non-ovigerous)	0.000562	2.816928
	mature (ovigerous)	0.000441	2.898686

4.4.4 Maturity and reproduction

It is now generally accepted that both Tanner crab males (Tamone et al. 2007) and females (Donaldson and Adams 1989) undergo a terminal molt to maturity, as in most majid crabs. Maturity in females can be determined visually rather unambiguously from the relative size of the abdomen. Females usually undergo their terminal molt from their last juvenile, or pubescent, instar while being grasped by a male (Donaldson and Adams 1989). Subsequent mating takes place annually in a hard shell state (Hilsinger 1976) and after extruding the female's clutch of eggs. While mating involving old-shell adult females has been documented (Donaldson and Hicks 1977), fertile egg clutches can be produced in the absence of males by using sperm stored in the spermathacae (Adams and Paul 1983; Paul and Paul 1992). Two or more consecutive egg fertilization events can follow a single copulation using stored sperm to self-fertilize the new clutch (Adams and Paul 1983; Paul 1992), although egg viability decreases with time and age of the stored sperm (Paul 1992).

Maturity in males can be classified either physiologically or morphometrically, but is not as easily determined as with females. Physiological maturity refers to the presence or absence of spermatophores in the gonads whereas morphometric maturity refers to the presence or absence of a large claw (Brown and Powell 1972). During the molt to morphometric maturity, there is a disproportionate increase in the size of the chelae in relation to the carapace (Somerton 1981a). The ratio of chela height (CH) to carapace width (CW) has been used to classify male Tanner crab as morphometrically immature or mature. While many earlier studies on Tanner crabs assumed that morphometrically mature male crabs continued to molt and grow, there is now convincing evidence to support a terminal molt for males (Otto 1998; Tamone et al. 2007). A consequence of the terminal molt in male Tanner crab is that a substantial portion of the population may never achieve legal size (NMFS 2008).

In this assessment, all models include fits to size-specific annual proportions of mature, new shell male crab to all new shell male from the NMFS EBS bottom trawl survey, based on classification by 10 mm CW size bin using CH:CW ratios to inform size-specific probabilities of terminal molt. The classifications are based on techniques described in Richar and Foy (2022).

Although observations are lacking in the EBS, seasonal differences have been observed between mating periods for pubescent and multiparous females in the Gulf of Alaska and Prince William Sound. There, pubescent molting and mating takes place over a protracted period from winter through early summer, whereas multiparous mating occurs over a relatively short period during mid April to early June (Hilsinger 1976; Munk et al. 1996; Stevens 2000). In the EBS, egg condition for multiparous Tanner crabs assessed between April and July 1976 also suggested that hatching

and extrusion of new clutches for this maturity state begins in April and ends sometime in mid-June (Somerton 1981a).

4.4.5 Fecundity

A variety of factors affect female fecundity, including somatic size, maturity status (primiparous vs. multiparous), age post terminal molt, and egg loss (NMFS 2004). Of these factors, somatic size is the most important, with estimates of 89 to 424 thousand eggs for females 75 to 124 mm CW, respectively (Haynes et al. 1976). Maturity status is another important factor affecting fecundity, with primiparous females being only ~70% as fecund as equal size multiparous females (Somerton and Meyers 1983). The number of years elapsed since the molt to maturity, and whether or not a female has had to use stored sperm from that first mating can also affect egg counts (Paul 1984; Paul and Paul 1992). Additionally, older senescent females often carry small clutches or no eggs (i.e., are barren) suggesting that female crab reproductive output is a concave function of age (NMFS 2004).

4.4.6 Size at maturity

Rugolo and Turnock (2012a) estimated size at 50% mature for females (all shell classes combined) at 68.8 mm CW, and 74.6 mm CW for new shell females from data collected in the NMFS bottom trawl survey. For males, Rugolo and Turnock (2012b) estimated classification lines using mixture-of-two-regressions analysis to define morphometric maturity for the unit Tanner crab stock, and for the sub-stock components east and west of 166° W, based on chela height and carapace width data collected during the 2008 NMFS bottom trawl survey. These rules were then applied to historical survey data from 1990-2007 to apportion male crab as immature or mature based on size (Rugolo and Turnock 2012a). Rugolo and Turnock (2012b) found no significant differences between the classification lines of the sub-stock components (i.e., east and west of 166° W), or between the sub-stock components and that of the unit stock classification line. Size at 50% mature for males (all shell condition classes combined) was estimated at 91.9 mm CW, and at 104.4 mm CW for new shell males. By comparison, Zheng and Kruse (1999) used knife-edge maturity at >79 mm CW for females and >112 mm CW for males in development of the original State harvest strategy.

4.4.7 Mortality

Due to the lack of age information for crab, Somerton (1981a) estimated mortality separately for individual EBS cohorts of immature and adult Tanner crab. Somerton postulated that age five crab (mean CW = 95 mm) were the first cohort to be fully recruited to the NMFS trawl survey sampling gear and estimated an instantaneous natural mortality rate (M) of 0.35 for this size class using catch curve analysis. Using this analysis with two different data sets, he estimated natural mortality rates of adult male crab from the fished stock to range from 0.20 to 0.28. When using CPUE data from the Japanese fishery, estimates of M ranged from 0.13 to 0.18. Somerton concluded that estimates of M from 0.22 to 0.28 obtained from models that used both the survey and fishery data were the most representative (Somerton 1981a).

Unlike its congener the snow crab, information on longevity of the Tanner crab is lacking. Rugolo and Turnock (2011a) examined empirical evidence for reliable estimates of oldest observed age for

male Tanner crab. They reasoned that longevity in a virgin population of Tanner crab would be analogous to that of the snow crab, where longevity would be at least 20 years, given the close analogues in population dynamic and life-history characteristics (Rugolo and Turnock 2011a). Employing 20 years as a proxy for longevity and assuming that this age represented the upper 98.5th percentile of the distribution of ages in an unexploited population, M was estimated to be 0.23 based on Hoenig’s (1983) method. Alternatively, if 20 years was assumed to represent the 95% percentile of the distribution of ages in the unexploited stock, the estimate for M would be 0.15. Rugolo and Turnock (2011a) adopted $M=0.23$ for both male and female Tanner because the value corresponded with the range estimated by Somerton (1981a), as well as the value used in the analysis to estimate the overfishing definitions underlying Amendment 24 to the Crab Fishery Management Plan (NMFS 2008).

4.5 Management history

Fisheries for Tanner crab have historically taken place throughout their range in Alaska, but currently only the fishery in the EBS is managed under a federal Fishery Management Plan (FMP, NPFMC 2024). The Fishery Management Plan (FMP) for the Commercial King and Tanner Crab Fisheries in the Bering Sea/Aleutian Islands (BSAI) was approved by the Secretary of Commerce on June 2, 1989 (NPFMC 2024). The FMP establishes a State/Federal cooperative management regime that defers crab management to the State of Alaska with Federal oversight (Bowers et al. 2008; NPFMC 2024). State regulations are subject to the provisions of the FMP, including its goals and objectives, the Magnuson-Stevens Act national standards, and other applicable federal laws. The FMP has been amended several times since its implementation (NPFMC 2021a). The federal process determines annual OFL and ABC levels using an F_{OFL} Control Rule based on long-term equilibrium concepts of MSY , F_{MSY} , B_{MSY} . The State manages Tanner crab based on registration areas divided into districts and, under the FMP, can adjust harvest levels under the ABC as needed to avoid overharvesting in a particular area, change size limits from other stocks in the registration area, change fishing seasons, or encourage exploration (NPFMC 2024). The State sets annual TAC limits under the federally-determined ABC using its own set of harvest strategies (ADF&G 2006, 2017; Daly et al. 2020). The Bering Sea District of Tanner crab Registration Area J (Figure 1) includes all waters of the Bering Sea north of Cape Sarichef at $54^{\circ} 36'N$ latitude and east of the U.S.-Russia Maritime Boundary Line of 1991. This district is divided into the Eastern and Western Subdistricts at $173^{\circ}W$ longitude. The Eastern Subdistrict is further divided at the Norton Sound Section north of the latitude of Cape Romanzof and east of $168^{\circ} W$ longitude and the General Section to the south and west of the Norton Sound Section (Bowers et al. 2008). The ADF&G sets separate annual values on retained catch, Total Allowable Catch (TAC), in the areas east and west of $166^{\circ}W$ longitude in the General Section. In this report, the terms “east” and “west” (or “East 166W” and “West 166W”) are used in shorthand fashion to refer to these management areas demarcated by $166^{\circ}W$ longitude where separate TACs are set. Federal and state management quantities and fishery catches since 2005 are listed in Table 2.

In March 2011, the Alaska Board of Fisheries (BOF) approved a new minimum size limit harvest strategy for Tanner crab effective for the 2011/12 fishery based on Bechtol et al. (2011) and Zheng and Pengilly (2011). Prior to this change, the minimum legal size limit had been 5.5” (140 mm CW, including lateral spines) throughout the Bering Sea District. The new regulations established different minimum size limits east and west of $166^{\circ} W$. The minimum legal size for the fishery to the east of $166^{\circ}W$ longitude is now 4.8” (122 mm CW) and that to the west is 4.4” (112 mm

CW), where the size measurement includes the lateral spines. For economic reasons, fishers may adopt larger minimum sizes for retention of crab in both areas, and the State’s harvest control rules (HCRs) used to determine TAC generally incorporate minimum “industry-preferred” sizes that are larger than the legal minimums. In 2011, these minimum preferred sizes were set at 5.5” (140 mm CW) in the east and 5” (127 mm CW) in the west, including the lateral spines (Daly et al. 2020). The harvest strategy also employed a minimum threshold that the mature female biomass (MFB) in the Eastern Subdistrict be larger than 40% of its long-term (1975-2010) average in two subsequent years before the fisheries in either management area could be opened. Minimum thresholds for opening the fishery in a management area were also defined using the ratio of area-specific MMB to its associated long-term average. Finally, the harvest strategy defined area-specific sloping harvest control rules to determine the maximum allowable exploitation rate on mature males in each area based on the ratio of MFB to average MFB, together with limits on the maximum exploitation rate (Figure 2).

Subsequently, the State’s harvest strategy has undergone three revisions (Daly et al. 2020). In 2015, the minimum preferred harvest size used to compute TAC for the area east of 166° W longitude was changed from 140 mm CW (5.5 inches; including the lateral spines) to 127 mm CW (5.0 inches), the preferred size used to compute TAC for the area west of 166° W longitude. In 2017, the criteria being used to determine MFB was changed from an area-specific one based on carapace width to one based on morphology (the same as is used by the NMFS EBS shelf bottom trawl survey), the definition of ‘long-term average’ for calculating average mature biomass was changed from 1975-2010 to 1982-2016, the spatial range for calculating average MFB was expanded to include the entire NMFS EBS shelf bottom trawl survey area, and a so-called ‘error band system’ was introduced in the HCR to account for survey uncertainty such that the exploitation rate on industry preferred-size males used to calculate was gradually reduced when the lower 95% confidence interval of the point estimate of MFB fell below 40% of the long-term average (replacing the requirement to close the fisheries when MFB fell below the 40% threshold; ADF&G (2017); Daly et al. (2020)).

Most recently, the harvest strategy was changed in March 2020 based on results from a management strategy evaluation (MSE) conducted with input from industry stakeholders, NMFS and academic scientists, and ADF&G managers (Daly et al. 2020; Heller-Shiple et al. 2021).

4.5.1 Annual ADFG harvest strategy

The current HCR (Figure 3; HCR 4_1 in Daly et al. (2020)) defines the period for calculating average mature biomass as 1982-2018 and implements sliding scales for exploitation rates on mature males which are functions of the ratios of MMB and MFB to their long-term averages. One particularly notable change from the previous HCR is that there is no longer a threshold for opening the fisheries based on MFB.

4.5.2 Summary of history the basis and estimates of B_{MSY}

Tanner crab has been considered a Tier 3 stock since 2012 (Rugolo and Turnock 2012a). For Tier 3 stocks, $B_{35\%}$ is the proxy for B_{MSY} and $F_{35\%}$ is the proxy for F_{MSY} . $F_{35\%}$ is the fishing mortality rate that would reduce the stock to 35% of its unfished, longterm equilibrium spawner-per-recruit ratio, SPR_{100} . The unfished longterm equilibrium biomass B_{100} is obtained from the SPR_{100} by scaling it by the longterm average recruitment $\bar{R}$ such that $B_{100} = \bar{R} \cdot SPR_{100}$. Consequently

$B_{MSY} = 0.35 \cdot B_{100}$. For BSAI crab stocks, B is taken as mature male biomass. For Tanner crab, the time period from 1982 to the current assessment year minus one is used to determine $\bar{R}$ while the current schedules for allometry, growth, maturation, and natural mortality determine SPR_{100} . Estimates for B_{MSY} from recent assessments are listed in Table 3.

4.6 History of the target fishery

Landings of Tanner crab in the Japanese pot and tangle net fisheries were reported in the period 1965-1978, peaking at 19.95 thousand t in 1969. The Russian tangle net fishery was prosecuted during 1965-1971 with peak landings in 1969 at 7.08 thousand t. Both the Japanese and Russian Tanner crab fisheries were displaced by the domestic fishery by the late-1970s (Table 4; Figure 4). Foreign fishing for Tanner crab ended in 1980.

The domestic Tanner crab pot fishery developed rapidly in the mid-1970s (Tables 4 and 5; Figure 4). Domestic US landings were first reported for Tanner crab in 1968 at 0.46 thousand t taken incidentally to the EBS red king crab fishery. Tanner crab was targeted thereafter by the domestic fleet and landings rose sharply in the early 1970s, reaching a high of 30.21 thousand t in 1977/78. Landings fell sharply after the peak in 1977/78 through the early 1980s, and domestic fishing was closed in 1985/86 and 1986/87 due to depressed stock status. In 1987/88, the fishery re-opened and landings rose again in the late-1980s to a second peak in 1990/91 at 16.61 thousand t, and then fell sharply through the mid-1990s. It was formally declared overfished by NMFS in 1999. The fishery was closed from 1997/98 to 2004/05 as a result of conservation concerns regarding the depressed status of the stock.

The major fisheries for crab in the BSAI, including Tanner crab, were rationalized in 2005 with the implementation of FMP amendments 18 and 19, which assigned quota shares allocated across the harvest and processing sectors to eliminate the “race for fish” (NPFMC 2021a). The Tanner crab fishery re-opened in 2005/06 and averaged 0.77 thousand t retained catch between 2005/06-2009/10 (Tables 6-2). The State closed directed commercial fishing for Tanner crab during the 2010/11-2012/13 seasons because estimated female stock metrics fell below thresholds adopted in the state harvest strategy. Additionally, the stock was once again declared overfished by NMFS in 2012 based on low survey estimates of mature male biomass.

Following a change in the federal assessment Tier level from 4 to 3 see 7 and acceptance of a Tier 3 assessment model in the fall of 2012, the stock was declared to be not overfished under Tier 3 and an OFL of 19,020 t was determined. The directed fisheries, however, remained closed per the State’s harvest strategy. For 2013/14, the Tier 3 OFL was determined to be 25,350 t, with an ABC of 17,820 t. While $maxABC$ is defined using the “p-star” (or p^*) statistical approach with $p^* = 0.49$ based on an assumed distribution for an OFL, this approach is not thought to capture the actual uncertainty in the OFL. Instead, the SSC has, in practice, used the strategy of applying a buffer to the OFL to determine the ABC, where the size of the buffer reflects a consensus level of uncertainty in the assessment model, environmental conditions, stock dynamics, and fishery conditions. For Tanner crab, this buffer has typically been 20%.

The stock metrics for 2013/14 surpassed the State harvest strategy thresholds and the directed fishery was opened in 2013/14 with a TAC was set at 1,645,000 lbs (746 t) for the area west of 166° W and at 1,463,000 lbs (664 t) for the area east of 166° W. On closing, 80% (594 t) of the TAC had been taken in the western area while 99% (654 t) had been taken in the eastern area. For 2014/15, the Tier 3 ABC was 25,180 t and TAC was set at 3,005 t for the area west of 166° W and at 3,846

t for the area east of 166° W. On closing, 78% (2,329 t) of the TAC was taken in the western area while 100% (3,829 t) was taken in the eastern area. For 2015/16, the ABC was 21,750 while TAC was set at 3,808 t in the western area and 5,113 t in the eastern area. On closing, essentially 100% of the TAC was taken in each area (3,798 t in the west, 5,111 t in the east). The total retained catch in 2015/16 (8,910 t) has been the largest taken in the fishery since 1992/93 (Tables 5 and 6; Figure 4).

Although the ABC for 2016/17 was 20,490 t, the directed fisheries in both areas were closed in 2016/17 by the State because mature female biomass in the 2016 NMFS EBS bottom trawl survey did not exceed the State's harvest strategy thresholds in either area to allow a fishery opening. Subsequently, the State has allowed a directed fishery in the eastern area only since 2022/23, following the revision of its harvest strategy, while directed fisheries in the western area have been allowed in all but two years (Table 6, Figure 5). Both areas were open to directed fishing in 2025/26, with TACs of 513 t in the eastern area and 4,590 t in the western area. Retained catch in the two areas were 510 t in the east and 4,599 t in the west.

Tanner crab can be incidentally retained in the snow crab and BBRKC fisheries, up to a limit of 5% of the target species. In general, incidental retention in these fisheries has been small compared with retained catch in the directed fishery, although the snow crab fishery was responsible for a sizable fraction of the landed catch in 2005/06 and 2006/07 (Tables 6 and 7, Figure 5). Both fisheries were closed in 2022/23, only the BBRKC fishery was open in 2023/24, but both fisheries were open in 2024/25 and 2025/26. Incidentally-retained catch in these fisheries has continued to be small (Table 7).

Information on bycatch and discard losses of Tanner crab originate from observer data taken in the directed Tanner crab pot fishery, the snow crab and Bristol Bay red king crab pot fisheries, and the groundfish fisheries (Tables 9-13; Figures 10-13). Bycatch estimates are converted to discard mortality using assumed handling mortality rates of 32.1% for bycatch in the crab fisheries (CPT 2014) and 80% for bycatch in the groundfish fisheries (when bycatch in the latter can be distinguished by gear type, then 80% for trawl fisheries and 50% for fixed gear fisheries; CPT (2021)). In the early-1970s, the groundfish fisheries contributed substantially to total bycatch losses (although bycatch in the crab fisheries was undocumented at the time). From the early 1990s (when reliable crab fishery bycatch estimates are considered to be first available) to 2004/05, the groundfish fisheries accounted for the largest proportion of discard mortality. Between 2005/06 and 2019/20, the snow crab fishery generally accounted for the largest proportion of Tanner crab taken as bycatch (1,947 t) on average while the Tanner crab fishery accounted for the next largest proportion (1,009 t). The snow crab fishery generally accounted for the largest proportion of Tanner crab bycatch *mortality* (625 t) on average while the Tanner crab fishery accounted for the next largest proportion (324 t). Since the collapse of the snow crab stock in 2020/21, the Tanner crab fishery generally accounted for the largest proportion of Tanner crab taken as bycatch (516 t) on average while the snow crab fishery accounted for the next largest proportion (194 t). The Tanner crab fishery generally accounted for the largest proportion of Tanner crab bycatch *mortality* (166 t) on average while the groundfish fisheries accounted for the next largest proportion (93 t). Total catch mortality for 2025/26 based on crab and groundfish observer data was 5.7018238 t.

5 Data

Data incorporated into the Tanner crab assessment this year include:

- 1) annual biomass and size composition data collected by crab fishery observers for Tanner crab retained in the directed fisheries and taken as bycatch in the directed and other (snow crab, Bristol Bay red king crab) fisheries provided by ADF&G;
- 2) annual abundance, biomass, and size composition data collected by groundfish fishery observers for bycatch in the groundfish fisheries provided by AFSC’s Fisheries Monitoring and Analysis Division and the NMFS Alaska Regional Office (AKRO; hosted by AKFIN, <https://akfin.psmfc.org>);
- 3) limited historical (pre-1990) data on annual biomass, and size compositions for Tanner crab retained in the foreign (1965-1980) and domestic (1968-1989) crab fisheries or taken as bycatch in the groundfish fisheries (1973-1990);
- 4) annual abundance, biomass and size composition data, as well as limited year-specific male maturity ogives estimated outside the model, from the NMFS EBS shelf bottom trawl survey (1975-2026);
- 5) abundance, biomass, and size composition data from BSFRF/NMFS cooperative side-by-side trawl studies (2013-2018); and
- 6) molt increment data from NMFS/ADF&G/BSFRF cooperative studies (2015-17, 2019).

5.1 Summary of new information

Table H summarizes the time frames of, and changes to, the input data for the 2026 assessment. Tyler Jackson (ADFG) provided revised estimates for the retained catch time series (catch abundance and biomass) and size compositions from the directed fishery and incidentally-retained catch from the snow crab and BBRKC fisheries, as well as providing new data from the directed Tanner crab fishery for 2025/26. Tyler also provided revised estimates of time series for total catch abundance and biomass and the size composition data from fishery observer sampling for the directed fishery and for bycatch in the snow crab, BBRKC, and the groundfish fisheries from 1990/91 and new estimates from the 2025/26 season . Fishery-independent time series (“survey” biomass and abundance) and size compositions were updated with data from the 1975-2026 NMFS EBS shelf bottom trawl surveys using the R “crabpack” package developed by AFSC’s Shellfish Assessment Program. Emily Ryznar (NMFS) provided estimates for male maturity ogives from 1990 to 2026 on 5-mm size bins using her new maturity workflow ([Ryznar 2026](#)). No updates occurred to the Bering Sea Fisheries Research Foundation (BSFRF) survey data or to molt increment data included in the assessment.

Table H. Data used in this assessment, with new and updated data noted.

Description	Data types	Time frame	Notes	Source
NMFS EBS Bottom Trawl Survey	area-swept abundance, biomass	1975-2019, 2021-26	2026 added	NMFS
	size compositions	1975-2019, 2021-25	2026 added	
	male maturity data	2006+	2026 added	
NMFS/BSFRF	molt-increment data	2015-17, 2019	no new data	NMFS, BSFRF
BSFRF SBS Bottom Trawl Survey	area-swept abundance, biomass	2013-18	no new data	BSFRF
	size compositions	2013-18	no new data	
Directed fishery	historical retained catch (numbers, biomass)	1965/66-1996/97	not updated	2018 assessment
	historical retained catch size compositions	1980/81-1996/97	not updated	2018 assessment
	retained catch (numbers, biomass)	2005/06+	2025/26 added, remainder revised	ADFG
	retained catch size compositions	2005/06+	2025/26 added, remainder revised	ADFG
	total catch (abundance, biomass)	1991/92+	2025/26 added, remainder revised	ADFG
	total catch size compositions	1991/92+	2025/26 added, remainder revised	ADFG
Snow Crab Fishery	historical effort	1978/79/1989/90	not updated	2018 assessment
	effort	1990/91+	2025/26 added, remainder revised	ADFG
	total bycatch (abundance, biomass)	1990/91+	2025/26 added, remainder revised	ADFG
	total bycatch size compositions	1990/91+	2025/26 added, remainder revised	ADFG
Bristol Bay Red King Crab Fishery	historical effort	1953/54-1989/90	not updated	2018 assessment
	effort	1990/91+	2025/26 added, remainder revised	ADFG
	total bycatch (abundance, biomass)	1990/91+	2025/26 added, remainder revised	ADFG
	total bycatch size compositions	1990/91+	2025/26 added, remainder revised	ADFG
Groundfish Fisheries (all gear types)	historical total bycatch (abundance, biomass)	1973/74-1990/91	not updated	2018 assessment
	historical total bycatch size compositions	1973/74-1990/91	not updated	
	total bycatch (abundance, biomass)	1991/92+	2025/26 added, remainder revised	NMFS/AKFIN
	total bycatch size compositions	1991/92+	2025/26 added, remainder revised	

5.2 Data sources that were available but excluded

ADFG provided results from previous ADFG Pribilof Islands pot surveys conducted in 2003, 2005, 2008, and 2011 in August, 2025. This data has not been incorporated into the assessment yet. Male maturity ogives estimated outside the model from before 2006 were excluded from the models because chela heights in the NMFS EBS bottom trawl survey prior to this were measured to 1 mm precision, whereas subsequently they were measured to 0.1 mm.

5.3 Retained Catch

5.3.1 Time Series Data

Retained catch in the Tanner crab fishery is male-only. Annual time series for retained catch extend back to 1965 (Table 4; Figure 4), with historical retained catch biomass available for the domestic and foreign fleet fisheries up to 1979, when the latter fisheries ended. Time series for annual retained catch abundance, as well as biomass, in the domestic fisheries were provided by ADF&G in 2019 for the 1980 to 1996 time period (Table 5); this dataset was truncated for the 2026 assessment to 1989/90. The fishery was closed from 1997/98 to 2004/05 due to concerns regarding stock biomass levels, during which time no retained catch occurred. The fishery was re-opened following rationalization of the crab fisheries in 2005. Time series of annual retained catch abundance and biomass taken in the directed fishery since rationalization, as well as incidentally-retained in the snow crab and BBRKC fisheries, was provided by Tyler Jackson (ADFG) by management area starting with the 1990/91 season (Tables 6 and 7; Figure 5) for subsequent seasons when the fishery was prosecuted in either area. Since 2013/14, most of the TAC has been taken each year in areas

open to fishing, while the TACs have generally been substantially lower than the corresponding Tier 3 OFLs and ABCs (Table 2, upper plot of Figure 5).

5.3.2 Size Composition Data

Size compositions for retained catch data, scaled to total retained catch, are available from 1980/81-1996/97 aggregated across ADF&G management areas and from 2005/06 identified by management area (Table 8, Figure 6) for seasons when the directed fishery was prosecuted. Median sizes of retained males are similar over the time period up to 2009/10, after which NMFS determined the stock was overfished and ADF&G closed the fishery in both management areas (Figure 6). Median sizes since NMFS declared the stock rebuilt (2012) have been somewhat smaller; the smallest median sizes occurred in the western management area in 2021/22 and 2022/23 while the smallest median size in the eastern management area occurred in 2022/23. Median size in 2025/26 in the eastern area was fairly large (~142 mm CW), just slightly less than that in 2024/25, while it was smaller in 2025/26 in the western area than in 2024/25 (130 vs. 134 mm CW) and more similar to the sizes in 2021/22 and 2022/23. However, this was consistent with a large recruitment event in 2023 starting to move into industry-preferred sizes. The fraction of retained catch smaller than the size historically preferred by processors (125 mm CW) has continued to increase in the western management area since 2017/18 (the eastern area was closed during most of this time period; Figures 7 and 8). The fraction of new shell males among the retained crab from the western management area in 2024/25 was high (~80%), similar to that since 2021/22 and much higher than other years since the 2015/16 season (Figure 9). The fraction in the eastern management area was similarly high in 2022/23-2025/26.

5.4 Total Catch and Discard Data

5.4.1 Time Series Data

Total catch estimates for Tanner crab in the directed Tanner crab, snow crab, BBRKC, and groundfish fisheries are provided in Tables 9-11 and Figure 10. ADF&G “at-sea” crab observer sampling programs started in 1989 but sampling in the different fisheries was initially inconsistent. The assessment uses observer catch data from the snow crab and BBRKC fisheries starting in 1990/91 and in 1991/92 from the directed fishery. Annual bycatch in the groundfish fisheries, based on NMFS groundfish observer programs, is available starting in 1973/74, but crab sex is not distinguished and bycatch is not distinguished by gear type until estimates are available from the Regional Office’s Catch Accounting System (CAS) database, starting in 1991.

All female crab and sub-legal males caught in the directed fishery or taken as bycatch in the other fisheries must be discarded. All legal males taken in the groundfish fisheries and “most” legal males in the other crab fisheries must be discarded as well; some retention of incidentally-caught legal males is allowed in the snow and BBRKC fisheries, but the amount retained in any year tends to be very small. The assessment model fits time series of fishery-specific total catch biomass (and abundance for the groundfish fisheries), but allows for some fraction of discarded crab to survive. In practice, a value of 0.321 is used in the assessment model for “handling mortality” in the crab fisheries to convert observed bycatch to (unobserved) discard mortality (Stockhausen 2014). For the groundfish fisheries, a value of 0.8 is used for handling mortality aggregated across gear types to reflect differences in groundfish gear effects and on-deck operations compared with the crab fleets

(bycatch in the groundfish fisheries is typically aggregated across gear types in the assessment model). When models in which groundfish bycatch type is identified by gear type are run, a value of 0.5 is used for bycatch by fixed gear and 0.8 for bycatch by trawl gear. However, no models with gear-specific bycatch in the groundfish fisheries were considered in this assessment.

Mortality associated with the handling process can also be estimated outside the assessment model for bycatch in the groundfish and non-directed crab fisheries (because most or all Tanner crab bycatch is discarded), but estimates of “discard mortality” for males in the directed fishery obtained outside the assessment model can be problematic if (due to sampling error) estimated total catch is less than reported retained catch. Annual estimates of bycatch (i.e., non-retained catch) using the “subtraction method” and mortality for the various fisheries are given in Tables 12 and 13 and illustrated in Figures 11 and 12. Estimated bycatch mortality in the groundfish fisheries was highest (~15,000 t) in the early 1970s, but it declined substantially by 1977 to ~2,000 t with the curtailment of foreign fishing fleets (Stockhausen 2017a). Bycatch mortality declined further in the 1980s (to ~500 t) but increased somewhat in the late 1980s to a peak of ~2,000 t in the early 1990s before undergoing another (gradual) decline until 2008, after which it has fluctuated annually below ~300 t to the present (101 t in 2025/26). In the crab fisheries, the largest component of bycatch occurs on males. In the early 1990s, female bycatch ranged between 6 and 40% of the bycatch in the directed and snow crab fisheries. Since the directed fishery re-opened in 2013/14, the fraction of bycatch that is female has ranged between 2% and 6% in the directed fishery, between 0.3 and 3% in the BBRKC fishery, and has been below 1% in the snow crab fishery. Estimates of total groundfish bycatch are not currently available by sex.

In 2025/26, the directed fishery was prosecuted in both State management areas for only the fourth time since 2015/16. Discard mortality on males, estimated using the subtraction method, was 327 t. Discard mortality on females in the directed fishery was 26 t. Bycatch mortality in the other crab fisheries in 2025/26 was very small, with 136 t occurring in the snow crab fishery and 4 t in the BBRKC fishery. Total bycatch mortality in the groundfish fisheries was 101 t. Total bycatch mortality, then, was 593 t (Table 13) whereas total catch mortality (including retained catch) was 5,702 t.

5.4.2 Size Composition Data

Expanded total catch (retained + discards) size compositions from at-sea crab fishery observer sampling are presented by sex for the directed fishery in Figures 14-17 and in the snow crab fishery and BBRKC fisheries in Figures 18-23. The snow crab fishery, conducted primarily in the northern and western parts of the EBS shelf, catches predominantly small males while the BBRKC fishery, conducted to the south and east in Bristol Bay, predominantly catches large males. The size compositions in the snow crab fishery clearly reflect some sort of “dome-shaped” selectivity pattern for males (assumed in the assessment model), with selectivity small for small and large males and highest for intermediate-sized males. In contrast, selectivity in the BBRKC fishery appears more consistent with asymptotic selection. The directed fishery, which extends across the shelf from west of the Pribilof Islands into Bristol Bay in the east, catches somewhat larger males than the snow crab fishery, but somewhat smaller males than the BBRKC fishery (although many more than either of the other two), with about half the new shell males caught being larger than the industry-preferred size of 125 mm CW. Similar patterns are apparent for females.

Size compositions from observer sampling for bycatch in the groundfish fisheries, expanded to total bycatch, are shown in Figures 24-28 starting in 1991/92. These fisheries, targeting a variety of groundfish stocks and using a variety of gear types, take a much larger size range of Tanner crab as bycatch than the pot gear used in the crab fisheries.

Raw (number of individuals measured) and scaled sample sizes for size composition data from the various fisheries are given in Tables 14-16. Since 2020/21, very few Tanner crab have been measured by observers in either the snow crab or BBRKC fisheries due to small TACs or closures in those fisheries.

5.5 Survey Data

The annual NMFS EBS shelf bottom trawl survey (“NMFS survey”) provides the primary source of fishery-independent data for indices of relative population size (“survey” biomass and abundance) and size structure (size compositions). Data from 1975-2026 except 2020 are included in the assessment; the survey was not conducted in 2020. In 2024, the NMFS survey discontinued hauls at the 26 so-called “corner” stations around the Pribilof Islands and around St. Matthew Island (Figure 29). In addition to the NMFS survey, data from the “side-by-side” Tanner crab selectivity studies, conducted collaboratively by BSFRF and NMFS during the 2013-2018 NMFS surveys, provide a secondary data source.

5.5.1 Time Series Data

Design-based estimates (and cv’s) for trends in annual survey biomass and abundance from the NMFS survey are given in Tables 18 and 19 by sex, maturity state, and ADF&G management area. Corresponding time series plots are given in Figures 30 and 31. Time series trends from the NMFS EBS bottom trawl survey suggest the Tanner crab stock in the EBS has undergone decadal-scale fluctuations.

Estimated biomass of male crab in the survey time series started at its maximum (295 thousand t) in 1975, decreased rapidly to a low (15 thousand t) in 1985, and rebounded quickly to a smaller peak (146 thousand t) in 1991 (Table 18). After 1991, male survey biomass decreased again, reaching a minimum of 14,600 t in 1997. Recovery following this decline was slow and male survey biomass did not peak again until 2007 (104 thousand t), after which it has fluctuated more rapidly—decreasing within two years by over 50% to a minimum in 2009 (47 thousand t), followed by a doubling to a peak in 2014 (109 thousand t). Since 2014 the trend had been a steady decline until 2021, with male biomass in 2019 at its lowest point (29 thousand t) since 2000. The survey was not conducted in 2020. In 2021, male survey biomass increased over the low in 2019 by ~10% to 32 thousand t, but it declined slightly to 30 thousand t in 2022. Subsequently, it has increased dramatically to 111 thousand t in 2025 and 131 thousand t in 2026, the largest since 1992. Most of this increase occurred in the area west of 166°W, although survey biomass more than doubled from 2025 to 2026 in the eastern area (14 thousand t to 35 thousand t).

Trends in female survey biomass have generally been in synchrony with those for males, although the changes for females precede those for males by a year or two (reflecting different growth patterns; Table 18). Immature female biomass declined the last two years from a recent high in 2024 (19 thousand t) to 5 thousand t in 2026. Mature female biomass declined from a recent peak in 2024 (29 thousand t) to 22 thousand t.

Survey abundance for males in 2024 had increased by 74% over that in 2023 but decreased slightly in 2025 due mainly to a decline east of 166° (Table 19). However, male abundance in the east almost doubled from 2025 (54 million) to 2026 (105 million) and reached levels not seen since 2014. In the western area, total male abundance declined from 573 million in 2025 to 362 million in 2026. Immature female abundance continued to decline from a recent high in 2023 of 395 million to 125 million in 2026. Mature female abundance decreased from its largest value since 1991 in 2025 (190 million) to 154 million in 2026.

Estimates for trends in industry-preferred males (IPM; ≥ 125 mm CW) from the NMFS survey are given in Tables 20 and 21; corresponding time series are illustrated in Figures 30 and 31. Industry-preferred male biomass in 2026 increased dramatically in both areas over the values obtained in 2025: in the eastern area by 350% (from 4.5 thousand to 14.1 thousand t) and in the western area by 370% (from 11.2 thousand t to 41.7 thousand t). The IPM biomass in the eastern area was the largest seen since 2014, in the western area since 1975 (the beginning of the time series), and combined the biggest since 1992. Changes in abundance from 2025 to 2026 followed similar patterns (Table 21).

The annual percentages (by biomass) of new shell industry-preferred size male from the survey and caught in the directed fishery are contrasted in Figure 32: in general, the fishery is able to catch a much higher percentage of new shell males than is estimated in the survey, but both caught similarly high percentages in 2026 (survey: 78%; fishery: 68%). The time series of biomass of industry-preferred males caught in the directed fishery is compared with the biomass estimated from the survey in Figure 33: the fishery came very close to catching more than the survey estimates in 2021/22 and 2022/23 in the western area, but this has no longer been the case since 2023/24 and estimates from the survey are now several times larger than that taken in the fishery.

BSFRF and NMFS engaged in a series of collaborative “side-by-side” selectivity studies (“SBS”) for Tanner crab that coincided with the 2013-2018 NMFS surveys. During the SBS catchability studies, NMFS performed standard survey tows (e.g., 83-122 trawl gear, 30 minute tow duration) as part of its annual EBS bottom trawl survey while BSFRF performed parallel tows within 0.5 nm using a nephrops trawl and 5 minute tow duration. Because the nephrops trawl has better bottom-tending performance than the 83-112 gear, the BSFRF tows are hypothesized to catch all crab within the net path (i.e., to have selectivity equal to 1 at all crab sizes) and thus provide a measure of absolute abundance/biomass. The NMFS surveys provide relative indices of stock size across the entire stock area; the BSFRF SBS data provides (presumed) absolute indices within the smaller (annually-varying) study footprints (Figure 34). The NMFS SBS data (a subset of stations from the full survey each year) provides information on the annual “availability” of Tanner crab across the entire stock area relative to the area included in the associated SBS study. Design-based estimates (and cv’s) for absolute biomass and abundance within the SBS study areas from BSFRF and NMFS are given in Tables 22 and 23 by sex and maturity state. Plots of biomass and abundance from the SBS studies are given in Figures 35. Any “trends” from these data are confounded by the varying areal coverage of the survey stations included in the SBS studies.

5.5.2 Size Composition Data

Bubble plots of NMFS EBS bottom survey size compositions for Tanner crab by sex and fishery region are shown in Figures 36 and 37. Distinct recruitment events (late 1970s, early 1990s, mid-2000s, early 2010s, and perhaps starting in 2023) and subsequent cohort progression are evident in

the plots, particularly in the western area. The absence of small male crab in the 2010-2016 period is notable, although there was evidence for new recruitment in the western area in 2017-2018, with perhaps some spillover to the eastern area lagged by a year at slightly larger sizes. Unfortunately, the 2017-2018 cohorts seems to be absent from, or much reduced in, the 2021-2024 surveys. On the positive side, there is certainly evidence for a strong recruitment event in the western area in 2023 (possibly starting in 2022) propagating into larger size classes since 2024.

The survey size compositions provide evidence for a decline in maximum size across the time series for both males and females (Figure 38). For males, maximum size decreased from over 180 mm CW in the late 1970's to less than 160 mm CW in 2023, although it was slightly larger in 2024 and 2025. In 2026, it was the largest in the past six years. For females, maximum size declined from over 120 mm CW to under 115 mm CW in 2023-2026, although the smallest maximum size occurred in 2019.

Based on the total abundance size compositions from the BSFRF-NMFS SBS studies (Figure 39), the BSFRF nephrops gear is in general (as expected) more selective for Tanner crab than the NMFS 83-112 gear, particularly at smaller sizes (< 60 mm CW). However, the size-specific catch ratio of the BSFRF survey to the NMFS survey appears to vary substantially across years, which one would not expect if gear-specific selectivity were, in general, constant. It is worth noting that the nephrops gear appears to give a much better indication of recruitment than the 83-112 gear (e.g., survey years 2017 and 2018).

Observed sample sizes for the NMFS survey size compositions, aggregated to the EBS regional level used in the assessment, are presented in Table 24. Given the large number of individuals sampled, a standard value of 200 is used as the input total input sample size for annual survey size compositions in the assessment model to prevent convergence issues associated with using the actual sample sizes. Input sample sizes for size compositions that are fit independently by individual category (e.g., sex) are then based on the ratio of the number of measured individuals in the category to the total number of individuals measured in the survey, such that the sum of input sample sizes over all categories for a given year would be 200.

Sample size for the SBS studies are given in Table 25.

5.5.3 Spatial patterns

Recent (2017-2026) spatial patterns of various population components (small males, large males, industry-preferred males, immature females, mature females) are illustrated in Figures 40-44. Small males and immature females exhibit similar spatial patterns during this time period (note that the scales in Figures 40 and 43 are different), predominantly distributed along the western shelf between the shelf edge and the 100 m isobath, but extending eastward to the 50 m isobath from the Pribilof Islands southward. High concentrations of small/immature crab were found along the outer shelf in 2024 and 2025, but these were much reduced in 2026. Large males were concentrated to the northeast of the Pribilof Islands extending into the middle shelf, but also extended along the Alaska Peninsula and into Bristol Bay (Figure 41). The patterns for industry-preferred males (Figure 42) were generally similar to those for large males, but the overall abundance in 2026 is much larger than in recent years. The spatial patterns for immature females generally reflected those for small males (Figure 43). The spatial distribution of mature females in 2026 was concentrated around the Pribilof Islands and along the outer shelf to the southeast but did not extend onto the middle

shelf east of the Pribilofs as it had in 2024 and 2025, possibly to the extensive cold pool in 2026 (Figure 44).

5.6 Other Data

Other data incorporated into the assessment model include male maturity ogives, molt increment data, weight-at-size relationships, and SBS survey availability. The first two are fit in the model estimation process while the latter two are determined outside the model framework.

5.6.1 Male maturity ogives

The maturity state for females can be unambiguously determined in the field based on abdominal morphology, but the state for males is much less well-defined morphometrically. For 2026, a new workflow has been adopted to provide estimates of the probability of immature males having undergone terminal molt during growth. Size-specific annual maturity ogives for males were estimated outside the model using spatiotemporal generalized mixed models (GLMMs) to fit subsets of new shell males which had chela heights (CHs) measured in addition to carapace widths (CWs) (Ryznar 2026). CH measurements were generally collected biennially for Tanner crab from 1990 until 2016 but have been taken annually since. The estimation yields annual estimates for years when CHs were collected (Figure 45). The resulting ogives are treated as the “observed” size-specific fraction of males classified as new shell and mature relative to all new shell males (i.e., immature males plus new shell mature males) for each year CH data were collected. These provide information to the assessment model on the size-specific probability of immature males undergoing terminal molt and are included in the data-derived likelihoods used to optimize the model and estimate parameter values.

5.6.2 Molt increment data

Molt increment data for Tanner crab in the EBS were collected as part of collaborative studies by NMFS, BSFRF, and ADF&G during 2015-2017 and 2019 (Figure 46). These are fit in the assessment model to estimate annual growth increments for immature crab, which are assumed to molt annually.

5.6.3 Weight-at-size

Weight-at-size relationships for Tanner crab are fixed in the assessment model based on power law models ($w = \alpha \cdot z^\beta$) for males, immature females, and mature females (Table 26, Figure 47).

5.6.4 SBS survey availability

For the purposes of the assessment, the BSFRF gear in the SBS catchability studies (2013-2018) is assumed to provide absolute indices of Tanner crab stock biomass and abundance within the area included in each year’s study area (Figure 34). However, these areas, which vary among years in the study, do not cover the entire stock area while the assessment model predicts stock abundance by

category and size for the entire stock area. To fit the SBS data, the model needs to take into account “survey availability” for the SBS study—i.e., the fraction of the stock (by category and size) within the study area—on an annual basis. Estimating survey availability within the stock assessment for the SBS studies is confounded with estimating survey catchability for the full NMFS survey, but can be estimated empirically outside the assessment model. Consequently, availability of Tanner crab to the BSFRF gear in the SBS catchability studies was determined outside the model (see [Stockhausen 2024a](#)) on a sex-specific basis from the ratio of area-swept abundance-at-size from the NMFS gear in the study area to area-swept abundance-at-size for the entire survey (Figure 48).

6 Analytic Approach

6.1 Recent CIE Review recommendations

A Center for Independent Experts (CIE) review of the Tanner crab assessment was conducted in June, 2026 at the AFSC in Seattle. As of this writing, the final report has not been received but draft recommendations from three reviewers have been made available to the stock assessment author. With regard to the assessment model, the reviewers recommend:

- transitioning to the GMACS modeling framework
- investigating why the current model fails to duplicate the magnitude of peaks in the survey biomass time series, including data weighting, priors and penalties, potential environmental drivers, and density-dependent feedback

Other suggestions included developing new harvest control rules to replace the current $F_{MSY} = F_{35\%}$ harvest control rule structure. Whether the Tanner crab assessment transitions to the GMACS framework this cycle is a decision for the SSC to make. Additional recommendations will be prioritized when the final report is provided.

6.2 History of modeling approaches for this stock

Prior to the 2012 stock assessment, Tanner crab was managed as a Tier-4 stock using a survey-based assessment approach ([Rugolo and Turnock 2011b](#)). The Tier 3 Tanner Crab Stock Assessment Model (TCSAM) was developed by Rugolo and Turnock and presented for review in February 2011 to the Crab Modeling Workshop. The model was subsequently revised and the report to the CPT in September 2011 ([Rugolo and Turnock 2011b](#)) described the developments in the model per recommendations of the CPT, SSC and Crab Modeling Workshop through September 2011. In January 2012, the TCSAM was reviewed at a second Crab Modeling Workshop. Model revisions were made during the Workshop based on consensus recommendations. The model resulting from the Workshop was presented to the SSC in January 2012. Recommendations from the January 2012 Workshop and the SSC, as well as the authors’ research plans, guided changes to the model. A model incorporating all revisions recommended by the CPT, the SSC and both Crab Modeling Workshops was presented to the SSC in March 2012.

In May 2012 and June 2012, respectively, the TCSAM was presented to the CPT and SSC to determine model suitability for stock assessment and the rebuilding analysis ([Rugolo and Turnock 2012b](#)). The CPT agreed that the model could be accepted for management of the stock in the 2012/13 cycle, and that the stock should be promoted to Tier-3 status. The CPT also agreed that

the TCSAM could be used as the basis for rebuilding analyses. In June 2012, the SSC reviewed the model and accepted the recommendations of the CPT. The Council subsequently approved the SSC recommendations and Tanner crab was assessed as a Tier-3 for the 2012 assessment using TCSAM for the first time to estimate status determination criteria and overfishing levels (Rugolo and Turnock 2012a).

The current model “framework”, TCSAM02, was reviewed by the CPT and SSC in May/June 2017 (SSC 2017; CPT (Crab Plan Team) 2017; Stockhausen 2017b) and adopted for use in subsequent assessments as a transition to GMACS. The framework is described in detail in (Stockhausen 2023a). Recent model configurations using the TCSAM02 framework are briefly described in the following table (Table I).

Table I. Recent Tanner crab assessment model configurations and the issues they addressed.

Year	Model	Accepted	Base model	Issue addressed	Result
2020-09	19.03	—	—	2019AM	—
2020-09	19.03R	—	19.03	updated w/ 2016/-2018/19 groundfish by-catch data	—
2020-09	19.03 (2020)	—	19.03R	+ 2019/20 data	—
2020-09	20.07	A	19.03 (2020)	empirical availability curves estimated outside model for SBS data	—
2020-09	20.10	—	19.03 (2020)	empirical NMFS selectivity curves estimated outside model from SBS data	preliminary use of selectivity curves estimated outside AM.
2021-09	20.07	—	—	2020AM	—
2021-09	20.07u	—	20.07	+ 2021/22 data	—
2021-09	21.22	—	—	full retention fixed at 100%; gaussian functions replace logistic functions in selectivity functions; fishery catch likelihood changed to lognormal	5 parameters at bounds w/ 2021/22 data
2021-09	21.22a	A	21.22	gaussian sel function replaced NMFS survey logistic sel function for males; parameters at bounds fixed	—
2021-09	21.24	—	21.22	growth estimated outside model	poor jittering performance
2022-09	21.22a	—	—	2021 AM + 2021/22 data	—
2022-09	22.01	—	21.22a	updated bycatch estimates for groundfish fisheries, new data	—
2022-09	22.03	A	22.01	fishery catch data aggregated across sex, "extended" size comps fit	—
2022-09	22.07	—	22.03	1982 model start, estimate initial Ns	—
2022-09	22.08	—	22.07	NMFS survey input sample sizes based on bootstrapped effective sample sizes	—
2022-09	22.09	—	22.01	2021/22 starts new time block for fishery retention	—
2022-09	22.10	—	22.03	2021/22 starts new time block for fishery retention	—
2022-09	22.11	—	22.07	2021/22 starts new time block for fishery retention	—
2023-09	22.03	—	—	2022AM + 2022/23 data	retention slope parameter at upper bound
2023-09	22.03b	A	22.03	fixed retention slope parameter to upper bound	no parameters at bounds
2024-05	22.03b	—	—	2023 AM	—
2024-05	22.03c	—	22.03b	bridging model for slightly revised 2013-2017 BSFRF SBS data resulting from addition of 2018 data	—

(continued)

Year	Model	Accepted	Base model	Issue addressed	Result
2024-05	22.03d	R	22.03c	2018 BSFRF SBS data	Dirichlet-Multinomial parameters for BSFRF data hit upper bounds; model recommended for Sept assessment
2024-05	G24.02	—	—	first attempt at transition to GMACS	—
2024-05	G24.02a	—	G24.02	sex-specific fits to crab fishery data	—
2024-05	G24.03	—	G24.02a	NMFS survey selectivity fixed to mean empirical estimates	—
2024-05	G24.04	—	G24.03	NMFS survey selectivity fixed to year-specific empirical estimates	—
2024-05	G24.05	—	G24.03	probability of terminal molt fixed to year-specific estimates	—
2024-05	G24.06	—	G24.04, G24.05	combination	—
2024-05	G24.07	—	—	fits to VAST survey biomass indices	—
2024-09	22.03b	—	—	2023AM	—
2024-09	22.03b1	—	22.03b	BM: revised 2013-2017 BSFRF data	Dirichlet-Multinomial parameters for BSFRF data NOT at bounds
2024-09	22.03b2	—	22.03b1	BM: add 2018 BSFRF data + 2018 SBS availability based on lognormal model	Dirichlet-Multinomial parameters for BSFRF data NOT at bounds
2024-09	22.03b3	—	22.03b2	BM: 2013-2018 SBS data + 2013-2018 availability based on lognormal model	Dirichlet-Multinomial parameters for female BSFRF data at upper bound
2024-09	22.03d	—	22.03b3	2013-2018 availability based on binomial model	Dirichlet-Multinomial parameters for female BSFRF data at upper bound
2024-09	22.03d1	—	22.03d	BM: added 2023/24 directed fishery data	Dirichlet-Multinomial parameters for female BSFRF data at upper bound
2024-09	22.03d2	—	22.03d1	BM: added 2023/24 groundfish fisheries bycatch data	Dirichlet-Multinomial parameters for female BSFRF data at upper bound
2024-09	22.03d3a	—	22.03d2	BM: added 2023/24 BBRKC fishery bycatch data	both Dirichlet-Multinomial parameters for BSFRF data at upper bounds
2024-09	22.03d3b	—	+	increased Dirichlet-Multinomial parameters bounds	no convergence
2024-09	22.03d3c	—	+	added priors for Dirichlet-Multinomial parameters	no convergence
2024-09	22.03d3d	—	+	fixed Dirichlet-Multinomial parameters to upper bounds	no parameters at bounds
2024-09	22.03d4	—	22.03d3	added 2024 NMFS Survey data	—
2024-09	22.03d5	A	22.03d4	—	—
2025-05	G25_05	—	—	GMACS attempt to match 22.03d5 (single recruitment time block, but no fits to growth data or maturity ogives)	result substantially different from bespoke model
2025-05	22.03d5	—	—	2024 assessment model	—
2025-05	25_01	—	22.03d5	no tail compression	no real effects
2025-05	25_01a	—	25_01	assumed normal, not lognormal, error distributions for aggregated survey biomass data	resulted in poor fits to survey data
2025-05	25_02	—	25_01a	used SBS-derived catchability curves rather than fitting BSFRF data as separate surveys	—
2025-09	G25-10	—	—	another GMACS attempt to match 22.03d5 in most respects; started in 1975	estimating parameters resulted in "not-a-number" results

(continued)

Year	Model	Accepted	Base model	Issue addressed	Result
2025-09	22.03d5	A	—	same as 2024 assessment model configuration	—
2026-05	GMACS	—	22.03d5	another GMACS attempt to match 22.03d5 by converting TCAM02 parameter values to equivalent GMACS parameters for a single model evaluation	generally good agreement for biological processes; OFL 8% different; estimation converged but not to TCSAM02 values
2026-05	22.03d5	—	—	incorporated new maturity workflow results from mature male ogives	—

In May 2024, several preliminary models based on the GMACS framework were presented to the CPT ([Stockhausen 2024b](#)). The CPT recommended that a comprehensive comparison between the TCSAM02 assessment model and an equivalent GMACS model be completed before the GMACS model could be adopted for Tanner crab. Incremental progress toward this goal was presented at the 2025 January Modeling Workshop and the May 2025 CPT meeting ([CPT 2025](#)), with a candidate model (G25_05) exhibiting similar fits to survey and fishery data but differences in overall scale possibly due to differences in estimated natural mortality rates, selectivity/retention curves, and/or applied constraints (i.e., penalties/priors included in the objective function). GMACS development prior to the September, 2025 CPT meeting included adding additional options for selectivity curves and recruitment size distributions to match those in the bespoke model, implementing time blocks for survey catchability, and correcting an issue with setting up random walk parameters when they span multiple time blocks. Testing the updated code with input files for other crab stocks did not reveal any issues with reproducibility, but this model crashed during optimization for reasons that were only identified later (primarily, updating values for a selectivity parameter that approached its lower bound generated instabilities and infinite values in the parameter search process). Consequently only results from the bespoke (TCSAM02) model recommended by the CPT and SSC were presented at the 2025 assessment. Considerable time since the 2025 assessment has been spent developing and testing code for GMACS to incorporate additional aspects of the TCSAM02 model that were not previously in GMACS, most notably the ability to include male maturity ogives data in the model likelihood, aspects of tail compression for size compositions, aspects of how fishery capture rates are averaged to calculate the OFL, and additional model output to better compare results directly with bespoke model results. The GMACS/TCSAM02 comparisons have also required substantial development or updating of several R packages developed by the author.

6.3 Model description

Models from two model development frameworks, TCSAM02 and GMACS, are considered in this assessment. As noted above, TCSAM02 is the bespoke framework used since 2017 strictly for Tanner crab (although it could have been applied to snow crab, as well). GMACS is the framework all other BSAI crab assessment models are formulated with. Given equivalent parameter values, models can be constructed in both frameworks that yield identical results for population processes and likelihood components for one evaluation of the models' objective functions (i.e., when parameter estimation is turned "off"; see ([Stockhausen 2026a](#))).

6.3.1 Overall modeling approach

TCSAM02 is a stage/size-based population dynamics model that incorporates sex (male, female), shell condition (new shell, old shell), and maturity (immature, mature) as different categories into which the overall stock is divided on a size-specific basis. For details of the model, the reader is referred to Stockhausen (2023a).

In brief,

- crab enter the modeled population as recruits on July 1 of each model year following a truncated size distribution based on the gamma probability distribution (see Figure 49 for the nominal shape).
- An equal (50:50) sex ratio is assumed at recruitment and all recruits begin as immature, new shell crab.
- Within a model year, new shell, immature recruits are added to the population numbers-at-sex/shell condition/maturity state/size remaining on July 1 from the previous year.
- These are then projected forward to February 15 ($\delta t = 0.625$ yr) and reduced for the interim effects of natural mortality.
- Subsequently, the various fisheries that either target Tanner crab or capture them as bycatch are prosecuted as pulse fisheries (i.e., instantaneously).
 - Catch by sex/shell condition/maturity state/size in the directed Tanner crab, snow crab, BBRKC, and groundfish fisheries is calculated based on fishery-specific stage/size-based selectivity curves and fully-selected fishing mortalities and then removed from the population.
- Surviving immature, new shell crab undergo growth through molting based on pre-molt size and a continuous probability distribution for sex-specific growth to post-molt size.
- Following growth, the probability of having undergone a terminal molt to maturity is calculated based on sex/size-specific probabilities of maturing.
- Crab undergoing the terminal molt are reclassified as mature and cease molting and growth.
- Crab that were new shell, mature crab become old shell, mature crab (i.e., they don't molt) and old shell (mature) crab remain old shell.
- Population numbers are then adjusted for the effects of maturation, growth, and change in shell condition.
- Finally, population numbers are reduced for the effects of natural mortality operating from February 15 through June 30 ($\delta t = 0.375$ yr) to calculate the population numbers (prior to recruitment) on July 1 at the start of the next year.

The GMACS models considered here have been constructed to retain these features.

Table J. Population processes and parameterization in the base/preferred model, 22.03d5c.

process	time blocks	time blocks	22.03d5 description
Population rates and quantities			
Population built from annual recruitment			
Recruitment	1949+	1949-1974 1975+	In-scale mean + annual devs constrained as AR1 process In-scale mean + annual devs
Growth	1949+ 1949+	1949+ 1949+	sigma-R fixed, sex ratio fixed at 1:1 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, 1985+ 1980-1984	1949-1979, 1985+ 1980-1984	estimated sex/maturity state-specific multipliers on base rate priors on multipliers based on uncertainty in max age estimated "enhanced mortality" period multipliers

Table K. Characteristics for retention and total catch in the directed (“TCF”) fishery and bycatch in the snow crab (“SCF”) fishery in the base/preferred model, 22.03d5c.

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

Table L. Characteristics for bycatch in the BBRKC (“RKF”) and groundfish fisheries (“GF All”) in the base/preferred model, 22.03d5c.

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

Unlike females, the maturity state of individual male Tanner crab is not readily identifiable in the field and is not provided as part of the annual NMFS EBS shelf survey datasets. Consequently, while data from the survey can be characterized by maturity state for females and treated differently in the likelihood depending on maturity state, this is not possible for males. Thus, the TCSAM02 assessment model characterizes the NMFS EBS shelf survey data separately by sex, referring to the male-specific dataset (with no information on maturity state) as the “NMFS M” survey and the female-specific dataset (with females characterized as immature or mature based on abdominal shape) as the “NMFS F” survey. Similar conventions hold for survey data from BSFRF. The GMACS models were similarly configured. The following table summarizes the parameterization and time blocks for the survey processes incorporated into 22.03d5c (2026).

Table M. Characteristics for the NMFS and BSFRF surveys in the base/preferred model, 22.03d5.

Survey/process	time blocks	22.03d5 description
NMFS EBS trawl survey		
male survey q	1975-1981	ln-scale
	1982+	ln-scale w/ prior based on Somerton's underbag experiment
female survey q	1975-1981	ln-scale
	1982+	ln-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

6.3.2 Software used and version

The TCSAM02 model was based on version 2026.08.01 (available on GitHub at this [link](https://github.com/wStockhausen/tcsam02/tree/202603))(<https://github.com/wStockhausen/tcsam02/tree/202603>). Changes since September, 2025 provide output to compare with similar output from GMACS models and include:

- * `weight-at-size` and
- * the estimated ln-scale mature biomass time series as an `sd_report` vector, which allows estim

The GMACS version used to produce final output was 2.20.45a, compiled on 2026-08-26. The GMACS code is also available on GitHub at this [link](#).

6.3.3 Description of likelihood components

Components included in the base (TCSAM02) model likelihood are summarized in the following table:

Table N. Likelihood components in the base/preferred model, 22.03d5. D-M indicates the Drichlet-multinomial likelihood.

		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

6.3.4 Population initialization

Population in all models was initialized at zero in 1948 across all biological classes and sizes. The population is subsequently built up through annual recruitment.

6.3.5 Parameter estimation framework

Both model frameworks are coded in AD Model Builder (ADMB; Fournier et al. (2016)), which supports the application of automatic differentiation (AD) for solutions to complex, non-linear statistical problems. ADMB implements a gradient search algorithm to find the set of parameters that minimizes an objective function which reflects both the goodness of fit to input data as well as any penalties imposed on the estimation process, such as prior probabilities assigned to poorly-estimable parameters. Minima in the objective function can be identified as combinations of parameters that result in the gradient of the objective function being zero and the hessian (the second-order gradient) being concave upwards (in a multivariate sense). For the Tanner crab assessment, both model frameworks implement a maximum likelihood approach in which the objective function is the sum of the negative log-likelihood components associated with input data and model predictions for those inputs, any prior probabilities assigned to parameters, and any penalties applied to regularize the solution (essentially prior probabilities placed on other aspects of the model, such as requiring that parameters representing deviations from a mean all sum to zero).

6.3.6 Model outputs

Model results in both frameworks is voluminous. For fully-converged models, output generally includes parameter estimates and standard errors; estimated quantities such as recruitment and mature male biomass time series and various management variables (e.g., F_{MSY} , B_{MSY}) with standard errors; time-varying population characteristics for all biological classes (sex, maturity state, shell condition, size); predicted sex/size-specific fishery selectivity and retention curves; fully-selected fishery capture rate time series; survey selectivities and catchability coefficients, predicted fishery and survey catch abundance, biomass, and size composition time series; and values for likelihood components, penalties, and prior probabilities.

6.3.7 Critical assumptions

Critical assumptions incorporated in the models include:

- immature crab molt annually
- the distribution of post-molt sizes is gamma-distributed with a constant scale factor across all pre-molt sizes
- crab undergoing terminal have the same growth distributions as those not maturing
- The BSFRF survey gear is not size-specific and has a catchability of 1 at all sizes in the model (25-185 mm CW)
- likelihood distributions to describe fits to data are correct
- prior probability distributions assigned to parameters are correct

6.3.8 Methods used to validate the model ‘

Model code has been validated by obtaining identical results for one function evaluation for equivalent models created using the TCSAM02 and GMACS frameworks (Stockhausen 2026a). In the

2025 assessment, likelihood profiles for important parameters demonstrated convergence to the MLE for the same TCSAM02 model used here.

6.4 Model selection and evaluation

6.4.1 Alternative model configurations

Model 22.03d5 (2026) is essentially identical to the 2025 assessment model, 22.03d5 (2025), except that it uses 2025/26 fishery and 2026 NMF EBS bottom trawl survey data, updated crab fishery data from 1990 on, and revised male maturity ogive results from the “new maturity workflow” developed by Emily Ryznar (AFSC) starting in 2006. The models were constructed and run using the bespoke TCSAM02 model framework. The 2025 model is described in detail in the 2025 Tanner crab assessment report ([Stockhausen 2025a](#)) and summarized above in Section 6.3.1 (Tables J-N).

The model 22.03d5 (GMACS) was constructed using the GMACS framework to be functionally as close as possible to the base model. It is not possible to replicate the TCSAM02 base model in GMACS because:

- GMACS estimates a single value for log-scale mean recruitment while the base model estimates one applied to the model spin-up period (1948-1974) and one applied to the remaining time frame
- selectivity function parameters are estimated on the log-scale in GMACS but mainly on the arithmetic scale in TCSAM02, which implies that gradient scales are different for equivalent parameter values for the two frameworks, as are likelihood priors
- GMACS uses separate parameters to estimate sex- and maturity state-specific natural mortality rates while TCSAM02 uses multipliers on a base rate
- TCSAM02 estimates smoothly-varying, non-parametric, sex- and size-specific functions for the probability of undergoing terminal molt whereas GMACS implements similar non-parametric curves, but as fixed inputs rather than allowing values to be estimated.

With regard to the latter difference, the fixed probabilities for undergoing terminal molt in 22.03d5 (GMACS) were taken from the base model in order to eliminate as many differences as possible between the two. The second GMACS model, 26.02 (GMACS), differs from 22.03d5 (GMACS) in largest respect in that these fixed probabilities are taken directly from the NMFS survey data for females (as the annual fraction by size bin of the abundance of new shell mature females relative to all new shell females) and from the new maturity workflow for males. The median curves over all “observed” years were assigned to years (e.g. 2020 or before 1975) when no survey occurred or male chela heights were not collected.

6.4.2 Criteria used to evaluate models

The criteria used to evaluate the models included:

- successful convergence of the optimization process to estimate model parameter values, with a small final maximum gradient and a covariance matrix allowing calculation of standard errors associated with parameters and other selected quantities (e.g., annual recruitment, MMB)

- the reasonableness of parameter estimates (including parameters on or near bounds) and derived quantities
- the ability to make additional model runs to calculate further diagnostics for model comparisons such as retrospective peels or projections

6.4.3 Basis for data weighting

The CV's associated with estimated annual survey biomass by biological class (males; immature females; mature females) were used as observation errors in fits to survey biomass data. The CV's for fishery biomass data (retained catch and total catch) were adopted heuristically based on discussions with ADFG personnel about the perceived relative accuracy of different collections data through time, with retained catch data following rationalization in 2005 having the smallest CVs (0.01 here) and total catch data assigned a CV of 0.2.

No additional weighting (e.g., likelihood multipliers) was applied to the data components of the likelihood in any of the models.

6.4.4 Assumed sample sizes for compositional data

The input sample sizes for annual fishery size compositions were scaled versions of the total number of crab by sex measured for size in a fishery, where the scaling factor was the median number of crab measured for size in the retained catch across the time series. The input sample size was the actual sample size divided by the median, scaled by 200, and truncated to a maximum of 200, the latter operation analogous to the survey size compositions (Table 27).

The input sample sizes associated with survey size compositions were based on the number of crab actually measured, by biological class (sex and maturity state, but aggregated over shell condition), although a maximum sample size of 200 was imposed to promote numerical stability in the estimation process (Table 28).

The input sample sizes used for the associated male maturity ogive estimates from the new maturity workflow were taken from the estimated total abundance, by 5-mm size bin, of new shell males sampled for both chela height and carapace width after expansion to the EBS (Table 29).

6.4.5 Parameter jittering results

Each of the three candidate 2026 models was subjected to a parameter jittering exercise, where initial values for estimated model parameters were randomly selected within a range of possible values, to identify the set of optimal parameter values leading to the minimum log-likelihood/objective function value and to assess the stability of the optimum (Table 30, Figures 50-52). Each model was run 400 times with jittered initial parameter values and the solution resulting in the minimum objective value, and then the minimum parameter gradient in case of ties, was selected as the “best”. Given the differences in likelihood formulation and fixed parameter values (e.g., the probabilities of terminal molt used in the two GMACS models), it was expected that the minimum objective function values would be different for the three models.

The TCSAM02 model 22.03d5 (2026) appears to have successfully converged to its global minimum objective function value, with a maximum gradient at the minimum of 7.5430806×10^{-4} and

217 of 376 runs converging to the minimum. Evidence that the GMACS model 22.03d5 (GMACS) successfully converged to its global is very much weaker, with a maximum gradient at the minimum of 0.0966388 and only 3 of 126 runs converging to the minimum. Given that the maximum gradient at the “minimum” was 0.1438861 for 26.02 (GMACS) and that no other model runs converged to the reputed minimum, it seems unlikely that the “best” parameter set for this model represents convergence to its global minimum.

6.4.6 Convergence status and other criteria

As noted in the previous section, 22.03d5 (2026) appears to have successfully converged to its global minimum in the “best” of its jittered runs, whereas 22.03d5 (GMACS) may have similarly converged to its global minimum, but the evidence for this is fairly weak (Table 30). However, ADMB was able to invert the model hessian and estimate parameter standard errors for 22.03d5 (GMACS), as well as 22.03d5 (2026), for the “best” jittered run. Given the maximum gradient for its “best” jittered run, it does not appear that 26.02 (GMACS) converged successfully in any model runs. Surprisingly, though, ADMB was able to successfully invert the model hessian in the “best” 26.02 (GMACS) jittered run and obtain estimates for parameter standard errors.

Model runs to conduct retrospective analyses for the two GMACS models failed. It may be necessary to conduct jitter runs to identify the global minimum for each model peel, but time constraints did not allow this. In addition, five-year stock projections for the two GMACS models yielded questionable results (probably due to the author’s relative inexperience running GMACS projections). In contrast, both retrospective analyses and stock projections were conducted successfully using the TCSAM02 model.

6.4.7 Progression of results from previous model

6.4.7.1 Model parameter estimates

Parameter estimation for the 2026 base model converged successfully, with an invertible hessian (allowing parameter uncertainty to be estimated; (Table O) and a maximum gradient of 0 after applying ADMB’s “hess_step” procedure. No parameters were estimated at a bound (Table 31). As expected, the total objective function value for “2026” increased over “2025” due to the addition of the 2025/26 data. All management-related quantities in Table O increased in “2026”. Only relatively small changes in estimated parameter values occurred (Tables 32-44).

6.4.7.2 Objective function components

Individual components to the overall objective function value for the models are compared in Tables 45-48 while the difference in values relative to “2025” are presented in Tables 49-52. Not surprisingly, given that “2026” fits results from the new maturity workflow, the biggest change occurred for the fit to the male maturity ogives with a large increase in negative log-likelihood value associated with this data (Table 51). Somewhat surprisingly, the fits to most of the aggregated fishery catch biomass time series were actually better for “2026” than those for “2025” despite the addition of new data.

Table O. Convergence properties and summary management quantities. Diagnostics for “2025” are from the 2025 assessment.

case	objective function	max gradient	avg recruitment	B_{100}	B_{MSY}	F_{MSY}	MSY	B
‘22.03d5 (2025)’	3,311.970	0.0000000	601.2125	123.4820	43.21868	1.469353	20.86257	150.3181
‘22.03d5 (2026)’	3,944.484	0.0007543	593.8570	121.8843	42.65950	1.423515	20.48074	192.8377

6.4.7.3 *Estimated Fishery-related Quantities*

Graphs of time series of estimated fully-selected F (total catch capture rates, not necessarily mortality) in the directed fishery are shown in Figure 53, while the associated selectivity functions are illustrated in Figures 54-56. The estimates of size-selective retention for males captured in the directed fishery are presented in Figure 57. Graphs of time series of estimated fully-selected F (again, total catch capture rates, not mortality) and the associated selectivity functions for the bycatch fisheries are shown in Figures 58-60.

The 2025 model estimated a highly uncertain but very large spike in directed fishery capture rates in 1973 (Figure 53) which the 2026 model did not. This spike has been occasionally been estimated in previous models but is not well-informed by data (only retained catch biomass from the foreign fleets and the first year of groundfish bycatch are available). Otherwise, the estimated fully-selected capture rates and selectivity curves are very similar for the two models.

6.4.7.4 *Estimated Survey-related Quantities*

Graphs of estimated sex-specific survey catchability and the associated selectivity functions for the NMFS EBS survey are shown in Figure 61. The fully-selected catchability coefficients (q 's) for the NMFS survey data were almost identical for females, but the 2026 model estimated lower values than the 2025 model for males (0.49 vs. 0.52), while survey selectivity curves were identical.

The BSFRF nephrops bottom trawl gear is assumed to be non-size-selective (i.e., selectivity=1 at all sizes) and catch all crab in its swept-area path (i.e., the fully-selected catchability coefficient $q = 1$). Assumed survey availability curves for the BSFRF side-by-side catchability surveys are illustrated in Figure 62. These were not estimated; they were determined outside the model and are the same in the two model runs (see Appendix A in Stockhausen 2024a for details).

6.4.7.5 *Estimated Population-related Quantities*

6.4.7.5.1 *Molting probabilities, growth, and other schedules depending on parameter estimates*

Immature crab are assumed to molt annually. The estimated sex-specific mean post-molt size (as a function of pre-molt size) and probability of undergoing the molt to maturity (terminal molt) is shown in Figure 63, together with estimated natural mortality rates. Estimated mean post-molt size increased slightly faster with pre-molt size in the 2025 model than the 2026 model, although the data was identical. This may be related to the difference in male maturity data used in the models, which certainly has an effect on the estimated probability of male terminal molt. The estimated mortality rates (multipliers on the base rate of 0.23 yr^{-1}) exhibit only very small differences except for the 1980-1984 time period multiplier for males, resulting in slightly higher rates on males during this time period in the 2026 model.

The cohort progressions (growth and development) resulting from these schedules are illustrated in Figures 64 and 65. While the female results are essentially identical. For males, the results are slightly different, with immature males molting to maturity earlier and at smaller sizes in the 2025 model relative to the 2026 model.

6.4.7.5.2 *Estimated population-related time series*

Estimated time series for recruitment and MMB are shown in Figures 66 and 67. Time series of abundance by sex and maturity state are illustrated in Figure 68; time series of biomass by sex and maturity state are illustrated in Figure 69. The time series exhibit some small differences at the beginning and end of the model period, the latter due to the addition of the 2025/26 fishery and 2026 survey data.

6.4.7.6 *Fits to Fishery Catch Data*

Fits to the observed and model-predicted fishery catch biomass data are presented in Figures 70-74 for the previous assessment (22.03d5 (2025)) and preferred (22.03d5 (2026)) models. Residuals to the fits and summary statistics are also shown on each figure. Despite the small changes to the previous crab fishery data and the addition of the 2026 data, the fits to the fleet-specific total catch time series are almost identical.

6.4.7.7 *Fits to Survey Indices and Related Data*

6.4.7.7.1 *Graphs of model fits to survey biomass and numbers*

Model fits to the survey biomass time series from the NMFS EBS shelf survey and the BSFRF SBS surveys are shown for the models in Figure 75. Residuals to the fits and summary fit statistics are shown in Figures 76-79. The fits to the NMFS survey data were similar in pattern across the models, with particularly poor fits in 1985 for both males and immature females. The models also substantially overpredict NMFS survey biomass for males in 2022 and 2023 and underpredict it in 2024 and (22.03d5 (2026)) 2025. The fits to the BSFRF data are more acceptable, although both models overpredict mature female biomass in most years.

Model fits to the survey abundance time series for both the NMFS EBS shelf survey and the BSFRF SBS surveys are shown for the models in Figure 80. Residuals to the fits and summary fit statistics are shown in Figures 81-84. Fits to survey abundance were not included in the model objective function but serve as independent diagnostics of model fit. As with survey biomass, both models exhibited fairly similar fits to the abundance data, and these fits generally exhibited temporal patterns that were similar to those for survey biomass. Somewhat unexpectedly, the fits to male abundance in the 2022 and 2023 NMFS surveys were much better than those for biomass.

6.4.8 Graphs of model fits to other data

Model fits to molt increment growth data, as well as residual patterns and summary fit statistics, are illustrated in Figure 85. The predicted mean growth curves were essentially identical across the models, with both models overpredicting post-molt size for large crab of either sex. The summary statistics are somewhat smaller for the 2026 model because the estimated scale parameter for the gamma distribution used to determine the probability of post-molt size given pre-molt size was smaller for the 2026 model, with increased variance associated with the estimates.

Model fits to maturity ogive data from the NMFS EBS shelf survey are presented in Figure 86, while Pearson's residuals to the fits are shown in Figure 87. The 2025 ogives are on 10-mm size bins while the 2026 ogives are on 5-mm bins. Based on the residual patterns and magnitudes, the 2026 model appears to fit the 2026 ogives better than the 2025 model fits the 2025 ogives, although overall differences may average out across sizes and years.

6.4.8.1 Fits to Fishery Size Compositions

Fits to the observed and model-predicted fishery catch proportions by size class, as well as the resulting patterns of residuals, are presented in Figures 88-123 for the previous assessment model, 22.03d5 (2025), and the preferred model 22.03d5 (2026). As requested, residual plots are provided for both Pearson's residuals and OSA residuals (the latter using the `afscOSA` R package). Retained catch size compositions in the directed fishery are male-only. Total catch size composition data from the directed and bycatch fisheries are fit in the models by normalizing it across sexes and fitting the resulting proportions jointly.

On the whole, the fits are very similar across both models.

6.4.8.2 Fits to Survey Size Compositions

Fits to the observed and model-predicted survey proportions by size class/sex/maturity state, as well as the resulting patterns of residuals (both Pearson's and OSA residuals), from the NMFS EBS shelf survey and the BSFRF SBS survey are presented in Figures 124-143 for the previous assessment model, 22.03d5 (2025), and the preferred model 22.03d5 (2026). Both models exhibit similar fits to the NMFS survey size composition data, with the most salient feature perhaps being that the models overpredict the proportion of crab in the largest size bins for both males and females starting around 2000. The fits to the BSFRF size composition data are similar across the models for both sexes.

6.4.9 Credibility of parameter estimates

All parameter estimates seemed credible.

6.4.10 Residual analyses

Residual analyses are discussed in the following sections.

6.4.11 Evidence of search for balance between realistic and simpler models

A simpler model based on Tier 4 considerations is presented in Section 9.

6.4.12 Best model(s) selection

Given the poor jittering results, the failure of retrospective model runs, and the failure of the stock projection runs for the GMACS model, the author’s preferred model is the bespoke TCSAM02 model, 22.03d5 (2026). However, results from all three models are compared in the next section, “Best Model(s) Results”.

6.5 Best Model(s) Results

Tables and figures comparing the results from the “best” models, or simply presenting the results from the (singular) best model, are presented in this section. As previously noted, although the two GMACS models are not considered to be “best” models because it was not possible to conduct retrospective analyses them, projection results exhibited problems, and support for convergence to the MLE was weak (at best), their results are compared here with the author’s preferred model to demonstrate that their results are not substantially different from the bespoke model results and that this should provide the basis for transitioning this assessment to GMACS in 2027.

6.5.1 Tables

6.5.1.1 Likelihoods

6.5.1.1.1 Data-related likelihoods

The likelihood contributions to the objective function from the data components are summarized in Table 53. The base case is the TCSAM02 model 22.03d5 (2026). The differences in negative log-likelihood contributions between each comparison case and the base case are also shown.

6.5.1.1.2 Penalties and priors

Likelihood contributions to the objective function from penalties and priors on parameters are summarized in Table 54 and Table 55. These are generally not comparable between the two model frameworks.

6.5.1.2 Parameters

Estimated parameters from the GMACS and TCSAM02 models are summarized in Table 56 through Table 66. The parameters do not “map” to one another simply between frameworks, so they are presented in different tables.

6.5.1.3 Biomass time series

Estimates of MMB from the GMACS and TCSAM02 models are summarized in Table 67.

6.5.1.4 Recruitment (including average recruitment)

Estimates of recruitment from the GMACS and TCSAM02 models are summarized in Table 68.

6.5.1.5 Time series of total catch mortality divided by spawning biomass

The ratios of total catch mortality to MMB from the GMACS and TCSAM02 models are summarized in Table 69.

6.5.2 Graphs of estimates

6.5.2.1 Predicted quantities related to non-fishery population characteristics

Predicted quantities from the models related to non-fishery population dynamics are compared in Figure 144 for the size distribution at recruitment, in Figure 145 for natural mortality rates, in Figure 146 for mean growth, in Figures 147 and 148 for probabilities of post-molt size given pre-molt size, and in Figures 149 and 150 for probabilities of terminal molt.

6.5.2.2 Predicted quantities related to fishery characteristics

Predicted fishery characteristics are compared in Figures 151-155 for sex- and size-specific retention and capture/selectivity functions and Figure 156 for fully-selected capture rates.

6.5.2.3 Predicted quantities related to survey characteristics

Predicted survey characteristics are compared in Figure 157 for sex- and size-specific selectivity, in Figure 158 for sex- and size-specific availability to the BSFRF survey, and in Figure 159 for fully-selected survey catchability.

6.5.2.4 Predicted population quantities

Estimated population quantities are compared among the models in Figure 160 for recruitment, in Figures 161 and 162 for sex-specific cohort progression, in Figures 163 and 164 for aggregated sex- and stage-specific population abundance, in Figures 165 and 166 for aggregated sex- and stage-specific population biomass, and in Figures 176 and 177 for size-specific male maturity ogives.

6.5.2.5 Predicted fisheries quantities

Estimated fishery-related quantities are compared among the models in Figures 178 and 179 for fishery-specific capture abundance, in Figures 180 and 181 for fishery-specific capture biomass, in Figure 182 for total fishing mortality, and in Figure 183 for retained catch mortality.

6.5.2.6 Predicted survey quantities

Predicted survey-related quantities are compared among the models in Figures -Figure 184 and 185 for sex-specific survey biomass in the NMFS and BSFRF surveys.

6.5.3 Fits to the data

6.5.4 Fits to growth (molt increment) data

The fits obtained for growth data from the GMACS and TCSAM02 models are compared in Figure 186.

6.5.5 Fits to male maturity ogive data

The fits obtained to male maturity ogive data for the GMACS and TCSAM02 models are compared in Figure 187.

6.5.6 Fits to survey biomass

The fits obtained to survey biomass data by sex and maturity state from the NMFS and BSFRF surveys for the GMACS and TCSAM02 models are compared in Figures 188-193. As noted previously, none of the models captures the dynamic range between the peaks and valleys of the observed NMFS survey biomass time series.

6.5.7 Fits to fishery catch biomass and abundance

The fits obtained to fishery catch biomass and abundance data for the GMACS and TCSAM02 models are compared in Figure 194 for retained catch biomass, Figures 195-198 for total catch biomass, and Figure 199 for total catch abundance in the groundfish fisheries.

6.5.8 Fits to survey size composition data

Fits to survey size compositions from the NMFS EBS bottom trawl survey are compared among the models in Figures 200 and 201 for males, 202 and 203 for immature females, and 204 and 205 for mature females. The first figure for each population class is a matrix of line plots showing the annual observed compositions and each model's predictions; the second figure includes, for each model, a bubble plot of one-step-ahead (OSA) residuals, a QQ plot of the same, and a plot of the observed and predicted marginal compositions. Similar figures are provided for fits to BSFRF size compositions collected in 2013-2018 in Figures 206 and 207 for males, 208 and 209 for immature females, and 210 and 211 for mature females.

The fits are substantially similar across all three models.

6.5.9 Fits to fishery size composition data

Fits to retained catch size compositions in the directed fishery are compared among the models in Figure 212 as line plots and as one-step-ahead (OSA) residuals in Figure 213. Fits to total catch size compositions in the directed, snow crab, BBRKC, and groundfish fisheries are compared by sex among the models in Figures 214-221 as line plots (it was not feasible to compare them using OSAs because they were fit as sex-extended compositions).

6.5.10 Fits to marginal distributions

Marginal distributions for fits to the compositional data from the fisheries by the TCSAM02 model are shown in Figures 222-225.

The marginal distributions for fits to the survey compositions data are shown in Figure 226 (as well as Figures 201, 203, 205, 207, 209, 211).

6.5.11 Implied vs. effective sample sizes

Implied effective sample sizes were calculated by year for all size compositions for 22.03d5 (2026) using the McAllister-Ianelli method (McAllister and Ianelli 1997); equivalent calculations were not available for the GMACS models. Time series plots of implied and input effective sample sizes for compositional data from the fisheries are shown in Figures 227-231. Similar plots for the survey compositional data are given in Figures 232 and 233.

The implied sample sizes for the fishery size compositions were larger than the input sample sizes for most years. This was also the case for the NMFS survey size compositions, although the implied sample sizes were consistently smaller than the input sample sizes for males before 1989. The results for the BSFRF size composition results provide support for fixing the effective sample size parameters in the Dirichlet-Multinomial likelihoods used to fit the BSFRF size compositions as a practical step to obtaining a model with no parameters estimated at a bound.

6.5.12 RMSEs

Time constraints did not allow completion of the relevant R code to compare RMSEs from the GMACS and TCSAM02 models together. RMSEs, MADs, and MAREs for the TCSAM02 model are provided in Figures 70 and 71-74 for fits to fishery retained and total catch biomass, Figure 76-79 for fits to survey biomass data, Figure 81-Figure 84 for diagnostic fits to survey abundance data (“fits” are not included in the overall likelihood), 85 for fits to growth data, and 87 for fits to maturity ogive data.

6.5.13 QQ plots and histograms of residuals

QQ plots are shown for fits to survey size compositions from all models in Figures 201, 203, 205, 207, 209, and 211. Similar plots were not created for the GMACS fishery size compositions because these were fit in extended fashion across sexes and time constraints did not allow the necessary R code development to correctly extract the results and make the figures similar to those for the TCSAM02 model. Time constraints also did not allow code development to complete this section for fits to other types of data (fishery catch, survey biomass, growth data, and maturity data).

6.6 Retrospective analyses

Retrospective model runs failed for both GMACS models beyond one year, so a retrospective analysis was only conducted for the base/TSAM02 model. The analysis used 10 peels (ending in 2016), with the model re-fit after each removal of the previous peel's terminal year's data. Time series plots of recruitment and MMB were made to identify potential patterns in how the terminal year's estimate for each peel differed from the model result using the complete dataset (Figures 234 and 235. Relative bias in the terminal year estimates was quantified using Mohn's rho (Mohn 1999). The results show a clear grouping among the peels with time series that end before 2023 and those that end in subsequent years. A large recruitment event was evident in 2023 in the NMFS survey size compositions. Mohn's rho for the pattern in MMB is -0.216; for the recruitment pattern, it is 0.557.

6.7 Historical analysis

The estimated time series of recruitment and mature biomass for the author's preferred model, 22.03d5 (2026), are compared with those from previous assessments in Figures 236 and 237. Prior to 1975, when the NMFS EBS shelf survey data begin, the results fall into three groups: 2017 and 2018, 2019 and 2020, and the remainder (2021-2025 plus this assessment's preferred model), with results for the first two groups differing mainly in scale while the latter group differs from the first two in temporal pattern, as well. After 1975, the models differ primarily in scale, while exhibiting similar temporal patterns. The plots indicate a generally-increasing trend in the overall scale of estimated recruitment and mature biomass by assessment.

6.7.1 Squid plots of retrospective patterns in recruitment deviations

Time constraints did not allow completion of the section.

6.7.2 Uncertainty and sensitivity analyses

Time constraints did not allow completion of the section. MCMC runs were not completed in time to include in the assessment. Uncertainty has been characterized using ADMB's sdreport functionality for parameters, recruitment estimates, MMB time series, and management quantities. This uses the so-called "delta approximation" to estimate uncertainty associated with parameters and derived quantities after inverting the model Hessian at the MLE and obtaining the covariance matrix.

6.7.3 Jitter analyses

Parameter jittering was used to find the optimal parameter values that resulted in the minimum model objective function, which consisted of a sum of negative log-likelihoods informed by data, prior probabilities, and additional penalties to achieve a solution. As such, it is discussed in the section on model selection and evaluation.

6.8 Stock projections

Stock projections for the TCSAM02 model were created for different fractions of its F_{MSY} by projecting the population forward under constant fishing mortality and by adding recruitment each year based on randomly resampling (with replacement) the estimated annual recruitments from the time frame used to determine average recruitment. Results from these projections are illustrated in Figure 238. Projections using the GMACS models were clearly wrong; the issue will be addressed in the near future.

7 Calculation of the OFL

7.1 Status determination and OFL calculation

The (total catch) OFL for 2025/26 was 51.02 thousand t while total catch mortality was 5.702 thousand t, based on applying mortality rates of 1.000 for retained catch, 0.321 to bycatch in the crab fisheries, 0.5 to bycatch in the groundfish fixed gear fisheries, and 0.8 to bycatch in the groundfish trawl fisheries to retained catch data and estimates of discards from fish ticket and observer data (see Tables A, 4, 12, and 13). Because total catch mortality is less than the OFL, **overfishing did not occur in 2025/26.**

For crab stocks managed by the NPFMC, *overfished* status is assessed with respect to the Minimum Stock Size Threshold (MSST, CPT (Crab Plan Team) 2022). If stock biomass drops below the MSST, the stock is considered to be overfished. For crab stocks, MSST is one-half of B_{MSY} , where B_{MSY} is the long-term equilibrium biomass (assumed to reflect the reproductive potential for the stock) when the stock is fished at maximum sustainable yield (MSY). Thus, the stock is overfished if $B/B_{MSY} < 0.5$, where B is the “current” biomass. In general, the overfishing limit (OFL) for the subsequent year is based on B/B_{MSY} and an F_{OFL} harvest control rule, where F_{OFL} is the fishing mortality rate that yields the OFL and $F_{OFL} \leq F_{MSY}$, the fishing mortality that yields the long-term maximum sustainable yield (MSY). Furthermore, if $B/B_{MSY} < \beta (= 0.25)$, directed fishing on the stock is prohibited. Tanner crab has been considered a “Tier 3” stock for status determination and fishery management since 2012/13 (SSC 2012) because the available biological and fishery information have been deemed sufficiently informative that Tier 3 proxies for B_{MSY} and F_{MSY} (i.e., spawner-per-recruit proxies $B_{35\%}$ and $F_{35\%}$ based on mature male biomass) can be reliably estimated.

Amendment 24 to the NPFMC fishery management plan revised the definitions for overfishing for EBS crab stocks (NMFS 2008; NPFMC 2021a). The information provided in this assessment is sufficient to estimate overfishing limits for Tanner crab under Tier 3. The OFL control rule for Tier 3 is outlined in Table P (see Figure 239 for a graphical representation).

Table P. Tier 3 F_{OFL} control rule.

$B, F_{35\%}, B_{35\%}$	3			
a.	$\frac{B}{B_{35\%}} > 1$	$F_{OFL} = F_{35\%}^*$		
b.	$\beta < \frac{B}{B_{35\%}} \leq 1$	$F_{OFL} = F_{35\%}^* \frac{\frac{B}{B_{35\%}} - \alpha}{1 - \alpha}$	ABC $\leq (1 - b_y) \cdot OFL$	
c.	$\frac{B}{B_{35\%}} \leq \beta$	Directed fishery $F = 0$ $F_{OFL} \leq F_{MSY}^{\dagger}$		

It is based on an estimate of “current” spawning biomass at mating (B above, taken as the projected MMB at mating in the assessment year) and spawning biomass per recruit (SBPR)-based proxies for F_{MSY} and B_{MSY} . In the equations above in Table P, $\alpha = 0.1$ and $\beta = 0.25$. For Tanner crab, the proxy for F_{MSY} is $F_{35\%}$, the fishing mortality that reduces the SBPR to 35% of its value for an unfished stock. Thus, if $\phi(F)$ is the SBPR at fishing mortality F , then $F_{35\%}$ is the value of fishing mortality that yields $\phi(F) = 0.35 \cdot \phi(0)$. The Tier 3 proxy for B_{MSY} is $B_{35\%}$, the equilibrium biomass achieved when fishing at $F_{35\%}$, where $B_{35\%}$ is simply 35% of the equilibrium (longterm average) unfished stock biomass. Given an estimate of average recruitment, $\bar{R}$, $B_{35\%} = 0.35 \cdot \bar{R} \cdot \phi(0)$.

Thus Tier 3 status determination and OFL setting for 2026/27 require estimates of $B = MMB_{2026/27}$ (the projected MMB at mating time for the coming year), $F_{35\%}$, spawning biomass per recruit in an unfished stock (ϕ_0), and $\bar{R}$. Current stock status is determined by the ratio $B/B_{35\%}$ for Tier 3 stocks. If the ratio is greater than 1, then the stock falls into Tier 3a and $F_{OFL} = F_{MSY} = F_{35\%}$. If the ratio is less than one but greater than β , then the stock falls into Tier 3b and F_{OFL} is reduced from $F_{35\%}$ following the descending limb of the control rule (Figure 239). If the ratio is less than β , then the stock falls into Tier 3c and directed fishing must cease. In addition, if B is less than the Minimum Stock Size Threshold (MSST, $= \frac{1}{2} B_{35\%}$), the stock must be declared overfished and a rebuilding plan subsequently developed.

The OFL is calculated within the assessment model based on equilibrium calculations for F_{MSY} and projecting the state of the population at the end of the modeled time period one year forward assuming fishing mortality at F_{OFL} . Using an estimate of the uncertainty in the OFL and assumptions about the underlying distribution or MCMC, one can estimate the probability distribution of the OFL (and related quantities of interest) and better characterize model uncertainty.

To calculate F_{MSY} , the fishery capture rate for males in the directed fishery is adjusted until the long term (equilibrium) MMB-at-mating is 35% of its unfished value (i.e., $B = 0.35 \cdot B_0 = B_{35\%} = B_{MSY}$). This calculation depends on the assumed bycatch F 's on Tanner crab in the snow crab, BBRKC and groundfish fisheries. Since 2017, the average F over the last 5 years for each of the bycatch fisheries has been used in these calculations. Fishery selectivity curves were set using the average curve over the last 5 years for each fishery, as in previous assessments (e.g., Stockhausen 2022).

The determination of $B_{MSY} = B_{35\%}$ for Tanner crab depends on the selection of an appropriate time period over which to calculate average recruitment ($\bar{R}$). Following discussion in 2012 and 2013, the SSC endorsed an averaging period of 1982+. Starting the average recruitment period in 1982 is consistent with a 5-6 year recruitment lag from 1976/77, when a well-known climate regime shift occurred in the EBS (Rodionov and Overland 2005) that may have affected stock productivity. This issue was revisited at the May 2018 CPT meeting with regard to whether

or not the final year should be included in the calculation, but no definitive recommendations were made. In 2020, the NMFS EBS shelf bottom trawl survey was canceled due to health and safety concerns associated with the COVID-19 pandemic. This resulted in enormous uncertainty in the estimate of final year recruitment for that assessment; it was subsequently dropped from the averaging time frame. Recruitment estimates and associated uncertainties for the intervening years do not raise any concerns, but the estimated confidence interval and standard deviation for the 2025 recruitment was an outlier in terms of the time series, being the third-largest in the 1982+ time frame (Figure 240). Consequently, average recruitment in the 2025 assessment was calculated by dropping the final year estimate and using the period 1982-2024. For this assessment, the same approach is applied and average recruitment is calculated over the time period 1982-2025, dropping the final 2026 estimate.

Once F_{MSY} and B_{MSY} are determined, the (total catch) OFL can be calculated iteratively based on projecting the population forward one year assuming an F , calculating the catch and projected biomass B , comparing the stock's position on the harvest control rule's phase plane and adjusting F and recalculating the projected B until the point (F, B) lies on the control rule. The OFL is then the predicted total catch mortality taken when fishing at $F = F_{OFL}$, which is calculated as

$$C = \sum_f \sum_x \sum_z \{F_{.,x,z} \cdot [1 - e^{F_{.,x,z}}] \cdot [e^{M_x \cdot \delta t} \cdot N_{x,z}]\}$$

where C is total catch (biomass), $F_{f,x,z}$ is the fishing mortality in fishery f on crab in size bin z by sex (x), $F_{.,x,z} = \sum_f F_{f,x,z}$ is the total fishing mortality by sex on crab in size bin z , $w_{x,z}$ is the mean weight of crab in size bin z by sex, M_x is the sex-specific rate of natural mortality, δt is the time from July 1 to the time of the fishery (0.625 yr), and $N_{x,z}$ is the numbers by sex in size bin z on July 1, 2026 as estimated by the assessment model.

The following tables summarize the OFL results for the models considered for potential management application in this assessment (repeating Tables A and B for convenience; ABC calculation is discussed in Section 8):

Table A. Management quantities (in 1,000s t) based on the ‘best’ models and recommended ABC buffer (20%). TAC is summed across ADF&G management areas.

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC	model
2021/22	17.37	62.05	0.50	0.49	0.78	27.17	21.74	NA
2022/23	18.19	74.17	0.91	0.91	1.19	32.81	26.25	NA
2023/24	20.00	88.21	0.94	0.94	1.09	36.20	27.15	NA
2024/25	21.61	99.53	2.84	2.85	3.09	41.29	33.03	NA
2025/26	23.78	129.04	5.10	5.11	5.70	51.02	40.81	‘22.03d5 (GMACS)’
2026/27	NA	108.19	NA	NA	NA	72.10	57.68	‘22.03d5 (GMACS)’
2025/26	24.90	127.49	5.10	5.11	5.70	51.02	40.81	‘26.02 (GMACS)’
2026/27	NA	111.30	NA	NA	NA	53.73	42.98	‘26.02 (GMACS)’
2025/26	21.33	116.89	5.10	5.11	5.70	51.02	40.81	‘22.03d5 (2026)’
2026/27	NA	97.85	NA	NA	NA	67.39	53.91	‘22.03d5 (2026)’

Table B. Management quantities (in millions of pounds) based on the ‘best’ models and recommended ABC buffer (20%). TAC is summed across ADF&G management areas.

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC	model
2021/22	38.29	136.80	1.10	1.08	1.72	59.90	47.93	NA
2022/23	40.10	163.52	2.01	2.01	2.62	72.33	57.87	NA
2023/24	44.09	194.47	2.08	2.07	2.40	79.81	59.86	NA
2024/25	47.64	219.43	6.27	6.29	6.81	91.03	72.82	NA
2025/26	52.42	284.49	11.25	11.26	12.57	112.48	89.97	‘22.03d5 (GMACS)’
2026/27	NA	238.51	NA	NA	NA	158.96	127.17	‘22.03d5 (GMACS)’
2025/26	54.89	281.06	11.25	11.26	12.57	112.48	89.97	‘26.02 (GMACS)’
2026/27	NA	245.36	NA	NA	NA	118.45	94.76	‘26.02 (GMACS)’
2025/26	47.02	257.70	11.25	11.26	12.57	112.48	89.97	‘22.03d5 (2026)’
2026/27	NA	215.72	NA	NA	NA	148.57	118.85	‘22.03d5 (2026)’

8 Calculation of the ABC

Amendments 38 and 39 to the Fishery Management Plan (NPFMC 2011) established methods for the Council to set Annual Catch Limits (ACLs). The Magnuson-Stevens Act requires that ACLs be established based upon an ABC control rule that accounts for scientific uncertainty in the OFL such that $ACL=ABC$ and the TAC be set below the ABC so as not to exceed the ACL. ABCs must be recommended annually by the Council’s SSC.

Two methods for establishing the ABC control rule are: 1) a constant buffer where the ABC is set by applying a multiplier to the OFL to meet a specified buffer below the OFL; and 2) a variable buffer, referred to as the p^* -ABC, where the ABC is set based on a specified percentile (p^*) of the distribution of the OFL that accounts for uncertainty in the OFL. p^* is the probability that ABC would exceed the OFL and overfishing occur. In 2010, the NPFMC prescribed that maximum ABCs for BSAI crab stocks be established at $p^*=0.49$. Thus, annual $ACL=ABC$ levels should be established such that the risk of overfishing, $P[ABC>OFL]$, is 49%. For this assessment, the model-based uncertainty in the OFL was obtained using ADMB’s `sd_report` functionality, which provides standard errors for derived quantities like the OFL based on the “delta method”, which approximates the likelihood surface at the MLE as multivariate normal using the estimated parameter covariance matrix. In 2014, however, the SSC adopted a buffer of 20% on OFL for the Tanner crab stock for calculating ABC that included consideration of additional uncertainty in the stock assessment. The Risk Table for this stock Section B provides a rationale for the buffer based on the current assessment, environmental conditions, and fishery performance. Here, ABCs are provided based on both methods.

The author remains concerned that the OFL calculation, based on $F_{35\%}$ as a proxy for F_{MSY} , is overly optimistic regarding the actual productivity of the stock. Fishery-related mortality similar to the P^* ABC level has occurred only in the latter half of the 1970s and in 1992/93, coincident with collapses in stock biomass to low levels. This suggests that $F_{35\%}$ may not be a realistic proxy for F_{MSY} and/or that MMB may not be a good proxy for reproductive success, as are currently assumed for this stock. In addition, estimates of survey catchability and mean recruitment are strongly correlated for this stock, suggesting that the estimated stock size may be problematic. However, these concerns are not new and are reflected in the previous ABC buffer. Other considerations in the evaluation of the Risk Table suggest these are at normal levels of concern and thus do not warrant increasing the buffer. Thus, the author recommends using the 20% buffer previously adopted by the SSC for this stock to calculate the ABC.

The following table (repeated as Table 70) summarizes the ABC results for the models considered for potential management application in this assessment (repeating Tables A and B for convenience):

Table Q. P-star and buffer ABCs from the models considered for management. The p-star ABCs are the maximum permissible ABCs under each model and are base on model-derived estimates of uncertainty in the associated OFL. The buffer ABCs are based on applying an author-recommended 0.2% buffer to the OFL.

case	OFL	se(OFL)	ABC.pstar	ABC.buff
‘22.03d5 (2026)‘	67.39	4.15	67.28	53.91
‘22.03d5 (GMACS)‘	72.10	4.37	71.99	57.68
‘26.02 (GMACS)‘	53.73	3.12	53.65	42.98

9 Tier 4 “fall back” model

9.1 Introduction

Tanner crab has been considered a “Tier 3” stock for status determination and fishery management since 2012/13 (SSC 2012) because the available biological and fishery information have been deemed sufficiently informative that Tier 3 proxies for B_{MSY} and F_{MSY} (i.e., spawner-per-recruit proxies $B_{35\%}$ and $F_{35\%}$ based on mature male biomass) can be reliably estimated. However, the SSC has expressed concerns regarding the complexity of the current Tier 3 models for Tanner and other crab stocks and has requested that simpler “Tier 4” models be developed as a fallback in the event that a candidate Tier 3 model is deemed unreliable (SSC 2022). Approaches to implement a “fallback” Tier 4 model were discussed at the March, 2023 meeting of the “simpler” crab modeling working group, a joint inter-agency and SSC working group (Anonymous 2023). The working group was formed in response to a recommendation made by the SSC during its October 2022 meeting that SSC members and stock assessments authors jointly explore model parsimony and legacy assumptions for the BBRKC, Tanner, and snow crab stocks (SSC 2022).

For Tier 4 stocks, the estimate of “current survey biomass” is considered to be reliable and the proxy B_{MSY} is defined as “average biomass over a specified time period” (CPT (Crab Plan Team) 2022 p. 8). F_{MSY} is taken to be $\gamma \cdot M$, where M is the assumed rate of natural mortality and γ is a constant (taken as 1 by default). Once the $B_{MSY_{proxy}}$ has been calculated, the overfished status is then determined by the ratio $B/B_{MSY_{proxy}}$: the stock is overfished if the ratio is less than 0.5, where B is taken as “current” biomass. The ratio also determines F_{OFL} relative to F_{MSY} :

1. if $B/B_{MSY_{proxy}} \geq 1$ then $F_{OFL} = F_{MSY}$;
2. if $0.25 < B/B_{MSY_{proxy}} < 1$, then $F_{OFL} < F_{MSY}$ as determined by a sloping F_{OFL} control rule (CPT (Crab Plan Team) 2022); or
3. $F_{OFL} = 0$ if $B/B_{MSY_{proxy}} < 0.25$.

For the Tier 3 stocks, the “simpler” crab modeling working group recommended using the mean of a smoothed time series for “vulnerable” male crab survey biomass as a very simple B_{MSY} proxy for fallback Tier 4 models, although it also supported authors bringing forward slightly more complex models that captured growth and mortality between the times of the survey and fishery (Anonymous 2023 pp. 4–5). At the May 2023 CPT meeting, the author presented a “slightly more complex” Tier

4 model for Tanner crab that incorporated natural mortality, recruitment, and fishing mortality into estimates of survey-based MMB-at-mating as the currency for the B_{MSY} proxy (Stockhausen 2023b). However, the SSC did not see the need for the additional complexity in a “fallback” model and requested that the author follow the working group’s simpler B_{MSY} proxy recommendation (SSC 2023 p. 12). It also requested that authors base the averaging period “on the whole time series or develop justification for a better time block that represents current fishing potential for the stock” (SSC 2023 p. 7). For Tanner crab specifically, the SSC further requested that “a clear justification for the choice of reference time period be provided in the September SAFE document, beyond simple precedent, and that several alternative time periods be considered (each with its own justification)” (SSC 2023 p. 12).

Here, fallback Tier 4 management quantities are calculated for the eastern Bering Sea Tanner crab stock using the approach requested by the SSC. First, a time series of “vulnerable” male biomass (VMB) is calculated using data from the NMFS Bering Sea shelf bottom trawl survey, to which a state-space random walk model is applied to reduce observation error and interannual variance (process error). Current B is taken as the estimate of VMB for 2026 from the random walk model. Then B_{MSY} proxies are calculated for several candidate time periods by averaging the random walk time series values over each time period. Finally, other management quantities (e.g., stock status, F_{OFL} , OFL) are calculated based on the Tier 4 rules noted above.

9.2 Vulnerable male biomass time series

A time series of observed survey biomass for male crab classified as “vulnerable” to capture by the directed and bycatch fisheries for Tanner crab was calculated from the annual NMFS EBS shelf bottom trawl survey for 1975-2026 (the survey was not conducted in 2020) using standard methods for design-based biomass indices (Wakabayashi et al. 1985), where male crab greater than 100 mm CW were classified as vulnerable to fishing gear (Table 71; Figure 243). The observed VMB time series is rather noisy; to reduce variability associated with survey sampling error, a state-space/random effects random walk model was fit to the observed time series using the *rema* R package (Sullivan 2022) (Table 71; Figure 243). The model provided an estimate of 86,371 t for current B , as well as the values to average to obtain the B_{MSY} proxy.

9.3 Tier 4 Management Quantities

Candidate values for the Tier 4 management quantities, dependent on the time block chosen for the B_{MSY} proxy, were calculated for the time periods listed in Table 72.

For the time blocks considered, the B_{MSY} proxy ranges from 43 to 110 thousand t (see Figure 244 also). Stock status ranges from 0.79 (Tier 4b, “not overfished”) to 1.99 (Tier 4a, “not overfished”). F_{OFL} and OFL cannot be determined from the control rule when the stock is in level “c” (status < 0.25): in this case, directed fishing is prohibited and an $F_{OFL} \leq F_{MSY}$ would be determined based on all other sources of mortality in the development of the rebuilding plan. However, none of the alternative time frames result in a stock status classification of “c”. The maximum F_{OFL} and OFL are 0.23 and 17.746 thousand t, respectively. The stock would not be considered “overfished” (status < 0.5) under any of the time frames.

The SSC has recommended that authors base this calculation for “fallback” Tier 4 calculations on the “whole time series or develop justification for a better time block that represents current

fishing potential for the stock” (SSC 2023). For the previous assessment (Stockhausen 2025a), the author recommended using the 1982-present time frame to calculate the B_{MSY} proxy, which the SSC adopted, after considering the following arguments:

The time period for calculating the B_{MSY} proxy should ideally correspond to a time period at which the stock was in equilibrium and fished at F_{MSY} (NPFMC 2021b). In 2008 for the previous Tier 4 model, the SSC recommended two time periods, 1969-1980 and 1969-2007 (i.e., “the present”, at the time of the recommendation) as candidates for the time block to use to calculate the B_{MSY} proxy (SSC 2008); both time blocks included survey results from 1969, 1970, and 1972-1975 based on associated INPFC reports in addition to subsequent NMFS EBS shelf surveys. The rationale for this time period seems to have included the importance of the pre-1975 time period as indicative of unexploited stock size and the effects of fishing down the stock from unexploited levels.

Rugolo and Turnock (2008) noted that both the authors and the CPT expressed concerns regarding the quality and availability of the data from the pre-1975 period, and suggested dropping the pre-1975 data. In addition (Rugolo and Turnock 2008), “the authors and CPT are not able to recommend...” the 1969-2007 period for OFL setting. From 1980-2007, the EBS Tanner crab stock collapsed twice resulting in two periods of fishery closures and a rebuilding plan by the Council. During this period, the stock experienced exploitation rates in excess of current F_{MSY} estimates.”

Rugolo and Turnock (2010) reiterated the criticism that “during 1980-2009, the stock has not maintained itself at a level that could be reasonably construed as in dynamic equilibrium or at a level indicative of B_{MSY} capable of providing MSY to the fisheries.”

The Tanner crab stock does not appear to have been in equilibrium under any fishing mortality rates since the inception of the fishery. The fishery has been closed a number of times (1985-1986, 1997/98-2004/05, 2010/11-2012/13, 2016/16, 2019/20), was declared overfished in 1999 and again in 2010, and was under rebuilding plans during 2001-2007 and 2012. Thus, it does not seem possible to identify a time period associated with the stock being at equilibrium while being fished at F_{MSY} and the selection of an averaging time period must then be based on other criteria. As noted above, the SSC has recommended that authors base this calculation for “fallback” Tier 4 calculations on the “whole time series or develop justification for a better time block that represents current fishing potential for the stock” (SSC 2023). The “whole time period” would be 1975-present or 1982-present, depending on whether the survey gear change in 1982 is a matter for concern for the consistency of the VMB time series. Results for both of these time periods are included in the analysis. The time block 1975-1980 was included in the analysis for historical continuity with the previous Tier 4 model. Two other time blocks were included in the analysis: 1987-1995 + 2005-2009 + 2013-2015 and 2005-2009 + 2013-2015, the latter a subset of the former that drops the 1987-1995 time period. These time blocks exclude the presumed “enhanced mortality” period (1980-1984) as well as periods when the fishery (as a whole) was closed.

The two time blocks that include the 1975-1980 time period are not recommended because this period encompasses a dramatic decline in VMB over the time period and thus does not appear to reflect the “current fishing potential” of the stock. In addition,

the different selectivity/catchability characteristics in the pre- and post-1982 survey gear introduce potential inconsistencies across the time series. The author does not see a strong argument for any of the remaining time periods because none appear to meet the criteria outlined above for the Tier 4 $B_{MSY_{proxy}}$. Consequently, the author recommends the OFL derived using the SSC-default period 1982-present.

Using the author-recommended time period results in a value of 43.4 thousand t for the B_{MSY} proxy, a stock status of 1.99, an F_{MSY} of 0.23, and an OFL of 17.7 thousand t.

The SSC also requested that authors recommend a suitable buffer to apply to the OFL to obtain the ABC. The cv for the estimated B (0.2) provides a natural starting point to define an ABC buffer. After review of the suggestions made at the September 2023 CPT meeting, the CPT recommended, and the SSC accepted, that authors use the cv for the estimated B , rounded to the nearest 0.05 increment (i.e., 5%), as the minimum buffer prior to evaluating any additional concerns. Taking the latter approach, the minimum buffer for ABC would be 20% and the corresponding ABC would be 14.2 thousand t.

10 Rebuilding Analyses

The Tanner crab stock is not overfished, so no rebuilding analyses are required.

11 Data Gaps and Research Priorities

The GMACS framework needs to be converted from ADMB to RTMB. ADMB development has sunsetted and is no longer actively supported. Conversion to RTMB allows analysis to be conducted completely within R, rather than switching between multiple platforms (ADMB, text-based output, R), provides more powerful tools for running and evaluating models, and allows the estimation of random effects. While development of an RTMB version of GMACS has begun, it needs to be recognized as a top priority.

Information on growth-per-molt has been collected in the EBS on Tanner crab and incorporated into the assessment. It would be helpful to have more information on growth associated with the terminal molt, because it seems likely this has different characteristics than previous molts. In addition, the current growth model “smears” crab across the smallest size bins when it appears growth variability for small crab may be more limited than the current model allows. It might be advantageous to develop a growth model that captured the early cohort dynamics in the assessment model better. This might be as simple as letting the variance be a function of pre-molt size, in addition to the mean. A better understanding of drivers of natural mortality and recruitment variability is another key to improving the ecological basis for the assessment. Implementation of density-dependent mortality may allow models to better capture the dynamic range between minima and maxima in the survey time series data. More comprehensive information regarding thermal tolerances and temperature-dependent effects on molting frequency and movement would be helpful to assess potential impacts of the EBS cold pool on recruitment processes and the stock distribution. Furthermore, it would be worthwhile to develop a “better” index of reproductive potential than MMB that can be calculated in the assessment model, as well as to revisit the issue of MSY proxies for this stock.

The characterization of fisheries in the assessment model also needs to be carefully reconsidered. How, and whether or not, the differences in the directed fishery in areas east and west 166°W longitude should be explicitly represented in the assessment model need to be addressed. This is particularly relevant because the eastern management area was closed for several years until recently, which has implications for selectivity time blocks and whether an asymptotic function remains a reasonable description of selectivity in the directed fishery. The question of whether or not bycatch in the groundfish fisheries should be split into fixed gear- and trawl-related components to better capture changes in bycatch selectivity also needs to be revisited.

Incorporating the BSFRF side-by-side (SBS) surveys into the assessment in the best way possible is also a matter for continued exploration. A catch ratio analysis using the SBS survey data outside the model (presented at the May, 2021 CPT meeting) provided initial estimates of year-specific NMFS survey selectivity that account for variations in stock abundance across different depths and benthic substrates. This analysis needs to be drawn to a conclusion and incorporated, at least as an option, into the assessment model framework. BSFRF has provided the 2018 survey data to the assessment author and analysis is underway.

12 Ecosystem Considerations

Information on ecosystem considerations relevant to the Tanner crab stock assessment are provided in the Risk Table Section [B](#) appendix. An update to the 2025 Tanner crab Ecosystem and Socioeconomic Profile (ESP) ([Hennessey and Garber-Yonts 2025](#)) was not available for this assessment.

13 Information for Prohibited Species Catch Limits

Table [73](#) lists Tanner crab total abundance (in millions of crab) in the NMFS EBS shelf survey using design-based expansion of the abundance of all Tanner crab in the survey, as well as survey abundance estimated by the author's preferred model, 22.03d5 (2026). The model only considers crab larger than 25 mm CW in its estimation process (and thus are included in the table), while all Tanner crab caught in the survey are included in the survey-estimated abundance in this table. The NMFS Alaska Regional Office will use this information when determining Prohibited Species Catch (PSC) limits.

14 Additional literature

This section was not updated due to time constraints associated with the assessment. It will be provided in future assessments.

15 Acknowledgments

The author would like to acknowledge the contributions to this assessment made by Tyler Jackson (ADF&G) to provide crab fishery data, Emily Ryznar (AFSC) to provide male maturity ogive results, and all personnel contributing to the planning and execution of the 2026 (and previous)

NMFS EBS shelf bottom trawl survey(s) as well the remarkably short turn-around time in providing me with the survey results. BSFRF provided the 2013-2018 BSFRF survey data collected during the cooperative side-by-side selectivity studies. Shannon Hennessey (AFSC), Erin Fedewa (AFSC), Kalei Shotwell (AFSC), and Ebett Siddon (AFSC) provided valuable information for the Risk Table appendix. Lee Cronin-Fine (AFSC) provided a helpful review of the report and appendices.

References

- Adams, A.E., and Paul, A.J. 1983. Male parent size, sperm storage and egg production in the crab *Chionoecetes bairdi* (Decapoda, Majidae). *Int. J. Invertebr. Reprod.* **6**(3): 181–187.
- ADF&G. 2006. 2006-2008 Commercial King and Tanner Crab Fishing Regulations. Alaska Department of Fish and Game, Division of Sport Fish and Commercial Fisheries, Juneau, AK.
- ADF&G. 2017. 2017-2019 King and Tanner Crab Commercial Fishing Regulations. Alaska Department of Fish and Game.
- Anonymous. 2023. Crab Modeling Workgroup Report. North Pacific Fishery Management Council, Anchorage, AK. Available from <https://meetings.npfmc.org/CommentReview/DownloadFile?p=707cf4ac-266d-4213-bd9d-b4002e96012d.pdf&fileName=Crab%20Modeling%20Working%20group%20Report.pdf>.
- Bechtol, W.R., Kruse, G.H., Greenberg, J., and Geier, H. 2011. Analysis of the minimum size limit for eastern Bering Sea Tanner crab fisheries. Bering Sea Fisheries Research Foundation, Kirkland, WA.
- Bowers, F.R., Schwenzfeier, M., Coleman, S., Failor-Rounds, B.J., Milani, K., Herring, K., Salmon, M., and Albert, M. 2008. Annual Management Report for the Commercial and Subsistence Shellfish Fisheries of the Aleutian Islands, Bering Sea and the Westward Region's Shellfish Observer Program, 2006/07. Alaska Department of Fish and Game, Juneau, AK.
- Brown, R.B., and Powell, G.C. 1972. Size at maturity in the male Alaskan Tanner crab, *Chionoecetes bairdi*, as determined by chela allometry, reproductive tract weights, and size of precopulatory males. *Journal of the Fisheries Research Board of Canada* **29**(4): 423–427.
- CPT. 2013. Crab Plan Team Report. North Pacific Fishery Management Council, Anchorage, AK.
- CPT. 2014. Crab Plan Team Report. North Pacific Fishery Management Council, Anchorage, AK. Available from <https://meetings.npfmc.org/CommentReview/DownloadFile?p=72c9a5fe-72fb-4f5d-a2f1-ac4a682adbea.pdf&fileName=C1%20CPTreport%20514.pdf>.
- CPT. 2015. Introduction. *In* 2012 Stock Assessment and Fishery Evaluation Report for the King and Tanner Crab Fisheries of the Bering Sea and Aleutian Islands. North Pacific Fishery Management Council, Anchorage, AK. Available from <https://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/CrabSAFE2012intro.pdf>.
- CPT. 2021. Crab Plan Team report. North Pacific Fishery Management Council, Anchorage, AK. Available from <https://meetings.npfmc.org/CommentReview/DownloadFile?p=068ec315-447c-46b1-9724-3fb4f0344096.pdf&fileName=C1%20January%202024%20CPT%20Report.pdf>.
- CPT. 2025. Crab Plan Team report. North Pacific Fishery Management Council, Anchorage, AK. Available from <https://meetings.npfmc.org/CommentReview/DownloadFile?p=b3bf30f5-19b7-463e-a862-633fe323f9c0.pdf&fileName=C2%20CPT%20Report%20May%202025.pdf>.
- CPT (Crab Plan Team). 2017. Crab Plan Team Report. North Pacific Fishery Management Council, Anchorage, AK. Available from <https://meetings.npfmc.org/CommentReview/DownloadFile?p=27175b87-79d8-43dd-ae8a-4d16284953b7.pdf&fileName=C7%20Crab%20Plan%20Team%20Report%20May%202017.pdf>.

- CPT (Crab Plan Team). 2022. Introduction. *In* Stock Assessment and Fishery Evaluation Report for the KING AND TANNER CRAB FISHERIES of the Bering Sea and Aleutian Islands Regions 2022 Final Crab SAFE. North Pacific Fishery Management Council, Anchorage, AK. pp. 1–43. Available from <https://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/2022/TannerCrabSAFE2022.pdf>.
- Daly, B., Armistead, C., and Foy, R. 2014. The 2014 Eastern Bering Sea Continental Shelf Bottom Trawl Survey: Results for Commercial Crab Species. NOAA. Available from <https://apps-afsc.fisheries.noaa.gov/Publications/AFSC-TM/NOAA-TM-AFSC-282.pdf>.
- Daly, B., Armistead, C., and Foy, R. 2015. The 2015 Eastern Bering Sea Continental Shelf Bottom Trawl Survey: Results for Commercial Crab Species. NOAA. Available from <https://apps-afsc.fisheries.noaa.gov/Publications/AFSC-TM/NOAA-TM-AFSC-308.pdf>.
- Daly, B., Heller-Shipley, M., Stichert, M., Stockhausen, W., Punt, A., and Goodman, S. 2020. Recommended harvest strategy for Bering Sea Tanner crab. Alaska Department of Fish and Game, Anchorage, AK.
- Donaldson, W.E., and Adams, A.E. 1989. Ethogram of behavior with emphasis on mating for the Tanner crab *Chionoecetes bairdi* Rathbun. *Journal of Crustacean Biology* **9**(1): 37–53.
- Donaldson, W.E., Cooney, R.T., and Hilsinger, J.R. 1981. Growth, age and size at maturity of Tanner crab, *Chionoecetes bairdi* M. J. Rathbun, in the northern gulf of Alaska (Decapoda, Brachyura). *Crustaceana* **40**(3): 286–301.
- Donaldson, W.E., and Hicks, D.M. 1977. Technical report to industry on the Kodiak crab population surveys. Results, life history, information, and history of the fishery for Tanner crab. Alaska Department of Fish and Game, Kodiak, AK.
- Fournier, D.A., Skaug, H.J., Ancheta, J., Ianelli, J., Magnusson, A., Maunder, M.N., Nielsen, A., and Sibert, J. 2016. AD model builder: Using automatic differentiation for statistical inference of highly parameterized complex nonlinear models. *Optim. Methods Softw.* **27**(1).
- Haynes, E., Karinen, J.F., Watson, J., and Hopson, D.J. 1976. Relation of number of eggs and egg length to carapace width in the brachyuran crabs *Chionoecetes bairdi* and *C. opilio* from the southeastern Bering Sea and *C. opilio* from the Gulf of St. Lawrence. *Journal of the Fisheries Research Board of Canada* **33**(11): 2592–2595.
- Heller-Shipley, M.A., Stockhausen, W.T., Daly, B.J., Punt, A.E., and Goodman, S.E. 2021. Should harvest control rules for male-only fisheries include reproductive buffers? A Bering Sea Tanner crab (*Chionoecetes bairdi*) case study. *Fisheries Research* **243**: 106049. doi:<https://doi.org/10.1016/j.fishres.2021.106049>.
- Hennessey, S., and Garber-Yonts, B. 2025. Appendix D. Ecosystem and Socioeconomic Profile of the Tanner crab stock in the Eastern Bering Sea. In: Stockhausen, W.T. 2025. Stock Assessment and Fishery Evaluation Report for the Tanner Crab Fisheries of the Bering Sea and Aleutian Islands Regions. North Pacific Fishery Management Council, Anchorage, AK. Available from <https://meetings.npfmc.org/Meeting/Details/3097>.
- Hilsinger, J.R. 1976. Aspects of the reproductive biology of female snow crabs, *Chionoecetes bairdi*, from Prince William Sound and the adjacent Gulf of Alaska. *Mar. Sci. Commun.* **2**(3-4): 201–225.
- Hoenig, J. 1983. Empirical use of longevity data to estimate mortality rates. *Fishery Bulletin* **82**: 898–903.
- Hosie, M.J., and Gaumer, T.F. 1974. Southern range extension of the baird crab (*Chionoecetes bairdi* Rathbun). *California Fish and Game* **60**(1): 44–47.
- Johnson, G.M. 2019. Population genetics of Tanner crab (*Chionoecetes bairdi*) in Alaskan waters. Master's thesis, University of Alaska Fairbanks, Fairbanks, AK.
- Karinen, J.F., and Hoopes, D.T. 1971. Occurrence of Tanner crabs (*Chionoecetes* sp.) in the

- eastern Bering Sea with characteristics intermediate between *c. Bairdi* and *C. opilio*. *Proc. Natl. Shellfish Assoc* **61**: 8–9.
- Kon, T. 1996. Overview of Tanner crab fisheries around the Japanese Archipelago. *In* High latitude crabs: Biology, management, and economics. University of Alaska Sea Grant, PO Box 755040 203 O'Neill Bldg. Fairbanks AK 99775-5040 USA. pp. 13–24.
- McAllister, M. K., and Ianelli, J.N. 1997. Bayesian stock assessment using catch-age data and the sampling-importance resampling algorithm. *Can. J. Fish. Aquat. Sci.* **54**(2): 284–300. doi:[doi:10.1139/cjfas-54-2-284](https://doi.org/10.1139/cjfas-54-2-284).
- McLaughlin, P.A., and Co-authors, 39. 2005. Common and scientific names of aquatic invertebrates from the United States and Canada: crustaceans. American Fisheries Society.
- Mohn, R. 1999. The retrospective problem in sequential population analysis: An investigation using cod fishery and simulated data. *ICES Journal of Marine Science* **56**(4): 473–488. doi:[10.1006/jmsc.1999.0481](https://doi.org/10.1006/jmsc.1999.0481).
- Munk, J.E., Payne, S.A., and Stevens, B.G. 1996. Timing and duration of the mating and molting season for shallow water Tanner crab (*Chionoecetes bairdi*). *In* High latitude crabs: Biology, management, and economics. University of Alaska Sea Grant, PO Box 755040 203 O'Neill Bldg. Fairbanks AK 99775-5040 USA. p. 341.
- Murphy, J.T. 2020. Climate change, interspecific competition, and poleward vs. Depth distribution shifts: Spatial analyses of the eastern Bering Sea snow and Tanner crab (*Chionoecetes opilio* and *C. bairdi*). *Fisheries Research* **223**: 105417. doi:<https://doi.org/10.1016/j.fishres.2019.105417>.
- Nevisi, A., Orensanz, J.M., Paul, A.J., and Armstrong, D.A. 1996. Radiometric estimation of shell age in *Chionoecetes* spp. From the eastern Bering Sea, and its use to interpret shell condition indices: Preliminary results. *In* High latitude crabs: Biology, management, and economics. University of Alaska Sea Grant, PO Box 755040 203 O'Neill Bldg. Fairbanks AK 99775-5040 USA. pp. 389–396.
- NMFS. 2004. Final Environmental Impact Statement for Bering Sea and Aleutian Islands Crab Fisheries. National Marine Fisheries Service, P.O. Box 21668, Juneau, AK 99802-1668.
- NMFS. 2008. Final Environmental Assessment for Amendment 24 to the Fishery Management Plan for Bering Sea/Aleutian Islands King and Tanner Crabs to Revise Overfishing Definitions. National Marine Fisheries Service. Available from https://repository.library.noaa.gov/view/noaa/18139/noaa_18139_DS1.pdf.
- NPFMC. 1998. Fishery Management Plan for Bering Sea/Aleutian Islands King and Tanner Crabs. North Pacific Fishery Management Council, 605 W. 4th Avenue, Suite, 306, Anchorage, AK 99501.
- NPFMC. 2011. Amendment 38 and 39 To the Fishery Management Plan for Bering Sea/Aleutian Islands King and Tanner Crabs. North Pacific Fishery Management Council. Available from <https://www.regulations.gov/document/NOAA-NMFS-2011-0033-0007>.
- NPFMC. 2021b. Fishery Management Plan for Bering Sea/Aleutian Islands King and Tanner Crabs. North Pacific Fishery Management Council, 1007 West Third, Suite 400, Anchorage, AK. Available from <https://www.npfmc.org/wp-content/PDFdocuments/fmp/Crab/CrabFMP.pdf>.
- NPFMC. 2021a. BSAI Crab Fishery Management Plan Amendment Summaries. North Pacific Fishery Management Council, 1007 West Third, Suite 400, Anchorage, AK. Available from https://www.npfmc.org/wp-content/PDFdocuments/Publications/Crab_Amendment_Summaries.pdf.
- NPFMC. 2024. Fishery Management Plan for Bering Sea/Aleutian Islands King and Tanner Crabs. North Pacific Fishery Management Council, 1007 West Third, Suite 400, Anchorage, AK. Available from <https://www.npfmc.org/wp-content/PDFdocuments/fmp/Crab/CrabFMP.pdf>.
- Otto, R.S. 1998. Assessment of the eastern Bering Sea snow crab, *Chionoecetes opilio*, stock

- under the terminal molting hypothesis. *In* Proceedings of the north pacific symposium on invertebrate stock assessment and management. *Edited by* G.S. Jamieson and A.C. (eds). pp. 109–124. Available from https://publications.gc.ca/collections/collection_2016/mpo-dfo/Fs41-31-125-eng.pdf.
- Paul, A.J. 1984. Mating frequency and viability of stored sperm in the Tanner crab *Chionoecetes bairdi* (Decapoda, Majidae). *Journal of crustacean biology*. Washington DC **4**(3): 375–381.
- Paul, A.J. 1992. A review of size at maturity in male Tanner (*Chionoecetes bairdi*) and king (*Paralithodes camtschaticus*) crabs and the methods used to determine maturity. *American Zoologist* **32**(3): 534–540.
- Paul, A.J., and Paul, J.M. 1992. Second clutch viability of *Chionoecetes bairdi* Rathbun (Decapoda: Majidae) inseminated only at the maturity molt. *Journal of crustacean biology*. Washington DC **12**(3): 438–441.
- Rathbun, M.J. 1924. New species and subspecies of spider crabs. *Proceedings of U.S. Nat. Museum* **64**: 1–5. doi:<https://doi.org/10.5479/si.00963801.2504>.
- Richar, J.I., and Foy, R.J. 2022. A novel morphometry-based method for assessing maturity in male Tanner crab, *Chionoecetes bairdi*. *FACETS* **7**: 1598–1616. doi:<https://doi.org/10.1139/facets-2021-0061>.
- Richar, J.I., Kruse, G.H., Curchitser, E., and Hermann, A.J. 2015. Patterns in connectivity and retention of simulated Tanner crab (*Chionoecetes bairdi*) larvae in the eastern Bering Sea. *Progress in Oceanography* **138**: 475–485. doi:<https://doi.org/10.1016/j.pocean.2014.08.001>.
- Rodionov, S., and Overland, J.E. 2005. Application of a sequential regime shift detection method to the Bering Sea ecosystem. *ICES Journal of Marine Science* **62**(3): 328–332. doi:[10.1016/j.icesjms.2005.01.013](https://doi.org/10.1016/j.icesjms.2005.01.013).
- Rugolo, L.J., and Turnock, B.J. 2008. 2008 Stock Assessment and Fishery Evaluation Report for the Tanner crab fisheries of the Bering Sea and Aleutian Islands regions. *In* Stock Assessment and Fishery Evaluation Report for the KING AND TANNER CRAB FISHERIES of the Bering Sea and Aleutian Islands regions 2008 BSAI Crab SAFE. North Pacific Fishery Management Council, Anchorage, AK. pp. 195–250. Available from <https://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/CRABSAFE2010.pdf>.
- Rugolo, L.J., and Turnock, B.J. 2010. 2010 Stock Assessment and Fishery Evaluation Report for the Tanner crab fisheries of the Bering Sea and Aleutian Islands regions. *In* Stock Assessment and Fishery Evaluation Report for the KING AND TANNER CRAB FISHERIES of the Bering Sea and Aleutian Islands regions 2010 Draft Crab SAFE. North Pacific Fishery Management Council, Anchorage, AK. pp. 247–308. Available from <https://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/CRABSAFE2010.pdf>.
- Rugolo, L.J., and Turnock, B.J. 2011a. Length-based stock assessment model of eastern Bering Sea Tanner crab: Report to subgroup of NPFMC Crab Plan Team. North Pacific Fishery Management Council, Anchorage, AK.
- Rugolo, L.J., and Turnock, B.J. 2011b. 2011 Stock Assessment and Fishery Evaluation Report for the Tanner crab fisheries of the Bering Sea and Aleutian Islands regions. *In* Stock Assessment and Fishery Evaluation Report for the KING AND TANNER CRAB FISHERIES of the Bering Sea and Aleutian Islands regions 2011 draft crab SAFE. North Pacific Fishery Management Council, Anchorage, AK. pp. 285–354. Available from <https://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/CrabSAFE2011.pdf>.
- Rugolo, L.J., and Turnock, B.J. 2012b. Length-based stock assessment model of eastern Bering Sea Tanner crab: Report to subgroup of NPFMC Crab Plan Team. North Pacific Fishery Management Council, Anchorage, AK.
- Rugolo, L.J., and Turnock, B.J. 2012a. 2012 Stock Assessment and Fishery Evaluation Report for

- the Tanner crab fisheries of the Bering Sea and Aleutian Islands regions. *In* Stock Assessment and Fishery Evaluation Report for the KING AND TANNER CRAB FISHERIES of the Bering Sea and Aleutian Islands regions 2012 draft crab SAFE. North Pacific Fishery Management Council, Anchorage, AK. pp. 269–425. Available from <https://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/CrabSAFE2012.pdf>.
- Ryznar, E. 2026. Updated workflow for processing morphometric maturity data for Bering Sea Chionoecetes crab stocks. Report to May 2026 Crab Plan Team meeting. U.S. National Oceanic; Atmospheric Administration (NOAA). Available from https://meetings.npfmc.org/CommentReview/DownloadFile?p=74a8dab6-e88b-438b-b340-fc383ee37914.pdf&fileName=chionoecetes_maturity_CPTMay26.pdf.
- Slater, L.M., Gaeuman, W., Cheng, W., Kruse, G.H., Habicht, C., and Pengilly, D. 2024. Molecular evaluation of the mating dynamics of snow crab (*Chionoecetes opilio*) in the Eastern Bering Sea. *Ecology and Evolution* **14**(10): e70416. doi:<https://doi.org/10.1002/ece3.70416>.
- Slizkin, A.G. 1990. Tanner crabs (*Chionoecetes opilio*, *C. bairdi*) of the northwest Pacific: Distribution, biological peculiarities, and population structure. *In* Proceedings of the international symposium on king and Tanner crabs. University of Alaska Sea Grant, PO Box 755040 203 O'Neill Bldg. Fairbanks AK 99775-5040 USA. pp. 27–33.
- Somerton, D.A. 1981a. Life history and population dynamics of two species of Tanner crab, *Chionoecetes bairdi* and *C. opilio*, in the eastern Bering Sea with implications for the management of the commercial harvest. PhD thesis, University of Washington, Seattle, WA.
- Somerton, D.A. 1981b. Regional variation in the size of maturity of two species of Tanner crab (*Chionoecetes bairdi* and *C. opilio*) in the eastern Bering Sea, and its use in defining management subareas. *Canadian Journal of Fisheries and Aquatic Sciences* **38**(2): 163–174.
- Somerton, D.A., and Meyers, W.S. 1983. Fecundity differences between primiparous and multiparous female Alaskan Tanner crab (*Chionoecetes bairdi*). *Journal of crustacean biology*. Washington DC **3**(2): 183–186.
- SSC. 2008. Scientific and Statistical Committee Final Report to the North Pacific Fishery Management Council. North Pacific Fishery Management Council, Anchorage, AK. Available from https://meetings.npfmc.org/CommentReview/DownloadFile?p=d95d28fe-3540-4e74-baa3-f029ce6a3a7d.pdf&fileName=SSC%20Report%20June%202008_Final.pdf.
- SSC. 2012. Final Report of the Scientific and Statistical Committee Final Report to the North Pacific Fishery Management Council. North Pacific Fishery Management Council, Anchorage, AK. Available from https://meetings.npfmc.org/CommentReview/DownloadFile?p=d95d28fe-3540-4e74-baa3-f029ce6a3a7d.pdf&fileName=SSC%20Report%20Oct%202012_Final.pdf.
- SSC. 2014. Report of the Scientific And Statistical Committee to the North Pacific Fishery Management Council. North Pacific Fishery Management Council, Anchorage, AK. Available from <https://meetings.npfmc.org/CommentReview/DownloadFile?p=c2b9efdb-a35d-4182-9055-1b9c9f22f97a.pdf&fileName=SSC%20Report%20Final%201014.pdf>.
- SSC. 2017. Scientific and Statistical Committee Final Report to the North Pacific Fishery Management Council. North Pacific Fishery Management Council, Anchorage, AK. Available from https://meetings.npfmc.org/CommentReview/DownloadFile?p=9cec6021-c359-4383-a841-68cf7603fbd2.pdf&fileName=SSC%20Report%20June%202017_FINAL.pdf.
- SSC. 2022. Scientific and Statistical Committee Final Report to the North Pacific Fishery Management Council. North Pacific Fishery Management Council, Anchorage, AK. Available from https://meetings.npfmc.org/CommentReview/DownloadFile?p=d95d28fe-3540-4e74-baa3-f029ce6a3a7d.pdf&fileName=SSC%20Report%20Oct%202022_Final.pdf.
- SSC. 2023. Scientific and Statistical Committee Final Report to the North Pacific Fishery Management Council. North Pacific Fishery Management Council, Anchorage, AK. Available

- from https://meetings.npfmc.org/CommentReview/DownloadFile?p=6e92b161-ea7f-4a57-97fd-45b3ff4aaff0.pdf&fileName=SSC%20Report%20June%202023_FINAL.pdf.
- Stevens, B.G. 2000. Moonlight madness and larval launch pads: Tidal synchronization of mound formation and hatching by Tanner crabs, *Chionoecetes bairdi*. *Journal of Shellfish Research* **19**(1): 640–641.
- Stockhausen, W.T. 2013. 2013 Stock Assessment and Fishery Evaluation Report for the Tanner crab fisheries of the Bering Sea and Aleutian Islands regions. *In* Stock Assessment and Fishery Evaluation Report for the KING AND TANNER CRAB FISHERIES of the Bering Sea and Aleutian Islands regions 2013 final crab SAFE. North Pacific Fishery Management Council, Anchorage, AK. Available from <https://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/CrabSAFE2013.pdf>.
- Stockhausen, W.T. 2014. 2014 Stock Assessment and Fishery Evaluation Report for the Tanner crab fisheries of the Bering Sea and Aleutian Islands regions. *In* Stock Assessment and Fishery Evaluation Report for the KING AND TANNER CRAB FISHERIES of the Bering Sea and Aleutian Islands regions 2014 final crab SAFE. North Pacific Fishery Management Council, Anchorage, AK. Available from https://meetings.npfmc.org/CommentReview/DownloadFile?p=84a80bf9-a465-4e91-8da7-b84e414c0e3e.pdf&fileName=C3%20CRAB%20SAFE%202014_reduced.pdf.
- Stockhausen, W.T. 2015. 2015 Stock Assessment and Fishery Evaluation Report for the Tanner crab fisheries of the Bering Sea and Aleutian Islands regions. *In* Stock Assessment and Fishery Evaluation Report for the KING AND TANNER CRAB FISHERIES of the Bering Sea and Aleutian Islands regions 2015 final crab SAFE. North Pacific Fishery Management Council, Anchorage, AK. Available from <https://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/CrabSAFE2015.pdf>.
- Stockhausen, W.T. 2016. 2016 Stock Assessment and Fishery Evaluation Report for the Tanner crab fisheries of the Bering Sea and Aleutian Islands regions. *In* Stock Assessment and Fishery Evaluation Report for the KING AND TANNER CRAB FISHERIES of the Bering Sea and Aleutian Islands regions 2016 final crab SAFE. North Pacific Fishery Management Council, Anchorage, AK. Available from https://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/2016CrabSAFE_final.pdf.
- Stockhausen, W.T. 2017a. 2017 Stock Assessment and Fishery Evaluation Report for the Tanner crab fisheries of the Bering Sea and Aleutian Islands regions. *In* Stock Assessment and Fishery Evaluation Report for the KING AND TANNER CRAB FISHERIES of the Bering Sea and Aleutian Islands regions 2017 final crab SAFE. North Pacific Fishery Management Council, Anchorage, AK. Available from <https://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/CrabSAFE2017.pdf>.
- Stockhausen, W.T. 2017b. Tanner crab assessment report for the may 2017 CPT meeting. North Pacific Fishery Management Council, Anchorage, AK. Available from https://meetings.npfmc.org/CommentReview/DownloadFile?p=be0e37c1-97da-4def-a7cd-0d3e79c93106.pdf&fileName=TannerCrab201705_CPTMeeting.pdf.
- Stockhausen, W.T. 2022. 2022 Stock Assessment and Fishery Evaluation Report for the Tanner crab fisheries of the Bering Sea and Aleutian Islands regions. *In* Stock Assessment and Fishery Evaluation Report for the KING AND TANNER CRAB FISHERIES of the Bering Sea and Aleutian Islands regions 2022 final crab SAFE. North Pacific Fishery Management Council, Anchorage, AK. p. 597. Available from <https://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/2022/TannerCrabSAFE2022.pdf>.
- Stockhausen, W.T. 2023b. Example tier 4 status determination for the Tanner crab stock. North Pacific Fishery Management Council, Anchorage, AK. Available from

- https://meetings.npfmc.org/CommentReview/DownloadFile?p=9a2353b6-6bc1-465f-9d44-b295136b3391.pdf&fileName=Tanner%20Crab_Appendix%20D_Tier4Model.pdf.
- Stockhausen, W.T. 2023a. Appendix c: Description of the Tanner crab stock assessment model, version 2. North Pacific Fishery Management Council, Anchorage, AK. Available from https://meetings.npfmc.org/CommentReview/DownloadFile?p=e5c38588-2e56-421d-bc34-d476d589feac.pdf&fileName=Tanner%20Crab_Appendix%20C_TCSAM02Description.pdf.
- Stockhausen, W.T. 2024a. 2024 Stock Assessment and Fishery Evaluation Report for the Tanner crab fisheries of the Bering Sea and Aleutian Islands regions. *In* Stock Assessment and Fishery Evaluation Report for the KING AND TANNER CRAB FISHERIES of the Bering Sea and Aleutian Islands regions 2024 final crab SAFE. North Pacific Fishery Management Council, Anchorage, AK. Available from <https://app.box.com/s/keq7xq8docu4ixqzw7zqgovsv48s0fsd>.
- Stockhausen, W.T. 2024b. Tanner Crab Proposed Models. North Pacific Fishery Management Council, Anchorage, AK. Available from https://meetings.npfmc.org/CommentReview/DownloadFile?p=357c9428-80f9-488e-917e-d9c805947897.pdf&fileName=Tanner%20Crab%20proposed%20models_updated%20model%20numbering.pdf.
- Stockhausen, W.T. 2025a. 2025 Stock Assessment and Fishery Evaluation Report for the Tanner Crab Fisheries of the Bering Sea and Aleutian Islands Regions. *In* Stock Assessment and Fishery Evaluation Report for the KING AND TANNER CRAB FISHERIES of the Bering Sea and Aleutian Islands Regions 2025 Final Crab SAFE. North Pacific Fishery Management Council, Anchorage, AK. Available from <https://meetings.npfmc.org/Meeting/Details/3097>.
- Stockhausen, W.T. 2025b. Appendix B: Risk Table for the 2025 Stock Assessment and Fishery Evaluation Report for the Tanner Crab Fisheries of the Bering Sea and Aleutian Islands Regions. *In* Stock Assessment and Fishery Evaluation Report for the KING AND TANNER CRAB FISHERIES of the Bering Sea and Aleutian Islands Regions 2025 Final Crab SAFE. North Pacific Fishery Management Council, Anchorage, AK. Available from <https://meetings.npfmc.org/Meeting/Details/3097>.
- Stockhausen, W.T. 2025c. Appendix A: Selected Likelihood Profiles for the 2025 Stock Assessment and Fishery Evaluation Report for the Tanner Crab Fisheries of the Bering Sea and Aleutian Islands Regions. *In* Stock Assessment and Fishery Evaluation Report for the KING AND TANNER CRAB FISHERIES of the Bering Sea and Aleutian Islands Regions 2025 Final Crab SAFE. North Pacific Fishery Management Council, Anchorage, AK. Available from <https://meetings.npfmc.org/Meeting/Details/3097>.
- Stockhausen, W.T. 2025d. Tanner Crab Proposed Models. North Pacific Fishery Management Council, Anchorage, AK. Available from <https://meetings.npfmc.org/CommentReview/DownloadFile?p=9fed548e-dfe8-490c-8108-c989f3b0219a.pdf&fileName=TannerCrab2025-05.ToCPT.pdf>.
- Stockhausen, W.T. 2026a. Transition from TCSAM02 to GMACS: 1 function call. *In* 2026 Stock Assessment and Fishery Evaluation Report for the Tanner Crab Fisheries of the Bering Sea and Aleutian Islands Regions. North Pacific Fishery Management Council, Anchorage, AK. p. 134. Available from <https://meetings.npfmc.org/Meeting/Details/6146>.
- Stockhausen, W.T. 2026b. Transition from TCSAM02 to GMACS: Results with Parameter Estimation. *In* 2026 Stock Assessment and Fishery Evaluation Report for the Tanner Crab Fisheries of the Bering Sea and Aleutian Islands Regions. North Pacific Fishery Management Council, Anchorage, AK. p. 136. Available from <https://meetings.npfmc.org/Meeting/Details/6146>.
- Stockhausen, W.T. 2026c. 2026 Stock Assessment and Fishery Evaluation Report for the Tanner Crab Fisheries of the Bering Sea and Aleutian Islands Regions. *In* Stock Assessment and Fishery Evaluation Report for the KING AND TANNER CRAB FISHERIES of the Bering Sea and Aleutian Islands Regions 2026 Final Crab SAFE. North Pacific Fishery Management Council,

- Anchorage, AK. p. 447.
- Stockhausen, W.T. 2026d. Tanner Crab Proposed Models. North Pacific Fishery Management Council, Anchorage, AK. Available from https://meetings.npfmc.org/CommentReview/DownloadFile?p=b0aa170e-f3f0-4a1e-accf-9491174c46ed.pdf&fileName=TannerCrab_2026-05.pdf.
- Stone, R.P., Masuda, M.M., and Clark, J.E. 2003. Growth of male Tanner crabs *Chionoecetes bairdi* in a Southeast Alaska estuary. Alaska Fishery Research Bulletin **10**(2): 137–148.
- Sullivan, J. 2022. rema: A generalized framework to fit the random effects (RE) model, a state-space random walk model developed at the Alaska Fisheries Science Center (AFSC) for apportionment and biomass estimation of groundfish and crab stocks. Available from <https://github.com/JaneSullivan-NOAA/rema>, <https://afsc-assessments.github.io/rema/>.
- Tamone, S.L., Taggart, S.J., Andrews, A.G., Mondragon, J., and Nielsen, J.K. 2007. The relationship between circulating ecdysteroids and chela allometry in male Tanner crabs: Evidence for a terminal molt in the genus *Chionoecetes*. Journal of Crustacean Biology **27**(4): 635–642. doi:<http://dx.doi.org/10.1651/S-2802.1>.
- Turnock, B.J., and Rugolo, L.J. 2011. Stock Assessment of eastern Bering Sea snow crab. In Stock Assessment and Fishery Evaluation Report for the KING AND TANNER CRAB FISHERIES of the Bering Sea and Aleutian Islands regions 2011 Draft Crab SAFE. North Pacific Fishery Management Council, Anchorage, AK. pp. 37–168. Available from <https://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/CrabSAFE/CrabSAFE2011.pdf>.
- Wakabayashi, K., Bakkala, R.G., and Alton, M.S. 1985. Methods of the U.S.-Japan demersal trawl surveys. In Results of cooperative U.S.-Japan groundfish investigations in the Bering Sea during May-August 1979. Edited by K. Wakabayashi. Int. North Pac. Fish. Comm. Bull. pp. 7–29.
- Williams, A.B., B., A., Abele, L.G., Felder, D.L., H. H. Hobbs, Jr., Manning, R.B., McLaughlin, P.A., and Farfante, I.P. 1989. Common and scientific names of aquatic invertebrates from the United States and Canada: Decapod crustaceans. American Fisheries Society.
- Zheng, J. 2008. Temporal changes in size at maturity and their implications for fisheries management for eastern Bering Sea Tanner crab. Journal of Northwest Atlantic Fishery Science **41**: 137–149. doi:<http://dx.doi.org/10.2960/J.v41.m623>.
- Zheng, J., and Kruse, G.H. 1999. Evaluation of harvest strategies for Tanner crab stocks that exhibit periodic recruitment. Journal of Shellfish Research **18**(2): 667–679.
- Zheng, J., and Pengilly, D. 2011. Overview of proposed harvest strategy and minimum size limits for Bering Sea district Tanner crab. Alaska Department of Fish; Game, Anchorage, AK.

Tables

List of Tables

2	Federal management quantities (OFL, ABC), State of Alaska TACs, and harvest (retained catch biomass) in the Tanner crab fisheries following rationalization in 2005. OFL and ABC values apply to the entire EBS Tanner crab stock area, TAC values apply to individual ADF&G management areas. Harvest is retained catch in the directed fisheries. Fishery closures are indicated by “—”. All quantities are in metric tons.	84
3	Estimates of B_{MSY} from recent stock assessments.	85
4	Retained catch (metric tons) during the period when fishing by foreign fleets was allowed (1965-1979; historical data).	86
5	Retained catch in the directed Tanner crab fishery during the period 1980-1996. The directed fishery was closed in 1985/86 and 1986/87 and from 1997/98-2004/05. Abundance units: number of individuals; biomass units: metric tons.	87
6	Retained catch biomass (metric tons) following rationalization of the crab fisheries in 2005, by ADF&G management area and fishery. Annual totals are also given. TCF: directed Tanner crab fishery; SCF: snow crab fishery; RKF: Bristol Bay red king crab fishery. Incidental catch of Tanner crab, up to a fraction of the retained target by trip, is allowed to be retained in the snow crab and red king crab fisheries.	88
7	Retained catch abundance (number of crab) following rationalization of the crab fisheries in 2005, by ADF&G management area and fishery. Annual totals are also given. TCF: directed Tanner crab fishery; SCF: snow crab fishery; RKF: Bristol Bay red king crab fishery. Incidental catch of Tanner crab, up to a fraction of the retained target by trip, is allowed to be retained in the snow crab and red king crab fisheries.	89
8	Original and scaled (input) sample sizes for retained catch size compositions. Only information aggregated to the EBS is available prior to 1990. ‘-’: no data due to prior aggregation or lack of sampling (e.g. the fishery was closed. In addition to the closures noted here, the directed fishery was closed from 1997/98 to 2004/05.	90
9	Annual total catch biomass estimates of Tanner crab, expanded from at-sea fishery observer data, in the groundfish fisheries (GF) prior to 1990. Units are metric tons. Groundfish bycatch data is from historical sources.	91
10	Annual total catch biomass (retained + discarded) estimates of Tanner crab, expanded from at-sea fishery observer data in all fleets after 1989. Units are metric tons. “TCF”: Tanner crab fishery; “SCF”: snow crab fishery; “RKF”: BBRKC fishery; “GF”: groundfish fisheries. Crab fishery values based on data provided by ADF&G. Groundfish bycatch estimates based on data provided by AKFIN and the AKRO.	92
11	Annual total catch abundance (retained + discarded) estimates of Tanner crab, expanded from at-sea fishery observer data, in all fleets after 1989. Units are 1,000s of crab. “TCF”: Tanner crab fishery; “SCF”: snow crab fishery; “RKF”: BBRKC fishery; “GF”: groundfish fisheries. Crab fishery values based on data provided by ADF&G. Groundfish bycatch estimates based on data provided by AKFIN and the AKRO.	94

12	Annual discard mortality (biomass) estimates of Tanner crab in the groundfish fisheries (“GF”) prior to 1990. Handling mortality rates for trawl gear have been applied. Units are metric tons.	96
13	Annual discard mortality (biomass) estimates of Tanner crab, expanded from at-sea fishery observer data in all fleets after 1989. Assumed gear-specific handling mortality rates have been applied after (where appropriate) subtracting retained catch biomass from total catch biomass. “TCF”: Tanner crab fishery; “SCF”: snow crab fishery; “RKF”: BBRKC fishery; “GF”: groundfish fisheries. Units are metric tons.	97
14	Original and scaled (input) sample sizes for Tanner crab total catch size compositions in the directed fishery. Observer information starts in 1990/91. ‘-’: no data due to prior aggregation or lack of sampling (e.g. the fishery was closed.)	99
15	Original and scaled (input) sample sizes for Tanner crab total catch size compositions in the snow crab ('SCF') and BBRKC ('RKF') fisheries. Observer information starts in 1990/91 in the snow crab and BBRKC fisheries. ‘-’: no data due to prior aggregation or lack of sampling (e.g. the fishery was closed).	100
16	Original and scaled (input) sample sizes for Tanner crab total catch size compositions in the groundfish fisheries. Observer information starts in 1973/74 in the groundfish fisheries, but is unclassified by gear type until 1991/92. ‘-’: no data for respective gear type.	101
17	Annual effort (potlifts) in the crab fisheries. “TCF”: Tanner crab fishery; “SCF”: snow crab fishery; “RKF”: BBRKC fishery.	103
18	Design-based survey biomass trends (estimates and cv's) from the NMFS EBS shelf bottom trawl survey, by sex, maturity state, and management area. Biomass units are metric tons. The survey was not conducted in 2020.	105
19	Design-based survey abundance trends (estimates and cv's) from the NMFS EBS shelf bottom trawl survey, by sex, maturity state, and management area. Abundance units are millions of crab. The survey was not conducted in 2020.	107
20	Design-based survey biomass trends (estimates and cv's) from the NMFS EBS shelf bottom trawl survey for industry-preferred males by management area. Biomass units are metric tons. The survey was not conducted in 2020.	109
21	Design-based survey abundance trends (estimates and cv's) from the NMFS EBS shelf bottom trawl survey for industry-preferred males by management area. Abundance units are millions of crab. The survey was not conducted in 2020.	111
22	Design-based survey biomass estimates (and cv's) from the SBS studies, by sex, maturity state, and fleet. Biomass units are metric tons. Tanner crab SBS studies were conducted annually during 2013-2018. Different areas were included in the studies each year.	113
23	Design-based survey abundance estimates (and cv's) from the SBS studies, by sex, maturity state, and fleet. Abundance units are millions of crab. Tanner crab SBS studies were conducted annually during 2013-2018. Different areas were included in the studies each year.	114
24	Original and scaled (input) sample sizes for Tanner crab size compositions in the NMFS EBS shelf bottom trawl survey. Scaled sample sizes are only shown for size compositions aggregated across ADF&G management areas (i.e., 'all EBS'). ‘-’: no survey conducted.	115
25	Original and scaled (input) sample sizes for Tanner crab size compositions in the SBS selectivity studies. ‘-’: no survey conducted.	117

26	Weight-at-size parameters ($w = a \cdot z^b$) for Tanner crab weight in grams.	118
27	Input sample sizes for fishery size composition data, by catch type, fleet, and sex. . .	118
28	Input sample sizes for survey size composition data, by fleet, sex, and maturity state.	120
29	Input sample sizes for male maturity ogive data.	122
30	Diagnostic results from 400 runs for each model, where the initial values for estimated parameters were randomly selected from a range of potential values. The number of converged runs represents the number of model runs that resulted in objective function values within 0.01 likelihood units of the minimum objective function; the 'out of'nuber of runs listed represents the number of runs that converged to any objective function value (i.e., local minima). The remaining runs (out of 400) failed to converge before being terminated.	123
31	No parameters were at a bound in the TCSAM02 models 22.03d5 (2025), 22.03d5 (2026).	123
32	TCSAM02 models final values for non-vector parameters related to recruitment, initial abundance, natural mortality, and growth. Parameters with values whose standard error is NA are fixed, not estimated.	124
33	TCSAM02 models final values for annual recruitment “devs” in the “historical” period up to 1975. Index begins in 1948.	125
34	TCSAM02 models final values for annual recruitment “devs” in the “current” period from 1975. The index begins in 1975.	126
35	TCSAM02 models final values for parameters related to the probability of terminal molt. Index corresponds to 5-mm size bin starting at 50 mm CW for females and 60 mm CW for males.	127
36	TCSAM02 models final values for non-vector parameters related to fisheries, surveys, and the Dirichlet-Multinomial likelihood. Parameters with values whose standard error is NA are fixed, not estimated.	128
37	TCSAM02 models final values for fishing mortality “devs” for the directed fishery. The index starts in 1965 and does not include years when the fishery was completely closed.	129
38	TCSAM02 models final values for fishing mortality “devs” for the snow crab fishery. The indices start in 1990.	130
39	TCSAM02 models final values for fishing mortality “devs” for the BBRKC fishery. The indices start in 1990.	131
40	TCSAM02 models final values for fishing mortality “devs” vectors for the groundfish fisheries. Indices start in 1973.	132
41	TCSAM02 models final values for the “pS1” parameters related to selectivity functions. Parameters with values whose standard error is NA are fixed, not estimated. .	133
42	TCSAM02 models final values for the “pS2” parameters related to selectivity functions. Parameters with values whose standard error is NA are fixed, not estimated. .	134
43	TCSAM02 models final values for the “pS3” and “pS4” parameters related to selectivity functions. Parameters with values whose standard error is NA are fixed, not estimated.	135
44	TCSAM02 models final values for the devs parameters related to selectivity in the directed fishery. Parameters with values whose standard error is NA are fixed, not estimated.	136

45	Objective function data component values for TCSAM02 models 22.03d5 (2025), 22.03d5 (2026). Table 1 of 3. Abbreviations: n.at.z: size composition data; M: males only; F: females only; NMFS: NMFS EBS shelf survey; SBS BSFRF: BSFRF side-by-side catchability study survey; TCF: directed Tanner crab fishery; SCF: snow crab fishery; RKF: BBRKC fishery; GF All: combined groundfish fisheries. Components not included in the objective function are indicated by “–”.	137
46	Objective function data component values for TCSAM02 models 22.03d5 (2025), 22.03d5 (2026). Table 2 of 3. Abbreviations: n.at.z: size composition data; M: males only; F: females only; NMFS: NMFS EBS shelf survey; SBS BSFRF: BSFRF side-by-side catchability study survey; TCF: directed Tanner crab fishery; SCF: snow crab fishery; RKF: BBRKC fishery; GF All: combined groundfish fisheries. Components not included in the objective function are indicated by “–”.	138
47	Objective function data component values for TCSAM02 models 22.03d5 (2025), 22.03d5 (2026). Table 3 of 3. Abbreviations: n.at.z: size composition data; M: males only; F: females only; NMFS: NMFS EBS shelf survey; SBS BSFRF: BSFRF side-by-side catchability study survey; TCF: directed Tanner crab fishery; SCF: snow crab fishery; RKF: BBRKC fishery; GF All: combined groundfish fisheries. Components not included in the objective function are indicated by “–”.	139
48	Objective function non-data component values for TCSAM02 models 22.03d5 (2025), 22.03d5 (2026). Table 1 of 1. Abbreviations: devsSumSq: sum of squared annual deviations (“devs”); pDevsLnC: fishery capture probability devs; pDevsLnR: recruitment devs; pDevsM: natural mortality devs; pDevsS1: selectivity deviations; pDM1: natural mortality multiplier; pQ: survey catchability. Components not included in the objective function are indicated by “–”.	140
49	Differences between objective function data component values for 22.03d5 (2026) relative to 22.03d5 (2025). Negative values indicate better fits. Table 1 of 3. Abbreviations: n.at.z: size composition data; M: males only; F: females only; NMFS: NMFS EBS shelf survey; SBS BSFRF: BSFRF side-by-side catchability study survey; TCF: directed Tanner crab fishery; SCF: snow crab fishery; RKF: BBRKC fishery; GF All: combined groundfish fisheries.	141
50	Differences between objective function data component values for 22.03d5 (2026) relative to 22.03d5 (2025). Negative values indicate better fits. Table 2 of 3. Abbreviations: n.at.z: size composition data; M: males only; F: females only; NMFS: NMFS EBS shelf survey; SBS BSFRF: BSFRF side-by-side catchability study survey; TCF: directed Tanner crab fishery; SCF: snow crab fishery; RKF: BBRKC fishery; GF All: combined groundfish fisheries.	142
51	Differences between objective function data component values for 22.03d5 (2026) relative to 22.03d5 (2025). Negative values indicate better fits. Table 3 of 3. Abbreviations: n.at.z: size composition data; M: males only; F: females only; NMFS: NMFS EBS shelf survey; SBS BSFRF: BSFRF side-by-side catchability study survey; TCF: directed Tanner crab fishery; SCF: snow crab fishery; RKF: BBRKC fishery; GF All: combined groundfish fisheries.	143
52	Differences between objective function non-data component values for 22.03d5 (2026) relative to 22.03d5 (2025). Negative values indicate better fits. Table 1 of 1. Abbreviations: devsSumSq: sum of squared annual deviations (“devs”); pDevsLnC: fishery capture probability devs; pDevsLnR: recruitment devs; pDevsM: natural mortality devs; pDevsS1: selectivity deviations; pDM1: natural mortality multiplier; pQ: survey catchability.	144

53	Negative log-likelihood contributions to the objective function by data type.	145
54	GMACS negative log-likelihood values for general penalties and priors on parameters. All penalties were set to 0. M: immature crab: (normal) prior on estimated M for immature crab, M: mature females: (normal) prior on estimated M for mature females, M: mature males: (normal) prior on estimated M for mature males, NMFS survey q: (normal) priors on estimated sex-specific catchability coefficients (i.e., q) for the NMFS survey. See text for details on comparison with TCSAM02 values. . .	146
55	TCSAM02 negative log-likelihood values for general penalties and priors on parameters. Smoothness: penalties on second differences and decreasing values in the size dependence of estimated male terminal molt parameters. Recruitment/pDevsLnr: sum of (normal) priors on individual recruitment deviation parameters. Natural mortality/pDM1: (normal) priors on estimated multipliers to base M for immature crab (level 1), mature males (level 2), and mature females (level 3). Surveys/pQ: (normal) priors on estimated survey catchability coefficients (i.e., q) for males (level 1) and females (level 2) in the NMFS survey. See text for details on comparison with GMACS values.	146
56	Main parameters from the 22.03d5 (GMACS) and 26.02 (GMACS) models.	147
57	Selectivity and retention parameters from the 22.03d5 (GMACS) and 26.02 (GMACS) models.	149
58	Fishing mortality deviation parameters from the 22.03d5 (GMACS) and 26.02 (GMACS) models.	152
59	Recruitment deviation parameters from the 22.03d5 (GMACS) and 26.02 (GMACS) models.	157
60	TCSAM02 models final values for parameters related to population processes, including growth, maturity, and natural mortality. Parameters with values whose standard error is NA are fixed, not estimated.	159
61	TCSAM02 models final values for parameters related to recruitment, including ln-scale means and ln-scale deviations. Parameters with values whose standard error is NA are fixed, not estimated.	160
62	TCSAM02 models final values for non-vector parameters related to fisheries, surveys, and likelihoods, including mean capture rates (pLnCs) and female offset (pDC2s), handling mortality (pHMs), maximum retention rates (pLogitRets), survey catchability (pQs), and Dirichlet Multinomial effective sample sizes (pLnDirMuls). Parameters with values whose standard error is NA are fixed, not estimated.	162
63	TCSAM02 models final values for annual capture rate devs parameters for the Tanner crab fishery (TCF). Parameters with values whose standard error is NA are fixed, not estimated.	163
64	TCSAM02 models final values for annual capture rate devs parameters for the snow crab fishery (SCF). Parameters with values whose standard error is NA are fixed, not estimated.	165
65	TCSAM02 models final values for annual capture rate devs parameters for the BBRKC fishery (RKF). Parameters with values whose standard error is NA are fixed, not estimated.	166
66	TCSAM02 models final values for annual capture rate devs parameters for the groundfish fisheries (GFA). Parameters with values whose standard error is NA are fixed, not estimated.	167
67	MMB (1,000's t) from the 22.03d5 (2026), 22.03d5 (GMACS), and 26.02 (GMACS) models.	169

68	Recruitment (millions) from the 22.03d5 (2026), 22.03d5 (GMACS), and 26.02 (GMACS) models.	171
69	Ratios of total catch mortality to MMB by year from the 22.03d5 (2026), 22.03d5 (GMACS), and 26.02 (GMACS) models.	173
70	P-star and buffer ABCs from the models considered for management. The p-star ABCs are the maximum permissible ABCs under each model and are base on model-derived estimates of uncertainty in the associated OFL. The buffer ABCs are based on applying an author-recommended 0.2% buffer to the OFL.	175
71	Observed and random walk model-estimated time series for vulnerable male biomass from the NMFS EBS shelf survey. All values are in 1,000s t. lci: lower confidence interval; uci: upper confidence interval. Confidence intervals are 80%.	175
72	Tier 4 management quantities for candidate B_{MSY} averaging periods. Biomass quantities (B, B_{MSY} , OFL) are in 1,000s t.	177
73	Abundance measures for PSC. “model”: preferred model-based estimates of total survey abundance (excludes crab < 25 mm CW). “survey”: design-based estimates of total survey abundance (includes crab < 25 mm CW). Abundance units are millions of crab. The survey was not conducted in 2020.	177
A.1	Rationales for recent recommended (author, CPT) and adopted (SSC) ABC buffers for Tanner crab.	439
B.2	Summary of risk-table considerations and concern levels for eastern Bering Sea Tanner crab.	442

Table 2. Federal management quantities (OFL, ABC), State of Alaska TACs, and harvest (retained catch biomass) in the Tanner crab fisheries following rationalization in 2005. OFL and ABC values apply to the entire EBS Tanner crab stock area, TAC values apply to individual ADF&G management areas. Harvest is retained catch in the directed fisheries. Fishery closures are indicated by “–”. All quantities are in metric tons.

year	OFL	ABC	TAC			Harvest		
	all EBS	all EBS	all EBS	East 166W	West 166W	all EBS	East 166W	West 166W
2005/06	–	–	735	–	735	245	–	245
2006/07	–	–	1,347	851	496	787	631	156
2007/08	–	–	2,550	1,563	987	861	710	151
2008/09	7,040	–	1,950	1,253	697	854	807	47
2009/10	2,270	–	612	612	–	592	592	–
2010/11	1,610	–	–	–	–	–	–	–
2011/12	2,750	2,480	–	–	–	–	–	–
2012/13	19,020	8,170	–	–	–	–	–	–
2013/14	25,350	17,820	1,410	664	746	1,248	654	594
2014/15	31,480	25,180	6,852	3,847	3,005	6,198	3,829	2,369
2015/16	27,190	21,750	8,921	5,113	3,808	8,878	5,108	3,770
2016/17	25,610	20,490	–	–	–	–	–	–
2017/18	25,420	20,330	1,134	–	1,134	1,118	–	1,117
2018/19	20,870	16,700	1,106	–	1,106	1,104	–	1,104
2019/20	28,860	23,090	–	–	–	–	–	–
2020/21	21,130	16,900	1,065	–	1,065	655	–	655
2021/22	27,170	21,740	499	–	499	494	–	494
2022/23	32,810	26,250	914	528	386	913	528	384
2023/24	36,200	27,150	944	345	599	940	344	597
2024/25	41,290	33,030	2,844	803	2,041	2,852	803	2,049
2025/26	51,020	40,810	5,103	513	4,590	5,109	510	4,599

Table 3. Estimates of B_{MSY} from recent stock assessments.

Year	Tier	Bmsy	Projected MMB	B/Bmsy	Fofl	Years to Define Bmsy	Natural Mortality
2017/18	3a	29.17	47.04	1.49	0.75	1982-2017	0.23
2018/19	3a	21.87	23.53	1.08	0.93	1982-2018	0.23
2019/20	3b	41.07	39.55	0.96	1.08	1982-2019	0.23
2020/21	3b	36.62	35.31	0.96	0.93	1982-2019	0.23
2021/22	3a	35.94	42.57	1.18	1.17	1982-2020	0.23
2022/23	3a	34.70	47.58	1.37	1.17	1982-2021	0.23
2023/24	3a	36.39	48.77	1.34	1.16	1982-2022	0.23
2024/25	3a	40.01	56.06	1.40	1.23	1982-2023	0.23
2025/26	3a	43.22	75.96	1.78	1.47	1982-2024	0.23

Table 4. Retained catch (metric tons) during the period when fishing by foreign fleets was allowed (1965-1979; historical data).

year	domestic	Japan	Russia	Total
1965/66	0	1,170	750	1,920
1966/67	0	1,690	750	2,440
1967/68	0	9,750	3,840	13,590
1968/69	460	13,590	3,960	18,010
1969/70	460	19,950	7,080	27,490
1970/71	80	18,930	6,490	25,500
1971/72	50	15,900	4,770	20,720
1972/73	100	16,800	0	16,900
1973/74	2,290	10,740	0	13,030
1974/75	3,300	12,060	0	15,360
1975/76	10,120	7,540	0	17,660
1976/77	23,360	6,660	0	30,020
1977/78	30,210	5,320	0	35,530
1978/79	19,280	1,810	0	21,090
1979/80	16,600	2,400	0	19,000

Table 5. Retained catch in the directed Tanner crab fishery during the period 1980-1996. The directed fishery was closed in 1985/86 and 1986/87 and from 1997/98-2004/05. Abundance units: number of individuals; biomass units: metric tons.

year	all EBS		East 166W		West 166W	
1980/81	12,928,112	13,426	—	—	—	—
1981/82	4,830,980	4,990	—	—	—	—
1982/83	2,286,756	2,390	—	—	—	—
1983/84	516,877	549	—	—	—	—
1984/85	1,272,501	1,429	—	—	—	—
1985/86	—	—	—	—	—	—
1986/87	—	—	—	—	—	—
1987/88	957,318	998	—	—	—	—
1988/89	2,894,480	3,180	—	—	—	—
1989/90	10,672,607	11,113	—	—	—	—
1990/91	16,608,625	18,181	13,213,073	14,622	3,395,552	3,559
1991/92	12,924,102	14,422	7,891,651	8,981	5,032,451	5,441
1992/93	15,265,865	15,935	11,047,718	11,649	4,218,147	4,286
1993/94	7,238,818	7,671	6,643,861	7,051	594,957	620
1994/95	3,351,639	3,523	3,041,714	3,206	309,925	317
1995/96	1,877,303	1,920	1,593,940	1,635	283,363	285
1996/97	734,296	819	714,240	798	20,056	21

Table 6. Retained catch biomass (metric tons) following rationalization of the crab fisheries in 2005, by ADF&G management area and fishery. Annual totals are also given. TCF: directed Tanner crab fishery; SCF: snow crab fishery; RKF: Bristol Bay red king crab fishery. Incidental catch of Tanner crab, up to a fraction of the retained target by trip, is allowed to be retained in the snow crab and red king crab fisheries.

year	TCF		SCF	RKF	all
	East 166W	West 166W	West 166W	East 166W	all EBS
2005/06	0.0	244.5	187.7	0.0	432.2
2006/07	631.2	155.5	171.4	4.6	962.8
2007/08	710.0	151.1	86.5	8.0	955.6
2008/09	806.9	47.2	2.5	23.2	879.8
2009/10	592.4	0.0	1.7	8.4	602.5
2010/11	0.0	0.0	1.2	0.0	1.2
2011/12	0.0	0.0	2.1	0.0	2.1
2012/13	0.0	0.0	1.1	0.0	1.1
2013/14	654.3	593.6	9.9	6.3	1,264.1
2014/15	3,829.3	2,368.7	14.5	3.8	6,216.2
2015/16	5,107.7	3,770.3	30.3	1.3	8,909.6
2016/17	0.0	0.0	1.2	0.0	1.2
2017/18	0.1	1,117.5	15.0	0.0	1,132.6
2018/19	0.0	1,103.9	3.4	0.0	1,107.3
2019/20	0.0	0.0	0.1	0.0	0.1
2020/21	0.0	655.2	2.3	0.0	657.5
2021/22		493.5	0.8		494.3
2022/23	528.4	384.9	0.0	0.0	913.3
2023/24	343.5	596.8	0.0	0.0	940.3
2024/25	802.6	2,048.9	0.5	0.0	2,852.1
2025/26	509.8	4,591.2	7.6	0.2	5,108.8

Table 7. Retained catch abundance (number of crab) following rationalization of the crab fisheries in 2005, by ADF&G management area and fishery. Annual totals are also given. TCF: directed Tanner crab fishery; SCF: snow crab fishery; RKF: Bristol Bay red king crab fishery. Incidental catch of Tanner crab, up to a fraction of the retained target by trip, is allowed to be retained in the snow crab and red king crab fisheries.

year	TCF		SCF	RKF	all
	East 166W	West 166W	West 166W	East 166W	all EBS
2005/06	0	255,859	188,118	0	443,977
2006/07	581,024	164,719	175,904	4,456	926,103
2007/08	677,661	151,525	90,148	7,830	927,164
2008/09	758,002	48,171	3,300	20,896	830,369
2009/10	476,668	0	2,544	6,751	485,963
2010/11	0	0	1,689	6	1,695
2011/12	0	0	3,095	0	3,095
2012/13	0	0	1,643	4	1,647
2013/14	704,201	722,469	13,256	5,842	1,445,768
2014/15	4,378,199	3,121,442	19,512	3,691	7,522,844
2015/16	5,998,876	4,817,144	39,012	1,386	10,856,418
2016/17	0	0	1,733	33	1,766
2017/18	139	1,322,542	17,688	25	1,340,394
2018/19	0	1,376,977	4,013	18	1,381,008
2019/20	0	0	125	0	125
2020/21	0	870,634	3,017	1	873,652
2021/22		782,983	970		783,953
2022/23	683,223	587,079	0	0	1,270,302
2023/24	404,036	814,417	0	4	1,218,457
2024/25	916,223	2,808,477	782	2	3,725,484
2025/26	594,306	6,615,591	10,432	180	7,220,509

Table 8. Original and scaled (input) sample sizes for retained catch size compositions. Only information aggregated to the EBS is available prior to 1990. '—': no data due to prior aggregation or lack of sampling (e.g. the fishery was closed. In addition to the closures noted here, the directed fishery was closed from 1997/98 to 2004/05.

year	new shell		old shell		East 166W all shell		new shell		old shell		West 166W all shell		new shell		old shell		all EBS all shell	
	original	scaled	original	scaled	original	scaled	original	scaled	original	scaled	original	scaled	original	scaled	original	scaled	original	scaled
1980/81	—	—	—	—	—	—	—	—	—	—	—	—	11,840	85.1	1,470	10.6	13,310	95.7
1981/82	—	—	—	—	—	—	—	—	—	—	—	—	10,386	74.6	925	6.6	11,311	81.3
1982/83	—	—	—	—	—	—	—	—	—	—	—	—	9,540	68.6	3,979	28.6	13,519	97.2
1983/84	—	—	—	—	—	—	—	—	—	—	—	—	679	4.9	996	7.2	1,675	12.0
1984/85	—	—	—	—	—	—	—	—	—	—	—	—	1,649	11.9	893	6.4	2,542	18.3
1985/86	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1986/87	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1987/88	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1988/89	—	—	—	—	—	—	—	—	—	—	—	—	11,277	81.0	1,103	7.9	12,380	89.0
1989/90	—	—	—	—	—	—	34,184	190.1	1,772	9.9	35,956	200.0	34,184	190.1	1,772	9.9	35,956	200.0
1990/91	—	—	—	—	—	—	78,310	187.4	5,280	12.6	83,590	200.0	78,310	187.4	5,280	12.6	83,590	200.0
1991/92	—	—	—	—	—	—	118,583	186.4	8,644	13.6	127,227	200.0	118,583	186.4	8,644	13.6	127,227	200.0
1992/93	—	—	—	—	—	—	113,509	181.0	11,886	19.0	125,395	200.0	113,509	181.0	11,886	19.0	125,395	200.0
1993/94	—	—	—	—	—	—	67,264	187.8	4,358	12.2	71,622	200.0	67,264	187.8	4,358	12.2	71,622	200.0
1994/95	—	—	—	—	—	—	25,585	183.9	2,073	14.9	27,658	198.8	25,585	183.9	2,073	14.9	27,658	198.8
1995/96	—	—	—	—	—	—	11,297	81.2	7,979	57.3	19,276	138.5	11,297	81.2	7,979	57.3	19,276	138.5
1996/97	—	—	—	—	—	—	2,063	14.8	2,367	17.0	4,430	31.8	2,063	14.8	2,367	17.0	4,430	31.8
2005/06	—	—	—	—	—	—	649	4.7	56	0.4	705	5.1	649	4.7	56	0.4	705	5.1
2006/07	815	5.9	1,544	11.1	2,359	17.0	238	1.7	343	2.5	581	4.2	1,053	7.6	1,887	13.6	2,940	21.1
2007/08	2,730	19.6	1,439	10.3	4,169	30.0	932	6.7	726	5.2	1,658	11.9	3,662	26.3	2,165	15.6	5,827	41.9
2008/09	2,717	19.5	252	1.8	2,969	21.3	429	3.1	92	0.7	521	3.7	3,146	22.6	344	2.5	3,490	25.1
2009/10	2,369	17.0	48	0.3	2,417	17.4	—	—	—	—	—	—	2,369	17.0	48	0.3	2,417	17.4
2010/11	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2011/12	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2012/13	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2013/14	2,250	16.2	274	2.0	2,524	18.1	1,869	13.4	368	2.6	2,237	16.1	4,119	29.6	642	4.6	4,761	34.2
2014/15	6,278	45.1	1,274	9.2	7,552	54.3	5,012	36.0	1,807	13.0	6,819	49.0	11,290	81.1	3,081	22.1	14,371	103.3
2015/16	11,066	79.5	4,159	29.9	15,225	109.4	7,364	52.9	1,731	12.4	9,095	65.4	18,430	132.5	5,890	42.3	24,320	174.8
2016/17	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2017/18	—	—	—	—	—	—	1,980	14.2	1,490	10.7	3,470	24.9	1,980	14.2	1,490	10.7	3,470	24.9
2018/19	—	—	—	—	—	—	879	6.3	2,427	17.4	3,306	23.8	879	6.3	2,427	17.4	3,306	23.8
2019/20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2020/21	—	—	—	—	—	—	1,378	9.9	1,945	14.0	3,323	23.9	1,378	9.9	1,945	14.0	3,323	23.9
2021/22	—	—	—	—	—	—	1,993	14.3	351	2.5	2,344	16.8	1,993	14.3	351	2.5	2,344	16.8
2022/23	2,073	14.9	258	1.9	2,331	16.8	2,059	14.8	348	2.5	2,407	17.3	4,132	29.7	606	4.4	4,738	34.1
2023/24	1,478	10.6	149	1.1	1,627	11.7	2,505	18.0	389	2.8	2,894	20.8	3,983	28.6	538	3.9	4,521	32.5
2024/25	2,013	14.5	288	2.1	2,301	16.5	3,371	24.2	677	4.9	4,048	29.1	5,384	38.7	965	6.9	6,349	45.6
2025/26	1,132	8.1	250	1.8	1,382	9.9	6,051	43.5	663	4.8	6,714	48.3	7,183	51.6	913	6.6	8,096	58.2

Table 9. Annual total catch biomass estimates of Tanner crab, expanded from at-sea fishery observer data, in the groundfish fisheries (GF) prior to 1990. Units are metric tons. Groundfish bycatch data is from historical sources.

	GF
	all gear
	all EBS
year	all sexes
1973/74	17,735
1974/75	24,449
1975/76	9,408
1976/77	4,699
1977/78	2,776
1978/79	1,869
1979/80	3,397
1980/81	2,114
1981/82	1,474
1982/83	449
1983/84	671
1984/85	644
1985/86	399
1986/87	649
1987/88	640
1988/89	463
1989/90	671

Table 10. Annual total catch biomass (retained + discarded) estimates of Tanner crab, expanded from at-sea fishery observer data in all fleets after 1989. Units are metric tons. “TCF”: Tanner crab fishery; “SCF”: snow crab fishery; “RKF”: BBRKC fishery; “GF”: groundfish fisheries. Crab fishery values based on data provided by ADF&G. Groundfish bycatch estimates based on data provided by AKFIN and the AKRO.

year	TCF				SCF		RKF		fixed all EBS all sexes	trawl all EBS all sexes	GF	all fleets
	crab pot		crab pot		crab pot		all EBS	all EBS			all gear all EBS	all gear all EBS
	East 166W	West 166W	West 166W	East 166W	East 166W							
male	female	male	female	male	female	male	female	all sexes	all sexes	all sexes	all sexes	
1990/91	–	–	–	–	7,733	106	3,489	35	–	–	943	12,306
1991/92	19,337	1,432	6,188	441	8,560	144	1,977	27	148	2,395	–	40,649
1992/93	29,395	1,307	7,291	602	2,573	162	1,325	19	103	2,657	–	45,434
1993/94	10,110	860	1,618	137	2,894	401	3,128	150	23	1,735	–	21,056
1994/95	6,863	728	354	113	1,334	194	–	–	24	2,072	–	11,682
1995/96	4,412	923	638	140	1,160	121	–	–	128	1,397	–	8,919
1996/97	227	56	71	–	1,942	120	268	2	118	1,477	–	4,281
1997/98	–	–	–	–	1,564	79	159	2	64	1,116	–	2,984
1998/99	–	–	–	–	861	61	126	2	88	847	–	1,985
1999/00	–	–	–	–	256	14	68	2	85	546	–	971
2000/01	–	–	–	–	217	5	57	1	53	688	–	1,021
2001/02	–	–	–	–	493	13	38	2	125	1,061	–	1,732
2002/03	–	–	–	–	243	15	56	1	96	624	–	1,035
2003/04	–	–	–	–	107	9	52	2	20	403	–	593
2004/05	–	–	–	–	132	28	42	2	65	610	–	879
2005/06	–	–	685	24	1,187	16	41	1	133	488	–	2,575
2006/07	1,134	49	576	73	1,531	86	29	2	346	371	–	4,197
2007/08	1,790	29	680	15	1,924	52	59	2	474	221	–	5,246
2008/09	1,187	7	120	1	1,119	25	280	3	288	245	–	3,275
2009/10	664	2	–	–	1,559	15	212	1	225	149	–	2,827
2010/11	–	–	–	–	1,456	9	32	0	118	113	–	1,728
2011/12	–	–	–	–	2,119	13	17	0	76	128	–	2,353
2012/13	–	–	–	–	1,571	10	43	1	46	107	–	1,778
2013/14	750	12	935	11	1,848	16	127	1	182	167	–	4,049
2014/15	5,328	9	3,081	32	5,388	51	306	1	261	174	–	14,631
2015/16	6,623	33	4,920	29	3,816	17	208	5	276	85	–	16,012

(continued)

year	East 166W		TCF crab pot West 166W		SCF crab pot West 166W		RKF crab pot East 166W		fixed	trawl	GF	all fleets
									all EBS	all EBS	all gear	all gear
	male	female	male	female	male	female	male	female	all sexes	all sexes	all sexes	all sexes
2016/17	–	–	–	–	2,698	17	190	4	161	145	–	3,215
2017/18	0	0	1,422	39	1,106	7	183	2	114	50	–	2,923
2018/19	–	–	1,685	36	959	7	71	0	122	57	–	2,937
2019/20	–	–	–	–	1,092	12	22	0	45	103	–	1,274
2020/21	–	–	953	42	212	0	7	0	23	102	–	1,339
2021/22	–	–	811	15	76	1	0	–	53	112	–	1,068
2022/23	767	7	638	4	–	–	0	–	26	101	–	1,543
2023/24	416	2	790	5	–	–	10	0	14	88	–	1,325
2024/25	695	9	2,554	37	64	2	6	0	47	69	–	3,483
2025/26	572	11	5,547	71	425	5	12	0	51	94	–	6,788

Table 11. Annual total catch abundance (retained + discarded) estimates of Tanner crab, expanded from at-sea fishery observer data, in all fleets after 1989. Units are 1,000s of crab. “TCF”: Tanner crab fishery; “SCF”: snow crab fishery; “RKF”: BBRKC fishery; “GF”: groundfish fisheries. Crab fishery values based on data provided by ADF&G. Groundfish bycatch estimates based on data provided by AKFIN and the AKRO.

	TCF				SCF		RKF				GF	all fleets
	East 166W		crab pot West 166W		crab pot West 166W		crab pot East 166W		fixed all EBS	trawl all EBS	all gear all EBS	all gear all EBS
year	male	female	male	female	male	female	male	female	all sexes	all sexes	all sexes	all sexes
1990/91	–	–	–	–	11,946	629	3,471	144	–	–	4,522	20,712
1991/92	25,658	5,550	8,211	2,001	14,007	753	1,955	95	356	5,756	–	64,342
1992/93	40,254	5,466	10,336	2,719	5,823	884	1,480	76	236	6,109	–	73,383
1993/94	13,438	3,430	2,346	634	6,842	2,315	3,404	567	49	3,595	–	36,620
1994/95	8,908	3,276	667	567	3,513	1,289	–	–	53	4,616	–	22,889
1995/96	6,084	4,057	1,093	684	2,422	727	–	–	312	3,405	–	18,784
1996/97	327	237	102	–	3,916	660	259	9	268	3,357	–	9,135
1997/98	–	–	–	–	2,936	467	163	6	183	3,202	–	6,957
1998/99	–	–	–	–	1,792	324	143	6	275	2,649	–	5,189
1999/00	–	–	–	–	587	72	92	4	222	1,432	–	2,409
2000/01	–	–	–	–	447	25	80	5	127	1,646	–	2,330
2001/02	–	–	–	–	1,032	74	51	4	249	2,118	–	3,528
2002/03	–	–	–	–	549	84	74	5	171	1,117	–	2,000
2003/04	–	–	–	–	263	45	76	6	53	1,038	–	1,481
2004/05	–	–	–	–	376	179	64	6	169	1,591	–	2,385
2005/06	–	–	1,004	113	2,182	90	61	4	285	1,046	–	4,785
2006/07	1,504	188	848	345	2,698	430	44	5	663	711	–	7,436
2007/08	2,681	121	1,060	72	3,642	263	80	5	1,349	627	–	9,900
2008/09	1,377	28	168	8	2,364	169	289	9	731	624	–	5,767
2009/10	622	9	–	–	3,055	98	196	4	381	455	–	4,820
2010/11	–	–	–	–	2,681	49	41	2	167	390	–	3,330
2011/12	–	–	–	–	3,634	73	21	0	105	918	–	4,751
2012/13	–	–	–	–	2,794	63	55	4	69	501	–	3,486
2013/14	899	43	1,343	51	3,645	91	145	4	302	689	–	7,212
2014/15	7,582	37	5,035	138	10,726	296	344	4	414	591	–	25,167
2015/16	9,775	134	8,214	140	7,078	85	250	21	470	249	–	26,416

(continued)

year	East 166W		TCF crab pot West 166W		SCF crab pot West 166W		RKF crab pot East 166W		fixed	trawl	GF	all fleets
									all EBS	all EBS	all gear	all gear
	male	female	male	female	male	female	male	female	all sexes	all sexes	all sexes	all sexes
2016/17	–	–	–	–	4,994	81	265	19	269	428	–	6,056
2017/18	0	0	2,068	185	2,033	45	230	6	178	126	–	4,871
2018/19	–	–	2,707	193	1,727	50	85	0	162	220	–	5,144
2019/20	–	–	–	–	2,120	82	26	0	65	453	–	2,746
2020/21	–	–	1,884	217	435	4	8	0	42	515	–	3,105
2021/22	–	–	1,582	76	178	8	0	–	93	465	–	2,402
2022/23	1,321	38	1,234	26	–	–	0	–	53	503	–	3,175
2023/24	556	8	1,262	26	–	–	13	0	24	540	–	2,429
2024/25	934	45	4,071	167	128	8	9	0	110	298	–	5,770
2025/26	729	41	9,290	328	896	25	17	0	107	319	–	11,752

Table 12. Annual discard mortality (biomass) estimates of Tanner crab in the groundfish fisheries (“GF”) prior to 1990. Handling mortality rates for trawl gear have been applied. Units are metric tons.

	GF
	all gear
	all EBS
year	all sexes
1973/74	14,188
1974/75	19,559
1975/76	7,526
1976/77	3,759
1977/78	2,221
1978/79	1,495
1979/80	2,718
1980/81	1,691
1981/82	1,179
1982/83	359
1983/84	537
1984/85	515
1985/86	319
1986/87	519
1987/88	512
1988/89	370
1989/90	537

Table 13. Annual discard mortality (biomass) estimates of Tanner crab, expanded from at-sea fishery observer data in all fleets after 1989. Assumed gear-specific handling mortality rates have been applied after (where appropriate) subtracting retained catch biomass from total catch biomass. “TCF”: Tanner crab fishery; “SCF”: snow crab fishery; “RKF”: BBRKC fishery; “GF”: groundfish fisheries. Units are metric tons.

year	East 166W		West 166W		TCF crab pot all EBS		SCF crab pot West 166W		RKF crab pot East 166W		fixed	trawl	GF	all fleets
	male	female	male	female	male	female	male	female	male	female	all EBS all sexes	all EBS all sexes	all EBS all sexes	all gear all EBS all sexes
1990/91	–	–	–	–	–	–	2,482	34	1,120	11	–	–	755	4,402
1991/92	–	–	–	–	3,564	601	2,748	46	635	8	74	1,916	–	9,592
1992/93	–	–	–	–	6,661	613	826	52	425	6	51	2,126	–	10,760
1993/94	–	–	–	–	1,302	320	929	129	1,004	48	12	1,388	–	5,131
1994/95	–	–	–	–	1,186	270	428	62	–	–	12	1,658	–	3,616
1995/96	–	–	–	–	1,004	342	373	39	–	–	64	1,118	–	2,939
1996/97	–	–	–	–	–	18	624	38	86	1	59	1,181	–	2,007
1997/98	–	–	–	–	–	–	502	25	51	0	32	893	–	1,504
1998/99	–	–	–	–	–	–	276	20	41	0	44	678	–	1,059
1999/00	–	–	–	–	–	–	82	4	22	0	42	437	–	588
2000/01	–	–	–	–	–	–	70	2	18	0	27	551	–	667
2001/02	–	–	–	–	–	–	158	4	12	0	62	848	–	1,085
2002/03	–	–	–	–	–	–	78	5	18	0	48	499	–	648
2003/04	–	–	–	–	–	–	34	3	16	0	10	323	–	387
2004/05	–	–	–	–	–	–	42	9	13	0	32	488	–	586
2005/06	–	–	141	8	–	–	321	5	13	0	66	390	–	945
2006/07	161	16	135	23	–	–	436	28	8	0	173	297	–	1,277
2007/08	347	9	170	5	–	–	590	17	16	0	237	176	–	1,568
2008/09	122	2	23	0	–	–	358	8	82	1	144	196	–	938
2009/10	23	1	–	–	–	–	500	5	65	0	113	119	–	826
2010/11	–	–	–	–	–	–	467	3	10	0	59	91	–	630
2011/12	–	–	–	–	–	–	680	4	6	–	38	102	–	830
2012/13	–	–	–	–	–	–	504	3	14	0	23	86	–	630
2013/14	31	4	110	4	–	–	590	5	39	0	91	134	–	1,006
2014/15	481	3	228	10	–	–	1,725	16	97	0	131	140	–	2,831
2015/16	486	10	369	9	–	–	1,215	6	66	2	138	68	–	2,370

(continued)

year	East 166W		West 166W		TCF crab pot all EBS		SCF crab pot West 166W		RKF crab pot East 166W		fixed	trawl	GF	all fleets
	male	female	male	female	male	female	male	female	male	female	all EBS	all EBS	all gear	all gear
											all sexes	all sexes	all sexes	all sexes
2016/17	–	–	–	–	–	–	866	6	61	1	80	116	–	1,130
2017/18	–	–	98	12	–	–	350	2	59	0	57	40	–	619
2018/19	–	–	186	12	–	–	307	2	23	0	61	45	–	636
2019/20	–	–	–	–	–	–	350	4	7	–	22	82	–	466
2020/21	–	–	96	13	–	–	67	0	2	–	12	81	–	272
2021/22	–	–	102	4	–	–	24	1	–	–	26	90	–	247
2022/23	77	2	81	2	–	–	–	–	–	–	13	81	–	256
2023/24	23	1	62	2	–	–	–	–	3	–	7	70	–	167
2024/25	–	3	162	12	–	–	20	1	2	–	24	56	–	279
2025/26	20	3	307	22	–	–	134	2	4	–	26	75	–	593

Table 14. Original and scaled (input) sample sizes for Tanner crab total catch size compositions in the directed fishery. Observer information starts in 1990/91. '—': no data due to prior aggregation or lack of sampling (e.g. the fishery was closed.)

year	East 166W						West 166W						all EBS					
	original	male scaled	original	female scaled	original	all sexes scaled	original	male scaled	original	female scaled	original	all sexes scaled	original	male scaled	original	female scaled	original	all sexes scaled
1991/92	21,600	155.2	3,935	28.3	25,535	183.5	9,703	69.7	1,704	12.2	11,407	82.0	31,303	169.5	5,639	30.5	36,942	200.0
1992/93	42,260	176.2	5,707	23.8	47,967	200.0	12,576	90.4	3,048	21.9	15,624	112.3	54,836	172.5	8,755	27.5	63,591	200.0
1993/94	36,062	158.6	9,417	41.4	45,479	200.0	4,326	31.1	1,054	7.6	5,380	38.7	40,388	158.8	10,471	41.2	50,859	200.0
1994/95	5,657	40.7	2,004	14.4	7,661	55.1	135	1.0	128	0.9	263	1.9	5,792	41.6	2,132	15.3	7,924	56.9
1995/96	5,180	37.2	2,914	20.9	8,094	58.2	409	2.9	205	1.5	614	4.4	5,589	40.2	3,119	22.4	8,708	62.6
1996/97	219	1.6	168	1.2	387	2.8	133	1.0	—	—	133	1.0	352	2.5	168	1.2	520	3.7
2005/06	—	—	—	—	—	—	19,715	141.7	1,107	8.0	20,822	149.6	19,715	141.7	1,107	8.0	20,822	149.6
2006/07	12,688	91.2	1,573	11.3	14,261	102.5	11,538	82.9	2,859	20.5	14,397	103.5	24,226	169.1	4,432	30.9	28,658	200.0
2007/08	51,105	191.0	2,415	9.0	53,520	200.0	10,441	75.0	903	6.5	11,344	81.5	61,546	189.8	3,318	10.2	64,864	200.0
2008/09	25,352	182.2	528	3.8	25,880	186.0	3,814	27.4	118	0.8	3,932	28.3	29,166	195.7	646	4.3	29,812	200.0
2009/10	17,289	124.3	147	1.1	17,436	125.3	—	—	—	—	—	—	17,289	124.3	147	1.1	17,436	125.3
2010/11	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2011/12	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2012/13	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2013/14	7,628	54.8	311	2.2	7,939	57.1	9,663	69.4	399	2.9	10,062	72.3	17,291	124.3	710	5.1	18,001	129.4
2014/15	51,181	198.9	286	1.1	51,467	200.0	33,903	194.8	905	5.2	34,808	200.0	85,084	197.2	1,191	2.8	86,275	200.0
2015/16	62,177	197.7	713	2.3	62,890	200.0	57,593	196.9	910	3.1	58,503	200.0	119,770	197.3	1,623	2.7	121,393	200.0
2016/17	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2017/18	—	—	—	—	—	—	18,775	134.9	1,720	12.4	20,495	147.3	18,785	135.0	1,721	12.4	20,506	147.4
2018/19	—	—	—	—	—	—	28,240	186.6	2,035	13.4	30,275	200.0	28,240	186.6	2,035	13.4	30,275	200.0
2019/20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2020/21	—	—	—	—	—	—	17,639	126.8	1,054	7.6	18,693	134.3	17,639	126.8	1,054	7.6	18,693	134.3
2021/22	—	—	—	—	—	—	19,214	138.1	1,008	7.2	20,222	145.3	19,214	138.1	1,008	7.2	20,222	145.3
2022/23	13,404	96.3	377	2.7	13,781	99.0	17,233	123.9	390	2.8	17,623	126.7	30,637	195.1	767	4.9	31,404	200.0
2023/24	8,500	61.1	129	0.9	8,629	62.0	26,134	187.8	436	3.1	26,570	191.0	34,634	196.8	565	3.2	35,199	200.0
2024/25	11,810	84.9	627	4.5	12,437	89.4	38,662	192.3	1,552	7.7	40,214	200.0	50,472	191.7	2,179	8.3	52,651	200.0
2025/26	6,702	48.2	343	2.5	7,045	50.6	59,529	192.8	2,232	7.2	61,761	200.0	66,231	192.5	2,575	7.5	68,806	200.0

Table 15. Original and scaled (input) sample sizes for Tanner crab total catch size compositions in the snow crab ('SCF') and BBRKC ('RKF') fisheries. Observer information starts in 1990/91 in the snow crab and BBRKC fisheries. '-': no data due to prior aggregation or lack of sampling (e.g. the fishery was closed).

year	SCF all EBS						RKF all EBS					
	original	male scaled	original	female scaled	original	all sexes scaled	original	male scaled	original	female scaled	original	all sexes scaled
1990/91	14,032	100.85	478	3.44	14,510	104.28	1,580	11.36	43	0.31	1,623	11.66
1991/92	11,708	84.14	686	4.93	12,394	89.07	2,273	16.34	89	0.64	2,362	16.98
1992/93	6,280	45.13	859	6.17	7,139	51.31	2,056	14.78	105	0.75	2,161	15.53
1993/94	6,969	50.09	1,542	11.08	8,511	61.17	7,359	52.89	1,196	8.60	8,555	61.48
1994/95	2,982	21.43	1,523	10.95	4,505	32.38	--	--	--	--	--	--
1995/96	1,898	13.64	428	3.08	2,326	16.72	--	--	--	--	--	--
1996/97	3,265	23.47	662	4.76	3,927	28.22	114	0.82	5	0.04	119	0.86
1997/98	3,970	28.53	657	4.72	4,627	33.25	1,030	7.40	41	0.29	1,071	7.70
1998/99	1,911	13.73	324	2.33	2,235	16.06	457	3.28	20	0.14	477	3.43
1999/00	976	7.01	82	0.59	1,058	7.60	207	1.49	14	0.10	221	1.59
2000/01	1,237	8.89	74	0.53	1,311	9.42	845	6.07	44	0.32	889	6.39
2001/02	3,113	22.37	160	1.15	3,273	23.52	456	3.28	39	0.28	495	3.56
2002/03	982	7.06	118	0.85	1,100	7.91	750	5.39	50	0.36	800	5.75
2003/04	688	4.94	152	1.09	840	6.04	555	3.99	46	0.33	601	4.32
2004/05	833	5.99	707	5.08	1,540	11.07	487	3.50	44	0.32	531	3.82
2005/06	9,807	70.48	368	2.64	10,175	73.13	983	7.06	70	0.50	1,053	7.57
2006/07	10,391	74.68	1,256	9.03	11,647	83.71	798	5.74	76	0.55	874	6.28
2007/08	13,797	99.16	728	5.23	14,525	104.39	1,399	10.05	91	0.65	1,490	10.71
2008/09	8,455	60.76	722	5.19	9,177	65.95	3,797	27.29	121	0.87	3,918	28.16
2009/10	11,057	79.46	474	3.41	11,531	82.87	3,395	24.40	72	0.52	3,467	24.92
2010/11	12,073	86.77	250	1.80	12,323	88.56	582	4.18	28	0.20	610	4.38
2011/12	9,453	67.94	189	1.36	9,642	69.30	323	2.32	4	0.03	327	2.35
2012/13	11,004	79.08	270	1.94	11,274	81.02	618	4.44	48	0.34	666	4.79
2013/14	12,932	92.94	356	2.56	13,288	95.50	2,139	15.37	60	0.43	2,199	15.80
2014/15	24,878	178.79	804	5.78	25,682	184.57	3,333	23.95	38	0.27	3,371	24.23
2015/16	19,839	142.58	230	1.65	20,069	144.23	2,312	16.62	189	1.36	2,501	17.97
2016/17	16,367	117.63	262	1.88	16,629	119.51	3,636	26.13	249	1.79	3,885	27.92
2017/18	5,596	40.22	109	0.78	5,705	41.00	4,213	30.28	90	0.65	4,303	30.92
2018/19	6,138	44.11	232	1.67	6,370	45.78	1,428	10.26	9	0.06	1,437	10.33
2019/20	8,880	63.82	423	3.04	9,303	66.86	493	3.54	4	0.03	497	3.57
2020/21	820	5.89	10	0.07	830	5.97	118	0.85	4	0.03	122	0.88
2021/22	632	4.54	30	0.22	662	4.76	--	--	--	--	--	--
2022/23	--	--	--	--	--	--	--	--	--	--	--	--
2023/24	--	--	--	--	--	--	233	1.67	11	0.08	244	1.75
2024/25	622	4.47	80	0.57	702	5.05	118	0.85	2	0.01	120	0.86
2025/26	3,041	21.86	88	0.63	3,129	22.49	212	1.52	3	0.02	215	1.55

Table 16. Original and scaled (input) sample sizes for Tanner crab total catch size compositions in the groundfish fisheries. Observer information starts in 1973/74 in the groundfish fisheries, but is unclassified by gear type until 1991/92. '-': no data for respective gear type.

year	original	male scaled	original	fixed female scaled	original	male scaled	original	trawl female scaled	original	male scaled	original	female scaled	original	all gear all sexes scaled
1973/74	--	--	--	--	--	--	--	--	3,151	22.6	2,273	16.3	5,424	39.0
1974/75	--	--	--	--	--	--	--	--	2,487	17.9	1,588	11.4	4,075	29.3
1975/76	--	--	--	--	--	--	--	--	1,244	8.9	822	5.9	2,066	14.8
1976/77	--	--	--	--	--	--	--	--	6,865	49.3	6,586	47.3	13,451	96.7
1977/78	--	--	--	--	--	--	--	--	10,541	75.8	8,264	59.4	18,805	135.1
1978/79	--	--	--	--	--	--	--	--	18,470	115.3	13,558	84.7	32,028	200.0
1979/80	--	--	--	--	--	--	--	--	19,006	125.6	11,261	74.4	30,267	200.0
1980/81	--	--	--	--	--	--	--	--	12,718	91.4	5,805	41.7	18,523	133.1
1981/82	--	--	--	--	--	--	--	--	6,085	43.7	4,028	28.9	10,113	72.7
1982/83	--	--	--	--	--	--	--	--	13,233	95.1	7,811	56.1	21,044	151.2
1983/84	--	--	--	--	--	--	--	--	18,267	131.3	8,228	59.1	26,495	190.4
1984/85	--	--	--	--	--	--	--	--	27,009	133.8	13,361	66.2	40,370	200.0
1985/86	--	--	--	--	--	--	--	--	22,893	129.3	12,524	70.7	35,417	200.0
1986/87	--	--	--	--	--	--	--	--	14,790	106.3	7,557	54.3	22,347	160.6
1987/88	--	--	--	--	--	--	--	--	23,371	119.7	15,667	80.3	39,038	200.0
1988/89	--	--	--	--	--	--	--	--	10,515	75.6	7,063	50.8	17,578	126.3
1989/90	--	--	--	--	--	--	--	--	59,642	118.5	41,027	81.5	100,669	200.0
1990/91	--	--	--	--	--	--	--	--	23,485	135.6	11,161	64.4	34,646	200.0
1991/92	1,116	8.0	290	2.1	5,683	40.8	3,157	22.7	--	--	--	--	10,246	73.6
1992/93	600	4.3	39	0.3	2,510	18.0	1,116	8.0	--	--	--	--	4,265	30.7
1993/94	683	4.9	25	0.2	530	3.8	332	2.4	--	--	--	--	1,570	11.3
1994/95	1,133	8.1	126	0.9	2,488	17.9	1,693	12.2	--	--	--	--	5,440	39.1
1995/96	162	1.2	44	0.3	3,693	26.5	2,600	18.7	--	--	--	--	6,499	46.7
1996/97	2,442	17.6	439	3.2	5,831	41.9	2,950	21.2	--	--	--	--	11,662	83.8
1997/98	1,650	11.9	217	1.6	8,272	59.4	3,668	26.4	--	--	--	--	13,807	99.2
1998/99	3,870	27.8	627	4.5	8,207	59.0	3,794	27.3	--	--	--	--	16,498	118.6
1999/00	3,551	25.5	719	5.2	7,482	53.8	3,801	27.3	--	--	--	--	15,553	111.8
2000/01	5,144	37.0	227	1.6	7,727	55.5	2,847	20.5	--	--	--	--	15,945	114.6
2001/02	6,950	49.9	303	2.2	8,809	63.3	2,763	19.9	--	--	--	--	18,825	135.3
2002/03	8,571	61.6	831	6.0	6,818	49.0	2,414	17.3	--	--	--	--	18,634	133.9
2003/04	4,589	33.0	923	6.6	4,924	35.4	1,778	12.8	--	--	--	--	12,214	87.8
2004/05	5,413	38.9	560	4.0	8,406	60.4	3,882	27.9	--	--	--	--	18,261	131.2
2005/06	8,816	63.4	388	2.8	8,963	64.4	3,318	23.8	--	--	--	--	21,485	154.4
2006/07	9,268	66.6	824	5.9	6,616	47.5	2,219	15.9	--	--	--	--	18,927	136.0
2007/08	7,235	52.0	1,175	8.4	8,910	64.0	2,642	19.0	--	--	--	--	19,962	143.5
2008/09	15,831	104.4	1,770	11.7	10,282	67.8	2,457	16.2	--	--	--	--	30,340	200.0
2009/10	12,916	92.8	688	4.9	6,037	43.4	1,988	14.3	--	--	--	--	21,629	155.4
2010/11	11,262	80.9	956	6.9	4,338	31.2	1,633	11.7	--	--	--	--	18,189	130.7
2011/12	8,709	62.6	386	2.8	7,615	54.7	3,869	27.8	--	--	--	--	20,579	147.9
2012/13	9,192	66.1	835	6.0	3,982	28.6	2,262	16.3	--	--	--	--	16,271	116.9
2013/14	22,471	128.7	3,488	20.0	6,390	36.6	2,584	14.8	--	--	--	--	34,933	200.0
2014/15	33,528	154.1	2,061	9.5	5,737	26.4	2,200	10.1	--	--	--	--	43,526	200.0
2015/16	24,488	146.3	5,149	30.8	3,208	19.2	627	3.7	--	--	--	--	33,472	200.0
2016/17	14,811	106.4	1,206	8.7	3,914	28.1	3,223	23.2	--	--	--	--	23,154	166.4

(continued)

year	male		fixed female		male		trawl female		male		female		all gear all sexes	
	original	scaled	original	scaled	original	scaled	original	scaled	original	scaled	original	scaled	original	scaled
2017/18	11,538	82.9	1,264	9.1	2,020	14.5	476	3.4	--	--	--	--	15,298	109.9
2018/19	4,130	29.7	198	1.4	3,038	21.8	1,124	8.1	--	--	--	--	8,490	61.0
2019/20	2,572	18.5	140	1.0	5,338	38.4	2,447	17.6	--	--	--	--	10,497	75.4
2020/21	2,267	16.3	418	3.0	6,389	45.9	2,558	18.4	--	--	--	--	11,632	83.6
2021/22	3,425	24.6	460	3.3	5,232	37.6	1,797	12.9	--	--	--	--	10,914	78.4
2022/23	3,792	27.3	407	2.9	5,440	39.1	1,809	13.0	--	--	--	--	11,448	82.3
2023/24	1,562	11.2	160	1.1	4,783	34.4	1,638	11.8	--	--	--	--	8,143	58.5
2024/25	5,037	36.2	1,252	9.0	2,859	20.5	1,200	8.6	--	--	--	--	10,348	74.4
2025/26	6,271	45.1	1,037	7.5	2,579	18.5	1,627	11.7	--	--	--	--	11,514	82.7

Table 17. Annual effort (potlifts) in the crab fisheries. “TCF”: Tanner crab fishery; “SCF”: snow crab fishery; “RKF”: BBRKC fishery.

year	East 166W	West 166W	TCF all EBS	SCF all EBS	RKF all EBS
1953	—	—	—	—	30,083
1954	—	—	—	—	17,122
1955	—	—	—	—	28,045
1956	—	—	—	—	41,629
1957	—	—	—	—	23,659
1958	—	—	—	—	27,932
1959	—	—	—	—	22,187
1960	—	—	—	—	26,347
1961	—	—	—	—	72,646
1962	—	—	—	—	123,643
1963	—	—	—	—	181,799
1964	—	—	—	—	180,809
1965	—	—	—	—	127,973
1966	—	—	—	—	129,306
1967	—	—	—	—	135,283
1968	—	—	—	—	184,666
1969	—	—	—	—	175,374
1970	—	—	—	—	168,059
1971	—	—	—	—	126,305
1972	—	—	—	—	208,469
1973	—	—	—	—	194,095
1974	—	—	—	—	212,915
1975	—	—	—	—	205,096
1976	—	—	—	—	321,010
1977	—	—	—	—	451,273
1978	—	—	—	190,746	406,165
1979	—	—	—	255,102	315,226
1980	—	—	—	435,742	567,292
1981	—	—	—	469,091	536,646
1982	—	—	—	287,127	140,492
1983	—	—	—	173,591	0
1984	—	—	—	370,082	107,406
1985	—	—	—	542,346	84,443
1986	—	—	—	616,113	175,753
1987	—	—	—	747,395	220,971
1988	—	—	—	665,242	146,179
1989	—	—	—	912,718	205,528
1990	493,820	479	494,299	1,382,908	262,761
1991	360,864	140,050	500,914	1,278,502	227,555
1992	508,922	166,670	675,592	969,209	206,815
1993	286,620	40,100	326,720	716,524	254,389
1994	228,254	21,282	249,536	507,603	697
1995	201,988	46,454	248,442	520,685	547

(continued)

year	East 166W	West 166W	TCF all EBS	SCF all EBS	RKF all EBS
1996	64,989	8,533	73,522	754,140	77,081
1997	0	0	0	930,794	91,085
1998	0	0	0	945,533	145,689
1999	0	0	0	182,634	151,212
2000	0	0	0	191,200	104,056
2001	0	0	0	326,977	66,947
2002	0	0	0	153,862	72,514
2003	0	0	0	123,709	134,515
2004	0	0	0	75,095	97,621
2005	0	6,346	6,346	117,375	114,944
2006	15,273	4,517	19,790	86,328	71,708
2007	26,441	7,268	33,709	140,857	113,214
2008	19,401	2,336	21,737	163,537	139,937
2009	6,635	0	6,635	137,292	118,521
2010	0	0	0	147,478	131,627
2011	0	0	0	270,602	45,784
2012	0	0	0	225,627	38,842
2013	16,633	23,062	39,695	225,245	46,589
2014	72,768	68,695	141,463	279,183	57,468
2015	130,302	84,933	215,235	202,526	48,763
2016	0	0	0	118,548	33,608
2017	11	19,284	19,295	114,673	49,169
2018	0	29,833	29,833	119,484	31,975
2019	0	0	0	188,958	35,033
2020	0	34,914	34,914	171,678	21,346
2021	0	19,252	19,252	36,878	294
2022	19,434	18,130	37,564	1,189	242
2023	6,336	22,861	29,197	0	15,694
2024	20,999	49,305	70,304	15,665	11,504
2025	11,007	67,823	78,830	45,051	13,491

Table 18. Design-based survey biomass trends (estimates and cv's) from the NMFS EBS shelf bottom trawl survey, by sex, maturity state, and management area. Biomass units are metric tons. The survey was not conducted in 2020.

year	East 166W		West 166W		male all maturity all EBS		East 166W		West 166W		immature all EBS		East 166W		West 166W		female mature all EBS	
	value	cv	value	cv	value	cv	value	cv	value	cv	value	cv	value	cv	value	cv	value	cv
1975	213,137	0.42	80,684	0.34	293,820	0.32	9,287	0.25	262	0.51	9,549	0.24	18,306	0.19	13,112	0.39	31,418	0.20
1976	101,952	0.18	55,066	0.20	157,018	0.14	4,448	0.26	1,920	0.57	6,368	0.25	20,967	0.20	10,189	0.42	31,157	0.19
1977	87,462	0.13	51,036	0.24	138,499	0.12	1,133	0.23	13,338	0.65	14,471	0.60	30,302	0.38	8,272	0.36	38,573	0.31
1978	72,913	0.15	25,392	0.18	98,305	0.12	714	0.29	6,099	0.27	6,814	0.24	17,691	0.31	8,065	0.26	25,757	0.23
1979	17,978	0.17	32,058	0.19	50,036	0.14	591	0.49	3,236	0.25	3,827	0.22	2,858	0.36	16,465	0.34	19,322	0.30
1980	48,978	0.31	103,501	0.18	152,479	0.16	1,320	0.26	12,190	0.25	13,510	0.23	11,562	0.38	52,221	0.33	63,783	0.28
1981	23,387	0.19	56,537	0.16	79,924	0.13	890	0.31	631	0.25	1,521	0.21	7,684	0.28	34,893	0.30	42,577	0.25
1982	16,600	0.16	49,252	0.18	65,852	0.14	1,309	0.34	406	0.27	1,715	0.27	6,797	0.26	57,347	0.29	64,143	0.26
1983	13,325	0.21	24,659	0.20	37,984	0.15	902	0.30	1,368	0.34	2,270	0.24	4,438	0.27	15,993	0.22	20,430	0.18
1984	12,019	0.19	18,483	0.17	30,503	0.13	670	0.46	1,563	0.23	2,233	0.21	4,129	0.44	10,785	0.26	14,914	0.22
1985	8,229	0.21	6,671	0.16	14,901	0.13	323	0.30	671	0.22	994	0.18	2,836	0.42	2,718	0.31	5,554	0.26
1986	9,611	0.22	11,983	0.36	21,594	0.22	1,486	0.21	1,207	0.28	2,693	0.17	2,006	0.25	1,360	0.31	3,366	0.20
1987	28,860	0.20	16,639	0.16	45,499	0.14	11,909	0.36	3,085	0.20	14,995	0.29	3,097	0.23	2,042	0.21	5,139	0.16
1988	58,124	0.31	41,083	0.24	99,207	0.21	3,697	0.22	6,475	0.24	10,172	0.17	19,182	0.30	6,184	0.26	25,366	0.23
1989	87,700	0.16	45,100	0.18	132,800	0.12	6,652	0.28	5,157	0.23	11,809	0.19	12,309	0.20	7,090	0.23	19,399	0.15
1990	76,879	0.14	55,538	0.23	132,417	0.13	5,990	0.28	3,869	0.20	9,859	0.19	19,032	0.24	18,663	0.48	37,694	0.27
1991	89,814	0.26	55,976	0.15	145,790	0.17	3,626	0.24	3,384	0.25	7,010	0.17	27,708	0.33	17,056	0.22	44,764	0.22
1992	89,918	0.32	37,665	0.18	127,582	0.23	345	0.29	1,636	0.19	1,981	0.17	11,013	0.22	15,213	0.23	26,226	0.16
1993	53,394	0.19	19,873	0.15	73,266	0.14	153	0.35	908	0.21	1,061	0.19	5,171	0.21	6,470	0.20	11,641	0.14
1994	32,303	0.16	16,029	0.14	48,332	0.12	65	0.33	1,135	0.34	1,199	0.33	5,268	0.30	4,579	0.28	9,846	0.21
1995	19,672	0.22	15,304	0.24	34,976	0.16	249	0.25	802	0.19	1,052	0.16	5,732	0.31	6,667	0.31	12,398	0.22
1996	19,979	0.28	10,785	0.31	30,764	0.21	1,013	0.28	416	0.21	1,430	0.21	5,533	0.36	4,047	0.45	9,580	0.28
1997	9,078	0.16	5,556	0.14	14,634	0.11	956	0.37	434	0.23	1,389	0.27	1,947	0.22	1,451	0.31	3,397	0.18
1998	8,403	0.13	6,600	0.16	15,003	0.10	550	0.21	1,407	0.25	1,957	0.19	1,202	0.21	1,076	0.24	2,278	0.16
1999	14,833	0.36	6,695	0.23	21,529	0.26	1,087	0.39	1,762	0.20	2,848	0.19	2,272	0.33	1,554	0.21	3,826	0.22
2000	16,427	0.27	6,898	0.14	23,325	0.20	728	0.30	1,745	0.18	2,473	0.15	2,885	0.39	1,246	0.25	4,131	0.28
2001	16,203	0.19	13,042	0.17	29,245	0.13	2,594	0.43	3,671	0.18	6,266	0.21	1,314	0.24	3,247	0.30	4,562	0.23
2002	14,401	0.20	13,006	0.17	27,407	0.13	1,768	0.28	3,724	0.20	5,492	0.16	1,701	0.33	2,766	0.25	4,468	0.20
2003	17,161	0.20	20,637	0.17	37,798	0.13	704	0.24	3,954	0.28	4,658	0.24	2,090	0.23	6,313	0.24	8,403	0.19
2004	12,454	0.22	26,417	0.17	38,871	0.14	267	0.38	3,812	0.15	4,079	0.15	863	0.20	3,865	0.21	4,729	0.17
2005	17,442	0.19	46,300	0.14	63,743	0.12	1,672	0.39	8,698	0.22	10,370	0.20	2,820	0.37	8,759	0.22	11,579	0.19
2006	28,635	0.34	72,894	0.17	101,529	0.15	2,450	0.50	10,789	0.25	13,238	0.22	4,025	0.29	10,914	0.21	14,939	0.17
2007	27,938	0.28	76,245	0.22	104,183	0.18	696	0.33	4,885	0.26	5,581	0.23	5,916	0.38	7,521	0.16	13,436	0.19
2008	37,176	0.50	47,720	0.22	84,897	0.25	621	0.52	2,220	0.22	2,841	0.21	4,457	0.31	7,206	0.23	11,663	0.18
2009	14,778	0.23	32,627	0.17	47,405	0.14	524	0.34	2,014	0.33	2,538	0.27	4,021	0.39	4,456	0.18	8,477	0.21
2010	14,420	0.21	34,575	0.22	48,996	0.17	789	0.31	2,986	0.19	3,775	0.16	2,115	0.42	3,358	0.24	5,473	0.22
2011	23,382	0.21	39,282	0.24	62,664	0.17	4,384	0.37	5,960	0.19	10,344	0.19	2,225	0.27	3,189	0.16	5,414	0.14
2012	45,365	0.28	34,747	0.13	80,112	0.17	5,692	0.45	5,959	0.19	11,651	0.24	8,550	0.31	3,805	0.18	12,355	0.22
2013	64,573	0.32	38,798	0.18	103,371	0.21	2,337	0.37	4,036	0.19	6,373	0.18	11,054	0.33	6,795	0.18	17,849	0.21
2014	58,196	0.14	50,711	0.14	108,906	0.10	489	0.20	1,964	0.25	2,453	0.21	8,159	0.47	6,705	0.27	14,864	0.29
2015	35,090	0.12	39,143	0.13	74,233	0.09	625	0.30	1,020	0.21	1,646	0.17	4,675	0.34	6,536	0.35	11,211	0.25
2016	25,813	0.15	43,812	0.12	69,625	0.09	50	0.33	1,068	0.22	1,118	0.22	1,450	0.30	6,176	0.31	7,625	0.26
2017	24,217	0.17	29,985	0.14	54,201	0.11	160	0.39	1,221	0.20	1,381	0.19	2,015	0.20	5,098	0.31	7,113	0.23
2018	13,931	0.13	33,152	0.12	47,083	0.10	1,010	0.25	4,005	0.20	5,015	0.17	607	0.23	4,360	0.23	4,967	0.20

(continued)

year	East 166W		West 166W		male all maturity all EBS		East 166W		West 166W		immature all EBS		East 166W		West 166W		female mature all EBS	
	value	cv	value	cv	value	cv	value	cv	value	cv	value	cv	value	cv	value	cv	value	cv
2019	10,931	0.26	17,742	0.10	28,673	0.12	1,513	0.33	3,406	0.19	4,919	0.16	662	0.34	4,184	0.25	4,846	0.22
2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2021	12,900	0.18	18,664	0.14	31,564	0.11	1,083	0.28	2,259	0.15	3,342	0.13	2,858	0.22	5,697	0.20	8,554	0.15
2022	14,940	0.18	14,692	0.13	29,633	0.11	698	0.38	1,996	0.24	2,694	0.20	1,827	0.23	4,842	0.27	6,669	0.20
2023	10,470	0.14	24,046	0.10	34,516	0.08	1,042	0.26	8,221	0.18	9,264	0.17	1,629	0.23	5,697	0.28	7,326	0.23
2024	19,262	0.22	64,151	0.14	83,413	0.12	2,955	0.50	16,162	0.18	19,117	0.17	3,362	0.27	21,277	0.22	24,638	0.19
2025	14,441	0.16	96,471	0.16	110,912	0.14	764	0.26	10,934	0.20	11,698	0.19	3,101	0.21	25,399	0.19	28,500	0.17
2026	34,553	0.36	96,185	0.21	130,738	0.18	642	0.30	4,555	0.23	5,196	0.21	3,860	0.44	18,160	0.17	22,020	0.16

Table 19. Design-based survey abundance trends (estimates and cv's) from the NMFS EBS shelf bottom trawl survey, by sex, maturity state, and management area. Abundance units are millions of crab. The survey was not conducted in 2020.

year	male										female									
	all maturity					immature					mature					all EBS				
	East 166W	West 166W	East 166W	West 166W	East 166W	West 166W	East 166W	West 166W	East 166W	West 166W	East 166W	West 166W	East 166W	West 166W	East 166W	West 166W	East 166W	West 166W	East 166W	West 166W
	value	cv	value	cv	value	cv	value	cv	value	cv	value	cv	value	cv	value	cv	value	cv	value	cv
1975	398.59	0.25	136.77	0.27	535.37	0.20	93.91	0.26	4.42	0.45	98.33	0.25	85.53	0.18	68.15	0.35	153.68	0.19		
1976	228.63	0.15	143.94	0.29	372.57	0.15	68.77	0.38	67.91	0.55	136.68	0.33	94.28	0.20	58.43	0.40	152.71	0.20		
1977	162.87	0.13	217.39	0.36	380.26	0.21	14.44	0.21	258.87	0.63	273.31	0.60	142.44	0.39	49.67	0.38	192.11	0.31		
1978	124.72	0.14	166.20	0.19	290.92	0.12	9.32	0.25	142.71	0.29	152.02	0.27	83.00	0.33	53.81	0.28	136.81	0.23		
1979	32.79	0.19	163.99	0.25	196.78	0.21	7.67	0.49	48.97	0.25	56.64	0.23	13.04	0.37	118.33	0.35	131.37	0.32		
1980	90.26	0.29	554.36	0.19	644.62	0.17	15.42	0.25	154.88	0.25	170.30	0.23	50.51	0.38	380.36	0.35	430.88	0.31		
1981	54.16	0.20	211.98	0.18	266.14	0.15	15.08	0.37	9.95	0.22	25.03	0.24	35.15	0.30	268.67	0.32	303.82	0.29		
1982	43.53	0.15	144.58	0.18	188.11	0.14	13.76	0.25	14.29	0.23	28.05	0.17	31.09	0.27	433.08	0.31	464.17	0.29		
1983	50.24	0.19	127.07	0.23	177.31	0.18	27.31	0.28	80.05	0.35	107.36	0.27	18.30	0.28	109.91	0.22	128.21	0.20		
1984	40.24	0.33	90.50	0.14	130.74	0.14	19.32	0.57	56.00	0.19	75.32	0.20	16.33	0.41	70.10	0.27	86.43	0.23		
1985	20.05	0.16	35.39	0.15	55.44	0.11	5.17	0.22	19.69	0.21	24.87	0.17	10.77	0.38	18.57	0.34	29.34	0.26		
1986	53.63	0.16	61.88	0.26	115.50	0.16	34.08	0.21	23.34	0.25	57.42	0.16	8.65	0.23	8.29	0.28	16.94	0.18		
1987	150.92	0.24	104.10	0.12	255.02	0.15	122.49	0.35	71.88	0.15	194.37	0.23	13.42	0.21	12.93	0.21	26.35	0.15		
1988	185.58	0.19	234.95	0.21	420.53	0.14	54.49	0.20	127.51	0.23	182.00	0.18	84.40	0.29	38.13	0.25	122.53	0.21		
1989	328.22	0.19	204.64	0.19	532.86	0.14	179.37	0.33	99.72	0.21	279.08	0.23	57.76	0.20	43.30	0.23	101.06	0.15		
1990	235.20	0.15	195.37	0.15	430.56	0.10	98.52	0.27	74.95	0.18	173.48	0.18	101.55	0.24	107.46	0.43	209.01	0.25		
1991	209.64	0.21	224.87	0.16	434.51	0.13	39.32	0.23	82.31	0.31	121.63	0.22	145.92	0.36	109.17	0.23	255.09	0.23		
1992	160.01	0.31	141.90	0.13	301.91	0.17	4.97	0.30	46.16	0.20	51.13	0.18	53.88	0.22	97.02	0.23	150.90	0.17		
1993	93.72	0.18	79.93	0.13	173.65	0.11	2.90	0.34	24.87	0.21	27.77	0.19	24.87	0.22	42.60	0.20	67.47	0.15		
1994	51.96	0.16	65.93	0.14	117.89	0.10	2.67	0.33	33.60	0.37	36.27	0.34	27.00	0.32	29.16	0.27	56.16	0.21		
1995	34.55	0.19	51.84	0.16	86.39	0.12	5.46	0.27	19.09	0.22	24.55	0.18	30.24	0.31	43.08	0.31	73.32	0.22		
1996	51.02	0.20	37.00	0.19	88.03	0.14	17.73	0.26	12.58	0.21	30.31	0.18	28.92	0.36	26.19	0.43	55.11	0.28		
1997	41.37	0.27	30.04	0.13	71.40	0.17	31.89	0.45	20.09	0.21	51.98	0.29	11.14	0.24	8.96	0.31	20.10	0.19		
1998	32.57	0.14	54.94	0.17	87.51	0.12	13.39	0.22	42.86	0.22	56.25	0.17	6.74	0.22	6.56	0.24	13.30	0.16		
1999	59.89	0.37	81.10	0.19	141.00	0.19	20.75	0.31	70.89	0.21	91.65	0.17	12.62	0.31	10.06	0.20	22.68	0.20		
2000	49.05	0.21	75.44	0.17	124.49	0.13	16.27	0.35	54.31	0.18	70.59	0.16	14.97	0.38	7.29	0.25	22.26	0.27		
2001	124.71	0.32	141.06	0.16	265.78	0.17	106.49	0.37	108.33	0.17	214.83	0.20	7.13	0.23	21.04	0.28	28.16	0.22		
2002	58.90	0.22	136.65	0.20	195.55	0.15	36.36	0.27	109.08	0.24	145.43	0.19	10.76	0.38	19.10	0.29	29.87	0.23		
2003	56.03	0.19	179.53	0.19	235.56	0.15	13.21	0.23	113.88	0.25	127.09	0.23	11.97	0.24	48.53	0.28	60.49	0.23		
2004	30.39	0.18	219.98	0.11	250.37	0.10	8.38	0.50	153.86	0.13	162.24	0.13	4.53	0.23	27.68	0.25	32.21	0.22		
2005	59.04	0.20	286.68	0.15	345.72	0.13	39.05	0.43	212.35	0.22	251.40	0.20	16.10	0.38	60.65	0.23	76.75	0.20		
2006	103.52	0.38	355.13	0.14	458.66	0.14	28.83	0.39	172.38	0.19	201.21	0.18	21.91	0.28	76.44	0.21	98.34	0.17		
2007	76.79	0.27	345.73	0.18	422.52	0.16	11.45	0.30	96.72	0.21	108.17	0.19	30.54	0.35	51.46	0.16	82.00	0.17		
2008	79.61	0.41	166.84	0.15	246.45	0.17	8.74	0.34	47.62	0.21	56.36	0.18	24.65	0.31	48.63	0.23	73.28	0.19		
2009	45.63	0.21	131.95	0.15	177.58	0.12	21.11	0.40	63.43	0.25	84.53	0.21	22.10	0.39	29.22	0.17	51.32	0.19		
2010	51.73	0.20	149.43	0.14	201.16	0.11	27.59	0.35	84.27	0.17	111.86	0.16	10.60	0.41	21.92	0.23	32.51	0.21		
2011	148.75	0.27	216.69	0.15	365.43	0.14	86.81	0.32	145.81	0.19	232.62	0.17	12.18	0.26	20.30	0.15	32.48	0.14		
2012	189.77	0.34	244.69	0.16	434.45	0.17	64.98	0.42	113.49	0.18	178.48	0.19	52.40	0.35	25.62	0.18	78.02	0.24		
2013	176.80	0.30	209.10	0.14	385.90	0.16	30.47	0.32	85.37	0.17	115.84	0.15	60.82	0.36	47.96	0.18	108.77	0.21		
2014	137.61	0.13	198.85	0.17	336.46	0.11	14.94	0.25	73.20	0.29	88.14	0.24	44.74	0.48	43.62	0.28	88.36	0.28		
2015	79.06	0.12	119.86	0.11	198.93	0.08	13.69	0.25	30.76	0.18	44.45	0.15	27.61	0.35	45.43	0.38	73.04	0.27		
2016	53.97	0.18	133.88	0.12	187.85	0.10	1.25	0.32	37.62	0.24	38.87	0.23	7.71	0.31	42.58	0.33	50.29	0.28		
2017	49.93	0.17	122.77	0.13	172.70	0.10	4.73	0.32	78.81	0.24	83.55	0.23	10.17	0.20	35.57	0.31	45.75	0.24		
2018	54.89	0.17	205.36	0.15	260.25	0.12	32.97	0.25	158.21	0.20	191.18	0.17	3.46	0.24	30.33	0.22	33.80	0.20		

(continued)

year					male								immature				female			
	East 166W		West 166W		all maturity		East 166W		West 166W		all EBS		East 166W		West 166W		mature		all EBS	
	value	cv	value	cv	value	cv	value	cv	value	cv	value	cv	value	cv	value	cv	value	cv	value	cv
2019	46.68	0.27	154.60	0.15	201.28	0.13	30.16	0.34	140.17	0.21	170.32	0.19	3.74	0.34	32.95	0.27	36.69	0.24		
2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2021	58.08	0.19	144.08	0.18	202.16	0.14	21.61	0.38	81.50	0.28	103.10	0.24	14.79	0.22	39.48	0.22	54.27	0.17		
2022	70.43	0.26	124.86	0.21	195.29	0.16	35.21	0.47	81.03	0.23	116.24	0.22	9.60	0.24	33.24	0.29	42.84	0.23		
2023	51.69	0.18	311.78	0.13	363.47	0.11	35.90	0.28	282.13	0.15	318.03	0.14	8.62	0.23	39.89	0.27	48.50	0.23		
2024	93.51	0.28	537.25	0.13	630.77	0.12	48.75	0.35	346.06	0.15	394.81	0.13	21.10	0.30	149.75	0.22	170.85	0.20		
2025	54.40	0.17	573.24	0.15	627.64	0.14	15.07	0.25	298.94	0.25	314.01	0.24	18.96	0.23	170.88	0.18	189.83	0.16		
2026	104.53	0.33	362.32	0.16	466.85	0.14	15.31	0.32	109.83	0.22	125.15	0.19	23.86	0.45	130.80	0.18	154.66	0.17		

Table 20. Design-based survey biomass trends (estimates and cv's) from the NMFS EBS shelf bottom trawl survey for industry-preferred males by management area. Biomass units are metric tons. The survey was not conducted in 2020.

year	new shell		old shell		East 166W all shell		new shell		old shell		West 166W all shell		new shell		old shell		all EBS all shell	
	value	cv	value	cv	value	cv	value	cv	value	cv	value	cv	value	cv	value	cv	value	cv
1975	151,213	0.56	6,193	0.41	157,406	0.54	56,181	0.42	2,509	0.33	58,691	0.41	207,394	0.42	8,703	0.31	216,097	0.41
1976	57,463	0.23	9,245	0.47	66,709	0.24	38,231	0.24	1,409	0.36	39,640	0.24	95,695	0.17	10,654	0.41	106,349	0.17
1977	50,855	0.16	7,543	0.24	58,399	0.16	26,511	0.36	6,808	0.30	33,319	0.30	77,366	0.16	14,351	0.19	91,717	0.15
1978	40,761	0.18	9,652	0.21	50,413	0.16	3,221	0.26	6,626	0.32	9,847	0.27	43,981	0.17	16,278	0.18	60,259	0.14
1979	9,816	0.23	3,377	0.26	13,192	0.19	4,115	0.30	3,745	0.35	7,860	0.24	13,930	0.18	7,122	0.22	21,052	0.15
1980	23,184	0.41	10,857	0.53	34,041	0.33	11,210	0.31	1,677	0.69	12,887	0.31	34,394	0.30	12,534	0.47	46,927	0.25
1981	3,445	0.33	11,286	0.27	14,731	0.22	5,884	0.27	2,167	0.38	8,050	0.24	9,329	0.21	13,452	0.23	22,781	0.17
1982	3,009	0.22	4,851	0.23	7,860	0.18	5,775	0.38	5,847	0.25	11,622	0.23	8,783	0.26	10,698	0.17	19,481	0.16
1983	5,151	0.31	2,082	0.29	7,233	0.25	2,429	0.29	3,226	0.26	5,655	0.21	7,580	0.23	5,309	0.19	12,889	0.17
1984	4,348	0.24	3,077	0.40	7,424	0.23	571	0.37	3,159	0.24	3,730	0.22	4,919	0.22	6,236	0.23	11,154	0.17
1985	4,055	0.28	1,046	0.32	5,101	0.26	588	0.34	870	0.29	1,458	0.22	4,642	0.25	1,917	0.22	6,559	0.21
1986	734	0.36	2,546	0.52	3,280	0.43	142	0.41	674	0.33	816	0.30	876	0.31	3,219	0.42	4,096	0.35
1987	4,911	0.23	3,473	0.37	8,385	0.24	3,505	0.41	658	0.27	4,163	0.35	8,416	0.22	4,132	0.32	12,548	0.20
1988	15,698	0.67	2,715	0.25	18,413	0.58	9,690	0.40	929	0.31	10,618	0.37	25,387	0.44	3,644	0.20	29,031	0.39
1989	37,386	0.21	3,718	0.39	41,104	0.19	13,758	0.34	2,741	0.36	16,499	0.29	51,144	0.18	6,459	0.27	57,603	0.16
1990	35,903	0.22	7,084	0.21	42,987	0.19	21,082	0.37	3,274	0.30	24,356	0.33	56,985	0.19	10,358	0.17	67,343	0.17
1991	32,973	0.42	14,476	0.25	47,449	0.30	13,386	0.29	8,430	0.20	21,816	0.21	46,359	0.31	22,906	0.17	69,265	0.22
1992	41,423	0.44	16,242	0.40	57,665	0.33	9,893	0.50	6,418	0.28	16,311	0.32	51,316	0.37	22,660	0.30	73,977	0.27
1993	22,942	0.28	11,990	0.26	34,932	0.20	3,716	0.35	2,596	0.29	6,312	0.26	26,658	0.24	14,586	0.22	41,244	0.17
1994	10,000	0.22	13,912	0.26	23,912	0.18	1,248	0.45	4,143	0.22	5,391	0.21	11,248	0.20	18,054	0.21	29,303	0.15
1995	1,380	0.25	13,377	0.28	14,757	0.26	370	0.41	5,392	0.34	5,761	0.33	1,749	0.22	18,769	0.22	20,518	0.21
1996	330	0.35	13,912	0.35	14,242	0.35	100	0.42	3,580	0.48	3,680	0.47	430	0.29	17,492	0.30	17,922	0.29
1997	316	0.33	4,245	0.22	4,561	0.20	179	0.36	942	0.26	1,121	0.23	495	0.25	5,187	0.18	5,681	0.17
1998	1,001	0.28	2,604	0.19	3,605	0.16	441	0.35	644	0.20	1,085	0.21	1,442	0.22	3,247	0.16	4,689	0.13
1999	1,645	0.39	1,838	0.35	3,483	0.25	256	0.32	356	0.31	612	0.24	1,902	0.34	2,194	0.30	4,095	0.22
2000	4,484	0.52	3,045	0.41	7,529	0.35	250	0.35	377	0.29	627	0.24	4,734	0.49	3,422	0.36	8,156	0.33
2001	4,473	0.35	3,600	0.21	8,073	0.25	418	0.27	1,361	0.37	1,780	0.32	4,892	0.32	4,961	0.18	9,853	0.21
2002	944	0.40	7,102	0.28	8,046	0.25	384	0.42	838	0.25	1,222	0.25	1,328	0.31	7,940	0.25	9,268	0.22
2003	1,558	0.32	6,433	0.33	7,991	0.28	434	0.31	2,227	0.35	2,661	0.31	1,992	0.26	8,660	0.26	10,652	0.22
2004	1,597	0.26	4,916	0.50	6,513	0.38	980	0.26	1,825	0.29	2,805	0.22	2,577	0.19	6,741	0.37	9,318	0.27
2005	2,368	0.22	5,822	0.36	8,190	0.27	8,776	0.33	5,062	0.30	13,839	0.26	11,145	0.27	10,884	0.24	22,029	0.19
2006	2,134	0.34	6,794	0.28	8,927	0.24	3,768	0.37	15,315	0.48	19,083	0.42	5,902	0.26	22,109	0.34	28,011	0.30
2007	4,143	0.61	5,314	0.26	9,457	0.30	8,523	0.84	7,757	0.35	16,281	0.48	12,666	0.60	13,071	0.23	25,737	0.32
2008	15,476	0.78	3,288	0.27	18,764	0.65	8,731	0.56	4,414	0.28	13,145	0.40	24,206	0.54	7,702	0.20	31,909	0.42
2009	2,644	0.26	5,139	0.36	7,783	0.29	6,670	0.29	4,143	0.20	10,812	0.21	9,313	0.22	9,282	0.22	18,595	0.17
2010	3,006	0.49	4,576	0.30	7,582	0.29	9,593	0.47	4,867	0.21	14,460	0.35	12,599	0.38	9,443	0.18	22,042	0.25
2011	1,513	0.25	6,987	0.36	8,500	0.32	9,023	0.74	6,637	0.21	15,660	0.44	10,536	0.64	13,624	0.21	24,160	0.31
2012	3,352	0.49	5,026	0.24	8,378	0.25	2,368	0.32	3,997	0.19	6,365	0.19	5,720	0.32	9,023	0.16	14,743	0.16
2013	10,871	0.29	3,527	0.22	14,397	0.23	5,383	0.43	2,837	0.22	8,220	0.29	16,254	0.24	6,364	0.16	22,618	0.18
2014	14,899	0.26	9,310	0.19	24,210	0.19	7,163	0.17	4,604	0.21	11,766	0.14	22,062	0.19	13,914	0.15	35,976	0.13
2015	9,084	0.22	10,217	0.24	19,301	0.15	8,380	0.27	5,925	0.21	14,306	0.18	17,464	0.17	16,143	0.17	33,607	0.12
2016	2,666	0.17	8,137	0.18	10,803	0.14	5,855	0.18	12,649	0.18	18,504	0.14	8,521	0.14	20,786	0.13	29,308	0.10
2017	1,646	0.74	10,947	0.17	12,593	0.18	904	0.21	11,777	0.24	12,681	0.23	2,550	0.49	22,724	0.15	25,274	0.15
2018	103	0.44	7,324	0.16	7,427	0.16	1,007	0.19	11,993	0.19	13,000	0.18	1,110	0.18	19,318	0.13	20,427	0.13
2019	318	0.36	4,502	0.21	4,821	0.21	204	0.32	4,844	0.16	5,048	0.16	522	0.25	9,347	0.13	9,869	0.13

(continued)

year	new shell		old shell		East 166W all shell		new shell		old shell		West 166W all shell		new shell		old shell		all EBS all shell	
	value	cv	value	cv	value	cv	value	cv	value	cv	value	cv	value	cv	value	cv	value	cv
2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2021	1,462	0.32	965	0.29	2,427	0.23	420	0.33	1,608	0.22	2,028	0.19	1,883	0.26	2,573	0.18	4,455	0.15
2022	3,803	0.28	924	0.30	4,727	0.23	757	0.26	835	0.21	1,592	0.17	4,560	0.24	1,759	0.19	6,319	0.18
2023	2,514	0.24	1,103	0.24	3,617	0.19	1,166	0.24	1,235	0.23	2,401	0.17	3,680	0.18	2,339	0.17	6,018	0.13
2024	3,386	0.24	2,925	0.26	6,311	0.17	3,387	0.20	1,809	0.22	5,196	0.15	6,773	0.16	4,734	0.18	11,507	0.12
2025	1,983	0.34	2,525	0.23	4,508	0.20	7,757	0.27	3,444	0.16	11,201	0.20	9,740	0.22	5,970	0.14	15,710	0.16
2026	11,537	0.48	2,578	0.23	14,115	0.41	35,323	0.39	6,395	0.23	41,718	0.33	46,860	0.32	8,973	0.18	55,833	0.27

Table 21. Design-based survey abundance trends (estimates and cv's) from the NMFS EBS shelf bottom trawl survey for industry-preferred males by management area. Abundance units are millions of crab. The survey was not conducted in 2020.

year	new shell		old shell		East 166W all shell		new shell		old shell		West 166W all shell		new shell		old shell		all EBS all shell	
	value	cv	value	cv	value	cv	value	cv	value	cv	value	cv	value	cv	value	cv	value	cv
1975	154.812	0.53	6.988	0.41	161.800	0.50	66.706	0.42	3.129	0.33	69.835	0.40	221.518	0.39	10.117	0.30	231.635	0.37
1976	64.022	0.21	9.945	0.45	73.967	0.22	42.219	0.23	1.643	0.35	43.862	0.23	106.241	0.16	11.588	0.39	117.829	0.16
1977	55.271	0.15	8.487	0.23	63.759	0.15	26.617	0.30	7.258	0.29	33.875	0.26	81.888	0.14	15.745	0.18	97.633	0.13
1978	44.641	0.18	11.539	0.21	56.180	0.15	3.591	0.27	7.183	0.32	10.774	0.28	48.233	0.16	18.722	0.18	66.955	0.14
1979	11.155	0.22	4.001	0.24	15.156	0.19	5.335	0.28	4.610	0.33	9.945	0.23	16.490	0.18	8.611	0.21	25.101	0.15
1980	24.363	0.39	13.118	0.52	37.481	0.32	14.802	0.30	1.916	0.65	16.718	0.30	39.165	0.27	15.034	0.46	54.199	0.24
1981	4.026	0.34	14.097	0.26	18.123	0.22	7.784	0.26	2.903	0.38	10.688	0.23	11.811	0.21	17.000	0.22	28.811	0.16
1982	3.492	0.21	6.377	0.24	9.869	0.19	8.085	0.37	8.190	0.25	16.275	0.23	11.577	0.27	14.567	0.18	26.144	0.16
1983	6.917	0.31	2.732	0.28	9.649	0.25	3.375	0.29	4.685	0.27	8.061	0.21	10.292	0.23	7.418	0.20	17.710	0.17
1984	4.898	0.23	3.946	0.39	8.845	0.23	0.820	0.37	4.520	0.25	5.340	0.22	5.719	0.21	8.466	0.23	14.185	0.17
1985	4.413	0.27	1.381	0.31	5.795	0.25	0.784	0.35	1.283	0.28	2.067	0.22	5.197	0.24	2.664	0.21	7.861	0.19
1986	0.981	0.38	2.742	0.47	3.723	0.38	0.213	0.40	0.870	0.31	1.083	0.28	1.194	0.32	3.612	0.36	4.806	0.30
1987	6.307	0.22	4.039	0.33	10.345	0.22	4.658	0.40	0.917	0.27	5.575	0.34	10.965	0.21	4.956	0.28	15.921	0.19
1988	18.560	0.67	3.515	0.24	22.074	0.56	12.210	0.39	1.241	0.32	13.451	0.36	30.769	0.43	4.756	0.20	35.525	0.37
1989	46.361	0.20	4.780	0.39	51.141	0.19	17.061	0.33	3.608	0.36	20.670	0.28	63.423	0.17	8.388	0.27	71.811	0.16
1990	38.932	0.22	9.361	0.21	48.293	0.19	26.645	0.36	4.216	0.29	30.860	0.32	65.577	0.20	13.576	0.17	79.153	0.17
1991	39.106	0.46	18.355	0.24	57.462	0.33	17.264	0.30	11.383	0.20	28.647	0.21	56.371	0.33	29.738	0.17	86.109	0.23
1992	50.821	0.44	21.453	0.40	72.274	0.33	11.949	0.47	8.559	0.28	20.509	0.29	62.770	0.37	30.012	0.30	92.782	0.26
1993	27.129	0.29	16.372	0.25	43.501	0.20	5.078	0.35	3.723	0.30	8.801	0.26	32.207	0.25	20.095	0.21	52.302	0.17
1994	10.707	0.23	18.458	0.26	29.165	0.19	1.575	0.41	5.751	0.22	7.326	0.21	12.282	0.21	24.209	0.20	36.491	0.16
1995	1.510	0.25	16.795	0.28	18.305	0.26	0.569	0.42	7.622	0.35	8.191	0.34	2.079	0.22	24.418	0.22	26.497	0.21
1996	0.302	0.33	17.040	0.35	17.343	0.35	0.154	0.42	5.271	0.49	5.425	0.48	0.456	0.26	22.312	0.29	22.768	0.29
1997	0.454	0.34	4.957	0.21	5.411	0.20	0.248	0.34	1.296	0.26	1.543	0.23	0.701	0.25	6.253	0.18	6.954	0.16
1998	1.395	0.29	3.155	0.18	4.550	0.16	0.619	0.34	0.922	0.20	1.541	0.20	2.014	0.22	4.077	0.15	6.091	0.13
1999	2.022	0.37	2.256	0.32	4.278	0.24	0.387	0.33	0.505	0.30	0.892	0.24	2.409	0.32	2.760	0.27	5.169	0.20
2000	5.647	0.52	3.921	0.40	9.567	0.35	0.347	0.33	0.544	0.29	0.891	0.24	5.994	0.49	4.465	0.35	10.459	0.32
2001	5.136	0.34	4.621	0.20	9.757	0.23	0.635	0.27	1.785	0.36	2.419	0.30	5.770	0.30	6.406	0.17	12.176	0.20
2002	1.087	0.41	8.110	0.25	9.197	0.23	0.546	0.41	1.140	0.24	1.686	0.25	1.633	0.30	9.250	0.22	10.883	0.20
2003	1.895	0.32	7.156	0.29	9.051	0.25	0.615	0.32	3.019	0.35	3.634	0.31	2.510	0.25	10.175	0.23	12.685	0.20
2004	2.150	0.26	5.277	0.44	7.426	0.31	1.431	0.26	2.626	0.29	4.057	0.21	3.581	0.18	7.903	0.31	11.484	0.22
2005	3.110	0.22	6.588	0.32	9.698	0.24	11.621	0.33	7.088	0.29	18.710	0.25	14.731	0.26	13.676	0.22	28.407	0.19
2006	2.674	0.36	8.262	0.25	10.936	0.22	5.256	0.37	20.672	0.46	25.928	0.40	7.930	0.27	28.934	0.34	36.864	0.29
2007	5.023	0.56	6.765	0.23	11.788	0.28	11.886	0.83	10.728	0.34	22.614	0.47	16.909	0.61	17.493	0.23	34.401	0.33
2008	17.411	0.74	4.518	0.27	21.929	0.60	12.273	0.54	6.233	0.27	18.505	0.39	29.683	0.49	10.751	0.20	40.435	0.37
2009	3.293	0.25	6.402	0.34	9.695	0.28	9.180	0.28	5.838	0.20	15.018	0.21	12.473	0.22	12.240	0.20	24.713	0.17
2010	3.702	0.50	5.364	0.28	9.066	0.29	12.360	0.45	6.754	0.21	19.114	0.33	16.062	0.36	12.118	0.17	28.180	0.24
2011	1.866	0.25	8.110	0.31	9.976	0.28	10.018	0.70	8.845	0.20	18.863	0.39	11.884	0.59	16.954	0.18	28.839	0.27
2012	4.229	0.46	6.042	0.23	10.270	0.24	3.051	0.28	5.218	0.18	8.269	0.18	7.279	0.29	11.259	0.15	18.539	0.16
2013	15.045	0.31	4.524	0.22	19.569	0.24	7.150	0.39	3.614	0.22	10.764	0.27	22.195	0.24	8.138	0.16	30.334	0.18
2014	18.764	0.25	11.735	0.19	30.499	0.18	9.947	0.17	6.192	0.21	16.140	0.14	28.711	0.17	17.927	0.14	46.639	0.13
2015	11.442	0.20	12.676	0.22	24.119	0.14	11.343	0.27	8.298	0.22	19.641	0.18	22.785	0.17	20.975	0.16	43.760	0.11
2016	3.349	0.18	10.545	0.17	13.894	0.14	7.580	0.18	17.080	0.17	24.661	0.14	10.929	0.14	27.625	0.12	38.554	0.10
2017	2.054	0.78	13.889	0.17	15.943	0.18	1.231	0.21	15.589	0.23	16.819	0.22	3.284	0.49	29.478	0.14	32.762	0.14
2018	0.149	0.44	9.100	0.16	9.250	0.16	1.422	0.19	15.823	0.19	17.245	0.18	1.571	0.17	24.923	0.13	26.494	0.13
2019	0.460	0.37	5.666	0.20	6.125	0.20	0.301	0.33	6.608	0.16	6.909	0.16	0.761	0.26	12.274	0.13	13.034	0.13

(continued)

year	new shell		old shell		East 166W all shell		new shell		old shell		West 166W all shell		new shell		old shell		all EBS all shell	
	value	cv	value	cv	value	cv	value	cv	value	cv	value	cv	value	cv	value	cv	value	cv
2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2021	2.047	0.32	1.311	0.29	3.357	0.23	0.632	0.32	2.243	0.22	2.875	0.19	2.679	0.25	3.553	0.18	6.232	0.15
2022	4.938	0.28	1.324	0.29	6.262	0.23	1.065	0.26	1.224	0.21	2.289	0.17	6.003	0.23	2.548	0.18	8.551	0.17
2023	3.220	0.24	1.504	0.24	4.725	0.18	1.611	0.23	1.819	0.23	3.430	0.17	4.831	0.18	3.323	0.17	8.154	0.13
2024	4.336	0.25	3.854	0.24	8.190	0.17	4.910	0.21	2.588	0.22	7.498	0.16	9.246	0.16	6.442	0.17	15.688	0.12
2025	2.695	0.34	3.214	0.22	5.909	0.20	11.113	0.27	4.782	0.16	15.895	0.21	13.808	0.23	7.996	0.13	21.805	0.16
2026	14.592	0.47	3.404	0.23	17.996	0.40	43.274	0.39	9.193	0.23	52.467	0.33	57.866	0.32	12.597	0.18	70.463	0.26

Table 22. Design-based survey biomass estimates (and cv's) from the SBS studies, by sex, maturity state, and fleet. Biomass units are metric tons. Tanner crab SBS studies were conducted annually during 2013-2018. Different areas were included in the studies each year.

year	male								female			
	all maturity				immature				mature			
	BSFRF (SBS)		NMFS (SBS)		BSFRF (SBS)		NMFS (SBS)		BSFRF (SBS)		NMFS (SBS)	
	value	cv	value	cv	value	cv	value	cv	value	cv	value	cv
2013	56,571	0.55	21,109	0.38	1,562	0.45	522	0.38	8,369	0.48	3,050	0.46
2014	42,969	0.21	30,866	0.24	379	0.33	148	0.33	3,428	0.33	1,252	0.35
2015	23,271	0.20	16,802	0.22	165	0.43	255	0.62	2,633	0.42	713	0.44
2016	55,992	0.18	29,037	0.15	1,275	0.31	202	0.33	11,016	0.29	2,649	0.29
2017	63,908	0.20	28,402	0.16	5,411	0.17	759	0.28	15,629	0.31	4,540	0.34
2018	47,051	0.17	25,810	0.15	9,539	0.21	2,425	0.23	12,340	0.24	3,976	0.25

Table 23. Design-based survey abundance estimates (and cv's) from the SBS studies, by sex, maturity state, and fleet. Abundance units are millions of crab. Tanner crab SBS studies were conducted annually during 2013-2018. Different areas were included in the studies each year.

year	male								female			
	all maturity				immature				mature			
	BSFRF (SBS)		NMFS (SBS)		BSFRF (SBS)		NMFS (SBS)		BSFRF (SBS)		NMFS (SBS)	
	value	cv	value	cv	value	cv	value	cv	value	cv	value	cv
2013	139.20	0.51	47.03	0.36	17.95	0.34	4.11	0.34	35.13	0.49	12.97	0.46
2014	90.89	0.20	60.45	0.24	5.74	0.39	2.20	0.50	14.41	0.33	5.29	0.38
2015	48.91	0.19	33.32	0.25	5.52	0.52	3.10	0.55	11.80	0.47	3.14	0.52
2016	168.96	0.20	66.34	0.17	51.21	0.28	5.19	0.37	62.79	0.31	15.32	0.31
2017	430.64	0.15	83.67	0.15	369.06	0.17	40.63	0.35	104.66	0.30	29.96	0.35
2018	442.19	0.19	119.00	0.15	429.49	0.20	86.10	0.22	82.83	0.25	26.84	0.25

Table 24. Original and scaled (input) sample sizes for Tanner crab size compositions in the NMFS EBS shelf bottom trawl survey. Scaled sample sizes are only shown for size compositions aggregated across ADF&G management areas (i.e., 'all EBS'). '-' : no survey conducted.

year	East 166W				West 166W								all EBS			
	male		female	all sexes	male		female	all sexes	male		immature	female	all sexes			
	all maturity original	immature original	mature original	all maturity original	all maturity original	immature original	mature original	all maturity original	all maturity original	scaled	original	scaled	original	scaled	original	scaled
1975/76	4,973	956	1,664	7,593	2,314	91	903	3,308	7,287	134	1,047	19	2,567	47	10,901	200
1976/77	2,891	510	1,182	4,583	1,843	587	433	2,863	4,734	127	1,097	29	1,615	43	7,446	200
1977/78	2,680	251	1,350	4,281	1,554	525	571	2,650	4,234	122	776	22	1,921	55	6,931	200
1978/79	2,342	175	1,338	3,855	2,885	1,774	608	5,267	5,227	115	1,949	43	1,946	43	9,122	200
1979/80	669	156	272	1,097	2,250	577	804	3,631	2,919	123	733	31	1,076	46	4,728	200
1980/81	1,986	319	629	2,934	5,544	1,172	1,412	8,128	7,530	136	1,491	27	2,041	37	11,062	200
1981/82	1,279	339	739	2,357	5,709	240	1,786	7,735	6,988	138	579	11	2,525	50	10,092	200
1982/83	1,428	440	1,026	2,894	3,776	383	1,815	5,974	5,204	117	823	19	2,841	64	8,868	200
1983/84	1,687	916	611	3,214	2,961	1,197	1,744	5,902	4,648	102	2,113	46	2,355	52	9,116	200
1984/85	934	319	415	1,668	2,920	1,560	1,400	5,880	3,854	102	1,879	50	1,815	48	7,548	200
1985/86	650	171	359	1,180	1,250	676	470	2,396	1,900	106	847	47	829	46	3,576	200
1986/87	1,501	942	272	2,715	1,636	646	250	2,532	3,137	120	1,588	61	522	20	5,247	200
1987/88	3,074	1,983	401	5,458	3,389	2,247	436	6,072	6,463	112	4,230	73	837	15	11,530	200
1988/89	3,788	1,422	1,484	6,694	4,524	2,313	799	7,636	8,312	116	3,735	52	2,283	32	14,330	200
1989/90	5,615	1,640	1,304	8,559	3,630	1,631	819	6,080	9,245	126	3,271	45	2,123	29	14,639	200
1990/91	5,500	1,521	1,722	8,743	4,098	1,593	1,291	6,982	9,598	122	3,114	40	3,013	38	15,725	200
1991/92	4,748	832	1,735	7,315	5,198	1,427	2,116	8,741	9,946	124	2,259	28	3,851	48	16,056	200
1992/93	2,864	169	1,265	4,298	4,065	1,325	1,760	7,150	6,929	121	1,494	26	3,025	53	11,448	200
1993/94	2,748	104	748	3,600	2,845	765	1,134	4,744	5,593	134	869	21	1,882	45	8,344	200
1994/95	1,471	59	557	2,087	2,361	862	884	4,107	3,832	124	921	30	1,441	47	6,194	200
1995/96	1,041	147	492	1,680	1,748	687	705	3,140	2,789	116	834	35	1,197	50	4,820	200
1996/97	1,404	424	484	2,312	1,301	459	588	2,348	2,705	116	883	38	1,072	46	4,660	200
1997/98	994	501	379	1,874	1,213	828	293	2,334	2,207	105	1,329	63	672	32	4,208	200
1998/99	1,132	482	248	1,862	1,920	1,228	256	3,404	3,052	116	1,710	65	504	19	5,266	200
1999/00	1,462	516	367	2,345	2,471	2,112	398	4,981	3,933	107	2,628	72	765	21	7,326	200
2000/01	1,599	556	312	2,467	2,518	1,693	275	4,486	4,117	118	2,249	65	587	17	6,953	200
2001/02	1,844	1,093	216	3,153	3,638	2,585	792	7,015	5,482	108	3,678	72	1,008	20	10,168	200
2002/03	1,816	1,097	260	3,173	3,643	2,488	590	6,721	5,459	110	3,585	72	850	17	9,894	200
2003/04	1,812	453	415	2,680	5,191	2,381	1,260	8,832	7,003	122	2,834	49	1,675	29	11,512	200
2004/05	1,020	213	168	1,401	6,448	3,709	915	11,072	7,468	120	3,922	63	1,083	17	12,473	200
2005/06	1,859	641	437	2,937	5,670	2,711	1,125	9,506	7,529	121	3,352	54	1,562	25	12,443	200
2006/07	2,422	715	603	3,740	9,613	3,649	2,056	15,318	12,035	126	4,364	46	2,659	28	19,058	200
2007/08	2,120	348	768	3,236	7,466	2,082	1,939	11,487	9,586	130	2,430	33	2,707	37	14,723	200
2008/09	1,991	254	674	2,919	5,398	1,493	1,689	8,580	7,389	129	1,747	30	2,363	41	11,499	200
2009/10	1,545	507	554	2,606	4,432	1,901	1,126	7,459	5,977	119	2,408	48	1,680	33	10,065	200
2010/11	1,562	623	410	2,595	5,062	2,557	776	8,395	6,624	121	3,180	58	1,186	22	10,990	200
2011/12	2,923	1,610	391	4,924	6,228	3,434	785	10,447	9,151	119	5,044	66	1,176	15	15,371	200
2012/13	2,709	977	848	4,534	5,677	2,634	814	9,125	8,386	123	3,611	53	1,662	24	13,659	200
2013/14	3,478	746	972	5,196	6,133	2,171	1,447	9,751	9,611	129	2,917	39	2,419	32	14,947	200
2014/15	4,309	440	740	5,489	6,552	1,771	1,326	9,649	10,861	143	2,211	29	2,066	27	15,138	200
2015/16	2,606	479	781	3,866	4,807	976	1,027	6,810	7,413	139	1,455	27	1,808	34	10,676	200
2016/17	1,821	43	277	2,141	5,252	1,330	1,341	7,923	7,073	141	1,373	27	1,618	32	10,064	200
2017/18	1,775	175	366	2,316	4,431	1,858	972	7,261	6,206	130	2,033	42	1,338	28	9,577	200

(continued)

year	East 166W							West 166W						all EBS		
	male		female	all sexes	male		female	all sexes	male		immature		female	all sexes		
	all maturity	immature	mature	all maturity	all maturity	immature	mature	all maturity	all maturity	scaled	original	scaled	mature	all maturity		
original	original	original	original	original	original	original	original	original	original	original	original	original	original	original		
2018/19	1,904	1,147	121	3,172	6,347	3,519	1,107	10,973	8,251	117	4,666	66	1,228	17	14,145	200
2019/20	1,301	730	132	2,163	4,612	3,080	1,058	8,750	5,913	108	3,810	70	1,190	22	10,913	200
2020/21	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2021/22	1,820	509	520	2,849	4,901	2,506	1,471	8,878	6,721	115	3,015	51	1,991	34	11,727	200
2022/23	1,919	778	345	3,042	3,474	1,906	827	6,207	5,393	117	2,684	58	1,172	25	9,249	200
2023/24	1,687	983	308	2,978	7,833	5,605	1,101	14,539	9,520	109	6,588	75	1,409	16	17,517	200
2024/25	1,875	747	482	3,104	6,941	3,960	1,841	12,742	8,816	111	4,707	59	2,323	29	15,846	200
2025/26	1,573	459	538	2,570	8,946	3,283	2,341	14,570	10,519	123	3,742	44	2,879	34	17,140	200
2026/27	2,238	442	425	3,105	6,806	1,603	1,500	9,909	9,044	139	2,045	31	1,925	30	13,014	200

Table 25. Original and scaled (input) sample sizes for Tanner crab size compositions in the SBS selectivity studies. '—': no survey conducted.

year	male								female				all sexes			
	all maturity				immature				mature				all maturity			
	BSFRF (SBS)		NMFS (SBS)		BSFRF (SBS)		NMFS (SBS)		BSFRF (SBS)		NMFS (SBS)		BSFRF (SBS)		NMFS (SBS)	
	original	scaled	original	scaled	original	scaled	original	scaled	original	scaled	original	scaled	original	scaled	original	scaled
2013/14	640	141	1,302	142	99	22	134	15	167	37	404	44	906	200	1,840	200
2014/15	441	166	1,814	180	25	9	58	6	66	25	149	15	532	200	2,021	200
2015/16	264	142	998	167	29	16	97	16	79	42	101	17	372	200	1,196	200
2016/17	992	117	2,270	154	318	38	179	12	380	45	502	34	1,690	200	2,951	200
2017/18	2,472	98	3,277	130	1,886	75	1,020	41	699	28	729	29	5,057	200	5,026	200
2018/19	2,334	92	4,306	112	2,121	84	2,406	63	618	24	969	25	5,073	200	7,681	200

Table 26. Weight-at-size parameters ($w = a \cdot z^b$) for Tanner crab weight in grams.

sex	maturity	a	b
males	all	0.000270	3.022134
females	immature (non-ovigerous)	0.000562	2.816928
	mature (ovigerous)	0.000441	2.898686

Table 27. Input sample sizes for fishery size composition data, by catch type, fleet, and sex.

Year	retained	total							
	TCF	GF		RKF		SCF		TCF	
	male	female	male	female	male	female	male	female	male
1980	96	42	91	NA	NA	NA	NA	NA	NA
1981	81	29	44	NA	NA	NA	NA	NA	NA
1982	97	56	95	NA	NA	NA	NA	NA	NA
1983	12	59	131	NA	NA	NA	NA	NA	NA
1984	18	66	134	NA	NA	NA	NA	NA	NA
1988	89	51	76	NA	NA	NA	NA	NA	NA
1989	200	82	118	NA	NA	NA	NA	NA	NA
1990	200	64	136	0	11	3	101	NA	NA
1991	200	25	49	1	16	5	84	31	169
1992	200	8	22	1	15	6	45	28	172
1993	200	3	9	9	53	11	50	41	159
1994	199	13	26	NA	NA	11	21	15	42
1995	139	19	28	NA	NA	3	14	22	40
1996	32	24	59	0	1	5	23	1	3
2005	5	27	128	1	7	3	70	8	142
2006	21	22	114	1	6	9	75	31	169
2007	42	27	116	1	10	5	99	10	190
2008	25	28	172	1	27	5	61	4	196
2009	17	19	136	1	24	3	79	1	124
2013	34	35	165	0	15	3	93	5	124
2014	103	20	180	0	24	6	179	3	197
2015	175	35	165	1	17	2	143	3	197
2017	25	13	97	1	30	1	40	12	135
2018	24	10	52	0	10	2	44	13	187
2020	24	21	62	0	1	0	6	8	127
2021	17	16	62	NA	NA	0	5	7	138
2022	34	16	66	NA	NA	NA	NA	5	195
2023	32	13	46	0	2	NA	NA	3	197

(continued)

Year	retained		total						
	TCF	GF		RKF		SCF		TCF	
	male	female	male	female	male	female	male	female	male
2024	46	18	57	0	1	1	4	8	192
2025	58	19	64	0	2	1	22	7	193
1997	NA	28	71	0	7	5	29	NA	NA
1998	NA	32	87	0	3	2	14	NA	NA
1999	NA	32	79	0	1	1	7	NA	NA
2000	NA	22	93	0	6	1	9	NA	NA
2001	NA	22	113	0	3	1	22	NA	NA
2002	NA	23	111	0	5	1	7	NA	NA
2003	NA	19	68	0	4	1	5	NA	NA
2004	NA	32	99	0	3	5	6	NA	NA
2010	NA	19	112	0	4	2	87	NA	NA
2011	NA	31	117	0	2	1	68	NA	NA
2012	NA	22	95	0	4	2	79	NA	NA
2016	NA	32	135	2	26	2	118	NA	NA
2019	NA	19	57	0	4	3	64	NA	NA
1973	NA	16	23	NA	NA	NA	NA	NA	NA
1974	NA	11	18	NA	NA	NA	NA	NA	NA
1975	NA	6	9	NA	NA	NA	NA	NA	NA
1976	NA	47	49	NA	NA	NA	NA	NA	NA
1977	NA	59	76	NA	NA	NA	NA	NA	NA
1978	NA	85	115	NA	NA	NA	NA	NA	NA
1979	NA	74	126	NA	NA	NA	NA	NA	NA
1985	NA	71	129	NA	NA	NA	NA	NA	NA
1986	NA	54	106	NA	NA	NA	NA	NA	NA
1987	NA	80	120	NA	NA	NA	NA	NA	NA

Table 28. Input sample sizes for survey size composition data, by fleet, sex, and maturity state.

Year	BSFRF (SBS)			NMFS		
	female		male	female		male
	immature	mature	undetermined	immature	mature	undetermined
1975	NA	NA	NA	19	47	134
1976	NA	NA	NA	29	43	127
1977	NA	NA	NA	22	55	122
1978	NA	NA	NA	43	43	115
1979	NA	NA	NA	31	46	123
1980	NA	NA	NA	27	37	136
1981	NA	NA	NA	11	50	138
1982	NA	NA	NA	19	64	117
1983	NA	NA	NA	46	52	102
1984	NA	NA	NA	50	48	102
1985	NA	NA	NA	47	46	106
1986	NA	NA	NA	61	20	120
1987	NA	NA	NA	73	15	112
1988	NA	NA	NA	52	32	116
1989	NA	NA	NA	45	29	126
1990	NA	NA	NA	40	38	122
1991	NA	NA	NA	28	48	124
1992	NA	NA	NA	26	53	121
1993	NA	NA	NA	21	45	134
1994	NA	NA	NA	30	47	124
1995	NA	NA	NA	35	50	116
1996	NA	NA	NA	38	46	116
1997	NA	NA	NA	63	32	105
1998	NA	NA	NA	65	19	116
1999	NA	NA	NA	72	21	107
2000	NA	NA	NA	65	17	118
2001	NA	NA	NA	72	20	108
2002	NA	NA	NA	72	17	110
2003	NA	NA	NA	49	29	122
2004	NA	NA	NA	63	17	120
2005	NA	NA	NA	54	25	121
2006	NA	NA	NA	46	28	126
2007	NA	NA	NA	33	37	130
2008	NA	NA	NA	30	41	129
2009	NA	NA	NA	48	33	119
2010	NA	NA	NA	58	22	121
2011	NA	NA	NA	66	15	119

(continued)

Year	BSFRF (SBS)			NMFS		
	female		male	female		male
	immature	mature	undetermined	immature	mature	undetermined
2012	NA	NA	NA	53	24	123
2013	22	37	141	39	32	129
2014	9	25	166	29	27	143
2015	16	42	142	27	34	139
2016	38	45	117	27	32	141
2017	75	28	98	42	28	130
2018	84	24	92	66	17	117
2019	NA	NA	NA	70	22	108
2021	NA	NA	NA	51	34	115
2022	NA	NA	NA	58	25	117
2023	NA	NA	NA	75	16	109
2024	NA	NA	NA	59	29	111
2025	NA	NA	NA	44	34	123
2026	NA	NA	NA	31	30	139

Table 29. Input sample sizes for male maturity ogive data.

Year	7.5	12.5	17.5	22.5	27.5	32.5	37.5	42.5	47.5	52.5	57.5	62.5	67.5	72.5	77.5	82.5	87.5	92.5	97.5	102.5	107.5	112.5	117.5	122.5
1990	3	12	50	210	369	703	548	439	769	720	543	680	683	711	614	526	522	587	469	417	450	445	469	460
1991	80	171	111	281	140	440	867	614	390	304	332	464	634	706	658	582	522	600	477	476	460	502	483	394
1992	12	109	117	203	114	247	208	164	247	207	199	247	226	243	221	276	305	344	319	344	283	419	408	330
1993	18	41	64	103	82	128	193	141	174	169	116	128	144	156	166	177	232	174	153	187	185	244	237	218
1994	7	29	52	149	68	186	221	145	99	74	59	79	79	52	48	73	89	74	69	66	70	57	58	68
1995	14	60	139	86	82	119	54	55	103	47	49	58	59	50	63	52	30	27	27	12	18	20	19	7
1996	20	51	55	80	151	164	50	101	82	86	88	72	92	71	67	81	74	59	33	15	11	3	5	2
1997	18	153	154	335	187	260	131	74	69	58	82	63	60	52	87	80	68	73	47	44	27	28	8	6
1998	16	43	138	229	314	453	266	232	192	139	75	82	104	68	64	59	58	67	66	47	45	38	26	24
1999	19	266	349	874	430	297	264	132	149	129	127	199	235	273	295	257	173	125	97	85	71	46	32	14
2000	38	59	85	301	374	732	329	235	284	217	112	89	106	87	102	118	90	83	70	61	64	37	39	35
2001	47	766	736	1443	1303	710	1077	847	649	442	305	230	310	190	126	112	105	77	57	51	53	45	33	28
2002	6	43	206	454	453	1363	892	442	662	594	354	207	166	130	185	134	104	78	35	28	30	23	12	18
2003	78	259	254	1025	464	584	654	1013	1029	481	424	510	552	434	331	256	166	131	96	68	57	43	33	20
2004	88	529	655	1405	1061	728	577	374	597	466	265	318	255	212	214	233	260	259	269	247	194	122	55	39
2005	11	121	275	801	474	930	1272	1257	1077	811	539	390	341	460	243	329	275	273	203	194	188	226	149	160
2006	38	146	183	250	197	459	535	494	1024	1288	1389	1551	1466	1080	792	622	526	519	315	274	149	127	82	57
2007	90	342	147	228	232	546	728	508	542	572	420	575	652	607	469	655	610	617	401	318	168	149	88	55
2008	85	124	126	233	136	186	125	120	231	205	215	254	259	245	339	439	549	477	453	405	337	329	308	258
2009	159	307	440	506	345	273	228	207	311	260	123	119	175	152	145	155	175	170	199	197	234	153	161	130
2010	176	305	282	761	468	520	678	452	299	281	249	159	140	98	84	136	130	152	157	140	177	191	172	141
2011	98	465	522	955	687	1322	1196	767	889	1059	1011	723	590	435	355	201	216	163	149	132	133	79	133	49
2012	131	166	200	336	386	740	602	819	1457	1731	1126	893	1027	1015	1111	936	673	480	355	252	180	107	63	49
2013	159	466	462	391	305	396	509	459	566	704	762	817	932	1014	804	592	542	734	804	855	928	641	341	167
2014	49	299	228	520	231	392	382	275	226	267	173	241	485	480	444	525	656	857	874	702	511	393	298	250
2015	36	182	148	216	136	167	206	236	226	198	162	149	146	149	129	166	219	227	256	255	288	282	233	226
2016	28	103	210	207	196	302	205	157	183	123	78	93	135	171	158	158	190	171	146	148	126	143	112	97
2017	114	606	640	801	241	192	182	81	79	73	57	78	77	75	72	70	78	66	51	47	46	35	38	34
2018	54	319	724	951	1179	1555	693	399	389	205	128	122	118	89	114	118	104	94	65	40	46	44	26	26
2019	18	248	619	1208	647	744	580	370	395	313	239	222	235	209	158	152	163	104	62	33	40	22	20	7
2021	54	275	574	900	255	480	326	286	350	332	294	311	315	299	300	290	267	235	191	133	73	77	36	18
2022	54	409	563	1375	774	612	405	212	275	215	121	138	132	154	167	183	182	191	151	130	130	102	63	57
2023	101	720	957	1881	1616	2401	1718	990	962	649	317	297	293	220	216	193	173	170	124	121	105	80	53	44
2024	14	279	294	893	786	1642	2216	1184	1328	1575	1223	1416	1349	1496	1114	589	435	281	218	153	132	107	125	65
2025	22	231	302	718	567	1630	1200	1347	1718	1232	891	761	816	815	740	650	587	788	894	701	573	317	207	109
2026	72	217	206	494	349	618	435	477	651	412	477	658	1019	1012	845	612	420	404	387	356	204	168	336	299

Table 30. Diagnostic results from 400 runs for each model, where the initial values for estimated parameters were randomly selected from a range of potential values. The number of converged runs represents the number of model runs that resulted in objective function values within 0.01 likelihood units of the minimum objective function; the 'out of'nuber of runs listed represents the number of runs that converged to any objective function value (i.e., local minima). The remaining runs (out of 400) failed to converge before being terminated.

Case	Objective function	Maximum gradient	Converged runs
‘22.03d5 (2026)‘	3944.53	0.001	217 of 376
‘22.03d5 (GMACS)‘	4135.45	0.097	3 of 126
‘26.02 (GMACS)‘	4685.59	0.144	0 of 158

Table 31. No parameters were at a bound in the TCSAM02 models 22.03d5 (2025), 22.03d5 (2026).

result	
1	No results were returned for this table.

Table 32. TCSAM02 models final values for non-vector parameters related to recruitment, initial abundance, natural mortality, and growth. Parameters with values whose standard error is NA are fixed, not estimated.

process	name	label	‘22.03d5 (2025)’		‘22.03d5 (2026)’	
			est.	sd.	est.	sd.
recruitment	pLnR[1]	historical recruitment period	7.019	0.58	7.242	0.77
	pLnR[2]	current recruitment period	6.118	0.065	6.121	0.066
	pRa[1]	fixed value	2.166	0.034	2.223	0.031
	pRb[1]	fixed value	1.291	0.092	1.493	0.075
	pRCV[1]	full model period	-0.7000	NA	-0.7000	NA
	pRX[1]	full model period	0.000	NA	0.000	NA
natural mortality	pDM1[1]	multiplier for immature crab	1.092	0.046	1.103	0.046
	pDM1[2]	multiplier for mature males	1.380	0.037	1.380	0.036
	pDM1[3]	multiplier for mature females	1.388	0.037	1.362	0.038
	pDM2[1]	1980-1984 multiplier for mature males	2.329	0.24	2.401	0.26
	pDM2[2]	1980-1984 multiplier for mature females	2.038	0.17	2.080	0.17
	pM[1]	base ln-scale M	-1.470	NA	-1.470	NA
growth	pGrA[1]	males	32.40	0.22	32.72	0.27
	pGrA[2]	females	33.37	0.28	33.04	0.28
	pGrB[1]	males	163.9	0.62	159.7	0.49
	pGrB[2]	females	115.4	0.57	115.8	0.53
	pGrBeta[1]	both sexes	0.7107	0.084	0.5564	0.098

Table 33. TCSAM02 models final values for annual recruitment “devs” in the “historical” period up to 1975. Index begins in 1948.

index	‘22.03d5 (2025)’		‘22.03d5 (2026)’	
	est.	sd.	est.	sd.
1	-0.5419	1.8	-0.4510	1.8
2	-0.5410	1.6	-0.4495	1.6
3	-0.5389	1.5	-0.4461	1.5
4	-0.5353	1.4	-0.4401	1.4
5	-0.5295	1.3	-0.4309	1.3
6	-0.5209	1.1	-0.4174	1.2
7	-0.5084	1.1	-0.3984	1.1
8	-0.4910	0.96	-0.3724	1.0
9	-0.4669	0.89	-0.3377	0.94
10	-0.4342	0.83	-0.2925	0.91
11	-0.3902	0.80	-0.2357	0.89
12	-0.3314	0.79	-0.1658	0.89
13	-0.2524	0.81	-0.07997	0.90
14	-0.1437	0.84	0.02814	0.92
15	0.01094	0.89	0.1692	0.93
16	0.2401	0.93	0.3592	0.94
17	0.5829	0.93	0.6125	0.93
18	1.028	0.87	0.9208	0.94
19	1.455	0.74	1.203	0.99
20	1.565	0.66	1.203	1.0
21	1.089	0.68	0.7131	0.91
22	0.6059	0.67	0.3265	0.84
23	0.3655	0.65	0.1306	0.81
24	-0.1424	0.65	-0.3289	0.82
25	-0.4945	0.65	-0.6132	0.82
26	-0.08027	0.67	-0.2063	0.83

Table 34. TCSAM02 models final values for annual recruitment “devs” in the “current” period from 1975. The index begins in 1975.

index	‘22.03d5 (2025)’		‘22.03d5 (2026)’	
	est.	sd.	est.	sd.
1	1.323	0.29	1.109	0.39
2	1.955	0.18	2.064	0.18
3	1.528	0.22	1.482	0.24
4	0.3525	0.46	0.4814	0.42
5	-0.1201	0.47	-0.1065	0.49
6	-0.3037	0.40	-0.2253	0.40
7	-0.06457	0.28	-0.02031	0.29
8	-0.1858	0.28	-0.2439	0.30
9	1.008	0.12	1.068	0.12
10	0.7437	0.16	0.7498	0.17
11	0.8384	0.16	0.8126	0.17
12	0.9722	0.14	0.9962	0.14
13	0.6227	0.17	0.5305	0.18
14	0.2532	0.20	0.2230	0.20
15	-0.5422	0.26	-0.4758	0.25
16	-1.150	0.33	-1.220	0.35
17	-1.479	0.32	-1.499	0.32
18	-1.356	0.25	-1.331	0.25
19	-1.312	0.25	-1.347	0.27
20	-1.194	0.24	-1.117	0.24
21	-0.6782	0.17	-0.6557	0.18
22	-0.9524	0.24	-1.035	0.25
23	-0.007354	0.12	0.02499	0.12
24	-0.9878	0.25	-1.010	0.25
25	0.5643	0.097	0.5790	0.097
26	-0.5766	0.28	-0.6013	0.29
27	0.9165	0.10	0.9317	0.10
28	-0.1948	0.27	-0.2203	0.28
29	1.003	0.11	1.011	0.11
30	0.3450	0.16	0.3700	0.15
31	-0.6627	0.27	-0.7554	0.28
32	-1.200	0.37	-1.215	0.38
33	-0.6053	0.27	-0.5672	0.27
34	0.1264	0.24	0.1416	0.25
35	1.265	0.10	1.252	0.10
36	0.2337	0.19	0.2004	0.20
37	-0.5201	0.21	-0.5188	0.21
38	-1.669	0.36	-1.650	0.36
39	-0.8097	0.15	-0.8080	0.15
40	-1.536	0.23	-1.526	0.24
41	-1.340	0.20	-1.370	0.21
42	-0.6876	0.14	-0.6659	0.14
43	0.7619	0.072	0.7591	0.073
44	0.1585	0.13	0.1950	0.13
45	0.4091	0.14	0.3996	0.15
46	-0.7346	0.58	-0.1839	0.47
47	1.347	0.13	1.279	0.14
48	1.539	0.14	1.498	0.13
49	1.514	0.16	1.247	0.16
50	0.7209	0.31	0.4512	0.29
51	0.3694	0.38	0.3897	0.30
52	—	—	0.1232	0.37

Table 35. TCSAM02 models final values for parameters related to the probability of terminal molt. Index corresponds to 5-mm size bin starting at 50 mm CW for females and 60 mm CW for males.

label	index	‘22.03d5 (2025)’		‘22.03d5 (2026)’	
		est.	sd.	est.	sd.
females 50-105 mmCW (entire model period)	1	-5.029	1.1	-5.134	1.1
	2	-3.913	0.51	-3.977	0.50
	3	-2.824	0.24	-2.853	0.23
	4	-1.637	0.14	-1.634	0.14
	5	-0.4814	0.089	-0.4979	0.087
	6	0.3560	0.090	0.3344	0.087
	7	0.6701	0.10	0.6681	0.099
	8	1.155	0.14	1.153	0.13
	9	2.046	0.23	2.054	0.22
	10	2.915	0.44	2.881	0.43
	11	3.825	1.0	3.730	0.99
males 60-150 mmCW (entire model period)	1	-2.070	0.14	-2.898	0.043
	2	-2.629	0.21	-3.188	0.059
	3	-2.623	0.19	-2.746	0.049
	4	-1.946	0.12	-2.371	0.040
	5	-1.322	0.10	-1.780	0.033
	6	-1.198	0.098	-1.179	0.028
	7	-0.7404	0.089	-0.6874	0.027
	8	-0.2212	0.083	-0.5074	0.027
	9	-0.2750	0.083	-0.3668	0.027
	10	0.1230	0.085	-0.1760	0.027
	11	0.4174	0.086	0.2099	0.029
	12	0.8591	0.10	0.7205	0.033
	13	1.387	0.12	1.234	0.043
	14	2.309	0.23	1.503	0.051
	15	2.775	0.25	1.958	0.066
	16	3.450	0.45	2.478	0.090
	17	4.670	1.0	3.153	0.14

Table 36. TCSAM02 models final values for non-vector parameters related to fisheries, surveys, and the Dirichlet-Multinomial likelihood. Parameters with values whose standard error is NA are fixed, not estimated.

process	name	label	‘22.03d5 (2025)’		‘22.03d5 (2026)’	
			est.	sd.	est.	sd.
fisheries	pDC2[1]	TCF: female offset	-2.798	0.20	-2.767	0.19
	pDC2[2]	SCF: female offset	-2.709	0.35	-2.920	0.30
	pDC2[3]	GTF: female offset	-0.9423	0.11	-0.8707	0.10
	pDC2[4]	RKF: female offset	-2.374	0.83	-2.364	0.83
	pHM[1]	handling mortality for pot fisheries	0.3210	NA	0.3210	NA
	pHM[2]	handling mortality for groundfish trawl fisheries	0.8000	NA	0.8000	NA
	pLgtRet[1]	TCF: logit-scale max retention (pre-1997)	14.90	NA	14.90	NA
	pLgtRet[2]	TCF: logit-scale max retention (2005-2009)	14.90	NA	14.90	NA
	pLgtRet[3]	TCF: logit-scale max retention (2013+)	14.90	NA	14.90	NA
	pLnC[1]	TCF: base capture rate, pre-1965 (=0.05)	-2.996	NA	-2.996	NA
	pLnC[2]	TCF: base capture rate, 1965+	-1.626	0.12	-1.856	0.25
	pLnC[3]	SCF: base capture rate, pre-1978 (=0.01)	-4.605	NA	-4.605	NA
	pLnC[4]	SCF: base capture rate, 1992+	-3.783	0.067	-3.793	0.068
	pLnC[5]	DUMMY CAPTURE RATE	-4.181	NA	-4.181	NA
	pLnC[6]	GTF: base capture rate, ALL YEARS	-4.910	0.088	-4.977	0.055
	pLnC[7]	RKF: base capture rate, pre-1953 (=0.02)	-3.912	NA	-3.912	NA
surveys	pLnC[8]	RKF: base capture rate, 1992+	-4.884	0.12	-5.023	0.12
	pQ[1]	NMFS trawl survey: males, 1975-1981	-0.8104	0.10	-0.9017	0.10
	pQ[2]	NMFS trawl survey: males, 1982+	-0.6594	0.047	-0.7175	0.049
	pQ[3]	NMFS trawl survey: females, 1975-1981	-1.109	0.13	-1.113	0.13
	pQ[4]	NMFS trawl survey: females, 1982+	-1.284	0.071	-1.323	0.072
Dirichlet-Multinomial	pQ[5]	BSFRF SBS	0.000	NA	0.000	NA
	pLnDirMul[1]	ln(theta) parameter for BSFRF SBS M	10.68	NA	10.68	NA
	pLnDirMul[2]	ln(theta) parameter for BSFRF SBS F	10.99	NA	10.99	NA

Table 37. TCSAM02 models final values for fishing mortality “devs” for the directed fishery. The index starts in 1965 and does not include years when the fishery was completely closed.

index	‘22.03d5 (2025)’		‘22.03d5 (2026)’	
	est.	sd.	est.	sd.
1	-1.111	0.89	-1.242	1.1
2	-0.9053	0.74	-1.059	1.0
3	0.9397	0.69	0.7011	1.1
4	1.525	0.68	1.113	1.3
5	2.714	1.0	1.737	1.7
6	4.012	0.84	1.716	1.9
7	2.831	1.7	1.199	1.3
8	0.9591	0.76	0.5370	0.68
9	-0.1073	0.36	-0.09742	0.32
10	-0.2520	0.21	-0.1077	0.26
11	-0.07345	0.18	0.1060	0.28
12	0.6884	0.17	0.8697	0.29
13	1.402	0.20	1.544	0.30
14	1.606	0.26	1.653	0.32
15	2.007	0.29	1.983	0.33
16	2.026	0.25	2.255	0.33
17	0.4223	0.15	0.8016	0.27
18	-0.7819	0.13	-0.5221	0.25
19	-2.238	0.13	-2.064	0.25
20	-0.9179	0.14	-0.7871	0.26
21	-1.204	0.12	-1.023	0.25
22	-0.2117	0.12	0.02505	0.25
23	0.9598	0.12	1.196	0.25
24	1.736	0.13	1.964	0.26
25	2.086	0.16	2.366	0.27
26	2.386	0.17	2.648	0.27
27	1.929	0.17	2.168	0.27
28	1.149	0.17	1.304	0.27
29	0.5433	0.17	0.6233	0.27
30	0.4855	0.23	0.5156	0.30
31	-2.171	0.12	-1.937	0.25
32	-1.541	0.12	-1.304	0.25
33	-1.735	0.12	-1.507	0.25
34	-1.881	0.12	-1.655	0.25
35	-1.917	0.14	-1.721	0.26
36	-1.751	0.12	-1.560	0.25
37	-0.4648	0.12	-0.2441	0.25
38	-0.1867	0.12	-0.003674	0.25
39	-1.909	0.12	-1.772	0.25
40	-1.744	0.12	-1.605	0.25
41	-1.925	0.12	-1.778	0.25
42	-2.245	0.12	-2.069	0.25
43	-1.933	0.12	-1.721	0.25
44	-2.115	0.12	-1.922	0.25
45	-1.087	0.12	-0.9219	0.25
46	—	—	-0.4040	0.25

Table 38. TCSAM02 models final values for fishing mortality “devs” for the snow crab fishery. The indices start in 1990.

index	‘22.03d5 (2025)’		‘22.03d5 (2026)’	
	est.	sd.	est.	sd.
1	1.601	0.20	1.708	0.20
2	1.843	0.20	1.925	0.20
3	0.8367	0.20	0.9367	0.20
4	1.227	0.19	1.295	0.19
5	0.6535	0.19	0.6846	0.19
6	0.5787	0.19	0.7131	0.19
7	1.427	0.20	1.427	0.20
8	1.168	0.21	0.9010	0.21
9	0.2363	0.20	0.4259	0.20
10	-1.370	0.21	-0.7691	0.21
11	-0.6158	0.22	-1.009	0.22
12	-0.1585	0.21	-0.2941	0.21
13	-1.448	0.21	-1.122	0.21
14	-2.567	0.24	-2.117	0.22
15	-1.887	0.19	-1.996	0.20
16	0.07822	0.20	0.06964	0.20
17	0.2096	0.19	0.1867	0.19
18	0.2535	0.19	0.2541	0.19
19	-0.3778	0.20	-0.3898	0.20
20	-0.001874	0.20	-0.04557	0.20
21	0.09881	0.20	0.05772	0.20
22	0.6546	0.20	0.6078	0.20
23	0.3661	0.20	0.3431	0.20
24	0.3009	0.20	0.2931	0.20
25	1.118	0.19	1.125	0.19
26	0.9107	0.19	0.8610	0.19
27	0.7395	0.20	0.7478	0.20
28	0.1239	0.20	0.1075	0.20
29	0.1350	0.20	0.1798	0.20
30	0.4584	0.20	0.5004	0.20
31	-1.518	0.21	-1.063	0.20
32	-2.196	0.23	-2.280	0.23
33	-2.878	0.24	-2.990	0.24
34	—	—	-1.274	0.20

Table 39. TCSAM02 models final values for fishing mortality “devs” for the BBRKC fishery. The indices start in 1990.

index	‘22.03d5 (2025)’		‘22.03d5 (2026)’	
	est.	sd.	est.	sd.
1	4.007	0.24	4.049	0.23
2	3.700	0.25	3.846	0.25
3	3.466	0.25	3.596	0.25
4	4.373	0.24	4.480	0.24
5	2.413	0.25	2.391	0.24
6	1.155	0.27	1.174	0.26
7	0.9009	0.27	1.030	0.26
8	0.4874	0.28	0.4380	0.28
9	0.2718	0.28	0.1835	0.30
10	-0.3100	0.35	-0.3219	0.38
11	-0.1190	0.29	-0.1129	0.30
12	-0.4192	0.29	-0.3867	0.30
13	-0.7442	0.30	-0.8242	0.35
14	-1.110	0.33	-1.003	0.34
15	-1.605	0.44	-1.510	0.45
16	-1.068	0.27	-0.9724	0.27
17	0.3239	0.22	0.4368	0.22
18	-0.1591	0.23	0.06266	0.22
19	-1.838	0.42	-1.771	0.42
20	-2.280	0.70	-2.210	0.69
21	-1.232	0.33	-1.144	0.32
22	-0.1736	0.23	-0.08525	0.23
23	0.4969	0.22	0.6388	0.22
24	0.06425	0.22	0.1924	0.22
25	0.01288	0.22	0.1643	0.22
26	0.2236	0.23	0.2781	0.23
27	-0.4709	0.26	-0.4497	0.26
28	-1.691	0.69	-1.417	0.58
29	-2.575	1.3	-2.496	1.3
30	-2.730	1.1	-2.597	1.1
31	-3.371	1.4	-3.119	1.3
32	—	—	-2.541	0.91

Table 40. TCSAM02 models final values for fishing mortality “devs” vectors for the groundfish fisheries. Indices start in 1973.

index	‘22.03d5 (2025)’		‘22.03d5 (2026)’	
	est.	sd.	est.	sd.
1	1.329	0.19	1.311	0.17
2	1.584	0.18	1.584	0.16
3	0.7835	0.18	0.7896	0.16
4	0.3891	0.17	0.3856	0.16
5	0.03743	0.17	0.02800	0.16
6	-0.1575	0.18	-0.1700	0.16
7	0.3313	0.18	0.3214	0.16
8	-0.1380	0.17	-0.1430	0.16
9	-0.1987	0.17	-0.2064	0.15
10	-1.036	0.17	-1.052	0.15
11	-0.5465	0.17	-0.5755	0.15
12	-0.2414	0.17	-0.2757	0.16
13	-0.6358	0.17	-0.6659	0.15
14	-0.4503	0.17	-0.4724	0.15
15	0.2554	0.33	0.3134	0.16
16	-0.2380	0.33	-0.1654	0.16
17	0.1731	0.33	0.2516	0.16
18	0.5856	0.33	0.6740	0.16
19	1.355	0.33	1.455	0.16
20	1.605	0.34	1.707	0.16
21	1.309	0.33	1.407	0.16
22	1.735	0.33	1.821	0.16
23	1.639	0.33	1.711	0.16
24	1.828	0.33	1.898	0.16
25	1.534	0.16	1.564	0.15
26	1.400	0.16	1.429	0.15
27	0.8800	0.16	0.9117	0.14
28	0.9209	0.16	0.9580	0.15
29	1.148	0.16	1.188	0.15
30	0.4382	0.16	0.4809	0.15
31	-0.1076	0.16	-0.06331	0.14
32	0.1800	0.16	0.2263	0.14
33	-0.1549	0.16	-0.1070	0.14
34	-0.1863	0.16	-0.1369	0.14
35	-0.09804	0.16	-0.04928	0.14
36	-0.4384	0.16	-0.3916	0.14
37	-0.8102	0.16	-0.7728	0.14
38	-1.144	0.16	-1.113	0.14
39	-0.8293	0.16	-0.7970	0.14
40	-1.306	0.16	-1.262	0.14
41	-0.7424	0.16	-0.6819	0.14
42	-0.6666	0.16	-0.6035	0.14
43	-0.8057	0.16	-0.7554	0.14
44	-0.7089	0.16	-0.6701	0.14
45	-1.267	0.16	-1.234	0.14
46	-0.9552	0.16	-0.9247	0.14
47	-0.8271	0.16	-0.7963	0.14
48	-0.9170	0.16	-0.8835	0.14
49	-0.9854	0.16	-0.9387	0.15
50	-1.340	0.16	-1.294	0.14
51	-1.610	0.16	-1.567	0.14
52	-1.899	0.16	-1.799	0.15
53	—	—	-1.847	0.15

Table 41. TCSAM02 models final values for the “pS1” parameters related to selectivity functions. Parameters with values whose standard error is NA are fixed, not estimated.

name	label	‘22.03d5 (2025)’		‘22.03d5 (2026)’	
		est.	sd.	est.	sd.
pS1[1]	size at 1 for NMFS survey selectivity (males, pre-1982)	179.0	NA	179.0	NA
pS1[10]	ascending z-at-1 for SCF selectivity (males, pre-1997)	159.9	3.0	166.4	3.7
pS1[11]	ascending z-at-1 for SCF selectivity (males, 1997-2004)	120.1	6.6	119.3	6.2
pS1[12]	ascending z-at-1 for SCF selectivity (males, 2005+)	124.9	1.3	124.4	1.2
pS1[13]	ascending z50 for SCF selectivity (females, pre-1997)	82.17	7.1	79.59	5.1
pS1[14]	ascending z50 for SCF selectivity (females, 1997-2004)	73.25	4.3	72.76	4.4
pS1[15]	ascending z50 for SCF selectivity (females, 2005+)	100.0	8.4	95.40	7.1
pS1[16]	z50 for GF.AllGear selectivity (males, pre-1987)	63.20	3.3	61.77	3.1
pS1[17]	z50 for GF.AllGear selectivity (males, 1987-1996)	157.1	59.	179.0	NA
pS1[18]	z50 for GF.AllGear selectivity (males, 1997+)	99.74	2.2	100.6	2.2
pS1[19]	z50 for GF.AllGear selectivity (females, pre-1987)	46.94	2.2	47.42	2.3
pS1[2]	size at 1 for NMFS survey selectivity (males, 1982+)	179.0	NA	179.0	NA
pS1[20]	z50 for GF.AllGear selectivity (females, 1987-1996)	114.6	49.	131.7	32.
pS1[21]	z50 for GF.AllGear selectivity (females, 1997+)	90.57	3.2	91.88	3.1
pS1[22]	size at 1 for RKF selectivity (males, pre-1997)	179.9	NA	179.9	NA
pS1[23]	size at 1 for RKF selectivity (males, 1997-2004)	179.9	NA	179.9	NA
pS1[24]	size at 1 for RKF selectivity (males, 2005+)	179.9	NA	179.9	NA
pS1[25]	size at 1 for RKF selectivity (females, pre-1997)	139.9	NA	139.9	NA
pS1[26]	size at 1 for RKF selectivity (females, 1997-2004)	130.7	34.	131.2	35.
pS1[27]	size at 1 for RKF selectivity (females, 2005+)	133.6	21.	134.6	22.
pS1[28]	z50 for TCF retention (2005-2009)	137.6	0.28	137.7	0.27
pS1[29]	z50 for TCF retention (2013+)	125.0	0.77	124.4	0.81
pS1[3]	size at 1 for NMFS survey selectivity (females, pre-1982)	129.9	NA	129.9	NA
pS1[4]	size at 1 for NMFS survey selectivity (females, 1982+)	129.9	NA	129.9	NA
pS1[5]	z50 for TCF retention (pre-1991)	139.0	0.69	139.6	0.58
pS1[6]	z50 for TCF retention (1991-1996)	138.4	1.5	139.1	0.73
pS1[7]	DUMMY VALUE	4.500	NA	4.500	NA
pS1[8]	ln(z50) for TCF selectivity (males)	4.833	0.0056	4.829	0.0053
pS1[9]	z50 for TCF selectivity (females)	93.01	2.1	92.85	2.0

Table 42. TCSAM02 models final values for the “pS2” parameters related to selectivity functions. Parameters with values whose standard error is NA are fixed, not estimated.

name	label	‘22.03d5 (2025)’		‘22.03d5 (2026)’	
		est.	sd.	est.	sd.
pS2[1]	width for NMFS survey selectivity (males, pre-1982)	64.48	2.3	65.98	2.5
pS2[10]	ascending width for SCF selectivity (males, pre-1997)	31.63	1.5	34.17	1.8
pS2[11]	ascending width for SCF selectivity (males, 1997-2004)	15.85	3.3	15.55	3.1
pS2[12]	ascending width for SCF selectivity (males, 2005+)	14.28	0.67	14.00	0.65
pS2[13]	slope for SCF selectivity (females, pre-1997)	0.1357	0.063	0.1545	0.064
pS2[14]	slope for SCF selectivity (females, 1997-2004)	0.3117	0.22	0.3257	0.27
pS2[15]	slope for SCF selectivity (females, 2005+)	0.1039	0.025	0.1169	0.032
pS2[16]	slope for GF.AllGear selectivity (males, pre-1987)	0.08518	0.0093	0.08697	0.0097
pS2[17]	slope for GF.AllGear selectivity (males, 1987-1996)	0.02504	0.0050	0.02247	0.0013
pS2[18]	slope for GF.AllGear selectivity (males, 1997+)	0.06175	0.0023	0.06050	0.0022
pS2[19]	slope for GF.AllGear selectivity (females, pre-1987)	0.1236	0.018	0.1182	0.017
pS2[2]	width for NMFS survey selectivity (males, 1982+)	81.18	2.1	83.43	2.3
pS2[20]	slope for GF.AllGear selectivity (females, 1987-1996)	0.02443	0.0073	0.02192	0.0050
pS2[21]	slope for GF.AllGear selectivity (females, 1997+)	0.06784	0.0039	0.06738	0.0038
pS2[22]	width for RKF selectivity (males, pre-1997)	19.75	0.78	19.67	0.78
pS2[23]	width for RKF selectivity (males, 1997-2004)	27.57	2.0	27.68	2.0
pS2[24]	width for RKF selectivity (males, 2005+)	27.17	0.93	27.12	0.90
pS2[25]	width for RKF selectivity (females, pre-1997)	17.76	2.2	17.77	2.2
pS2[26]	width for RKF selectivity (females, 1997-2004)	17.33	13.	17.33	13.
pS2[27]	width for RKF selectivity (females, 2005+)	17.39	7.4	17.75	7.5
pS2[28]	slope for TCF retention (2005-2009)	1.990	NA	1.990	NA
pS2[29]	slope for TCF retention (2013+)	0.3186	0.059	0.2711	0.042
pS2[3]	width for NMFS survey selectivity (females, pre-1982)	40.03	2.0	39.85	2.0
pS2[4]	width for NMFS survey selectivity (females, 1982+)	68.02	3.8	70.19	4.1
pS2[5]	slope for TCF retention (pre-1991)	0.7305	0.20	0.6513	0.12
pS2[6]	slope for TCF retention (1991-1996)	1.067	1.0	0.8033	0.24
pS2[7]	slope for TCF selectivity (males, pre-1997)	0.1238	0.0066	0.1240	0.0063
pS2[8]	slope for TCF selectivity (males, 1997+)	0.1757	0.0069	0.1784	0.0068
pS2[9]	slope for TCF selectivity (females)	0.2014	0.024	0.2025	0.024

Table 43. TCSAM02 models final values for the “pS3” and “pS4” parameters related to selectivity functions. Parameters with values whose standard error is NA are fixed, not estimated.

name	label	‘22.03d5 (2025)’		‘22.03d5 (2026)’	
		est.	sd.	est.	sd.
pS3[1]	scaled increment for descending z-at-1 for SCF selectivity (males, pre-1997)	0.001000	NA	0.001000	NA
pS3[2]	scaled increment for descending z-at-1 for SCF selectivity (males, 1997-2004)	0.001000	NA	0.001000	NA
pS3[3]	scaled increment for descending z-at-1 for SCF selectivity (males, 2005+)	0.001000	NA	0.001000	NA
pS4[1]	descending width for SCF selectivity (males, pre-1997)	1.100	NA	1.100	NA
pS4[2]	descending width for SCF selectivity (males, 1997-2004)	19.42	9.0	19.84	8.8
pS4[3]	descending width for SCF selectivity (males, 2005+)	13.39	1.3	13.72	1.3

Table 44. TCSAM02 models final values for the devs parameters related to selectivity in the directed fishery. Parameters with values whose standard error is NA are fixed, not estimated.

index	‘22.03d5 (2025)’		‘22.03d5 (2026)’	
	est.	sd.	est.	sd.
1	0.1175	0.014	0.1238	0.014
2	0.09448	0.014	0.1004	0.014
3	0.1311	0.013	0.1365	0.013
4	0.1311	0.018	0.1337	0.017
5	0.1054	0.021	0.1021	0.021
6	0.2086	0.021	0.2099	0.020
7	-0.02416	0.013	-0.02072	0.013
8	-0.007486	0.013	-0.002796	0.013
9	-0.07497	0.013	-0.07246	0.013
10	0.04251	0.011	0.04759	0.011
11	0.1584	0.011	0.1610	0.011
12	-0.003785	0.013	-0.0009641	0.013
13	-0.05401	0.011	-0.04739	0.011
14	-0.08958	0.013	-0.08340	0.013
15	-0.06070	0.015	-0.06209	0.015
16	-0.1047	0.014	-0.1051	0.014
17	-0.1553	0.015	-0.1421	0.015
18	-0.1388	0.013	-0.1350	0.013
19	-0.1238	0.012	-0.1162	0.012
20	-0.07256	0.012	-0.06742	0.012
21	-0.07935	0.013	-0.07425	0.012
22	—	—	-0.08519	0.011

Table 45. Objective function data component values for TCSAM02 models 22.03d5 (2025), 22.03d5 (2026). Table 1 of 3. Abbreviations: n.at.z: size composition data; M: males only; F: females only; NMFS: NMFS EBS shelf survey; SBS BSFRF: BSFRF side-by-side catchability study survey; TCF: directed Tanner crab fishery; SCF: snow crab fishery; RKF: BBRKC fishery; GF All: combined groundfish fisheries. Components not included in the objective function are indicated by “–”.

category	fleet	catch type	data type	sex	‘22.03d5 (2025)’	‘22.03d5 (2026)’	
surveys data	NMFS M	abundance		female	–	–	
				male	–	–	
		biomass		female	–	–	
				male	99.36	110.13	
		n.at.z		male	438.72	436.24	
		NMFS F	abundance		female	–	–
	male				–	–	
	biomass			female	175.61	185.97	
				male	–	–	
	n.at.z			female	322.95	328.76	
	SBS BSFRF		index catch	abundance		female	–
		male				–	–
biomass				female	–	–	
				male	-2.84	-2.36	
n.at.z			male	284.20	283.25		
SBS BSFRF F		abundance		female	–	–	
				male	–	–	
		biomass		female	1.70	2.17	
	male			–	–		

Table 46. Objective function data component values for TCSAM02 models 22.03d5 (2025), 22.03d5 (2026). Table 2 of 3. Abbreviations: n.at.z: size composition data; M: males only; F: females only; NMFS: NMFS EBS shelf survey; SBS BSFRF: BSFRF side-by-side catchability study survey; TCF: directed Tanner crab fishery; SCF: snow crab fishery; RKF: BBRKC fishery; GF All: combined groundfish fisheries. Components not included in the objective function are indicated by “–”.

category	fleet	catch type	data type	sex	‘22.03d5 (2025)’	‘22.03d5 (2026)’
surveys data	SBS BSFRF F	index catch	n.at.z	female	169.98	172.17
			abundance	female	–	–
				male	–	–
		retained catch	biomass	female	–	–
				male	-156.26	-160.45
	TCF		n.at.z	male	68.12	89.47
			abundance	all sexes	–	–
			biomass	all sexes	2.22	-0.91
				female	96.30	104.36
			n.at.z	male	96.79	97.37
fisheries data			abundance	all sexes	–	–
			biomass	all sexes	-53.67	-55.26
	SCF			female	52.45	50.02
		total catch	n.at.z	male	81.54	82.03
			abundance	all sexes	-71.10	-72.52
			biomass	all sexes	-72.38	-73.78
	GF All			female	241.54	241.95
			n.at.z	male	325.59	332.22
	RKF		abundance	all sexes	–	–

Table 47. Objective function data component values for TCSAM02 models 22.03d5 (2025), 22.03d5 (2026). Table 3 of 3. Abbreviations: n.at.z: size composition data; M: males only; F: females only; NMFS: NMFS EBS shelf survey; SBS BSFRF: BSFRF side-by-side catchability study survey; TCF: directed Tanner crab fishery; SCF: snow crab fishery; RKF: BBRKC fishery; GF All: combined groundfish fisheries. Components not included in the objective function are indicated by “–”.

category	fleet	catch type	data type	sex	‘22.03d5 (2025)’	‘22.03d5 (2026)’
fisheries data	RKF	total catch	biomass	all sexes	-36.47	-36.31
			n.at.z	female	6.07	6.09
				male	32.76	38.89
growth data			EBS molt	female	240.53	232.85
			increment data	male	270.52	253.70
maturity ogive data	NMFS M		EBS mature male ratios	male	428.91	1027.30

Table 48. Objective function non-data component values for TCSAM02 models 22.03d5 (2025), 22.03d5 (2026). Table 1 of 1. Abbreviations: devsSumSq: sum of squared annual deviations (“devs”); pDevsLnC: fishery capture probability devs; pDevsLnR: recruitment devs; pDevsM: natural mortality devs; pDevsS1: selectivity deviations; pDM1: natural mortality multiplier; pQ: survey catchability. Components not included in the objective function are indicated by “–”.

category	type	element	‘22.03d5 (2025)’	‘22.03d5 (2026)’
penalties	devsSumSq	pDevsLnC	0.000	0.000
		pDevsLnR	0.000	0.000
		pDevsS1	0.000	0.000
	maturity	smoothness	1.789	0.999
priors	natural mortality	pDM1	54.463	50.961
	recruitment	pDevsLnR	117.663	117.307
	surveys	pQ	94.905	101.878

Table 49. Differences between objective function data component values for 22.03d5 (2026) relative to 22.03d5 (2025). Negative values indicate better fits. Table 1 of 3. Abbreviations: n.at.z: size composition data; M: males only; F: females only; NMFS: NMFS EBS shelf survey; SBS BSFRF: BSFRF side-by-side catchability study survey; TCF: directed Tanner crab fishery; SCF: snow crab fishery; RKF: BBRKC fishery; GF All: combined groundfish fisheries.

category	fleet	catch type	data type	sex	‘22.03d5 (2025)’	‘22.03d5 (2026)’	
surveys data	NMFS M	abundance		female	0.000	0.000	
				male	0.000	0.000	
		biomass		female	0.000	0.000	
				male	99.360	10.767	
		n.at.z	male	438.720	-2.476		
		NMFS F	abundance		female	0.000	0.000
	male				0.000	0.000	
	biomass			female	175.611	10.356	
				male	0.000	0.000	
	n.at.z		female	322.952	5.808		
	SBS BSFRF		M	index catch		female	0.000
		abundance				male	0.000
biomass				female	0.000	0.000	
				male	-2.841	0.486	
n.at.z		male		284.195	-0.947		
F		abundance		female	0.000	0.000	
				male	0.000	0.000	
		biomass		female	1.702	0.463	
				male	0.000	0.000	

Table 50. Differences between objective function data component values for 22.03d5 (2026) relative to 22.03d5 (2025). Negative values indicate better fits. Table 2 of 3. Abbreviations: n.at.z: size composition data; M: males only; F: females only; NMFS: NMFS EBS shelf survey; SBS BSFRF: BSFRF side-by-side catchability study survey; TCF: directed Tanner crab fishery; SCF: snow crab fishery; RKF: BBRKC fishery; GF All: combined groundfish fisheries.

category	fleet	catch type	data type	sex	‘22.03d5 (2025)’	‘22.03d5 (2026)’
surveys data	SBS BSFRF F	index catch	n.at.z	female	169.982	2.186
			abundance	female	0.000	0.000
				male	0.000	0.000
		retained catch	biomass	female	0.000	0.000
				male	-156.261	-4.193
	TCF		n.at.z	male	68.118	21.357
			abundance	all sexes	0.000	0.000
			biomass	all sexes	2.223	-3.130
				female	96.300	8.065
			n.at.z	male	96.794	0.577
fisheries data			abundance	all sexes	0.000	0.000
			biomass	all sexes	-53.666	-1.598
	SCF			female	52.447	-2.430
		total catch	n.at.z	male	81.541	0.487
			abundance	all sexes	-71.102	-1.422
			biomass	all sexes	-72.379	-1.398
	GF All			female	241.545	0.401
			n.at.z	male	325.587	6.632
	RKF		abundance	all sexes	0.000	0.000

Table 51. Differences between objective function data component values for 22.03d5 (2026) relative to 22.03d5 (2025). Negative values indicate better fits. Table 3 of 3. Abbreviations: n.at.z: size composition data; M: males only; F: females only; NMFS: NMFS EBS shelf survey; SBS BSFRF: BSFRF side-by-side catchability study survey; TCF: directed Tanner crab fishery; SCF: snow crab fishery; RKF: BBRKC fishery; GF All: combined groundfish fisheries.

category	fleet	catch type	data type	sex	‘22.03d5 (2025)’	‘22.03d5 (2026)’
fisheries data	RKF	total catch	biomass	all sexes	-36.468	0.157
			n.at.z	female	6.068	0.025
				male	32.760	6.128
growth data			EBS molt	female	240.528	-7.679
			increment data	male	270.523	-16.819
maturity ogive data	NMFS M		EBS mature male ratios	male	428.912	598.386

Table 52. Differences between objective function non-data component values for 22.03d5 (2026) relative to 22.03d5 (2025). Negative values indicate better fits. Table 1 of 1. Abbreviations: devsSumSq: sum of squared annual deviations (“devs”); pDevsLnC: fishery capture probability devs; pDevsLnR: recruitment devs; pDevsM: natural mortality devs; pDevsS1: selectivity deviations; pDM1: natural mortality multiplier; pQ: survey catchability.

category	type	element	‘22.03d5 (2025)’	‘22.03d5 (2026)’
		pDevsLnC	0.000	0.000
penalties	devsSumSq	pDevsLnR	0.000	0.000
		pDevsS1	0.000	0.000
	maturity	smoothness	1.789	-0.790
	natural mortality	pDM1	54.463	-3.502
priors	recruitment	pDevsLnR	117.663	-0.356
	surveys	pQ	94.905	6.974

Table 53. Negative log-likelihood contributions to the objective function by data type.

type	'22.03d5 (GMACS)'	'26.02 (GMACS)'	'22.03d5 (2026)'	diff(case-'22.03d5 (2026)')	
				'22.03d5 (GMACS)'	'26.02 (GMACS)'
catch data	-187.94	-190.22	-178.67	-9.27	-11.55
index biomass data	310.31	275.62	295.90	14.40	-20.28
size comp. data	2,222.94	2,256.32	2,262.82	-39.88	-6.50
growth data	498.66	501.20	486.55	12.11	14.65
MMO data	1,032.79	1,533.74	1,027.30	5.49	506.44

Table 54. GMACS negative log-likelihood values for general penalties and priors on parameters. All penalties were set to 0. M: immature crab: (normal) prior on estimated M for immature crab, M: mature females: (normal) prior on estimated M for mature females, M: mature males: (normal) prior on estimated M for mature males, NMFS survey q: (normal) priors on estimated sex-specific catchability coefficients (i.e., q) for the NMFS survey. See text for details on comparison with TCSAM02 values.

parameter	‘22.03d5 (GMACS)’	‘26.02 (GMACS)’
M: immature crab	1.156355	0.7072514
M: mature female	21.670650	30.1188669
M: mature males	15.502720	48.3315796
NMFS survey q, females 1982+	77.930743	84.7878187
NMFS survey q, males 1982+	34.328695	36.4647551

Table 55. TCSAM02 negative log-likelihood values for general penalties and priors on parameters. Smoothness: penalties on second differences and decreasing values in the size dependence of estimated male terminal molt parameters. Recruitment/pDevsLnR: sum of (normal) priors on individual recruitment deviation parameters. Natural mortality/pDM1: (normal) priors on estimated multipliers to base M for immature crab (level 1), mature males (level 2), and mature females (level 3). Surveys/pQ: (normal) priors on estimated survey catchability coefficients (i.e., q) for males (level 1) and females (level 2) in the NMFS survey. See text for details on comparison with GMACS values.

category	type	element	level	NLL
penalties	maturity	smoothness	1	0.4388140
penalties	maturity	smoothness	2	0.5602695
priors	recruitment	pDevsLnR	1	47.1590495
priors	recruitment	pDevsLnR	2	70.1480065
priors	natural mortality	pDM1	1	0.0520794
priors	natural mortality	pDM1	2	26.7562294
priors	natural mortality	pDM1	3	24.1525705
priors	surveys	pQ	2	28.6605641
priors	surveys	pQ	4	73.2177038

Table 56. Main parameters from the 22.03d5 (GMACS) and 26.02 (GMACS) models.

Description	‘22.03d5 (GMACS)’					‘26.02 (GMACS)’				
	Estimate	SE	Phase	LB	UB	Estimate	SE	Phase	LB	UB
Log(Rbar)	6.998e+00	1.552e-01	1.000e+00	0.000e+00	1.200e+01	6.870e+00	1.544e-01	1.000e+00	0.000e+00	1.200e+01
Recruitment ra-males	3.769e+01	4.178e+00	5.000e+00	1.000e+01	4.250e+01	2.651e+01	4.999e+00	5.000e+00	1.000e+01	4.250e+01
Recruitment rb-males	4.163e+00	3.562e-01	5.000e+00	1.000e-01	1.000e+01	3.198e+00	4.583e-01	5.000e+00	1.000e-01	1.000e+01
log(SigmaR)	-7.561e-01	NA	-4.000e+00	NA	NA	-7.561e-01	NA	-4.000e+00	NA	NA
Steepness	7.500e-01	NA	-2.000e+00	NA	NA	7.500e-01	NA	-2.000e+00	NA	NA
Rho	1.000e-02	NA	-3.000e+00	NA	NA	1.000e-02	NA	-3.000e+00	NA	NA
Log(Rbar) block group 10 block 1	5.522e+00	9.083e-02	1.000e+00	0.000e+00	2.000e+01	5.443e+00	9.068e-02	1.000e+00	0.000e+00	2.000e+01
Alpha0 base male	2.500e+01	NA	-1.000e+00	NA	NA	2.500e+01	NA	-1.000e+00	NA	NA
Alpha male	3.314e+01	2.067e-01	4.000e+00	2.500e+01	4.000e+01	3.298e+01	2.001e-01	4.000e+00	2.500e+01	4.000e+01
Beta0 base male	1.250e+02	NA	-1.000e+00	NA	NA	1.250e+02	NA	-1.000e+00	NA	NA
Beta male	1.596e+02	4.397e-01	4.000e+00	1.300e+02	1.800e+02	1.604e+02	4.439e-01	4.000e+00	1.300e+02	1.800e+02
Gscale male (ln-scale)	7.107e-01	NA	-5.000e+00	NA	NA	7.107e-01	NA	-5.000e+00	NA	NA
Alpha0 base female	2.500e+01	NA	-1.000e+00	NA	NA	2.500e+01	NA	-1.000e+00	NA	NA
Alpha female	3.338e+01	2.380e-01	4.000e+00	2.500e+01	4.000e+01	3.323e+01	2.395e-01	4.000e+00	2.500e+01	4.000e+01
Beta0 base female	1.000e+02	NA	-1.000e+00	NA	NA	1.000e+02	NA	-1.000e+00	NA	NA
Beta female	1.158e+02	4.129e-01	4.000e+00	1.100e+02	1.500e+02	1.164e+02	4.382e-01	4.000e+00	1.100e+02	1.500e+02
Gscale female (ln-scale)	7.107e-01	NA	-5.000e+00	NA	NA	7.107e-01	NA	-5.000e+00	NA	NA
M base male mature	3.010e-01	7.810e-03	4.000e+00	1.000e-01	1.500e+00	3.471e-01	8.282e-03	4.000e+00	1.000e-01	1.500e+00
M male mature block group 1 block 1	6.110e-01	7.514e-02	4.000e+00	1.000e-01	1.500e+00	8.515e-01	1.058e-01	4.000e+00	1.000e-01	1.500e+00
M base male immature	2.653e-01	9.327e-03	4.000e+00	1.000e-01	1.500e+00	1.965e-01	9.347e-03	4.000e+00	1.000e-01	1.500e+00
M base female mature	3.117e-01	7.940e-03	4.000e+00	1.000e-01	1.500e+00	3.244e-01	8.128e-03	4.000e+00	1.000e-01	1.500e+00
M female mature block group 1 block 1	6.494e-01	4.746e-02	4.000e+00	1.000e-01	1.500e+00	6.196e-01	4.271e-02	4.000e+00	1.000e-01	1.500e+00
Log fbar TCF	-2.044e+00	7.068e-02	2.000e+00	-1.000e+03	1.000e+03	-2.037e+00	7.121e-02	2.000e+00	-1.000e+03	1.000e+03
Log fbar SCF	-3.956e+00	7.742e-02	2.000e+00	-1.000e+03	1.000e+03	-3.911e+00	7.851e-02	2.000e+00	-1.000e+03	1.000e+03
Log fbar RKF	-5.182e+00	1.048e-01	2.000e+00	-1.000e+03	1.000e+03	-5.197e+00	1.040e-01	2.000e+00	-1.000e+03	1.000e+03
Log fbar GF All	-5.141e+00	6.186e-02	4.000e+00	-1.000e+03	1.000e+03	-5.058e+00	6.699e-02	4.000e+00	-1.000e+03	1.000e+03
Log foff TCF	-2.756e+00	1.803e-01	4.000e+00	-1.000e+03	1.000e+03	-3.103e+00	1.725e-01	4.000e+00	-1.000e+03	1.000e+03
Log foff SCF	-2.754e+00	2.928e-01	4.000e+00	-1.000e+03	1.000e+03	-3.138e+00	2.457e-01	4.000e+00	-1.000e+03	1.000e+03
Log foff RKF	-2.443e+00	6.026e-01	4.000e+00	-1.000e+03	1.000e+03	-3.240e+00	6.175e-01	4.000e+00	-1.000e+03	1.000e+03
Log foff GF All	-1.219e+00	9.818e-02	4.000e+00	-1.000e+03	1.000e+03	-1.466e+00	1.084e-01	4.000e+00	-1.000e+03	1.000e+03
Log vn size comp 13	1.068e+01	NA	-4.000e+00	NA	NA	1.068e+01	NA	-4.000e+00	NA	NA
Log vn size comp 14	1.099e+01	NA	-4.000e+00	NA	NA	1.099e+01	NA	-4.000e+00	NA	NA
Log vn size comp 15	1.099e+01	NA	-4.000e+00	NA	NA	1.099e+01	NA	-4.000e+00	NA	NA
Survey q survey 1	5.198e-01	4.641e-02	3.000e+00	1.000e-02	1.100e+00	5.289e-01	4.732e-02	3.000e+00	1.000e-02	1.100e+00
Survey q survey 2	4.534e-01	2.186e-02	3.000e+00	1.000e-02	1.100e+00	4.410e-01	2.119e-02	3.000e+00	1.000e-02	1.100e+00
Survey q survey 3	2.881e-01	3.564e-02	3.000e+00	1.000e-02	1.100e+00	3.588e-01	4.554e-02	3.000e+00	1.000e-02	1.100e+00
Survey q survey 4	2.475e-01	1.630e-02	3.000e+00	1.000e-02	1.100e+00	2.210e-01	1.453e-02	3.000e+00	1.000e-02	1.100e+00

Survey q survey 5		1.000e+00	NA	-5.000e+00	NA	NA	1.000e+00	NA	-5.000e+00	NA	NA
-------------------	--	-----------	----	------------	----	----	-----------	----	------------	----	----

Table 57. Selectivity and retention parameters from the 22.03d5 (GMACS) and 26.02 (GMACS) models.

Description	‘22.03d5 (GMACS)’					‘26.02 (GMACS)’				
	Estimate	SE	Phase	LB	UB	Estimate	SE	Phase	LB	UB
Sel TCF male base Logistic mean	4.409e+00	6.410e-02	4.000e+00	1.609e+00	5.193e+00	4.311e+00	7.362e-02	4.000e+00	1.609e+00	5.193e+00
Sel TCF male base Logistic cv	2.089e+00	5.252e-02	4.000e+00	0.000e+00	4.605e+00	2.057e+00	5.392e-02	4.000e+00	0.000e+00	4.605e+00
Sel TCF male Logistic cv block group 9 block 1	1.739e+00	NA	-4.000e+00	NA	NA	1.739e+00	NA	-4.000e+00	NA	NA
Sel SCF male base Double normala par 1	3.361e+00	1.129e-01	4.000e+00	0.000e+00	4.605e+00	3.338e+00	1.112e-01	4.000e+00	0.000e+00	4.605e+00
Sel SCF male base Double normala par 2	5.007e+00	5.626e-02	4.000e+00	1.609e+00	5.193e+00	5.000e+00	5.518e-02	4.000e+00	1.609e+00	5.193e+00
Sel SCF male base Double normala par 3	2.857e+00	1.433e+00	4.000e+00	0.000e+00	4.605e+00	2.582e+00	1.299e+00	4.000e+00	0.000e+00	4.605e+00
Sel SCF male base Double normala par 4	-4.600e+00	NA	-4.000e+00	NA	NA	-4.600e+00	NA	-4.000e+00	NA	NA
Sel SCF male base Double normala par 5	1.820e+02	NA	-1.000e+00	NA	NA	1.820e+02	NA	-1.000e+00	NA	NA
Sel SCF male Double normala par 1 block group 6 block 1	2.716e+00	2.116e-01	4.000e+00	0.000e+00	4.605e+00	2.734e+00	1.965e-01	4.000e+00	0.000e+00	4.605e+00
Sel SCF male Double normala par 1 block group 6 block 2	2.639e+00	4.663e-02	4.000e+00	0.000e+00	4.605e+00	2.634e+00	4.532e-02	4.000e+00	0.000e+00	4.605e+00
Sel SCF male Double normala par 2 block group 6 block 1	4.769e+00	5.222e-02	4.000e+00	1.609e+00	5.193e+00	4.779e+00	4.954e-02	4.000e+00	1.609e+00	5.193e+00
Sel SCF male Double normala par 2 block group 6 block 2	4.821e+00	9.576e-03	4.000e+00	1.609e+00	5.193e+00	4.823e+00	9.331e-03	4.000e+00	1.609e+00	5.193e+00
Sel SCF male Double normala par 3 block group 6 block 1	3.021e+00	4.267e-01	4.000e+00	0.000e+00	4.605e+00	2.916e+00	4.047e-01	4.000e+00	0.000e+00	4.605e+00
Sel SCF male Double normala par 3 block group 6 block 2	2.601e+00	9.448e-02	4.000e+00	0.000e+00	4.605e+00	2.573e+00	9.273e-02	4.000e+00	0.000e+00	4.605e+00
Sel SCF male Double normala par 4 block group 6 block 1	-4.600e+00	NA	-4.000e+00	NA	NA	-4.600e+00	NA	-4.000e+00	NA	NA
Sel SCF male Double normala par 4 block group 6 block 2	-4.600e+00	NA	-4.000e+00	NA	NA	-4.600e+00	NA	-4.000e+00	NA	NA
Sel RKF male base Ascending normal par 1 asc width	3.000e+00	4.024e-02	4.000e+00	0.000e+00	4.605e+00	3.015e+00	4.057e-02	4.000e+00	0.000e+00	4.605e+00
Sel RKF male base Ascending normal par 2 size-at-1	5.192e+00	NA	-4.000e+00	NA	NA	5.192e+00	NA	-4.000e+00	NA	NA
Sel RKF male Ascending normal par 1 asc width block group 7 block 1	3.335e+00	7.396e-02	4.000e+00	0.000e+00	4.605e+00	3.341e+00	7.332e-02	4.000e+00	0.000e+00	4.605e+00
Sel RKF male Ascending normal par 1 asc width block group 7 block 2	3.311e+00	3.319e-02	4.000e+00	0.000e+00	4.605e+00	3.317e+00	3.292e-02	4.000e+00	0.000e+00	4.605e+00
Sel RKF male Ascending normal par 2 size-at-1 block group 7 block 1	5.192e+00	NA	-4.000e+00	NA	NA	5.192e+00	NA	-4.000e+00	NA	NA
Sel RKF male Ascending normal par 2 size-at-1 block group 7 block 2	5.192e+00	NA	-4.000e+00	NA	NA	5.192e+00	NA	-4.000e+00	NA	NA
Sel GF All male base Logistic mean	4.266e+00	5.487e-02	4.000e+00	1.609e+00	5.193e+00	4.411e+00	6.588e-02	4.000e+00	1.609e+00	5.193e+00
Sel GF All male base Logistic cv	2.669e+00	9.855e-02	4.000e+00	0.000e+00	4.605e+00	2.862e+00	9.547e-02	4.000e+00	0.000e+00	4.605e+00
Sel GF All male Logistic mean block group 8 block 1	4.416e+00	9.015e-02	4.000e+00	1.609e+00	5.193e+00	4.542e+00	1.002e-01	4.000e+00	1.609e+00	5.193e+00
Sel GF All male Logistic mean block group 8 block 2	4.593e+00	2.183e-02	4.000e+00	1.609e+00	5.193e+00	4.603e+00	2.105e-02	4.000e+00	1.609e+00	5.193e+00
Sel GF All male Logistic cv block group 8 block 1	3.258e+00	1.308e-01	4.000e+00	0.000e+00	4.605e+00	3.380e+00	1.266e-01	4.000e+00	0.000e+00	4.605e+00
Sel GF All male Logistic cv block group 8 block 2	2.807e+00	3.696e-02	4.000e+00	0.000e+00	4.605e+00	2.813e+00	3.556e-02	4.000e+00	0.000e+00	4.605e+00
Sel NMFS male base Ascending normal par 1 asc width	4.100e+00	3.231e-02	4.000e+00	0.000e+00	4.605e+00	4.052e+00	3.095e-02	4.000e+00	0.000e+00	4.605e+00
Sel NMFS male base Ascending normal par 2 size-at-1	5.187e+00	NA	-4.000e+00	NA	NA	5.187e+00	NA	-4.000e+00	NA	NA
Sel NMFS male Ascending normal par 1 asc width block group 2 block 1	4.433e+00	2.699e-02	4.000e+00	0.000e+00	4.605e+00	4.465e+00	2.830e-02	4.000e+00	0.000e+00	4.605e+00
Sel NMFS male Ascending normal par 2 size-at-1 block group 2 block 1	5.187e+00	NA	-4.000e+00	NA	NA	5.187e+00	NA	-4.000e+00	NA	NA
Sel TCF female base Logistic mean	4.525e+00	2.095e-02	4.000e+00	1.609e+00	5.193e+00	4.501e+00	2.161e-02	4.000e+00	1.609e+00	5.193e+00
Sel TCF female base Logistic cv	1.593e+00	1.159e-01	4.000e+00	0.000e+00	4.605e+00	1.611e+00	1.286e-01	4.000e+00	0.000e+00	4.605e+00
Sel SCF female base Logistic mean	4.358e+00	5.803e-02	4.000e+00	1.609e+00	5.193e+00	4.290e+00	5.033e-02	4.000e+00	1.609e+00	5.193e+00
Sel SCF female base Logistic cv	1.818e+00	4.115e-01	4.000e+00	0.000e+00	4.605e+00	1.594e+00	4.765e-01	4.000e+00	0.000e+00	4.605e+00
Sel SCF female Logistic mean block group 6 block 1	4.296e+00	6.039e-02	4.000e+00	1.609e+00	5.193e+00	4.264e+00	6.047e-02	4.000e+00	1.609e+00	5.193e+00

Sel SCF female Logistic mean block group 6 block 2	4.587e+00	7.629e-02	4.000e+00	1.609e+00	5.193e+00	4.554e+00	7.052e-02	4.000e+00	1.609e+00
Sel SCF female Logistic cv block group 6 block 1	1.185e+00	7.560e-01	4.000e+00	0.000e+00	4.605e+00	9.452e-01	1.192e+00	4.000e+00	0.000e+00
Sel SCF female Logistic cv block group 6 block 2	2.236e+00	2.488e-01	4.000e+00	0.000e+00	4.605e+00	2.222e+00	2.611e-01	4.000e+00	0.000e+00
Sel RKF female base Ascending normal par 1 asc width	2.896e+00	1.025e-01	4.000e+00	0.000e+00	3.912e+00	2.971e+00	1.265e-01	4.000e+00	0.000e+00
Sel RKF female base Ascending normal par 2 size-at-1	4.941e+00	NA	-4.000e+00	NA	NA	4.941e+00	NA	-4.000e+00	NA
Sel RKF female Ascending normal par 1 asc width block group 7 block 1	2.857e+00	1.960e-01	4.000e+00	0.000e+00	4.605e+00	2.969e+00	2.289e-01	4.000e+00	0.000e+00
Sel RKF female Ascending normal par 1 asc width block group 7 block 2	2.874e+00	1.324e-01	4.000e+00	0.000e+00	4.605e+00	2.992e+00	1.514e-01	4.000e+00	0.000e+00
Sel RKF female Ascending normal par 2 size-at-1 block group 7 block 1	4.873e+00	NA	-4.000e+00	NA	NA	4.873e+00	NA	-4.000e+00	NA
Sel RKF female Ascending normal par 2 size-at-1 block group 7 block 2	4.895e+00	NA	-4.000e+00	NA	NA	4.895e+00	NA	-4.000e+00	NA
Sel GF All female base Logistic mean	3.831e+00	4.335e-02	4.000e+00	1.609e+00	5.193e+00	3.890e+00	7.289e-02	4.000e+00	1.609e+00
Sel GF All female base Logistic cv	2.088e+00	1.394e-01	4.000e+00	0.000e+00	4.605e+00	2.342e+00	1.923e-01	4.000e+00	0.000e+00
Sel GF All female Logistic mean block group 8 block 1	3.704e+00	5.319e-02	4.000e+00	1.609e+00	5.193e+00	3.662e+00	4.815e-02	4.000e+00	1.609e+00
Sel GF All female Logistic mean block group 8 block 2	4.388e+00	3.399e-02	4.000e+00	1.609e+00	5.193e+00	4.333e+00	4.093e-02	4.000e+00	1.609e+00
Sel GF All female Logistic cv block group 8 block 1	1.787e+00	3.103e-01	4.000e+00	0.000e+00	4.605e+00	1.617e+00	3.147e-01	4.000e+00	0.000e+00
Sel GF All female Logistic cv block group 8 block 2	2.575e+00	6.285e-02	4.000e+00	0.000e+00	4.605e+00	2.543e+00	7.594e-02	4.000e+00	0.000e+00
Sel NMFS female base Ascending normal par 1 asc width	3.686e+00	4.771e-02	4.000e+00	0.000e+00	4.605e+00	3.589e+00	4.145e-02	4.000e+00	0.000e+00
Sel NMFS female base Ascending normal par 2 size-at-1	4.867e+00	NA	-4.000e+00	NA	NA	4.867e+00	NA	-4.000e+00	NA
Sel NMFS female Ascending normal par 1 asc width block group 2 block 1	4.272e+00	5.592e-02	4.000e+00	0.000e+00	4.605e+00	4.409e+00	7.370e-02	4.000e+00	0.000e+00
Sel NMFS female Ascending normal par 2 size-at-1 block group 2 block 1	4.867e+00	NA	-4.000e+00	NA	NA	4.867e+00	NA	-4.000e+00	NA
Ret TCF male base Logistic mean	4.939e+00	4.001e-03	4.000e+00	1.609e+00	5.193e+00	4.938e+00	4.149e-03	4.000e+00	1.609e+00
Ret TCF male base Logistic cv	4.068e-01	1.682e-01	4.000e+00	-4.605e+00	2.996e+00	3.776e-01	1.851e-01	4.000e+00	-4.605e+00
Ret TCF male Logistic mean block group 4 block 1	4.935e+00	5.188e-03	4.000e+00	1.609e+00	5.193e+00	4.936e+00	4.727e-03	4.000e+00	1.609e+00
Ret TCF male Logistic mean block group 4 block 2	4.921e+00	3.972e-04	4.000e+00	1.609e+00	5.193e+00	4.921e+00	3.974e-04	4.000e+00	1.609e+00
Ret TCF male Logistic mean block group 4 block 3	4.822e+00	6.467e-03	4.000e+00	1.609e+00	5.193e+00	4.822e+00	6.405e-03	4.000e+00	1.609e+00
Ret TCF male Logistic cv block group 4 block 1	2.244e-01	3.003e-01	4.000e+00	-4.605e+00	3.689e+00	2.795e-01	2.529e-01	4.000e+00	-4.605e+00
Ret TCF male Logistic cv block group 4 block 2	-2.303e+00	NA	-4.000e+00	NA	NA	-2.303e+00	NA	-4.000e+00	NA
Ret TCF male Logistic cv block group 4 block 3	1.291e+00	1.583e-01	4.000e+00	-4.605e+00	3.689e+00	1.287e+00	1.561e-01	4.000e+00	-4.605e+00
Selectivity selectivity male TCF par 1 dev for year 1991	5.226e-01	6.412e-02	8.000e+00	-1.200e+01	1.200e+01	6.031e-01	7.345e-02	8.000e+00	-1.200e+01
Selectivity selectivity male TCF par 1 dev for year 1992	5.104e-01	6.471e-02	8.000e+00	-1.200e+01	1.200e+01	5.935e-01	7.360e-02	8.000e+00	-1.200e+01
Selectivity selectivity male TCF par 1 dev for year 1993	5.466e-01	6.526e-02	8.000e+00	-1.200e+01	1.200e+01	6.267e-01	7.451e-02	8.000e+00	-1.200e+01
Selectivity selectivity male TCF par 1 dev for year 1994	5.443e-01	6.674e-02	8.000e+00	-1.200e+01	1.200e+01	6.271e-01	7.629e-02	8.000e+00	-1.200e+01
Selectivity selectivity male TCF par 1 dev for year 1995	5.184e-01	6.750e-02	8.000e+00	-1.200e+01	1.200e+01	6.002e-01	7.690e-02	8.000e+00	-1.200e+01
Selectivity selectivity male TCF par 1 dev for year 1996	6.187e-01	6.804e-02	8.000e+00	-1.200e+01	1.200e+01	7.076e-01	7.710e-02	8.000e+00	-1.200e+01
Selectivity selectivity male TCF par 1 dev for year 2005	3.977e-01	6.555e-02	8.000e+00	-1.200e+01	1.200e+01	4.962e-01	7.483e-02	8.000e+00	-1.200e+01
Selectivity selectivity male TCF par 1 dev for year 2006	4.144e-01	6.550e-02	8.000e+00	-1.200e+01	1.200e+01	5.142e-01	7.487e-02	8.000e+00	-1.200e+01
Selectivity selectivity male TCF par 1 dev for year 2007	3.467e-01	6.534e-02	8.000e+00	-1.200e+01	1.200e+01	4.448e-01	7.470e-02	8.000e+00	-1.200e+01
Selectivity selectivity male TCF par 1 dev for year 2008	4.664e-01	6.505e-02	8.000e+00	-1.200e+01	1.200e+01	5.573e-01	7.452e-02	8.000e+00	-1.200e+01
Selectivity selectivity male TCF par 1 dev for year 2009	5.806e-01	6.507e-02	8.000e+00	-1.200e+01	1.200e+01	6.675e-01	7.463e-02	8.000e+00	-1.200e+01
Selectivity selectivity male TCF par 1 dev for year 2013	4.175e-01	6.548e-02	8.000e+00	-1.200e+01	1.200e+01	5.082e-01	7.475e-02	8.000e+00	-1.200e+01
Selectivity selectivity male TCF par 1 dev for year 2014	3.693e-01	6.506e-02	8.000e+00	-1.200e+01	1.200e+01	4.670e-01	7.441e-02	8.000e+00	-1.200e+01
Selectivity selectivity male TCF par 1 dev for year 2015	3.332e-01	6.541e-02	8.000e+00	-1.200e+01	1.200e+01	4.369e-01	7.470e-02	8.000e+00	-1.200e+01
Selectivity selectivity male TCF par 1 dev for year 2017	3.578e-01	6.602e-02	8.000e+00	-1.200e+01	1.200e+01	4.591e-01	7.525e-02	8.000e+00	-1.200e+01

Selectivity selectivity male TCF par 1 dev for year 2018	3.136e-01	6.555e-02	8.000e+00	-1.200e+01	1.200e+01	4.161e-01	7.483e-02	8.000e+00	-1.200e+01
Selectivity selectivity male TCF par 1 dev for year 2020	2.760e-01	6.583e-02	8.000e+00	-1.200e+01	1.200e+01	3.812e-01	7.500e-02	8.000e+00	-1.200e+01
Selectivity selectivity male TCF par 1 dev for year 2021	2.819e-01	6.546e-02	8.000e+00	-1.200e+01	1.200e+01	3.897e-01	7.477e-02	8.000e+00	-1.200e+01
Selectivity selectivity male TCF par 1 dev for year 2022	2.990e-01	6.523e-02	8.000e+00	-1.200e+01	1.200e+01	4.038e-01	7.459e-02	8.000e+00	-1.200e+01
Selectivity selectivity male TCF par 1 dev for year 2023	3.498e-01	6.526e-02	8.000e+00	-1.200e+01	1.200e+01	4.531e-01	7.461e-02	8.000e+00	-1.200e+01
Selectivity selectivity male TCF par 1 dev for year 2024	3.444e-01	6.529e-02	8.000e+00	-1.200e+01	1.200e+01	4.403e-01	7.472e-02	8.000e+00	-1.200e+01
Selectivity selectivity male TCF par 1 dev for year 2025	3.339e-01	6.502e-02	8.000e+00	-1.200e+01	1.200e+01	4.389e-01	7.437e-02	8.000e+00	-1.200e+01

Table 58. Fishing mortality deviation parameters from the 22.03d5 (GMACS) and 26.02 (GMACS) models.

Description	‘22.03d5 (GMACS)’					‘26.02 (GMACS)’				
	Estimate	SE	Phase	LB	UB	Estimate	SE	Phase	LB	UB
Log fdev TCF year 1965 season 2	-2.070e+00	2.119e-01	2.000e+00	-1.000e+03	1.000e+03	-2.080e+00	2.189e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 1966 season 2	-1.822e+00	2.082e-01	2.000e+00	-1.000e+03	1.000e+03	-1.830e+00	2.148e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 1967 season 2	-5.060e-02	2.148e-01	2.000e+00	-1.000e+03	1.000e+03	-5.418e-02	2.210e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 1968 season 2	3.429e-01	2.325e-01	2.000e+00	-1.000e+03	1.000e+03	3.419e-01	2.379e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 1969 season 2	9.401e-01	2.709e-01	2.000e+00	-1.000e+03	1.000e+03	9.432e-01	2.749e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 1970 season 2	1.057e+00	3.237e-01	2.000e+00	-1.000e+03	1.000e+03	1.064e+00	3.254e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 1971 season 2	9.568e-01	3.596e-01	2.000e+00	-1.000e+03	1.000e+03	9.735e-01	3.597e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 1972 season 2	7.260e-01	3.420e-01	2.000e+00	-1.000e+03	1.000e+03	7.639e-01	3.478e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 1973 season 2	3.039e-01	2.529e-01	2.000e+00	-1.000e+03	1.000e+03	3.628e-01	2.680e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 1974 season 2	3.093e-01	1.806e-01	2.000e+00	-1.000e+03	1.000e+03	3.664e-01	1.928e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 1975 season 2	4.761e-01	1.465e-01	2.000e+00	-1.000e+03	1.000e+03	5.210e-01	1.511e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 1976 season 2	1.211e+00	1.383e-01	2.000e+00	-1.000e+03	1.000e+03	1.264e+00	1.422e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 1977 season 2	1.854e+00	1.366e-01	2.000e+00	-1.000e+03	1.000e+03	1.924e+00	1.390e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 1978 season 2	1.938e+00	1.449e-01	2.000e+00	-1.000e+03	1.000e+03	2.033e+00	1.477e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 1979 season 2	2.213e+00	1.344e-01	2.000e+00	-1.000e+03	1.000e+03	2.289e+00	1.376e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 1980 season 2	2.642e+00	1.640e-01	2.000e+00	-1.000e+03	1.000e+03	2.696e+00	1.611e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 1981 season 2	1.383e+00	1.596e-01	2.000e+00	-1.000e+03	1.000e+03	1.456e+00	1.690e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 1982 season 2	-8.961e-02	1.138e-01	2.000e+00	-1.000e+03	1.000e+03	5.999e-03	1.231e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 1983 season 2	-1.838e+00	9.396e-02	2.000e+00	-1.000e+03	1.000e+03	-1.768e+00	1.036e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 1984 season 2	-7.218e-01	1.028e-01	2.000e+00	-1.000e+03	1.000e+03	-5.765e-01	1.205e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 1987 season 2	-1.040e+00	7.769e-02	2.000e+00	-1.000e+03	1.000e+03	-1.050e+00	7.925e-02	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 1988 season 2	-4.442e-02	7.543e-02	2.000e+00	-1.000e+03	1.000e+03	-6.745e-02	7.664e-02	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 1989 season 2	1.087e+00	7.600e-02	2.000e+00	-1.000e+03	1.000e+03	1.058e+00	7.634e-02	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 1990 season 2	1.813e+00	8.089e-02	2.000e+00	-1.000e+03	1.000e+03	1.794e+00	8.019e-02	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 1991 season 2	2.269e+00	1.181e-01	2.000e+00	-1.000e+03	1.000e+03	2.199e+00	1.112e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 1992 season 2	2.752e+00	1.406e-01	2.000e+00	-1.000e+03	1.000e+03	2.660e+00	1.357e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 1993 season 2	2.198e+00	1.364e-01	2.000e+00	-1.000e+03	1.000e+03	2.027e+00	1.321e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 1994 season 2	1.312e+00	1.390e-01	2.000e+00	-1.000e+03	1.000e+03	1.146e+00	1.325e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 1995 season 2	6.531e-01	1.278e-01	2.000e+00	-1.000e+03	1.000e+03	4.928e-01	1.197e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 1996 season 2	4.340e-01	1.933e-01	2.000e+00	-1.000e+03	1.000e+03	2.612e-01	1.875e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 2005 season 2	-1.880e+00	7.835e-02	2.000e+00	-1.000e+03	1.000e+03	-1.884e+00	7.899e-02	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 2006 season 2	-1.246e+00	7.759e-02	2.000e+00	-1.000e+03	1.000e+03	-1.241e+00	7.865e-02	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 2007 season 2	-1.437e+00	7.788e-02	2.000e+00	-1.000e+03	1.000e+03	-1.445e+00	7.862e-02	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 2008 season 2	-1.585e+00	7.721e-02	2.000e+00	-1.000e+03	1.000e+03	-1.689e+00	7.769e-02	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 2009 season 2	-1.653e+00	1.032e-01	2.000e+00	-1.000e+03	1.000e+03	-1.970e+00	9.811e-02	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 2013 season 2	-1.497e+00	8.084e-02	2.000e+00	-1.000e+03	1.000e+03	-1.500e+00	7.885e-02	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 2014 season 2	-1.794e-01	7.566e-02	2.000e+00	-1.000e+03	1.000e+03	-1.925e-01	7.604e-02	2.000e+00	-1.000e+03	1.000e+03

Log fdev TCF year 2015 season 2	7.737e-02	7.474e-02	2.000e+00	-1.000e+03	1.000e+03	1.002e-01	7.558e-02	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 2017 season 2	-1.694e+00	7.462e-02	2.000e+00	-1.000e+03	1.000e+03	-1.689e+00	7.517e-02	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 2018 season 2	-1.548e+00	7.388e-02	2.000e+00	-1.000e+03	1.000e+03	-1.504e+00	7.444e-02	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 2020 season 2	-1.750e+00	7.529e-02	2.000e+00	-1.000e+03	1.000e+03	-1.634e+00	7.611e-02	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 2021 season 2	-2.053e+00	7.587e-02	2.000e+00	-1.000e+03	1.000e+03	-1.936e+00	7.746e-02	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 2022 season 2	-1.697e+00	7.723e-02	2.000e+00	-1.000e+03	1.000e+03	-1.658e+00	7.894e-02	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 2023 season 2	-1.865e+00	7.713e-02	2.000e+00	-1.000e+03	1.000e+03	-1.871e+00	7.813e-02	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 2024 season 2	-8.498e-01	7.761e-02	2.000e+00	-1.000e+03	1.000e+03	-8.920e-01	7.827e-02	2.000e+00	-1.000e+03	1.000e+03
Log fdev TCF year 2025 season 2	-3.370e-01	8.043e-02	2.000e+00	-1.000e+03	1.000e+03	-2.113e-01	8.080e-02	2.000e+00	-1.000e+03	1.000e+03
Log fdev SCF year 1990 season 2	1.494e+00	2.243e-01	2.000e+00	-1.000e+03	1.000e+03	1.462e+00	2.264e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev SCF year 1991 season 2	1.776e+00	2.261e-01	2.000e+00	-1.000e+03	1.000e+03	1.741e+00	2.273e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev SCF year 1992 season 2	7.780e-01	2.324e-01	2.000e+00	-1.000e+03	1.000e+03	7.452e-01	2.329e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev SCF year 1993 season 2	1.112e+00	2.327e-01	2.000e+00	-1.000e+03	1.000e+03	1.072e+00	2.337e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev SCF year 1994 season 2	4.919e-01	2.331e-01	2.000e+00	-1.000e+03	1.000e+03	4.556e-01	2.346e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev SCF year 1995 season 2	5.052e-01	2.340e-01	2.000e+00	-1.000e+03	1.000e+03	4.764e-01	2.361e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev SCF year 1996 season 2	1.196e+00	2.364e-01	2.000e+00	-1.000e+03	1.000e+03	1.179e+00	2.390e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev SCF year 1997 season 2	9.502e-01	2.147e-01	2.000e+00	-1.000e+03	1.000e+03	9.974e-01	2.143e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev SCF year 1998 season 2	4.610e-01	2.143e-01	2.000e+00	-1.000e+03	1.000e+03	5.194e-01	2.138e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev SCF year 1999 season 2	-7.398e-01	2.157e-01	2.000e+00	-1.000e+03	1.000e+03	-6.847e-01	2.151e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev SCF year 2000 season 2	-9.886e-01	2.172e-01	2.000e+00	-1.000e+03	1.000e+03	-9.458e-01	2.161e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev SCF year 2001 season 2	-2.789e-01	2.177e-01	2.000e+00	-1.000e+03	1.000e+03	-2.438e-01	2.165e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev SCF year 2002 season 2	-1.094e+00	2.189e-01	2.000e+00	-1.000e+03	1.000e+03	-1.062e+00	2.171e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev SCF year 2003 season 2	-2.083e+00	2.196e-01	2.000e+00	-1.000e+03	1.000e+03	-2.064e+00	2.180e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev SCF year 2004 season 2	-1.953e+00	2.194e-01	2.000e+00	-1.000e+03	1.000e+03	-1.953e+00	2.170e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev SCF year 2005 season 2	1.258e-01	2.026e-01	2.000e+00	-1.000e+03	1.000e+03	1.126e-01	2.031e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev SCF year 2006 season 2	2.502e-01	2.024e-01	2.000e+00	-1.000e+03	1.000e+03	2.219e-01	2.029e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev SCF year 2007 season 2	3.224e-01	2.017e-01	2.000e+00	-1.000e+03	1.000e+03	3.094e-01	2.021e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev SCF year 2008 season 2	-3.198e-01	2.028e-01	2.000e+00	-1.000e+03	1.000e+03	-3.340e-01	2.032e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev SCF year 2009 season 2	3.778e-02	2.024e-01	2.000e+00	-1.000e+03	1.000e+03	3.219e-02	2.027e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev SCF year 2010 season 2	1.325e-01	2.024e-01	2.000e+00	-1.000e+03	1.000e+03	1.630e-01	2.027e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev SCF year 2011 season 2	6.618e-01	2.010e-01	2.000e+00	-1.000e+03	1.000e+03	7.128e-01	2.012e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev SCF year 2012 season 2	3.957e-01	2.007e-01	2.000e+00	-1.000e+03	1.000e+03	4.726e-01	2.009e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev SCF year 2013 season 2	3.565e-01	2.004e-01	2.000e+00	-1.000e+03	1.000e+03	4.021e-01	2.009e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev SCF year 2014 season 2	1.198e+00	1.957e-01	2.000e+00	-1.000e+03	1.000e+03	1.159e+00	1.962e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev SCF year 2015 season 2	9.457e-01	1.971e-01	2.000e+00	-1.000e+03	1.000e+03	8.995e-01	1.979e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev SCF year 2016 season 2	8.228e-01	1.991e-01	2.000e+00	-1.000e+03	1.000e+03	7.616e-01	1.998e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev SCF year 2017 season 2	1.643e-01	2.018e-01	2.000e+00	-1.000e+03	1.000e+03	1.170e-01	2.021e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev SCF year 2018 season 2	2.196e-01	2.026e-01	2.000e+00	-1.000e+03	1.000e+03	1.946e-01	2.029e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev SCF year 2019 season 2	5.253e-01	2.028e-01	2.000e+00	-1.000e+03	1.000e+03	5.296e-01	2.029e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev SCF year 2020 season 2	-1.053e+00	2.033e-01	2.000e+00	-1.000e+03	1.000e+03	-1.026e+00	2.037e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev SCF year 2021 season 2	-2.267e+00	2.040e-01	2.000e+00	-1.000e+03	1.000e+03	-2.269e+00	2.046e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev SCF year 2024 season 2	-2.926e+00	2.049e-01	2.000e+00	-1.000e+03	1.000e+03	-2.973e+00	2.053e-01	2.000e+00	-1.000e+03	1.000e+03

Log fdev SCF year 2025 season 2	-1.221e+00	2.057e-01	2.000e+00	-1.000e+03	1.000e+03	-1.181e+00	2.059e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev RKF year 1990 season 2	3.898e+00	2.262e-01	2.000e+00	-1.000e+03	1.000e+03	3.871e+00	2.247e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev RKF year 1991 season 2	3.778e+00	2.420e-01	2.000e+00	-1.000e+03	1.000e+03	3.748e+00	2.405e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev RKF year 1992 season 2	3.638e+00	2.459e-01	2.000e+00	-1.000e+03	1.000e+03	3.601e+00	2.461e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev RKF year 1993 season 2	4.465e+00	2.313e-01	2.000e+00	-1.000e+03	1.000e+03	4.420e+00	2.332e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev RKF year 1996 season 2	2.332e+00	2.343e-01	2.000e+00	-1.000e+03	1.000e+03	2.245e+00	2.324e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev RKF year 1997 season 2	1.146e+00	2.489e-01	2.000e+00	-1.000e+03	1.000e+03	1.139e+00	2.443e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev RKF year 1998 season 2	9.958e-01	2.461e-01	2.000e+00	-1.000e+03	1.000e+03	1.006e+00	2.421e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev RKF year 1999 season 2	4.046e-01	2.449e-01	2.000e+00	-1.000e+03	1.000e+03	4.306e-01	2.419e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev RKF year 2000 season 2	1.562e-01	2.437e-01	2.000e+00	-1.000e+03	1.000e+03	1.853e-01	2.419e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev RKF year 2001 season 2	-3.503e-01	2.864e-01	2.000e+00	-1.000e+03	1.000e+03	-3.216e-01	2.851e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev RKF year 2002 season 2	-1.380e-01	2.422e-01	2.000e+00	-1.000e+03	1.000e+03	-1.051e-01	2.413e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev RKF year 2003 season 2	-3.955e-01	2.415e-01	2.000e+00	-1.000e+03	1.000e+03	-3.580e-01	2.412e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev RKF year 2004 season 2	-8.251e-01	2.684e-01	2.000e+00	-1.000e+03	1.000e+03	-7.961e-01	2.689e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev RKF year 2005 season 2	-9.862e-01	2.482e-01	2.000e+00	-1.000e+03	1.000e+03	-9.688e-01	2.482e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev RKF year 2006 season 2	-1.489e+00	3.274e-01	2.000e+00	-1.000e+03	1.000e+03	-1.471e+00	3.275e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev RKF year 2007 season 2	-9.417e-01	2.151e-01	2.000e+00	-1.000e+03	1.000e+03	-9.280e-01	2.151e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev RKF year 2008 season 2	4.680e-01	2.149e-01	2.000e+00	-1.000e+03	1.000e+03	4.136e-01	2.146e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev RKF year 2009 season 2	1.006e-01	2.144e-01	2.000e+00	-1.000e+03	1.000e+03	-5.468e-02	2.138e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev RKF year 2010 season 2	-1.724e+00	3.064e-01	2.000e+00	-1.000e+03	1.000e+03	-1.853e+00	3.060e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev RKF year 2011 season 2	-2.173e+00	5.163e-01	2.000e+00	-1.000e+03	1.000e+03	-2.231e+00	5.160e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev RKF year 2012 season 2	-1.122e+00	2.358e-01	2.000e+00	-1.000e+03	1.000e+03	-1.160e+00	2.352e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev RKF year 2013 season 2	-6.600e-02	2.149e-01	2.000e+00	-1.000e+03	1.000e+03	-8.375e-02	2.141e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev RKF year 2014 season 2	6.621e-01	2.155e-01	2.000e+00	-1.000e+03	1.000e+03	6.405e-01	2.151e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev RKF year 2015 season 2	2.257e-01	2.147e-01	2.000e+00	-1.000e+03	1.000e+03	2.489e-01	2.146e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev RKF year 2016 season 2	2.048e-01	2.142e-01	2.000e+00	-1.000e+03	1.000e+03	2.294e-01	2.140e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev RKF year 2017 season 2	3.112e-01	2.140e-01	2.000e+00	-1.000e+03	1.000e+03	3.266e-01	2.138e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev RKF year 2018 season 2	-4.357e-01	2.138e-01	2.000e+00	-1.000e+03	1.000e+03	-3.665e-01	2.138e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev RKF year 2019 season 2	-1.419e+00	4.243e-01	2.000e+00	-1.000e+03	1.000e+03	-1.355e+00	4.241e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev RKF year 2020 season 2	-2.514e+00	1.082e+00	2.000e+00	-1.000e+03	1.000e+03	-2.380e+00	1.082e+00	2.000e+00	-1.000e+03	1.000e+03
Log fdev RKF year 2023 season 2	-2.590e+00	8.406e-01	2.000e+00	-1.000e+03	1.000e+03	-2.575e+00	8.406e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev RKF year 2024 season 2	-3.095e+00	1.081e+00	2.000e+00	-1.000e+03	1.000e+03	-3.112e+00	1.081e+00	2.000e+00	-1.000e+03	1.000e+03
Log fdev RKF year 2025 season 2	-2.522e+00	7.037e-01	2.000e+00	-1.000e+03	1.000e+03	-2.385e+00	7.038e-01	2.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 1973 season 2	1.761e+00	1.591e-01	4.000e+00	-1.000e+03	1.000e+03	1.878e+00	1.693e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 1974 season 2	1.983e+00	1.530e-01	4.000e+00	-1.000e+03	1.000e+03	2.078e+00	1.588e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 1975 season 2	1.155e+00	1.518e-01	4.000e+00	-1.000e+03	1.000e+03	1.227e+00	1.560e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 1976 season 2	7.214e-01	1.506e-01	4.000e+00	-1.000e+03	1.000e+03	7.858e-01	1.539e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 1977 season 2	3.808e-01	1.506e-01	4.000e+00	-1.000e+03	1.000e+03	4.363e-01	1.542e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 1978 season 2	2.173e-01	1.516e-01	4.000e+00	-1.000e+03	1.000e+03	2.612e-01	1.561e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 1979 season 2	7.419e-01	1.525e-01	4.000e+00	-1.000e+03	1.000e+03	7.487e-01	1.568e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 1980 season 2	3.314e-01	1.538e-01	4.000e+00	-1.000e+03	1.000e+03	3.470e-01	1.584e-01	4.000e+00	-1.000e+03	1.000e+03

Log fdev GF All year 1981 season 2	2.740e-01	1.538e-01	4.000e+00	-1.000e+03	1.000e+03	3.152e-01	1.594e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 1982 season 2	-6.572e-01	1.515e-01	4.000e+00	-1.000e+03	1.000e+03	-5.982e-01	1.571e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 1983 season 2	-2.779e-01	1.522e-01	4.000e+00	-1.000e+03	1.000e+03	-1.606e-01	1.593e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 1984 season 2	-4.202e-02	1.570e-01	4.000e+00	-1.000e+03	1.000e+03	1.441e-01	1.675e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 1985 season 2	-4.342e-01	1.548e-01	4.000e+00	-1.000e+03	1.000e+03	-2.508e-01	1.637e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 1986 season 2	-2.313e-01	1.505e-01	4.000e+00	-1.000e+03	1.000e+03	-7.874e-02	1.572e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 1987 season 2	-3.921e-01	1.551e-01	4.000e+00	-1.000e+03	1.000e+03	-3.280e-01	1.576e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 1988 season 2	-8.645e-01	1.540e-01	4.000e+00	-1.000e+03	1.000e+03	-8.195e-01	1.567e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 1989 season 2	-4.210e-01	1.527e-01	4.000e+00	-1.000e+03	1.000e+03	-3.908e-01	1.556e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 1990 season 2	4.885e-02	1.524e-01	4.000e+00	-1.000e+03	1.000e+03	7.948e-02	1.555e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 1991 season 2	8.718e-01	1.525e-01	4.000e+00	-1.000e+03	1.000e+03	9.028e-01	1.559e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 1992 season 2	1.122e+00	1.534e-01	4.000e+00	-1.000e+03	1.000e+03	1.153e+00	1.570e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 1993 season 2	8.173e-01	1.534e-01	4.000e+00	-1.000e+03	1.000e+03	8.495e-01	1.571e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 1994 season 2	1.228e+00	1.540e-01	4.000e+00	-1.000e+03	1.000e+03	1.268e+00	1.575e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 1995 season 2	1.116e+00	1.538e-01	4.000e+00	-1.000e+03	1.000e+03	1.169e+00	1.570e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 1996 season 2	1.273e+00	1.549e-01	4.000e+00	-1.000e+03	1.000e+03	1.338e+00	1.579e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 1997 season 2	1.600e+00	1.493e-01	4.000e+00	-1.000e+03	1.000e+03	1.571e+00	1.504e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 1998 season 2	1.453e+00	1.478e-01	4.000e+00	-1.000e+03	1.000e+03	1.425e+00	1.489e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 1999 season 2	9.332e-01	1.471e-01	4.000e+00	-1.000e+03	1.000e+03	9.070e-01	1.483e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 2000 season 2	9.738e-01	1.473e-01	4.000e+00	-1.000e+03	1.000e+03	9.380e-01	1.484e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 2001 season 2	1.209e+00	1.473e-01	4.000e+00	-1.000e+03	1.000e+03	1.169e+00	1.485e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 2002 season 2	5.061e-01	1.472e-01	4.000e+00	-1.000e+03	1.000e+03	4.575e-01	1.483e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 2003 season 2	-3.022e-02	1.470e-01	4.000e+00	-1.000e+03	1.000e+03	-8.179e-02	1.482e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 2004 season 2	2.661e-01	1.469e-01	4.000e+00	-1.000e+03	1.000e+03	2.121e-01	1.482e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 2005 season 2	-6.154e-02	1.469e-01	4.000e+00	-1.000e+03	1.000e+03	-1.132e-01	1.483e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 2006 season 2	-8.646e-02	1.470e-01	4.000e+00	-1.000e+03	1.000e+03	-1.369e-01	1.485e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 2007 season 2	6.399e-03	1.469e-01	4.000e+00	-1.000e+03	1.000e+03	-4.215e-02	1.484e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 2008 season 2	-3.292e-01	1.467e-01	4.000e+00	-1.000e+03	1.000e+03	-3.994e-01	1.481e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 2009 season 2	-7.050e-01	1.462e-01	4.000e+00	-1.000e+03	1.000e+03	-7.868e-01	1.477e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 2010 season 2	-1.052e+00	1.459e-01	4.000e+00	-1.000e+03	1.000e+03	-1.111e+00	1.474e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 2011 season 2	-7.471e-01	1.458e-01	4.000e+00	-1.000e+03	1.000e+03	-7.837e-01	1.472e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 2012 season 2	-1.215e+00	1.459e-01	4.000e+00	-1.000e+03	1.000e+03	-1.254e+00	1.473e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 2013 season 2	-6.270e-01	1.461e-01	4.000e+00	-1.000e+03	1.000e+03	-6.933e-01	1.473e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 2014 season 2	-5.387e-01	1.460e-01	4.000e+00	-1.000e+03	1.000e+03	-6.375e-01	1.472e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 2015 season 2	-6.888e-01	1.458e-01	4.000e+00	-1.000e+03	1.000e+03	-7.796e-01	1.470e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 2016 season 2	-6.112e-01	1.458e-01	4.000e+00	-1.000e+03	1.000e+03	-7.015e-01	1.470e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 2017 season 2	-1.188e+00	1.455e-01	4.000e+00	-1.000e+03	1.000e+03	-1.265e+00	1.468e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 2018 season 2	-8.929e-01	1.457e-01	4.000e+00	-1.000e+03	1.000e+03	-9.448e-01	1.470e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 2019 season 2	-7.765e-01	1.460e-01	4.000e+00	-1.000e+03	1.000e+03	-8.163e-01	1.473e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 2020 season 2	-8.734e-01	1.465e-01	4.000e+00	-1.000e+03	1.000e+03	-9.058e-01	1.479e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 2021 season 2	-9.192e-01	1.469e-01	4.000e+00	-1.000e+03	1.000e+03	-9.708e-01	1.483e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 2022 season 2	-1.257e+00	1.468e-01	4.000e+00	-1.000e+03	1.000e+03	-1.329e+00	1.482e-01	4.000e+00	-1.000e+03	1.000e+03

Log fdev GF All year 2023 season 2	-1.520e+00	1.469e-01	4.000e+00	-1.000e+03	1.000e+03	-1.602e+00	1.483e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 2024 season 2	-1.752e+00	1.479e-01	4.000e+00	-1.000e+03	1.000e+03	-1.829e+00	1.493e-01	4.000e+00	-1.000e+03	1.000e+03
Log fdev GF All year 2025 season 2	-1.799e+00	1.496e-01	4.000e+00	-1.000e+03	1.000e+03	-1.849e+00	1.509e-01	4.000e+00	-1.000e+03	1.000e+03

Table 59. Recruitment deviation parameters from the 22.03d5 (GMACS) and 26.02 (GMACS) models.

Description	‘22.03d5 (GMACS)’					‘26.02 (GMACS)’				
	Estimate	SE	Phase	LB	UB	Estimate	SE	Phase	LB	UB
Rec dev est 1948	-5.848e-04	4.694e-01	5.000e+00	-8.000e+00	8.000e+00	-1.827e-04	4.694e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1949	-7.805e-04	4.693e-01	5.000e+00	-8.000e+00	8.000e+00	-2.723e-04	4.694e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1950	-1.032e-03	4.693e-01	5.000e+00	-8.000e+00	8.000e+00	-4.015e-04	4.694e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1951	-1.366e-03	4.692e-01	5.000e+00	-8.000e+00	8.000e+00	-5.912e-04	4.694e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1952	-1.810e-03	4.691e-01	5.000e+00	-8.000e+00	8.000e+00	-8.662e-04	4.693e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1953	-2.394e-03	4.690e-01	5.000e+00	-8.000e+00	8.000e+00	-1.270e-03	4.692e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1954	-3.146e-03	4.688e-01	5.000e+00	-8.000e+00	8.000e+00	-1.849e-03	4.691e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1955	-4.058e-03	4.686e-01	5.000e+00	-8.000e+00	8.000e+00	-2.662e-03	4.689e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1956	-5.095e-03	4.684e-01	5.000e+00	-8.000e+00	8.000e+00	-3.783e-03	4.687e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1957	-6.217e-03	4.681e-01	5.000e+00	-8.000e+00	8.000e+00	-5.313e-03	4.684e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1958	-7.450e-03	4.679e-01	5.000e+00	-8.000e+00	8.000e+00	-7.381e-03	4.680e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1959	-8.759e-03	4.677e-01	5.000e+00	-8.000e+00	8.000e+00	-1.008e-02	4.675e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1960	-9.584e-03	4.676e-01	5.000e+00	-8.000e+00	8.000e+00	-1.295e-02	4.670e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1961	-8.062e-03	4.680e-01	5.000e+00	-8.000e+00	8.000e+00	-1.400e-02	4.668e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1962	-6.075e-04	4.697e-01	5.000e+00	-8.000e+00	8.000e+00	-9.720e-03	4.676e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1963	1.917e-02	4.739e-01	5.000e+00	-8.000e+00	8.000e+00	6.112e-03	4.705e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1964	6.004e-02	4.822e-01	5.000e+00	-8.000e+00	8.000e+00	4.023e-02	4.770e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1965	1.368e-01	4.978e-01	5.000e+00	-8.000e+00	8.000e+00	1.032e-01	4.888e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1966	2.908e-01	5.310e-01	5.000e+00	-8.000e+00	8.000e+00	2.313e-01	5.129e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1967	6.095e-01	5.841e-01	5.000e+00	-8.000e+00	8.000e+00	5.285e-01	5.559e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1968	4.247e-01	5.110e-01	5.000e+00	-8.000e+00	8.000e+00	4.218e-01	4.863e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1969	1.358e-02	4.040e-01	5.000e+00	-8.000e+00	8.000e+00	-1.849e-02	3.920e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1970	-9.350e-02	3.323e-01	5.000e+00	-8.000e+00	8.000e+00	-7.069e-02	3.177e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1971	-4.610e-01	3.183e-01	5.000e+00	-8.000e+00	8.000e+00	-4.233e-01	3.091e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1972	-7.934e-01	3.244e-01	5.000e+00	-8.000e+00	8.000e+00	-7.042e-01	3.232e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1973	-1.444e-01	2.719e-01	5.000e+00	-8.000e+00	8.000e+00	-4.274e-02	2.759e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1974	8.172e-01	4.919e-01	5.000e+00	-8.000e+00	8.000e+00	1.500e+00	3.098e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1975	2.231e+00	1.803e-01	5.000e+00	-8.000e+00	8.000e+00	2.282e+00	1.882e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1976	1.555e+00	2.192e-01	5.000e+00	-8.000e+00	8.000e+00	1.885e+00	1.943e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1977	5.007e-01	3.317e-01	5.000e+00	-8.000e+00	8.000e+00	4.570e-01	3.420e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1978	-1.181e-01	3.257e-01	5.000e+00	-8.000e+00	8.000e+00	-4.509e-02	3.123e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1979	-2.440e-01	2.817e-01	5.000e+00	-8.000e+00	8.000e+00	-1.842e-01	2.669e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1980	-5.002e-02	2.313e-01	5.000e+00	-8.000e+00	8.000e+00	2.951e-02	2.110e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1981	-1.302e-01	2.382e-01	5.000e+00	-8.000e+00	8.000e+00	-2.297e-02	2.207e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1982	1.078e+00	1.270e-01	5.000e+00	-8.000e+00	8.000e+00	9.930e-01	1.245e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1983	8.348e-01	1.651e-01	5.000e+00	-8.000e+00	8.000e+00	6.705e-01	1.588e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1984	7.791e-01	1.789e-01	5.000e+00	-8.000e+00	8.000e+00	6.957e-01	1.628e-01	5.000e+00	-8.000e+00	8.000e+00

Rec dev est 1985	9.353e-01	1.516e-01	5.000e+00	-8.000e+00	8.000e+00	8.768e-01	1.408e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1986	6.630e-01	1.650e-01	5.000e+00	-8.000e+00	8.000e+00	6.030e-01	1.539e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1987	1.830e-01	1.882e-01	5.000e+00	-8.000e+00	8.000e+00	5.140e-02	1.850e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1988	-4.593e-01	2.042e-01	5.000e+00	-8.000e+00	8.000e+00	-4.835e-01	1.952e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1989	-1.125e+00	2.384e-01	5.000e+00	-8.000e+00	8.000e+00	-1.097e+00	2.301e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1990	-1.407e+00	2.253e-01	5.000e+00	-8.000e+00	8.000e+00	-1.406e+00	2.199e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1991	-1.366e+00	2.025e-01	5.000e+00	-8.000e+00	8.000e+00	-1.405e+00	1.974e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1992	-1.324e+00	2.034e-01	5.000e+00	-8.000e+00	8.000e+00	-1.370e+00	1.944e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1993	-1.131e+00	1.972e-01	5.000e+00	-8.000e+00	8.000e+00	-1.217e+00	1.902e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1994	-7.523e-01	1.695e-01	5.000e+00	-8.000e+00	8.000e+00	-7.883e-01	1.607e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1995	-8.343e-01	1.957e-01	5.000e+00	-8.000e+00	8.000e+00	-8.772e-01	1.832e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1996	-9.632e-02	1.302e-01	5.000e+00	-8.000e+00	8.000e+00	-2.309e-01	1.302e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1997	-8.232e-01	2.028e-01	5.000e+00	-8.000e+00	8.000e+00	-8.472e-01	1.955e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1998	4.660e-01	1.156e-01	5.000e+00	-8.000e+00	8.000e+00	4.009e-01	1.141e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 1999	-3.995e-01	2.237e-01	5.000e+00	-8.000e+00	8.000e+00	-4.269e-01	2.152e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 2000	8.197e-01	1.179e-01	5.000e+00	-8.000e+00	8.000e+00	7.156e-01	1.210e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 2001	-1.585e-01	2.315e-01	5.000e+00	-8.000e+00	8.000e+00	-6.329e-02	2.068e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 2002	9.529e-01	1.196e-01	5.000e+00	-8.000e+00	8.000e+00	7.398e-01	1.240e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 2003	3.266e-01	1.551e-01	5.000e+00	-8.000e+00	8.000e+00	1.745e-01	1.523e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 2004	-7.122e-01	2.232e-01	5.000e+00	-8.000e+00	8.000e+00	-6.521e-01	2.068e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 2005	-1.025e+00	2.489e-01	5.000e+00	-8.000e+00	8.000e+00	-1.059e+00	2.440e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 2006	-6.657e-01	2.261e-01	5.000e+00	-8.000e+00	8.000e+00	-7.229e-01	2.205e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 2007	-2.369e-02	2.199e-01	5.000e+00	-8.000e+00	8.000e+00	6.714e-02	2.083e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 2008	1.174e+00	1.130e-01	5.000e+00	-8.000e+00	8.000e+00	1.039e+00	1.226e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 2009	2.601e-01	1.737e-01	5.000e+00	-8.000e+00	8.000e+00	1.698e-01	1.689e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 2010	-5.790e-01	1.922e-01	5.000e+00	-8.000e+00	8.000e+00	-5.504e-01	1.854e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 2011	-1.357e+00	2.325e-01	5.000e+00	-8.000e+00	8.000e+00	-1.194e+00	2.201e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 2012	-9.049e-01	1.551e-01	5.000e+00	-8.000e+00	8.000e+00	-9.041e-01	1.569e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 2013	-1.428e+00	1.923e-01	5.000e+00	-8.000e+00	8.000e+00	-1.382e+00	1.892e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 2014	-1.328e+00	1.851e-01	5.000e+00	-8.000e+00	8.000e+00	-1.189e+00	1.809e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 2015	-7.176e-01	1.473e-01	5.000e+00	-8.000e+00	8.000e+00	-6.325e-01	1.470e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 2016	7.032e-01	9.699e-02	5.000e+00	-8.000e+00	8.000e+00	7.238e-01	9.473e-02	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 2017	1.679e-01	1.377e-01	5.000e+00	-8.000e+00	8.000e+00	5.369e-02	1.387e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 2018	3.173e-01	1.530e-01	5.000e+00	-8.000e+00	8.000e+00	2.739e-01	1.512e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 2019	-1.115e-01	3.186e-01	5.000e+00	-8.000e+00	8.000e+00	-2.929e-02	3.062e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 2020	1.190e+00	1.428e-01	5.000e+00	-8.000e+00	8.000e+00	1.223e+00	1.335e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 2021	1.429e+00	1.425e-01	5.000e+00	-8.000e+00	8.000e+00	1.325e+00	1.444e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 2022	1.182e+00	1.671e-01	5.000e+00	-8.000e+00	8.000e+00	1.209e+00	1.571e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 2023	4.107e-01	2.578e-01	5.000e+00	-8.000e+00	8.000e+00	4.397e-01	2.461e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 2024	2.664e-01	2.701e-01	5.000e+00	-8.000e+00	8.000e+00	2.048e-01	2.699e-01	5.000e+00	-8.000e+00	8.000e+00
Rec dev est 2025	4.285e-02	3.024e-01	5.000e+00	-8.000e+00	8.000e+00	-8.553e-03	3.042e-01	5.000e+00	-8.000e+00	8.000e+00

Table 60. TCSAM02 models final values for parameters related to population processes, including growth, maturity, and natural mortality. Parameters with values whose standard error is NA are fixed, not estimated.

Description	‘22.03d5 (2026)’				
	Estimate	SE	Phase	LB	UB
pGrA[1] males	3.271e+01	2.684e-01	4.000e+00	2.500e+01	4.000e+01
pGrA[2] females	3.304e+01	2.802e-01	4.000e+00	2.500e+01	4.000e+01
pGrB[1] males	1.597e+02	4.885e-01	4.000e+00	1.300e+02	1.800e+02
pGrB[2] females	1.158e+02	5.284e-01	4.000e+00	1.100e+02	1.500e+02
pGrBeta[1] both sexes	5.564e-01	9.779e-02	5.000e+00	5.000e-01	2.000e+00
pvLgtPrM2M males 60-150 mmCW (entire model period)	-2.898e+00	4.258e-02	4.000e+00	-1.500e+01	1.500e+01
pvLgtPrM2M females 50-105 mmCW (entire model period)	-5.134e+00	1.115e+00	4.000e+00	-1.500e+01	1.500e+01
pvLgtPrM2M males 60-150 mmCW (entire model period)	-3.188e+00	5.860e-02	4.000e+00	-1.500e+01	1.500e+01
pvLgtPrM2M females 50-105 mmCW (entire model period)	-3.977e+00	4.973e-01	4.000e+00	-1.500e+01	1.500e+01
pvLgtPrM2M males 60-150 mmCW (entire model period)	-2.746e+00	4.846e-02	4.000e+00	-1.500e+01	1.500e+01
pvLgtPrM2M females 50-105 mmCW (entire model period)	-2.854e+00	2.333e-01	4.000e+00	-1.500e+01	1.500e+01
pvLgtPrM2M males 60-150 mmCW (entire model period)	-2.371e+00	4.013e-02	4.000e+00	-1.500e+01	1.500e+01
pvLgtPrM2M females 50-105 mmCW (entire model period)	-1.634e+00	1.357e-01	4.000e+00	-1.500e+01	1.500e+01
pvLgtPrM2M males 60-150 mmCW (entire model period)	-1.780e+00	3.258e-02	4.000e+00	-1.500e+01	1.500e+01
pvLgtPrM2M females 50-105 mmCW (entire model period)	-4.979e-01	8.655e-02	4.000e+00	-1.500e+01	1.500e+01
pvLgtPrM2M males 60-150 mmCW (entire model period)	-1.179e+00	2.842e-02	4.000e+00	-1.500e+01	1.500e+01
pvLgtPrM2M females 50-105 mmCW (entire model period)	3.344e-01	8.674e-02	4.000e+00	-1.500e+01	1.500e+01
pvLgtPrM2M males 60-150 mmCW (entire model period)	-6.874e-01	2.689e-02	4.000e+00	-1.500e+01	1.500e+01
pvLgtPrM2M females 50-105 mmCW (entire model period)	6.681e-01	9.868e-02	4.000e+00	-1.500e+01	1.500e+01
pvLgtPrM2M males 60-150 mmCW (entire model period)	-5.074e-01	2.700e-02	4.000e+00	-1.500e+01	1.500e+01
pvLgtPrM2M females 50-105 mmCW (entire model period)	1.153e+00	1.313e-01	4.000e+00	-1.500e+01	1.500e+01
pvLgtPrM2M males 60-150 mmCW (entire model period)	-3.668e-01	2.662e-02	4.000e+00	-1.500e+01	1.500e+01
pvLgtPrM2M females 50-105 mmCW (entire model period)	2.054e+00	2.230e-01	4.000e+00	-1.500e+01	1.500e+01
pvLgtPrM2M males 60-150 mmCW (entire model period)	-1.760e-01	2.737e-02	4.000e+00	-1.500e+01	1.500e+01
pvLgtPrM2M females 50-105 mmCW (entire model period)	2.880e+00	4.268e-01	4.000e+00	-1.500e+01	1.500e+01
pvLgtPrM2M males 60-150 mmCW (entire model period)	2.099e-01	2.892e-02	4.000e+00	-1.500e+01	1.500e+01
pvLgtPrM2M females 50-105 mmCW (entire model period)	3.730e+00	9.911e-01	4.000e+00	-1.500e+01	1.500e+01
pvLgtPrM2M males 60-150 mmCW (entire model period)	7.205e-01	3.290e-02	4.000e+00	-1.500e+01	1.500e+01
pvLgtPrM2M males 60-150 mmCW (entire model period)	1.234e+00	4.272e-02	4.000e+00	-1.500e+01	1.500e+01
pvLgtPrM2M males 60-150 mmCW (entire model period)	1.503e+00	5.050e-02	4.000e+00	-1.500e+01	1.500e+01
pvLgtPrM2M males 60-150 mmCW (entire model period)	1.958e+00	6.585e-02	4.000e+00	-1.500e+01	1.500e+01
pvLgtPrM2M males 60-150 mmCW (entire model period)	2.478e+00	9.023e-02	4.000e+00	-1.500e+01	1.500e+01
pvLgtPrM2M males 60-150 mmCW (entire model period)	3.153e+00	1.411e-01	4.000e+00	-1.500e+01	1.500e+01
pDM1[1] multiplier for immature crab	1.103e+00	4.565e-02	4.000e+00	2.000e-01	2.000e+00
pDM1[2] multiplier for mature males	1.380e+00	3.651e-02	4.000e+00	1.000e-01	1.900e+00
pDM1[3] multiplier for mature females	1.362e+00	3.760e-02	4.000e+00	1.000e-01	1.900e+00
pDM2[1] 1980-1984 multiplier for mature males	2.401e+00	2.624e-01	4.000e+00	1.000e-01	1.000e+00
pDM2[2] 1980-1984 multiplier for mature females	2.081e+00	1.752e-01	4.000e+00	1.000e-01	1.000e+00
pM[1] base ln-scale M	-1.470e+00	NA	-1.000e+00	-2.000e+00	1.000e+00

Table 61. TCSAM02 models final values for parameters related to recruitment, including ln-scale means and ln-scale deviations. Parameters with values whose standard error is NA are fixed, not estimated.

Description	‘22.03d5 (2026)’				
	Estimate	SE	Phase	LB	UB
pDevsLnR historical recruitment period	-4.509e-01	1.762e+00	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	1.109e+00	3.941e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR historical recruitment period	-4.495e-01	1.629e+00	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	2.064e+00	1.822e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR historical recruitment period	-4.461e-01	1.501e+00	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	1.482e+00	2.421e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR historical recruitment period	-4.401e-01	1.380e+00	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	4.814e-01	4.234e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR historical recruitment period	-4.309e-01	1.267e+00	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	-1.065e-01	4.890e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR historical recruitment period	-4.174e-01	1.165e+00	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	-2.253e-01	4.038e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR historical recruitment period	-3.984e-01	1.075e+00	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	-2.031e-02	2.863e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR historical recruitment period	-3.724e-01	1.001e+00	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	-2.439e-01	3.030e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR historical recruitment period	-3.377e-01	9.454e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	1.068e+00	1.170e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR historical recruitment period	-2.925e-01	9.086e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	7.498e-01	1.673e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR historical recruitment period	-2.357e-01	8.902e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	8.126e-01	1.717e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR historical recruitment period	-1.658e-01	8.878e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	9.962e-01	1.359e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR historical recruitment period	-7.997e-02	8.982e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	5.305e-01	1.853e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR historical recruitment period	2.814e-02	9.159e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	2.230e-01	2.025e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR historical recruitment period	1.692e-01	9.324e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	-4.758e-01	2.467e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR historical recruitment period	3.591e-01	9.379e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	-1.220e+00	3.509e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR historical recruitment period	6.125e-01	9.331e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	-1.499e+00	3.239e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR historical recruitment period	9.208e-01	9.417e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	-1.332e+00	2.508e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR historical recruitment period	1.203e+00	9.860e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	-1.347e+00	2.661e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR historical recruitment period	1.203e+00	1.000e+00	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	-1.117e+00	2.420e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR historical recruitment period	7.131e-01	9.080e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	-6.557e-01	1.762e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR historical recruitment period	3.264e-01	8.373e-01	1.000e+00	-5.000e+00	5.000e+00

pDevsLnR current recruitment period	-1.035e+00	2.540e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR historical recruitment period	1.306e-01	8.095e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	2.499e-02	1.148e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR historical recruitment period	-3.289e-01	8.187e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	-1.010e+00	2.506e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR historical recruitment period	-6.132e-01	8.200e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	5.790e-01	9.724e-02	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR historical recruitment period	-2.063e-01	8.312e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	-6.013e-01	2.916e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	9.317e-01	1.008e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	-2.203e-01	2.808e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	1.011e+00	1.060e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	3.701e-01	1.550e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	-7.554e-01	2.803e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	-1.215e+00	3.786e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	-5.672e-01	2.685e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	1.416e-01	2.468e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	1.252e+00	1.008e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	2.004e-01	2.002e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	-5.188e-01	2.088e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	-1.650e+00	3.648e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	-8.080e-01	1.552e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	-1.526e+00	2.381e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	-1.370e+00	2.128e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	-6.659e-01	1.436e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	7.591e-01	7.290e-02	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	1.950e-01	1.280e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	3.995e-01	1.506e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	-1.839e-01	4.736e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	1.279e+00	1.391e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	1.498e+00	1.296e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	1.247e+00	1.632e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	4.512e-01	2.948e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	3.897e-01	3.051e-01	1.000e+00	-5.000e+00	5.000e+00
pDevsLnR current recruitment period	1.232e-01	3.694e-01	1.000e+00	-5.000e+00	5.000e+00
pLnR[1] historical recruitment period	7.242e+00	7.659e-01	1.000e+00	0.000e+00	1.000e+01
pLnR[2] current recruitment period	6.121e+00	6.623e-02	1.000e+00	0.000e+00	1.000e+01
pRCV[1] full model period	-7.000e-01	NA	-5.000e+00	-2.000e+00	2.000e+00
pRX[1] full model period	-1.110e-16	NA	-1.000e+00	-2.500e+01	2.500e+01
pRa[1] fixed value	2.223e+00	3.057e-02	5.000e+00	1.000e+00	4.000e+00
pRb[1] fixed value	1.493e+00	7.539e-02	5.000e+00	0.000e+00	4.000e+00

Table 62. TCSAM02 models final values for non-vector parameters related to fisheries, surveys, and likelihoods, including mean capture rates (pLnCs) and female offset (pDC2s), handling mortality (pHMs), maximum retention rates (pLogitRets), survey catchability (pQs), and Dirichlet Multinomial effective sample sizes (pLnDirMuls). Parameters with values whose standard error is NA are fixed, not estimated.

Description	‘22.03d5 (2026)’				
	Estimate	SE	Phase	LB	UB
pDC2[1] TCF: female offset	-2.767e+00	1.933e-01	1.000e+00	-5.000e+00	0.000e+00
pDC2[2] SCF: female offset	-2.920e+00	2.957e-01	2.000e+00	-5.000e+00	0.000e+00
pDC2[3] GTF: female offset	-8.707e-01	1.040e-01	2.000e+00	-5.000e+00	0.000e+00
pDC2[4] RKF: female offset	-2.364e+00	8.341e-01	2.000e+00	-5.000e+00	0.000e+00
pHM[1] handling mortality for pot fisheries	3.210e-01	NA	-1.000e+00	0.000e+00	1.000e+00
pHM[2] handling mortality for groundfish trawl fisheries	8.000e-01	NA	-1.000e+00	0.000e+00	1.000e+00
pLgtRet[1] TCF: logit-scale max retention (pre-1997)	1.490e+01	NA	-3.000e+00	0.000e+00	1.500e+01
pLgtRet[2] TCF: logit-scale max retention (2005-2009)	1.490e+01	NA	-3.000e+00	0.000e+00	1.500e+01
pLgtRet[3] TCF: logit-scale max retention (2013+)	1.490e+01	NA	-3.000e+00	0.000e+00	1.500e+01
pLnC[1] TCF: base capture rate, pre-1965 (=0.05)	-2.996e+00	NA	-1.000e+00	-1.000e+01	2.000e+00
pLnC[2] TCF: base capture rate, 1965+	-1.856e+00	2.495e-01	1.000e+00	-1.000e+01	2.000e+00
pLnC[3] SCF: base capture rate, pre-1978 (=0.01)	-4.605e+00	NA	-2.000e+00	-1.000e+01	2.000e+00
pLnC[4] SCF: base capture rate, 1992+	-3.793e+00	6.793e-02	2.000e+00	-1.000e+01	2.000e+00
pLnC[5] DUMMY CAPTURE RATE	-4.181e+00	NA	-2.000e+00	-1.000e+01	2.000e+00
pLnC[6] GTF: base capture rate, ALL YEARS	-4.977e+00	5.482e-02	2.000e+00	-1.000e+01	2.000e+00
pLnC[7] RKF: base capture rate, pre-1953 (=0.02)	-3.912e+00	NA	-2.000e+00	-1.000e+01	2.000e+00
pLnC[8] RKF: base capture rate, 1992+	-5.023e+00	1.164e-01	2.000e+00	-1.000e+01	2.000e+00
pLnDirMul[1] ln(theta) parameter for BSFRF SBS M	1.068e+01	NA	-5.000e+00	-5.000e+00	1.100e+01
pLnDirMul[2] ln(theta) parameter for BSFRF SBS F	1.099e+01	NA	-5.000e+00	-5.000e+00	1.100e+01
pQ[1] NMFS trawl survey: males, 1975-1981	-9.017e-01	1.038e-01	5.000e+00	-4.605e+00	9.531e-02
pQ[2] NMFS trawl survey: males, 1982+	-7.175e-01	4.864e-02	5.000e+00	-4.605e+00	9.531e-02
pQ[3] NMFS trawl survey: females, 1975-1981	-1.113e+00	1.318e-01	5.000e+00	-4.605e+00	9.531e-02
pQ[4] NMFS trawl survey: females, 1982+	-1.323e+00	7.186e-02	5.000e+00	-4.605e+00	9.531e-02
pQ[5] BSFRF SBS	0.000e+00	NA	-5.000e+00	-6.931e-01	4.055e-01

Table 63. TCSAM02 models final values for annual capture rate devs parameters for the T
crab fishery (TCF). Parameters with values whose standard error is NA are fixed
estimated.

Description	‘22.03d5 (20		
	Estimate	SE	Phase
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	-1.242e+00	1.121e+00	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	-1.059e+00	1.036e+00	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	7.011e-01	1.085e+00	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	1.113e+00	1.270e+00	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	1.737e+00	1.684e+00	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	1.716e+00	1.867e+00	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	1.199e+00	1.326e+00	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	5.370e-01	6.788e-01	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	-9.742e-02	3.207e-01	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	-1.077e-01	2.616e-01	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	1.060e-01	2.804e-01	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	8.697e-01	2.872e-01	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	1.544e+00	2.976e-01	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	1.653e+00	3.215e-01	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	1.983e+00	3.323e-01	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	2.255e+00	3.254e-01	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	8.016e-01	2.670e-01	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	-5.221e-01	2.515e-01	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	-2.064e+00	2.520e-01	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	-7.871e-01	2.589e-01	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	-1.023e+00	2.508e-01	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	2.505e-02	2.510e-01	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	1.196e+00	2.521e-01	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	1.964e+00	2.556e-01	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	2.366e+00	2.705e-01	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	2.648e+00	2.742e-01	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	2.168e+00	2.695e-01	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	1.304e+00	2.731e-01	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	6.233e-01	2.673e-01	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	5.156e-01	3.007e-01	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	-1.937e+00	2.521e-01	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	-1.304e+00	2.519e-01	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	-1.507e+00	2.518e-01	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	-1.655e+00	2.516e-01	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	-1.721e+00	2.612e-01	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	-1.560e+00	2.531e-01	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	-2.441e-01	2.514e-01	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	-3.674e-03	2.506e-01	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	-1.771e+00	2.505e-01	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	-1.605e+00	2.506e-01	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	-1.778e+00	2.517e-01	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	-2.069e+00	2.522e-01	1.000e+00
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	-1.721e+00	2.530e-01	1.000e+00

pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	-1.922e+00	2.521e-01	1.000e+0
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	-9.219e-01	2.519e-01	1.000e+0
pDevsLnC TCF: 1965-1984, 1987-1996, 2005-2009, 2013-2015, 2017-2018, 2020-2024	-4.040e-01	2.531e-01	1.000e+0

Table 64. TCSAM02 models final values for annual capture rate devs parameters for the snow crab fishery (SCF). Parameters with values whose standard error is NA are fixed, not estimated.

Description	‘22.03d5 (2026)’				
	Estimate	SE	Phase	LB	UB
pDevsLnC SCF: 1992+	1.708e+00	1.963e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC SCF: 1992+	1.925e+00	2.014e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC SCF: 1992+	9.367e-01	1.987e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC SCF: 1992+	1.295e+00	1.903e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC SCF: 1992+	6.846e-01	1.875e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC SCF: 1992+	7.131e-01	1.909e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC SCF: 1992+	1.427e+00	1.982e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC SCF: 1992+	9.010e-01	2.058e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC SCF: 1992+	4.259e-01	2.025e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC SCF: 1992+	-7.691e-01	2.092e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC SCF: 1992+	-1.009e+00	2.168e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC SCF: 1992+	-2.941e-01	2.137e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC SCF: 1992+	-1.122e+00	2.120e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC SCF: 1992+	-2.117e+00	2.229e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC SCF: 1992+	-1.996e+00	1.993e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC SCF: 1992+	6.964e-02	1.974e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC SCF: 1992+	1.867e-01	1.903e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC SCF: 1992+	2.541e-01	1.941e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC SCF: 1992+	-3.898e-01	1.959e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC SCF: 1992+	-4.557e-02	1.976e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC SCF: 1992+	5.772e-02	1.985e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC SCF: 1992+	6.078e-01	1.973e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC SCF: 1992+	3.431e-01	1.967e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC SCF: 1992+	2.931e-01	1.960e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC SCF: 1992+	1.125e+00	1.914e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC SCF: 1992+	8.610e-01	1.932e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC SCF: 1992+	7.478e-01	1.948e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC SCF: 1992+	1.075e-01	1.976e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC SCF: 1992+	1.798e-01	1.986e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC SCF: 1992+	5.004e-01	1.983e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC SCF: 1992+	-1.063e+00	2.044e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC SCF: 1992+	-2.280e+00	2.318e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC SCF: 1992+	-2.990e+00	2.447e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC SCF: 1992+	-1.274e+00	2.018e-01	2.000e+00	-5.000e+00	5.000e+00

Table 65. TCSAM02 models final values for annual capture rate devs parameters for the BBRKC fishery (RKF). Parameters with values whose standard error is NA are fixed, not estimated.

Description	‘22.03d5 (2026)’				
	Estimate	SE	Phase	LB	UB
pDevsLnC RKF: 1992+	4.049e+00	2.355e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC RKF: 1992+	3.846e+00	2.519e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC RKF: 1992+	3.597e+00	2.519e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC RKF: 1992+	4.480e+00	2.359e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC RKF: 1992+	2.391e+00	2.431e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC RKF: 1992+	1.174e+00	2.639e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC RKF: 1992+	1.030e+00	2.640e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC RKF: 1992+	4.380e-01	2.847e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC RKF: 1992+	1.835e-01	2.970e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC RKF: 1992+	-3.218e-01	3.765e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC RKF: 1992+	-1.129e-01	2.967e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC RKF: 1992+	-3.867e-01	3.024e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC RKF: 1992+	-8.242e-01	3.517e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC RKF: 1992+	-1.003e+00	3.376e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC RKF: 1992+	-1.510e+00	4.467e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC RKF: 1992+	-9.724e-01	2.674e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC RKF: 1992+	4.368e-01	2.221e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC RKF: 1992+	6.266e-02	2.242e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC RKF: 1992+	-1.771e+00	4.189e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC RKF: 1992+	-2.210e+00	6.905e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC RKF: 1992+	-1.144e+00	3.211e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC RKF: 1992+	-8.525e-02	2.319e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC RKF: 1992+	6.388e-01	2.235e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC RKF: 1992+	1.924e-01	2.215e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC RKF: 1992+	1.643e-01	2.223e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC RKF: 1992+	2.781e-01	2.248e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC RKF: 1992+	-4.497e-01	2.564e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC RKF: 1992+	-1.417e+00	5.756e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC RKF: 1992+	-2.496e+00	1.319e+00	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC RKF: 1992+	-2.597e+00	1.062e+00	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC RKF: 1992+	-3.119e+00	1.314e+00	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC RKF: 1992+	-2.541e+00	9.107e-01	2.000e+00	-5.000e+00	5.000e+00

Table 66. TCSAM02 models final values for annual capture rate devs parameters for the ground-fish fisheries (GFA). Parameters with values whose standard error is NA are fixed, not estimated.

Description	‘22.03d5 (2026)’				
	Estimate	SE	Phase	LB	UB
pDevsLnC GF.AllGear: 1973+	1.311e+00	1.680e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	1.584e+00	1.593e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	7.896e-01	1.572e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	3.856e-01	1.557e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	2.800e-02	1.558e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	-1.700e-01	1.570e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	3.214e-01	1.588e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	-1.430e-01	1.561e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	-2.064e-01	1.511e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	-1.052e+00	1.492e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	-5.755e-01	1.519e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	-2.757e-01	1.574e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	-6.659e-01	1.549e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	-4.724e-01	1.503e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	3.134e-01	1.635e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	-1.654e-01	1.615e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	2.517e-01	1.591e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	6.740e-01	1.582e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	1.455e+00	1.573e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	1.707e+00	1.578e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	1.407e+00	1.579e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	1.821e+00	1.591e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	1.711e+00	1.594e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	1.898e+00	1.610e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	1.564e+00	1.477e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	1.429e+00	1.461e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	9.117e-01	1.454e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	9.580e-01	1.456e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	1.188e+00	1.457e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	4.809e-01	1.455e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	-6.332e-02	1.453e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	2.263e-01	1.451e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	-1.070e-01	1.451e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	-1.369e-01	1.452e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	-4.928e-02	1.451e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	-3.916e-01	1.449e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	-7.727e-01	1.442e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	-1.113e+00	1.438e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	-7.970e-01	1.437e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	-1.261e+00	1.441e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	-6.819e-01	1.445e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	-6.035e-01	1.443e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	-7.554e-01	1.439e-01	2.000e+00	-5.000e+00	5.000e+00

pDevsLnC GF.AllGear: 1973+	-6.701e-01	1.438e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	-1.234e+00	1.436e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	-9.247e-01	1.437e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	-7.963e-01	1.441e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	-8.835e-01	1.448e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	-9.387e-01	1.455e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	-1.294e+00	1.452e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	-1.567e+00	1.451e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	-1.799e+00	1.461e-01	2.000e+00	-5.000e+00	5.000e+00
pDevsLnC GF.AllGear: 1973+	-1.847e+00	1.482e-01	2.000e+00	-5.000e+00	5.000e+00

Table 67. MMB (1,000's t) from the 22.03d5 (2026), 22.03d5 (GMACS), and 26.02 (GMACS) models.

year	'22.03d5 (2026)'	'22.03d5 (GMACS)'	'26.02 (GMACS)'
1948	0.0	0.0	0.0
1949	0.0	0.0	0.0
1950	0.0	0.1	0.1
1951	0.6	1.6	1.3
1952	4.5	12.3	10.4
1953	18.4	50.3	47.2
1954	45.6	123.2	124.3
1955	77.3	206.1	214.0
1956	103.0	273.7	285.0
1957	121.8	324.1	335.7
1958	135.6	361.3	371.4
1959	146.1	388.8	396.6
1960	154.6	409.0	414.3
1961	161.7	423.1	426.0
1962	168.5	432.7	433.4
1963	175.5	438.8	437.6
1964	184.0	443.2	440.3
1965	195.2	443.6	439.1
1966	208.9	442.5	436.5
1967	212.3	421.1	413.2
1968	220.2	393.9	384.1
1969	229.9	353.2	340.8
1970	268.3	325.5	309.8
1971	345.3	323.9	303.0
1972	439.0	349.9	323.1
1973	500.7	383.8	354.6
1974	494.4	390.0	363.8
1975	444.0	365.8	343.9
1976	359.4	295.5	276.7
1977	267.3	203.4	186.5
1978	210.5	149.1	136.0
1979	183.9	118.9	114.2
1980	142.4	80.3	71.2
1981	130.4	86.8	73.0
1982	123.1	100.8	85.8
1983	96.5	94.5	79.3
1984	63.7	72.1	55.6
1985	58.7	69.0	56.8
1986	67.4	78.6	72.6
1987	82.1	96.3	93.2

(continued)

year	‘22.03d5 (2026)’	‘22.03d5 (GMACS)’	‘26.02 (GMACS)’
1988	103.5	120.3	118.0
1989	114.4	125.8	122.7
1990	108.4	105.5	101.6
1991	109.1	102.7	98.6
1992	97.5	93.1	89.5
1993	87.9	87.3	84.5
1994	76.4	78.0	75.6
1995	62.4	65.4	63.1
1996	50.1	53.9	51.5
1997	41.7	45.9	43.2
1998	36.7	41.0	38.2
1999	35.1	39.6	36.9
2000	36.3	41.2	38.8
2001	39.9	45.5	43.1
2002	46.6	52.7	50.3
2003	56.2	63.0	60.6
2004	68.8	76.6	74.9
2005	83.2	91.9	90.4
2006	98.0	107.8	106.4
2007	112.6	123.1	117.0
2008	123.8	135.3	128.2
2009	124.9	135.8	138.1
2010	111.9	121.9	122.4
2011	95.5	105.3	101.2
2012	90.3	100.0	94.1
2013	101.2	111.2	103.4
2014	113.7	124.4	125.5
2015	111.0	121.0	119.5
2016	100.4	109.6	108.7
2017	82.5	91.3	91.5
2018	66.7	75.1	72.5
2019	56.4	64.2	62.9
2020	51.9	59.7	56.6
2021	58.8	67.6	65.0
2022	75.0	84.7	84.3
2023	90.6	100.3	103.4
2024	100.6	110.7	121.6
2025	116.9	129.0	127.5

Table 68. Recruitment (millions) from the 22.03d5 (2026), 22.03d5 (GMACS), and 26.02 (GMACS) models.

year	‘22.03d5 (2026)’	‘22.03d5 (GMACS)’	‘26.02 (GMACS)’
1948	889.7	2,187.2	1,925.9
1949	891.0	2,186.7	1,925.7
1950	894.1	2,186.2	1,925.5
1951	899.4	2,185.5	1,925.1
1952	907.7	2,184.5	1,924.6
1953	920.1	2,183.2	1,923.8
1954	937.7	2,181.6	1,922.7
1955	962.4	2,179.6	1,921.1
1956	996.4	2,177.3	1,919.0
1957	1,042.4	2,174.9	1,916.1
1958	1,103.4	2,172.2	1,912.1
1959	1,183.3	2,169.4	1,906.9
1960	1,289.4	2,167.6	1,901.5
1961	1,436.6	2,170.9	1,899.5
1962	1,654.3	2,187.1	1,907.6
1963	2,000.2	2,230.8	1,938.1
1964	2,577.0	2,323.9	2,005.3
1965	3,507.4	2,509.3	2,135.6
1966	4,649.3	2,927.0	2,427.7
1967	4,652.8	4,025.7	3,267.7
1968	2,849.8	3,346.4	2,936.9
1969	1,935.9	2,218.4	1,891.0
1970	1,591.6	1,993.1	1,794.8
1971	1,005.2	1,380.2	1,261.4
1972	756.5	989.9	952.6
1973	1,136.4	1,894.2	1,845.7
1974	1,381.3	1,133.2	2,070.8
1975	3,587.3	4,659.6	4,525.4
1976	2,005.9	2,369.9	3,044.6
1977	737.1	825.7	729.9
1978	409.5	444.7	441.8
1979	363.6	392.1	384.4
1980	446.3	476.1	476.0
1981	356.9	439.4	451.7
1982	1,325.2	1,470.6	1,247.5
1983	964.1	1,153.3	903.6
1984	1,026.6	1,090.7	926.7
1985	1,233.4	1,275.2	1,110.7
1986	774.2	971.2	844.6
1987	569.3	601.0	486.5

(continued)

year	‘22.03d5 (2026)’	‘22.03d5 (GMACS)’	‘26.02 (GMACS)’
1988	283.0	316.2	285.0
1989	134.4	162.4	154.4
1990	101.8	122.6	113.3
1991	120.3	127.7	113.4
1992	118.4	133.2	117.4
1993	149.1	161.5	136.8
1994	236.4	235.9	210.1
1995	161.8	217.3	192.2
1996	467.0	454.5	366.9
1997	165.9	219.7	198.1
1998	812.7	797.6	690.1
1999	249.7	335.7	301.6
2000	1,156.4	1,136.0	945.3
2001	365.4	427.1	433.8
2002	1,251.7	1,297.8	968.5
2003	659.5	693.8	550.3
2004	214.0	245.5	240.8
2005	135.1	179.5	160.3
2006	258.3	257.2	224.3
2007	524.8	488.8	494.3
2008	1,593.7	1,618.4	1,306.6
2009	556.5	649.1	547.7
2010	271.1	280.5	266.5
2011	87.4	128.9	140.0
2012	203.0	202.5	187.1
2013	99.1	120.0	116.0
2014	115.7	132.7	140.8
2015	234.0	244.2	245.5
2016	973.1	1,011.1	953.1
2017	553.5	591.9	487.6
2018	679.2	687.4	607.8
2019	379.0	447.7	448.8
2020	1,636.3	1,644.6	1,570.0
2021	2,037.9	2,088.5	1,739.3
2022	1,585.3	1,631.4	1,548.4
2023	715.2	754.7	717.4
2024	672.6	653.2	567.2
2025	515.2	522.4	458.2

Table 69. Ratios of total catch mortality to MMB by year from the 22.03d5 (2026), 22.03d5 (GMACS), and 26.02 (GMACS) models.

year	‘22.03d5 (2026)’	‘22.03d5 (GMACS)’	‘26.02 (GMACS)’
1948	0.0000	0.0000	0.0000
1949	0.0000	0.0000	0.0000
1950	0.5092	0.0000	0.0000
1951	0.1302	0.0000	0.0000
1952	0.0464	0.0000	0.0000
1953	0.0275	0.0002	0.0001
1954	0.0246	0.0002	0.0002
1955	0.0258	0.0006	0.0006
1956	0.0271	0.0011	0.0011
1957	0.0269	0.0007	0.0007
1958	0.0272	0.0009	0.0009
1959	0.0271	0.0007	0.0007
1960	0.0272	0.0009	0.0008
1961	0.0288	0.0024	0.0023
1962	0.0305	0.0041	0.0040
1963	0.0323	0.0060	0.0058
1964	0.0322	0.0060	0.0058
1965	0.0289	0.0131	0.0134
1966	0.0318	0.0156	0.0161
1967	0.1095	0.0719	0.0761
1968	0.1447	0.1057	0.1128
1969	0.2236	0.1889	0.2046
1970	0.1949	0.2091	0.2300
1971	0.1235	0.1861	0.2089
1972	0.0792	0.1479	0.1696
1973	0.0778	0.1388	0.1580
1974	0.0906	0.1484	0.1664
1975	0.0804	0.1371	0.1525
1976	0.1388	0.2600	0.2950
1977	0.2239	0.4893	0.5862
1978	0.1997	0.5218	0.6813
1979	0.2274	0.7412	0.9902
1980	0.2690	1.3420	1.8974
1981	0.1039	0.3488	0.4838
1982	0.0429	0.0812	0.1042
1983	0.0160	0.0206	0.0248
1984	0.0492	0.0567	0.0731
1985	0.0197	0.0192	0.0211
1986	0.0254	0.0246	0.0257
1987	0.0436	0.0524	0.0557

(continued)

year	‘22.03d5 (2026)’	‘22.03d5 (GMACS)’	‘26.02 (GMACS)’
1988	0.0651	0.0894	0.0949
1989	0.1741	0.2509	0.2668
1990	0.3176	0.5124	0.5547
1991	0.2267	0.2369	0.2528
1992	0.2874	0.3022	0.3190
1993	0.1581	0.1587	0.1653
1994	0.0873	0.0846	0.0872
1995	0.0657	0.0617	0.0639
1996	0.0549	0.0502	0.0526
1997	0.0376	0.0341	0.0364
1998	0.0302	0.0270	0.0290
1999	0.0160	0.0142	0.0153
2000	0.0164	0.0145	0.0154
2001	0.0223	0.0197	0.0209
2002	0.0111	0.0099	0.0103
2003	0.0062	0.0055	0.0058
2004	0.0079	0.0071	0.0073
2005	0.0170	0.0154	0.0156
2006	0.0234	0.0212	0.0215
2007	0.0237	0.0216	0.0226
2008	0.0158	0.0145	0.0153
2009	0.0120	0.0110	0.0108
2010	0.0059	0.0054	0.0054
2011	0.0094	0.0085	0.0088
2012	0.0071	0.0064	0.0068
2013	0.0224	0.0203	0.0218
2014	0.0791	0.0721	0.0716
2015	0.1042	0.0952	0.0968
2016	0.0114	0.0105	0.0106
2017	0.0214	0.0193	0.0193
2018	0.0256	0.0227	0.0235
2019	0.0087	0.0076	0.0077
2020	0.0186	0.0161	0.0170
2021	0.0130	0.0113	0.0118
2022	0.0163	0.0143	0.0145
2023	0.0129	0.0116	0.0112
2024	0.0332	0.0300	0.0273
2025	0.0528	0.0477	0.0483

Table 70. P-star and buffer ABCs from the models considered for management. The p-star ABCs are the maximum permissible ABCs under each model and are base on model-derived estimates of uncertainty in the associated OFL. The buffer ABCs are based on applying an author-recommended 0.2% buffer to the OFL.

case	OFL	se(OFL)	ABC.pstar	ABC.buff
‘22.03d5 (2026)’	67.38800	4.148100	67.28401	53.91040
‘22.03d5 (GMACS)’	72.10207	4.367417	71.99258	57.68166
‘26.02 (GMACS)’	53.72778	3.122627	53.64949	42.98222

Table 71. Observed and random walk model-estimated time series for vulnerable male biomass from the NMFS EBS shelf survey. All values are in 1,000s t. lci: lower confidence interval; uci: upper confidence interval. Confidence intervals are 80%.

year	observed			rema		
	value	lci	uci	value	lci	uci
1975	268.0	173.6	413.7	208.8	147.5	295.5
1976	139.5	115.1	169.0	142.8	119.8	170.1
1977	119.2	100.9	140.7	117.1	100.4	136.5
1978	82.6	70.0	97.5	79.9	68.5	93.1
1979	33.5	28.3	39.6	38.3	32.7	44.9
1980	88.7	69.5	113.3	72.7	58.8	89.8
1981	51.8	44.2	60.7	53.0	45.7	61.4
1982	51.7	43.0	62.3	49.3	41.7	58.4
1983	30.2	24.9	36.7	31.0	26.0	36.9
1984	24.2	20.3	28.9	23.4	19.9	27.5
1985	11.7	9.6	14.2	12.9	10.8	15.4
1986	13.6	10.1	18.4	15.0	11.8	19.1
1987	22.9	19.0	27.7	24.1	20.3	28.7
1988	68.1	48.4	96.0	58.7	45.2	76.2
1989	104.4	87.3	124.8	99.0	84.0	116.7
1990	103.2	85.2	125.0	103.6	87.1	123.2
1991	116.7	90.0	151.5	111.8	89.6	139.3
1992	112.2	82.1	153.4	100.3	78.2	128.7
1993	64.2	52.6	78.4	64.6	54.0	77.3
1994	43.1	36.5	50.9	43.4	37.2	50.6
1995	31.1	24.7	39.2	31.2	25.5	38.2
1996	26.0	19.1	35.4	22.8	17.9	29.2
1997	10.7	9.2	12.5	11.3	9.8	13.1
1998	10.5	9.1	12.0	10.6	9.3	12.1
1999	11.8	9.2	15.0	12.1	9.8	14.9
2000	16.9	12.4	23.0	15.9	12.4	20.3
2001	17.5	14.4	21.2	17.3	14.5	20.6
2002	16.5	13.5	20.2	17.1	14.3	20.5
2003	21.8	17.9	26.5	21.7	18.2	25.9
2004	25.6	20.4	32.2	26.8	22.0	32.7
2005	43.4	36.2	52.1	42.7	36.1	50.4
2006	60.9	48.1	77.0	58.3	47.5	71.6
2007	67.5	50.8	89.7	64.0	50.6	81.1
2008	66.9	46.7	95.9	58.4	44.5	76.6
2009	37.2	30.5	45.4	39.4	32.9	47.1

(continued)

year	observed	lci	uci	rema	lci	uci
	value			value		
2010	40.0	31.1	51.3	40.0	32.3	49.6
2011	41.1	30.6	55.2	41.2	32.4	52.3
2012	39.3	31.5	49.0	42.4	34.9	51.6
2013	76.2	55.3	104.9	69.2	53.9	88.8
2014	88.8	77.9	101.2	86.2	76.1	97.7
2015	64.5	57.1	73.0	65.2	58.0	73.4
2016	60.4	53.6	68.1	60.0	53.5	67.3
2017	48.2	41.7	55.7	48.0	41.9	55.0
2018	37.8	32.9	43.4	36.8	32.4	42.0
2019	18.3	15.7	21.3	19.2	16.6	22.2
2020	— —	— —	— —	18.3	12.3	27.1
2021	17.2	14.7	20.0	17.4	15.0	20.2
2022	19.9	16.9	23.5	19.7	16.9	22.8
2023	18.6	16.6	20.9	19.1	17.1	21.3
2024	32.1	28.3	36.5	32.4	28.7	36.6
2025	68.8	54.6	86.9	64.0	52.3	78.4
2026	93.5	70.9	123.3	86.4	67.3	110.9

Table 72. Tier 4 management quantities for candidate B_{MSY} averaging periods. Biomass quantities (B, B_{MSY} , OFL) are in 1,000s t.

time block	M	B	B_{MSY}	status	F_{OFL}	OFL
1975:2026	0.23	86.37	51.25	1.69	0.23	17.75
1975:1980	0.23	86.37	109.93	0.79	0.18	13.88
1982:2026	0.23	86.37	43.39	1.99	0.23	17.75
1987:1995,2005:2009,2013:2015	0.23	86.37	65.89	1.31	0.23	17.75
2005:2009,2013:2015	0.23	86.37	60.43	1.43	0.23	17.75

Table 73. Abundance measures for PSC. “model”: preferred model-based estimates of total survey abundance (excludes crab < 25 mm CW). “survey”: design-based estimates of total survey abundance (includes crab < 25 mm CW). Abundance units are millions of crab. The survey was not conducted in 2020.

	model	survey
year	millions	millions
1975	753.8	790.1
1976	726.3	683.5
1977	683.8	847.9
1978	636.4	582.0
1979	607.6	384.9
1980	574.2	1252.8
1981	425.0	598.5
1982	505.3	684.5
1983	475.9	451.3
1984	454.7	298.4
1985	472.5	113.2
1986	558.2	199.1
1987	586.6	483.2
1988	584.1	734.0
1989	541.2	925.9
1990	470.6	813.8
1991	387.9	822.6
1992	316.9	510.2
1993	251.1	272.3
1994	206.9	212.2
1995	185.1	188.0
1996	164.5	178.8
1997	183.0	153.7
1998	173.0	160.7
1999	234.3	272.3
2000	234.1	222.9
2001	329.6	555.2
2002	335.0	374.8
2003	432.2	442.5
2004	458.3	478.1
2005	432.5	681.7

(continued)

	model	survey
year	millions	millions
2006	394.7	769.0
2007	365.5	644.3
2008	359.7	388.5
2009	463.9	336.5
2010	456.0	368.1
2011	426.9	659.6
2012	385.2	708.6
2013	356.1	642.8
2014	309.1	540.0
2015	257.7	329.2
2016	222.8	285.4
2017	279.5	344.8
2018	294.5	507.3
2019	328.1	420.9
2020	332.8	NA
2021	469.3	385.0
2022	635.5	381.4
2023	740.1	774.8
2024	746.2	1215.7
2025	743.6	1151.3
2026	712.4	779.9

Figures

List of Figures

- 1 Eastern Bering Sea District of the ADF&G Tanner crab Registration Area J, including sub-districts and sections (from Bowers et al. 2008). Separate TACs are set annually for the areas east and west of 166°W in the General Section. These management areas are identified in the text, tables, and figures as 'East 166W' and 'West 166W', respectively based on the split at 166°W longitude. 194
- 2 Sloping control rule used by ADF&G from 2011 to 2019 as part of its TAC setting process to determine the maximum exploitation rate on mature male biomass as a function of the ratio of current mature female biomass (MFB) to MFB averaged over some time period. 195
- 3 Current ADF&G “floating” sloping control rule to determine the maximum exploitation rate on mature male biomass (MMB) as a function of the ratio of current MMB to the average MMB over 1982-2018. The ratio of current mature female biomass (MFB) to MFB averaged over 1982-2018 is used to determine the value of the maximum exploitation rate for the control rule, up to a maximum of 20%. 196
- 4 Total retained catch (males, 1000's t) in the directed fisheries (foreign [1965-1979] and domestic [1968-]) for Tanner crab (aggregated across State management areas). The bars indicate the Tier 3 OFL and ABC (upper and lower limits, respectively; (values start in 2011/12); the triangles indicate the area-aggregated TAC (values start in 2005/06, following rationalization). 197
- 5 Upper plot: time series of retained catch biomass (1000's t) in the directed Tanner crab (TCF), snow crab (SCF), and BBRKC (RKF) fisheries since 2005. The bars indicate the OFL and ABC (upper and lower limits, respectively; values start in 2011/12); the triangles indicate the total (area-combined) TAC, points indicate the retained catch. Legal-sized Tanner crab can be incidentally-retained in the snow crab and BBRKC fisheries up to a cap of 5% the target catch. Lower plot: retained catch biomass (1000's t) by SOA management area and combined. The triangles indicate the area-combined (“all EBS”) and area-specific (“East 166W”, “West 166W”) TACS. The directed fisheries in both SOA management areas were both closed from 2010/11 to 2012/13, as well as in 2016/17 and 2019/20. The directed fishery in the eastern area was also closed in 2005/06, 2017/18, 2018/19, 2020/21, and 2021/22. . . 198
- 6 Retained catch size compositions, scaled to total abundance by area and year. Vertical bars and points indicate median sizes, dotted vertical line indicates recent industry-preferred size. 199
- 7 Retained catch size compositions, scaled to total retained abundance by area and year from recent seasons. Vertical bars and points indicate median sizes. Vertical dotted line indicates recent industry-preferred size. 200
- 8 Retained catch size compositions from recent seasons, normalized to sum to 1 by area and year to show contrast. Vertical bars and points indicate median size. Dotted line indicates recent industry-preferred size. 201
- 9 The fraction of new shell males in the retained catch, by management area, for the directed fishery since 2005/06. 202

10	Total catch (retained + discards) biomass estimates for Tanner crab (sexes combined) in the directed Tanner crab (TCF), snow crab (SCF), Bristol Bay red king crab (RKF), and groundfish fisheries (GF). Values for the directed fishery prior to 1991/92 do not include bycatch. Discard mortality rates have not been applied to these estimates.	203
11	Discard biomass estimates for Tanner crab (sexes combined) in the directed Tanner crab (TCF), snow crab (SCF), Bristol Bay red king crab (RKF), and groundfish fisheries (GF). Discard estimates for the directed fishery were derived using the subtraction method. Discard mortality rates have not been applied to these estimates.	204
12	Discard mortality (biomass) estimates for Tanner crab (sexes combined) in the directed Tanner crab (TCF), snow crab (SCF), Bristol Bay red king crab (RKF), and groundfish fisheries (GF). Discard estimates for the directed fishery were derived using the subtraction method. Gear-specific assumed discard mortality rates have been applied.	205
13	Total catch mortality (biomass) estimates for Tanner crab (sexes combined) in the directed Tanner crab (TCF), snow crab (SCF), Bristol Bay red king crab (RKF), and groundfish fisheries (GF). The bars indicate the Tier 3 OFL and ABC (upper and lower limits, respectively; values start in 2011/12). Values for discards in the crab fisheries are not available prior to 1991/92.	206
14	Comparison of expanded size compositions for retained and total catch in the directed fishery prior to 1997/98. Retained catch has already been aggregated across ADF&G management areas. Dotted line indicates recent industry-preferred size.	207
15	Comparison of expanded size compositions for retained and total catch in the directed fishery after 2004/05. Dotted line indicates recent industry-preferred size.	208
16	Comparison of <i>relative</i> size compositions for retained and total catch in the directed fishery prior to 1997/98. Individual compositions are scaled to sum to 1 across sizes. Retained catch has already been aggregated across ADF&G management areas. Dotted line indicates recent industry-preferred size.	209
17	Comparison of <i>relative</i> size compositions for retained and total catch in the directed fishery after 2004/05. Individual compositions are scaled to sum to 1 across sizes. Dotted line indicates recent industry-preferred size.	210
18	Comparison of expanded size compositions for total catch of Tanner crab in the crab fisheries prior to 2005/06. Catch has already been aggregated across ADF&G management areas. Dotted line indicates recent industry-preferred size. TCF: directed Tanner crab fishery; SCF: snow crab fishery; RKF: BBRKC fishery.	211
19	Comparison of expanded size compositions for total catch of Tanner crab in the crab fisheries after 2004/05. Catch has already been aggregated across ADF&G management areas. Dotted line indicates recent industry-preferred size. TCF: directed Tanner crab fishery; SCF: snow crab fishery; RKF: BBRKC fishery.	212
20	Comparison of <i>relative</i> size compositions for total catch of Tanner crab in the directed and snow crab fisheries prior to 2005/06. Catch has already been aggregated across ADF&G management areas. Individual compositions are scaled to sum to 1 across sizes. Dotted line indicates recent industry-preferred size. TCF: directed Tanner crab fishery; SCF: snow crab fishery.	213

21	Comparison of <i>relative</i> size compositions for total catch of Tanner crab in the crab fisheries after 2004/05. Catch has already been aggregated across ADF&G management areas. Individual compositions are scaled to sum to 1 across sizes. Dotted line indicates recent industry-preferred size. TCF: directed Tanner crab fishery; SCF: snow crab fishery.	214
22	Comparison of <i>relative</i> size compositions for total catch of Tanner crab in the directed and BBRKC fisheries prior to 2005/06. Catch has already been aggregated across ADF&G management areas. Individual compositions are scaled to sum to 1 across sizes. Size compositions limited to a few samples are not plotted to improve clarity. Dotted line indicates recent industry-preferred size. TCF: directed Tanner crab fishery; RKF: BBRKC fishery.	215
23	Comparison of <i>relative</i> size compositions for total catch of Tanner crab in the directed and BBRKC fisheries after 2004/05. Catch has already been aggregated across ADF&G management areas. Individual compositions are scaled to sum to 1 across sizes. Size compositions limited to a few samples are not plotted to improve clarity. Dotted line indicates recent industry-preferred size. TCF: directed Tanner crab fishery; RKF: BBRKC fishery.	216
24	Expanded size compositions for total catch of Tanner crab in the groundfish fisheries prior to 1990/91. Dotted line indicates recent industry-preferred size.	217
25	Comparison of expanded size compositions for total catch of Tanner crab in the directed ('TCF') and groundfish ('GF') fisheries during 1991/92-2004/05. Dotted line indicates recent industry-preferred size.	218
26	Comparison of expanded size compositions for total catch of Tanner crab in the directed ('TCF') and groundfish ('GF') fisheries since 2005/06. Dotted line indicates recent industry-preferred size.	219
27	Comparison of <i>relative</i> size compositions for total catch of Tanner crab in the directed ('TCF') and groundfish ('GF') fisheries during 1991/92-2004/05. Dotted line indicates recent industry-preferred size.	220
28	Comparison of <i>relative</i> size compositions for total catch of Tanner crab in the directed ('TCF') and groundfish ('GF') fisheries since 2005/06. Dotted line indicates recent industry-preferred size.	221
29	NMFS EBS shelf station grid (squares and circles). Hauls at the 26 so-called “corner” stations (circles) near the Pribilof Islands and St. Matthew Island were discontinued in 2024.	222
30	Annual estimates of design-based area-swept biomass (upper plots) and abundance (lower plots) from the NMFS EBS bottom trawl survey by sex. The lower plot in each pair shows the trends since 2000. The biomass/abundance trends for industry-preferred size males (> 125 mm CW; 'IPM') are also shown.	223
31	Annual estimates of design-based area-swept biomass (upper plots) and abundance (lower plots) from the NMFS EBS bottom trawl survey by population category and management area.	224
32	Comparison of the annual percent of new shell industry-preferred size males caught in the NMFS EBS shelf survey and the directed fishery ('TCF'), by ADF&G management area. The survey values have been lagged a year to align visually with the fishery values.	225
33	Comparison of the biomass of industry-preferred size males estimated from the NMFS EBS shelf survey and caught in the directed fishery ('TCF'), by ADF&G management area.	226

34	Annual spatial footprints of the BSFRF-NMFS collaborative side-by-side (SBS) Tanner crab catchability studies (2013-2018). BSFRF SBS tows were made in parallel to standard NMFS survey tows at a (different) subset of standard NMFS stations each year of the study. The BSFRF vessel used a modified nephrops bottom trawl assumed to capture all crab within the area swept.	227
35	Comparison of estimates of area-swept biomass (left column) and abundance (right column) from the BSFRF-NMFS cooperative side-by-side (SBS) catchability studies and the full NMFS survey in 2013-2018. The SBS studies had different spatial footprints each year, so annual changes in biomass do not necessarily reflect underlying population trends.	228
36	Annual size compositions, by 5-mm CW bin, from the NMFS EBS shelf bottom trawl survey for males by ADF&G management area for 1975-2026 as a bubble plot. The size compositions are truncated for crab < 25 mm CW.	229
37	Annual size compositions, by 5-mm CW bin, from the NMFS EBS shelf bottom trawl survey for females by ADF&G management area for 1975-2026 as a bubble plot. The size compositions are truncated for crab < 25 mm CW.	230
38	Maximum size in the annual 5-mm CW binned size compositions from the NMFS EBS shelf bottom trawl survey by sex for 1975-2026. Circles: annual values; lines and shading: loess-smoothed trends.	231
39	Comparison of size compositions from the SBS catchability study and the corresponding full NMFS EBS shelf survey. The size compositions are truncated for crab < 25 mm CW.	232
40	Spatial CPUE of small males (< 60 mm CW) in the NMFS EBS survey. The grey area with blue outline indicates the summer cod pool.	233
41	Spatial CPUE of large males (> 60 mm CW) in the NMFS EBS survey. The grey area with blue outline indicates the summer cod pool.	234
42	Spatial CPUE of industry-preferred (≥ 125 mm CW) in the NMFS EBS survey. The grey area with blue outline indicates the summer cod pool.	235
43	Spatial CPUE of immature females in the NMFS EBS survey. The grey area with blue outline indicates the summer cod pool.	236
44	Spatial CPUE of mature females in the NMFS EBS survey. The grey area with blue outline indicates the summer cod pool.	237
45	Estimates of the proportion of mature new shell males in the NMFS EBS shelf survey, by 5 mm CW size bin, based on male crab with chela height/carapace width measurements taken with 0.1 mm precision. Symbol size (area) indicates the number of crab measured. Chela heights for Tanner crab are not measured every year.	238
46	Molt increment data collected collaboratively by NMFS, BSFRF, and ADF&G. Symbol color denotes collection year. Dotted line indicates no growth (i.e., post-molt size = pre-molt size).	239
47	Size-weight relationships for Tanner crab.	240
48	Empirical availability curves for BSFRF SBS data. Circles: “raw” empirical availability estimates. Size: total number of individual crab sampled. Lines/fills: smooth GAM model fits to “raw” data, with 95% confidence intervals.	241
49	The nominal shape (a truncated gamma distribution) for the assumed size distribution of Tanner crab at recruitment to the model.	242
50	Results from 400 jitter runs for 22.03d5 (2026). Of these, 217 appear to have converged to the MLE (blue dots). The minimum objective function found was 3,944.48; the maximum gradient for that model run was 0.000754. 24 failed to finish.	243

51	Results from 400 jitter runs for 22.03d5 (GMACS). Of these, 3 appear to have converged to the MLE (blue dots). The minimum objective function found was 4,135.40; the maximum gradient for that model run was 0.0966. 274 failed to finish.	244
52	Results from 400 jitter runs for 26.02 (GMACS). Of these, 0 appear to have converged to the MLE (blue dots). The minimum objective function found was 4,685.54; the maximum gradient for that model run was 0.144. 242 failed to finish.	245
53	Estimated fully-selected capture rates (not mortality) in the directed fishery. The lower pair of plots show the estimated time series since 1980. Preferred model is 22.03d5 (2026).	246
54	Estimated selectivity for females in the directed fishery for all years. Preferred model is 22.03d5 (2026).	247
55	Estimated selectivity curves for males in the directed fishery, faceted by model scenario. Curves labelled 1990 applies to all years before 1991. Others apply in the year indicated in the legend. Preferred model is 22.03d5 (2026).	248
56	Estimated selectivity curves for males in the directed fishery by year. Curve labelled 1990 applies to all years before 1991. Others apply in the year indicated in the panel. Preferred model is 22.03d5 (2026).	249
57	TCSAM02 models estimated retention curves for males in the directed fishery by time block. The dotted line indicates the current industry-preferred size (125 mm CW). Preferred model is 22.03d5 (2026).	250
58	TCSAM02 models estimated fully-selected bycatch capture rates (not mortality) and selectivity functions in the snow crab fishery. Time blocks for selectivity functions are labelled: 1) before 1997; 2) 1997-2004; 3) 2005-present. Preferred model is 22.03d5 (2026).	251
59	TCSAM02 models estimated fully-selected bycatch capture rates (not mortality) and selectivity functions in the BBRKC fishery. Time blocks for selectivity functions are 1) before 1997; 2) 1997-2004; 3) 2005-present. Preferred model is 22.03d5 (2026).	252
60	TCSAM02 models estimated fully-selected bycatch capture rates (not mortality) and selectivity functions in the groundfish fisheries. Time blocks for selectivity functions are : 1) before 1988; 2) 1987-1996; 3) 1997-present. Preferred model is 22.03d5 (2026).	253
61	Estimated NMFS EBS Survey fully-selected catchability (survey Q's) and selectivity functions by sex for different time periods. 1975: 1975-1981; 1982: 1982-current. Preferred model is 22.03d5 (2026).	254
62	Annual sex-specific availability curves assumed for the BSFRF side-by-side (SBS) survey data. The availability curves were estimated outside the TCSAM02 models. Preferred model is 22.03d5 (2026).	255
63	Estimated population processes. Plots in upper lefthand quadrant: sex-specific mean growth; plots in lower lefthand quadrant: sex-specific probability of the molt-to-maturity (i.e., terminal molt); plots in righthand column: natural mortality rates, by maturity state and sex. Preferred model is 22.03d5 (2026).	256
64	Estimated annual cohort progression for female crab based on rates from final model year (by age; individual scales are relative). Preferred model is 22.03d5 (2026).	257
65	Estimated annual cohort progression for male crab based on rates from final model year (by age; individual scales are relative). Preferred model is 22.03d5 (2026).	258
66	Estimated recruitment and mature biomass time series (all years). Upper plot: recruitment; lower plots: sex-specific mature biomass-at-mating. Preferred model is 22.03d5 (2026).	259

67	Estimated recruitment and mature biomass time series (recent years). Upper plot: recruitment; lower plots: sex-specific mature biomass-at-mating. Preferred model is 22.03d5 (2026).	260
68	Estimated population abundance trends, by sex and maturity state. Upper plots: all years; lower plots: recent years. Preferred model is 22.03d5 (2026).	261
69	Estimated population biomass trends, by sex and maturity state. Upper plots: all years; lower plots: recent years. Preferred model is 22.03d5 (2026).	262
70	TCSAM02 models fits to retained catch biomass in the directed fishery (upper two rows) and residuals analysis plots (lower two rows). Confidence intervals are 95%.	263
71	TCSAM02 models fits to total catch biomass of all crab in the TCF fishery (upper row) and residuals analysis plots (lower two rows). Confidence intervals are 95%.	264
72	TCSAM02 models fits to total catch biomass of all crab in the SCF fishery (upper row) and residuals analysis plots (lower two rows). Confidence intervals are 95%.	265
73	TCSAM02 models fits to total catch biomass of all crab in the RKF fishery (upper row) and residuals analysis plots (lower two rows). Confidence intervals are 95%.	266
74	TCSAM02 models fits to total catch biomass of all crab in the GF All fishery (upper row) and residuals analysis plots (lower two rows). Confidence intervals are 95%.	267
75	TCSAM02 models fits to time series of all male (upper graph), immature female (center graph), and mature female (lower plot) biomass from the NMFS EBS shelf bottom trawl survey (left column) and the BSFRF SBS trawl survey (right column). Confidence intervals are 95%.	268
76	TCSAM02 models residuals analysis by model scenario for fits to male biomass in the NMFS EBS bottom trawl survey. Upper row: annual z-scores; bottom row: 1) MAD: median absolute deviations, 2) MARE: median absolute relative error; 3) RMSE: root mean square error.	269
77	TCSAM02 models residuals analysis by model scenario for fits to female biomass in the NMFS EBS bottom trawl survey. Upper row: annual z-scores; bottom row: 1) MAD: median absolute deviations, 2) MARE: median absolute relative error; 3) RMSE: root mean square error.	270
78	TCSAM02 models residuals analysis by model scenario for fits to male biomass in the BSFRF SBS bottom trawl survey. Upper row: annual z-scores; bottom row: 1) MAD: median absolute deviations, 2) MARE: median absolute relative error; 3) RMSE: root mean square error.	271
79	TCSAM02 models residuals analysis by model scenario for fits to female biomass in the BSFRF SBS bottom trawl survey. Upper row: annual z-scores; bottom row: 1) MAD: median absolute deviations, 2) MARE: median absolute relative error; 3) RMSE: root mean square error.	272
80	TCSAM02 models fits to time series of all male (upper graph), immature female (center graph), and mature female (lower plot) abundance from the NMFS EBS shelf bottom trawl survey (left column) and the BSFRF SBS trawl survey (right column). Note that these fits are not included in the model objective function and simply provide a diagnostic check. Confidence intervals are 95%.	273
81	TCSAM02 models residuals analysis by model scenario for fits to male abundance in the NMFS EBS bottom trawl survey. Upper row: annual z-scores; bottom row: 1) MAD: median absolute deviations, 2) MARE: median absolute relative error; 3) RMSE: root mean square error.	274

82	TCSAM02 models residuals analysis by model scenario for fits to female abundance in the NMFS EBS bottom trawl survey. Upper row: annual z-scores; bottom row: 1) MAD: median absolute deviations, 2) MARE: median absolute relative error; 3) RMSE: root mean square error.	275
83	TCSAM02 models residuals analysis by model scenario for fits to male abundance in the BSFRF SBS bottom trawl survey. Upper row: annual z-scores; bottom row: 1) MAD: median absolute deviations, 2) MARE: median absolute relative error; 3) RMSE: root mean square error.	276
84	TCSAM02 models residuals analysis by model scenario for fits to female abundance in the BSFRF SBS bottom trawl survey. Upper row: annual z-scores; bottom row: 1) MAD: median absolute deviations, 2) MARE: median absolute relative error; 3) RMSE: root mean square error.	277
85	TCSAM02 models fits and residuals analysis by model scenario for fits to molt increment data. Upper row: fits to data; center row: annual z-scores; bottom row: 1) MAD: median absolute deviations, 2) MARE: median absolute relative error; 3) RMSE: root mean square error.	278
86	TCSAM02 models fits to maturity ogive data by model scenario and year.	279
87	TCSAM02 models residuals analysis for maturity ogive data, by model scenario and year.	280
88	TCSAM02 models fits to retained catch size compositions in the directed fishery. Preferred model is 22.03d5 (2026).	281
89	Pearson's residuals for fits to retained catch size composition data. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X'to facilitate identification.	282
90	Pearson's residuals for fits to retained catch size composition data. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X'to facilitate identification.	283
91	OSA residuals for TCSAM02 models fit to male retained catch size compositions from the directed fishery.	284
92	TCSAM02 models fits to total catch size compositions in the TCF fishery.	285
93	TCSAM02 models fits to total catch size compositions in the TCF fishery.	286
94	Pearson's residuals for fits to total catch size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X'to facilitate identification.	287
95	Pearson's residuals for fits to total catch size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X'to facilitate identification.	288
96	Pearson's residuals for fits to total catch size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X'to facilitate identification.	289
97	Pearson's residuals for fits to total catch size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X'to facilitate identification.	290
98	TCSAM02 models fits to total catch size compositions in the SCF fishery.	291
99	TCSAM02 models fits to total catch size compositions in the SCF fishery.	292
100	Pearson's residuals for fits to total catch size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X'to facilitate identification.	293

101	Pearson's residuals for fits to total catch size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X'to facilitate identification.	294
102	Pearson's residuals for fits to total catch size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X'to facilitate identification.	295
103	Pearson's residuals for fits to total catch size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X'to facilitate identification.	296
104	TCSAM02 models fits to total catch size compostiions in the RKF fishery.	297
105	TCSAM02 models fits to total catch size compostiions in the RKF fishery.	298
106	Pearson's residuals for fits to total catch size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X'to facilitate identification.	299
107	Pearson's residuals for fits to total catch size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X'to facilitate identification.	300
108	Pearson's residuals for fits to total catch size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X'to facilitate identification.	301
109	Pearson's residuals for fits to total catch size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X'to facilitate identification.	302
110	TCSAM02 models fits to total catch size compostiions in the GF All fishery.	303
111	TCSAM02 models fits to total catch size compostiions in the GF All fishery.	304
112	Pearson's residuals for fits to total catch size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X'to facilitate identification.	305
113	Pearson's residuals for fits to total catch size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X'to facilitate identification.	306
114	Pearson's residuals for fits to total catch size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X'to facilitate identification.	307
115	Pearson's residuals for fits to total catch size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X'to facilitate identification.	308
116	OSA residuals for TCSAM02 models fit to male size compositions from the TCF fishery.	309
117	OSA residuals for TCSAM02 models fit to female size compositions from the TCF fishery.	310
118	OSA residuals for TCSAM02 models fit to male size compositions from the SCF fishery.	311
119	OSA residuals for TCSAM02 models fit to female size compositions from the SCF fishery.	312
120	OSA residuals for TCSAM02 models fit to male size compositions from the RKF fishery.	313

121	OSA residuals for TCSAM02 models fit to female size compositions from the RKF fishery.	314
122	OSA residuals for TCSAM02 models fit to male size compositions from the GF All fishery.	315
123	OSA residuals for TCSAM02 models fit to female size compositions from the GF All fishery.	316
124	TCSAM02 models fits to survey size compositions in the NMFS M survey. Preferred model is 22.03d5 (2026).	317
125	TCSAM02 models fits to survey size compositions in the NMFS M survey. Preferred model is 22.03d5 (2026).	318
126	Pearson's residuals for fits to survey size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X'to facilitate identification.	319
127	Pearson's residuals for fits to survey size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X'to facilitate identification.	320
128	OSA residuals for fits to size compositions from the NMFS_M survey. The base/preferred model is 22.03d5.	321
129	TCSAM02 models fits to survey size compositions in the NMFS F survey. Preferred model is 22.03d5 (2026).	322
130	TCSAM02 models fits to survey size compositions in the NMFS F survey. Preferred model is 22.03d5 (2026).	323
131	TCSAM02 models fits to survey size compositions in the NMFS F survey. Preferred model is 22.03d5 (2026).	324
132	TCSAM02 models fits to survey size compositions in the NMFS F survey. Preferred model is 22.03d5 (2026).	325
133	Pearson's residuals for fits to survey size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X'to facilitate identification.	326
134	Pearson's residuals for fits to survey size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X'to facilitate identification.	327
135	OSA residuals for fits to size compositions from the NMFS_F survey. The base/preferred model is 22.03d5.	328
136	OSA residuals for fits to size compositions from the NMFS_F survey. The base/preferred model is 22.03d5.	329
137	Fits to survey size compositions in the SBS BSFRF M survey. The base/preferred model is 22.03d5.	330
138	Pearson's residuals for fits to survey size composition in the BSFRF_M survey.Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X'to facilitate identification.	331
139	Pearson's residuals for fits to survey size composition in the BSFRF_M survey.Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X'to facilitate identification.	332
140	Fits to survey size compositions in the SBS BSFRF F survey. The base/preferred model is 22.03d5.	333
141	Fits to survey size compositions in the SBS BSFRF F survey. The base/preferred model is 22.03d5.	334

142	Pearson's residuals for fits to survey size composition in the BSFRF_F survey.Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X'to facilitate identification.	335
143	Pearson's residuals for fits to survey size composition in the BSFRF_F survey.Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X'to facilitate identification.	336
144	Comparison of estimated size-at-recruitment from the 22.03d5 (2026), 22.03d5 (GMACS), and 26.02 (GMACS) models. The size distribution at recruitment is not sex-specific.	337
145	Estimated natural mortality rates (M) from the 22.03d5 (2026), 22.03d5 (GMACS), and 26.02 (GMACS), by biological category. Upper: immature crab; lower: mature crab. "heightened": 1980-1984 time period; "normal": remaining time period.M did not change for immature crab in the "heightened" time period.	338
146	Estimated mean postmolt size, as a function of premolt size, from the 22.03d5 (2026), 22.03d5 (GMACS), and 26.02 (GMACS) models, by sex.	339
147	Estimated distribution of postmolt sizes, as a function of premolt size, from the 22.03d5 (2026), 22.03d5 (GMACS), and 26.02 (GMACS) models for males.	340
148	Estimated distribution of postmolt sizes, as a function of premolt size, from the 22.03d5 (2026), 22.03d5 (GMACS), and 26.02 (GMACS) models for females.	341
149	Comparison of the estimated probability of terminal molt for males from the 22.03d5 (2026), 22.03d5 (GMACS), and 26.02 (GMACS), by sex. Ogives prior to 2005 are the same as in that year.	342
150	Comparison of the estimated probability of terminal molt for females from the 22.03d5 (2026), 22.03d5 (GMACS), and 26.02 (GMACS), by sex. Ogives prior to 2005 are the same as in that year.	343
151	Comparison of the estimated fishery retention curves from the GMACS and TC-SAM02 models.	344
152	Comparison of the estimated fishery selectivity curves for males in the directed fishery as used in the GMACS and TCSAM02 models. The dotted line at 125 mm CW provides a reference point to the current industry-preferred size.	345
153	Comparison of the estimated fishery bycatch selectivity curves by sex in the snow crab fishery as used in the GMACS and TCSAM02 models. The dotted line at 125 mm CW provides a reference point to the current industry-preferred size.	346
154	Comparison of the estimated fishery bycatch selectivity curves by sex in the BBRKC fishery as used in the GMACS and TCSAM02 models. The dotted line at 125 mm CW provides a reference point to the current industry-preferred size.	347
155	Comparison of the estimated fishery bycatch selectivity curves by sex in the groundfish fisheries as used in the GMACS and TCSAM02 models. The dotted line at 125 mm CW provides a reference point to the current industry-preferred size.	348
156	Comparison of the estimated fully-selected fishery capture rates for males in the directed and bycatch fisheries from the GMACS and TCSAM02 models. TCF: directed Tanner crab fishery; SCF: snow crab fishery, RKF: BBRKC fishery; GF All: groundfish fisheries. Capture rates before 1990 in the snow crab and BBRKC fisheries are based on effort extrapolation. Capture rates for females (plots not shown) are propotional to those for males.	349
157	Comparison of the estimated NMFS survey selectivity curves by sex as used in the GMACS and TCSAM02 models.	350

158	Comparison of the BSFRF survey availability curves by sex as used in the GMACS and TCSAM02 models. Values were estimated outside the models and are identical across models.	351
159	Comparison of estimated fully-selected survey catchability ('q') for the NMFS survey by sex and year from the GMACS and TCSAM02 models. Fully-selected q's for the BSFRF surveys are 1 in both models and are not shown.	352
160	Comparison of estimated recruitment by year from the GMACS and TCSAM02 models. Upper plot: arithmetic scale; Lower plot: log-scale. The dotted vertical lines various temporal reference points: 1965-start of foreign fleet catch data; 1973-start of groundfish bycatch data; 1990-start of at sea observer estimates of total catch and size compositions in the crab fisheries; 2005-crab rationalization; 2020-no NMFS survey.	353
161	Comparison of the predicted abundance of a single recruitment cohort through time by sex and maturity/shell state using conditions from the final model year for the GMACS and TCSAM02 models.	354
162	Comparison of the predicted abundance-at-size of a single recruitment cohort through time by sex and maturity/shell condition using conditions from the final model year for the GMACS and TCSAM02 models.	355
163	Comparison of the predicted population abundance through time by maturity/shell condition for males from the GMACS and TCSAM02 models. The dotted vertical lines indicate various temporal reference points: 1965-start of foreign fleet catch data; 1973-start of groundfish bycatch data; 1990-start of at sea observer estimates of total catch and size compositions in the crab fisheries; 2005-crab rationalization; 2020-no NMFS survey.	356
164	Comparison of the predicted population abundance through time by maturity/shell condition for females from the GMACS and TCSAM02 models. The dotted vertical lines indicate various temporal reference points: 1965-start of foreign fleet catch data; 1973-start of groundfish bycatch data; 1990-start of at sea observer estimates of total catch and size compositions in the crab fisheries; 2005-crab rationalization; 2020-no NMFS survey.	357
165	Comparison of the predicted population biomass through time by maturity/shell condition for males from the GMACS and TCSAM02 models. The dotted vertical lines indicate various temporal reference points: 1965-start of foreign fleet catch data; 1973-start of groundfish bycatch data; 1990-start of at sea observer estimates of total catch and size compositions in the crab fisheries; 2005-crab rationalization; 2020-no NMFS survey.	358
166	Comparison of the predicted population biomass through time by maturity/shell condition for females from the GMACS and TCSAM02 models. The dotted vertical lines indicate various temporal reference points: 1965-start of foreign fleet catch data; 1973-start of groundfish bycatch data; 1990-start of at sea observer estimates of total catch and size compositions in the crab fisheries; 2005-crab rationalization; 2020-no NMFS survey.	359
167	Comparison of the predicted population abundance-at-size through time (1953-1975) for immature, new shell males from the GMACS and TCSAM02 models. Left: values; right: percent differences.	360
168	Comparison of the predicted population abundance-at-size through time (1976-2000) for immature, new shell males from the GMACS and TCSAM02 models. Left: values; right: percent differences.	361

169	Comparison of the predicted population abundance-at-size through time (2001-2025) for immature, new shell males from the GMACS and TCSAM02 models. Left: values; right: percent differences.	362
170	Comparison of the predicted population abundance-at-size through time (1953-1975) for mature, new shell males from the GMACS and TCSAM02 models. Left: values; right: percent differences.	363
171	Comparison of the predicted population abundance-at-size through time (1976-2000) for mature, new shell males from the GMACS and TCSAM02 models. Left: values; right: percent differences.	364
172	Comparison of the predicted population abundance-at-size through time (2001-2025) for mature, new shell males from the GMACS and TCSAM02 models. Left: values; right: percent differences.	365
173	Comparison of the predicted population abundance-at-size through time (1953-1975) for mature, old shell males from the GMACS and TCSAM02 models. Left: values; right: percent differences.	366
174	Comparison of the predicted population abundance-at-size through time (1976-2000) for mature, old shell males from the GMACS and TCSAM02 models. Left: values; right: percent differences.	367
175	Comparison of the predicted population abundance-at-size through time (2001-2025) for mature, old shell males from the GMACS and TCSAM02 models. Left: values; right: percent differences.	368
176	Comparison of the predicted male maturity ogives through time based on predicted NMFS survey abundance-at-size for immature and mature new shell crab from the GMACS and TCSAM02 models using model size bins. Left: values; right: percent differences.	369
177	Comparison of the predicted male maturity ogives through time based on predicted NMFS survey abundance-at-size for immature and mature new shell crab from the GMACS and TCSAM02 models, using observed size bins. Left: values; right: percent differences.	370
178	Comparison of the predicted capture abundance by fishery through time for males from the GMACS and TCSAM02 models. Left: values; right: percent differences. . .	371
179	Comparison of the predicted capture abundance by fishery through time for females from the GMACS and TCSAM02 models. Left: values; right: percent differences. . .	372
180	Comparison of the predicted capture biomass by fishery through time for males from the GMACS and TCSAM02 models.	373
181	Comparison of the predicted capture biomass by fishery through time for females from the GMACS and TCSAM02 models.	374
182	Comparison of the predicted total fishing mortality (biomass) through time from the GMACS and TCSAM02 models.	375
183	Comparison of the predicted retained catch mortality (biomass) through time from the GMACS and TCSAM02 models. Dotted vertical lines indicate 1973, 1980, 1990, and 2005	376
184	Comparison of the predicted NMFS survey biomass through time from the GMACS and TCSAM02 models.	377
185	Comparison of the predicted BSFRF survey biomass through time from the GMACS and TCSAM02 models.	378
186	Comparison of fits to molt increment data by sex. Observed values: points, predicted values: lines.	379

187	Comparison of fits to male maturity ogives based on chela height/carapace width measurements on males during the NMFS EBS bottom trawl surveys. Observed: points and dotted line, predicted: lines.	380
188	Comparison of fits to male survey biomass in the NMFS surveys. Observed values: points, dotted line, and shading (90% lognormal CIs); predicted: lines.	381
189	Comparison of fits to immature female survey biomass in the NMFS surveys. Observed values: points, dotted line, and shading (90% lognormal CIs); predicted: lines.	382
190	Comparison of fits to mature female survey biomass in the NMFS surveys. Observed values: points, dotted line, and shading (90% lognormal CIs); predicted: lines.	383
191	Comparison of fits to male survey biomass in the BSFRF surveys. Observed values: points, dotted line, and shading (90% lognormal CIs); predicted: lines.	384
192	Comparison of fits to immature female survey biomass in the BSFRF surveys. Observed values: points, dotted line, and shading (90% lognormal CIs); predicted: lines.	385
193	Comparison of fits to mature female survey biomass in the BSFRF surveys. Observed values: points, dotted line, and shading (90% lognormal CIs); predicted: lines.	386
194	Comparison of fits to retained catch biomass in the directed fishery. Observed—points, dotted line, and shading (90% lognormal CIs), predicted—lines.	387
195	Comparison of fits to total catch biomass in the directed fishery. Observed—points, dotted line, and shading (90% lognormal CIs), predicted—lines.	388
196	Comparison of fits to total catch biomass in the snow crab fishery. Observed—points, dotted line, and shading (90% lognormal CIs), predicted—lines.	389
197	Comparison of fits to total catch biomass in the BBRKC fishery. Observed—points, dotted line, and shading (90% lognormal CIs), predicted—lines.	390
198	Comparison of fits to total catch biomass in the groundfish fisheries. Observed—points, dotted line, and shading (90% lognormal CIs), predicted—lines.	391
199	Comparison of fits to total catch abundance in the groundfish fisheries. Observed—points, dotted line, and shading (90% lognormal CIs), predicted—lines.	392
200	Fits to size composition data from the NMS surveys for males. Points: observed values; lines: predicted values.	393
201	OSA residuals for models fit to NMFS survey size compositions for males.	394
202	Fits to size composition data from the NMFS surveys for immature females. Points: observed values; lines: predicted values.	395
203	OSA residuals for models fit to NMFS survey size compositions for immature females.	396
204	Fits to total catch size composition data from the NMFS surveys for mature females. Points: observed values; lines: predicted values.	397
205	OSA residuals for models fit to NMFS survey size compositions for mature females.	398
206	Fits to size composition data from the BSFRF surveys for males. Points: observed values; lines: predicted values.	399
207	OSA residuals for models fit to BSFRF survey size compositions for males.	400
208	Fits to size composition data from the BSFRF survey for immature females. Points: observed values; lines: predicted values.	401
209	OSA residuals for models fit to BSFRF survey size compositions for immature females.	402
210	Fits to total catch size composition data from the BSFRF surveys for mature females. Points: observed values; lines: predicted values.	403
211	OSA residuals for models fit to BSFRF survey size compositions for mature females.	404
212	Fits to retained catch size composition data from the directed fishery. Points: observed values; lines: predicted values.	405

213	OSA residuals for models fit to retained catch size compositions from the directed fishery.	406
214	Fits to total catch size composition data from the directed fishery for males. Points: observed values; lines: predicted values.	407
215	Fits to total catch size composition data from the directed fishery for females. Points: observed values; lines: predicted values.	408
216	Fits to total catch size composition data from the snow crab fishery for males. Points: observed values; lines: predicted values.	409
217	Fits to total catch size composition data from the snow crab fishery for females. Points: observed values; lines: predicted values.	410
218	Fits to total catch size composition data from the BBRKC fishery for males. Points: observed values; lines: predicted values.	411
219	Fits to total catch size composition data from the BBRKC fishery for females. Points: observed values; lines: predicted values.	412
220	Fits to total catch size composition data from the groundfish fisheries for males. Points: observed values; lines: predicted values.	413
221	Fits to total catch size composition data from the groundfish fisheries for females. Points: observed values; lines: predicted values.	414
222	TCSAM02 models fits to directed fishery mean size compositions. Upper plot: retained catch; lower plot: total catch. Model 22.03d5 (2026) is the preferred model.	415
223	TCSAM02 models fits to mean bycatch size compositions from the snow crab fishery. Model 22.03d5 (2026) is the preferred model.	416
224	TCSAM02 models fits to mean bycatch size compositions from the BBRKC fishery. Model 22.03d5 (2026) is the preferred model.	417
225	TCSAM02 models fits to mean bycatch size compositions from the groundfish fisheries. The total catch size compositions were normalized similarly for all model scenarios. Model 22.03d5 (2026) is the preferred model.	418
226	TCSAM02 models fits to mean survey size compositions from the NMFS EBS (left column) and BSFRF SBS (right column) surveys. The total catch size compositions were normalized similarly for all model scenarios.	419
227	Effective sample sizes compared with input sample sizes for retained catch data. Dotted lines are effective N's, solid lines are input sample sizes. Input sample sizes are constrained to a maximum of 200. Model 22.03d5 (2026) is the preferred model.	420
228	Effective sample sizes compared with input sample sizes for total catch data from the TCF fishery. Dotted lines are effective N's, solid lines are input sample sizes. Input sample sizes are scaled to sum to 200 in each year across categories. Model 22.03d5 (2026) is the preferred model.	421
229	Effective sample sizes compared with input sample sizes for total catch data from the SCF fishery. Dotted lines are effective N's, solid lines are input sample sizes. Input sample sizes are scaled to sum to 200 in each year across categories. Model 22.03d5 (2026) is the preferred model.	422
230	Effective sample sizes compared with input sample sizes for total catch data from the RKF fishery. Dotted lines are effective N's, solid lines are input sample sizes. Input sample sizes are scaled to sum to 200 in each year across categories. Model 22.03d5 (2026) is the preferred model.	423

231	Effective sample sizes compared with input sample sizes for total catch data from the GF All fishery. Dotted lines are effective N's, solid lines are input sample sizes. Input sample sizes are scaled to sum to 200 in each year across categories. Model 22.03d5 (2026) is the preferred model.	424
232	Effective sample sizes compared with input sample sizes for NMFS survey data. Dotted lines are effective N's, solid lines are input sample sizes. Input sample sizes are scaled to sum to 200 in each year across categories.	425
233	Effective sample sizes compared with input sample sizes for the BSFRF survey data. Dotted lines are effective N's, solid lines are input sample sizes. Input sample sizes are scaled to sum to 200 in each year across categories.	426
234	Retrospective analysis for recruitment time series, with Mohn's rho value (0.557). Each "peel" represents results from the model run with that number of years of data removed from the complete data series. Lines: estimates; fills: 80% confidence intervals; points: end point of estimated time series for each peel.	427
235	Retrospective analysis for mature male biomass time series, with Mohn's rho value (-0.216). Each "peel" represents results from the model run with that number of years of data removed from the complete data series. Lines: estimates; fills: 80% confidence intervals; points: end point of estimated time series for each peel.	428
236	Comparison of estimated recruitment (upper plot) and mature biomass (lower plot) for the full model time period from the preferred model and previous assessments. .	429
237	Comparison of estimated recruitment (upper plot) and mature biomass (lower plot) for the last 20 years from the preferred model and previous assessments.	430
238	Tanner crab stock projections (lower plot) from 22.03d5 (2026) under constant F's based on multipliers of the directed F_{OFL} and randomly-resampled annual recruitment using the same population dynamics used to determine the OFL.	431
239	The F_{OFL} control rule.	432
240	Time series of estimated ln-scale recruitment, with 90% confidence intervals from the GMACS and TCSAM02 models.	433
241	Quad plot for the author's preferred model, 22.03d5 (2026). Estimated values are shown starting in 1980. The value for 2026 assumes the OFL is taken in the upcoming fishing season. Colors refer to different time periods (PR: post-rationalization). Vertical dashed lines indicate: red- β ; orange-MSST; blue- B_{MSY} . Horizontal dashed line indicates F_{MSY}	434
242	OFL and ABCs from the models considered for management, with the distribution used to determine the p-star ABCs. The p-star ABCs are the maximum permissible ABCs under each model and are base on model-derived estimates of uncertainty in the associated OFL. The buffer ABCs are based on applying an author-recommended 0.2% buffer to the OFL.	435
243	Estimated time series for vulnerable male biomass from the NMFS EBS shelf survey: 1) design based estimates (circles) and 80% lognormal confidence intervals (vertical bars); 2) random walk model-estimated time series (line) and 80% confidence intervals (shading). Upper plot: y-axis on arithmetic scale; lower plot: y-axis on log-scale.	436
244	B_{MSY} proxies for different averaging time blocks. REMA-estimated vulnerable male biomass time series: black line and points (estimates), grey shading (80% confidence intervals). Colored rectangles indicate averaging time periods. Colored horizontal colored lines indicate resulting B_{MSY} proxy value.	437

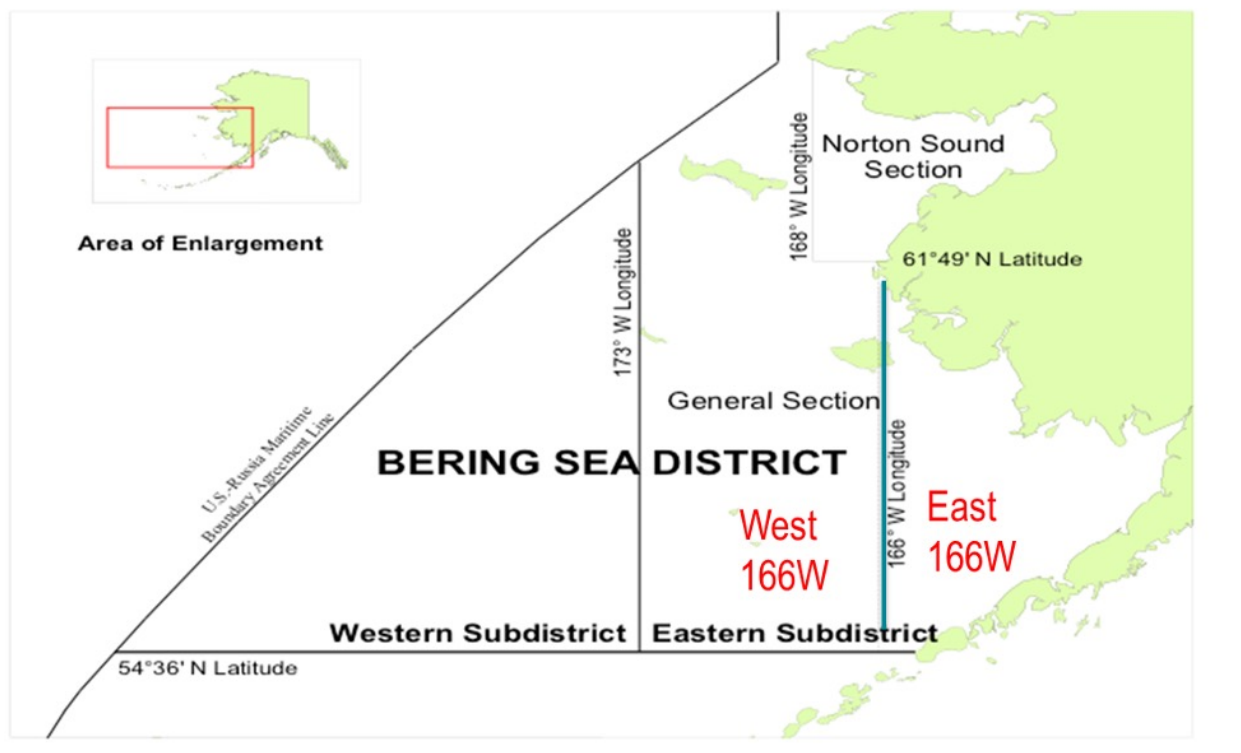


Figure 1. Eastern Bering Sea District of the ADF&G Tanner crab Registration Area J, including sub-districts and sections (from Bowers et al. 2008). Separate TACs are set annually for the areas east and west of 166°W in the General Section. These management areas are identified in the text, tables, and figures as 'East 166W' and 'West 166W', respectively based on the split at 166°W longitude.

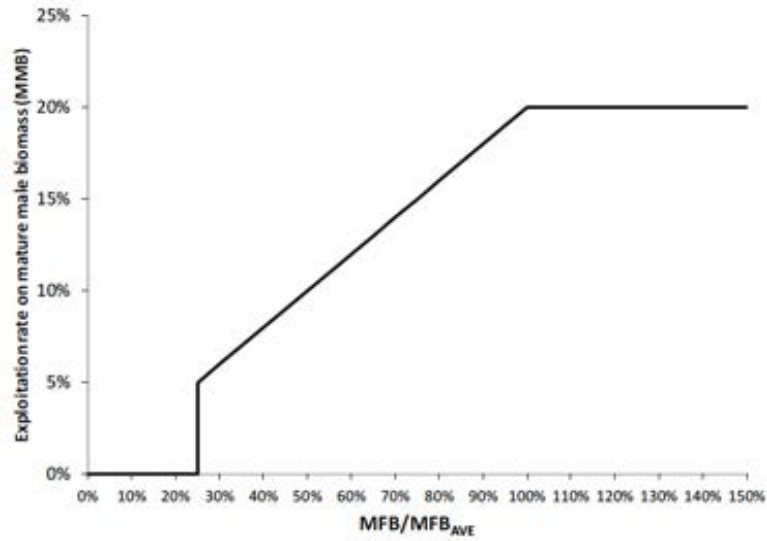


Figure 2. Sloping control rule used by ADF&G from 2011 to 2019 as part of its TAC setting process to determine the maximum exploitation rate on mature male biomass as a function of the ratio of current mature female biomass (MFB) to MFB averaged over some time period.

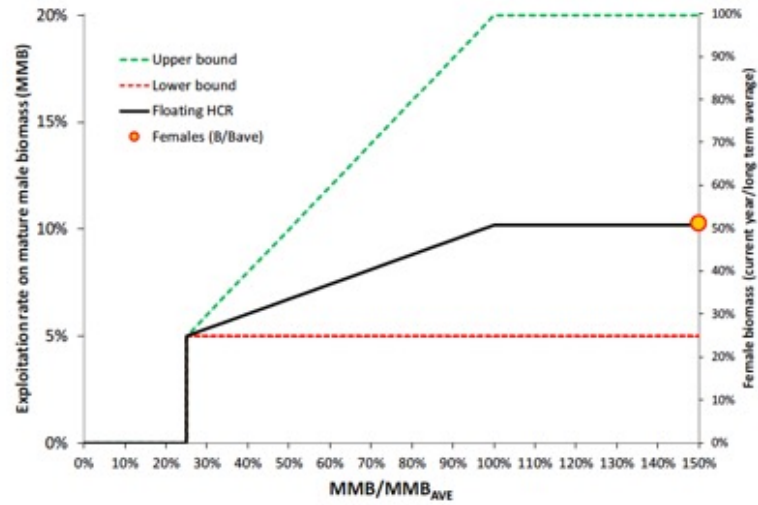


Figure 3. Current ADF&G “floating” sloping control rule to determine the maximum exploitation rate on mature male biomass (MMB) as a function of the ratio of current MMB to the average MMB over 1982-2018. The ratio of current mature female biomass (MFB) to MFB averaged over 1982-2018 is used to determine the value of the maximum exploitation rate for the control rule, up to a maximum of 20%.

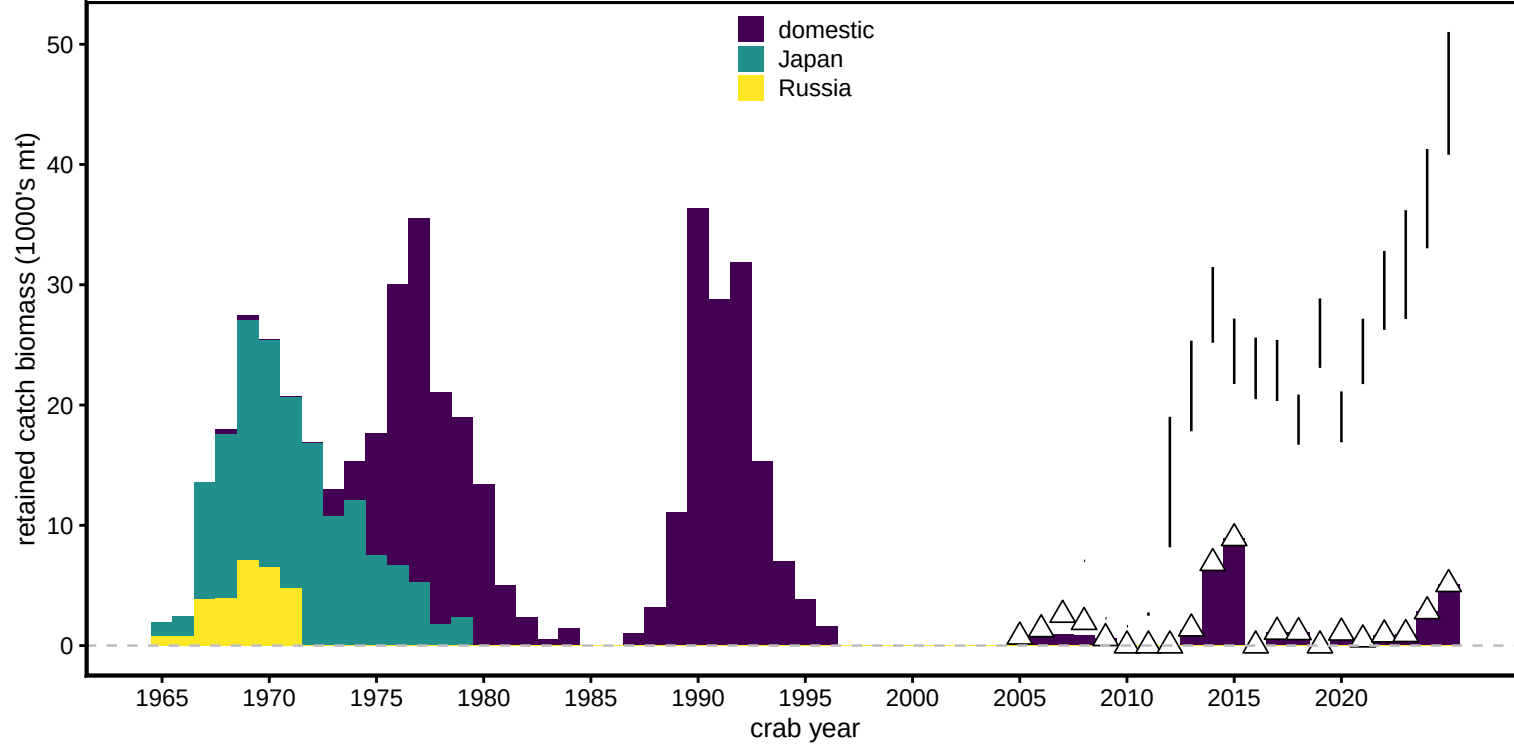


Figure 4. Total retained catch (males, 1000's t) in the directed fisheries (foreign [1965-1979] and domestic [1968-]) for Tanner crab (aggregated across State management areas). The bars indicate the Tier 3 OFL and ABC (upper and lower limits, respectively; (values start in 2011/12); the triangles indicate the area-aggregated TAC (values start in 2005/06, following rationalization).

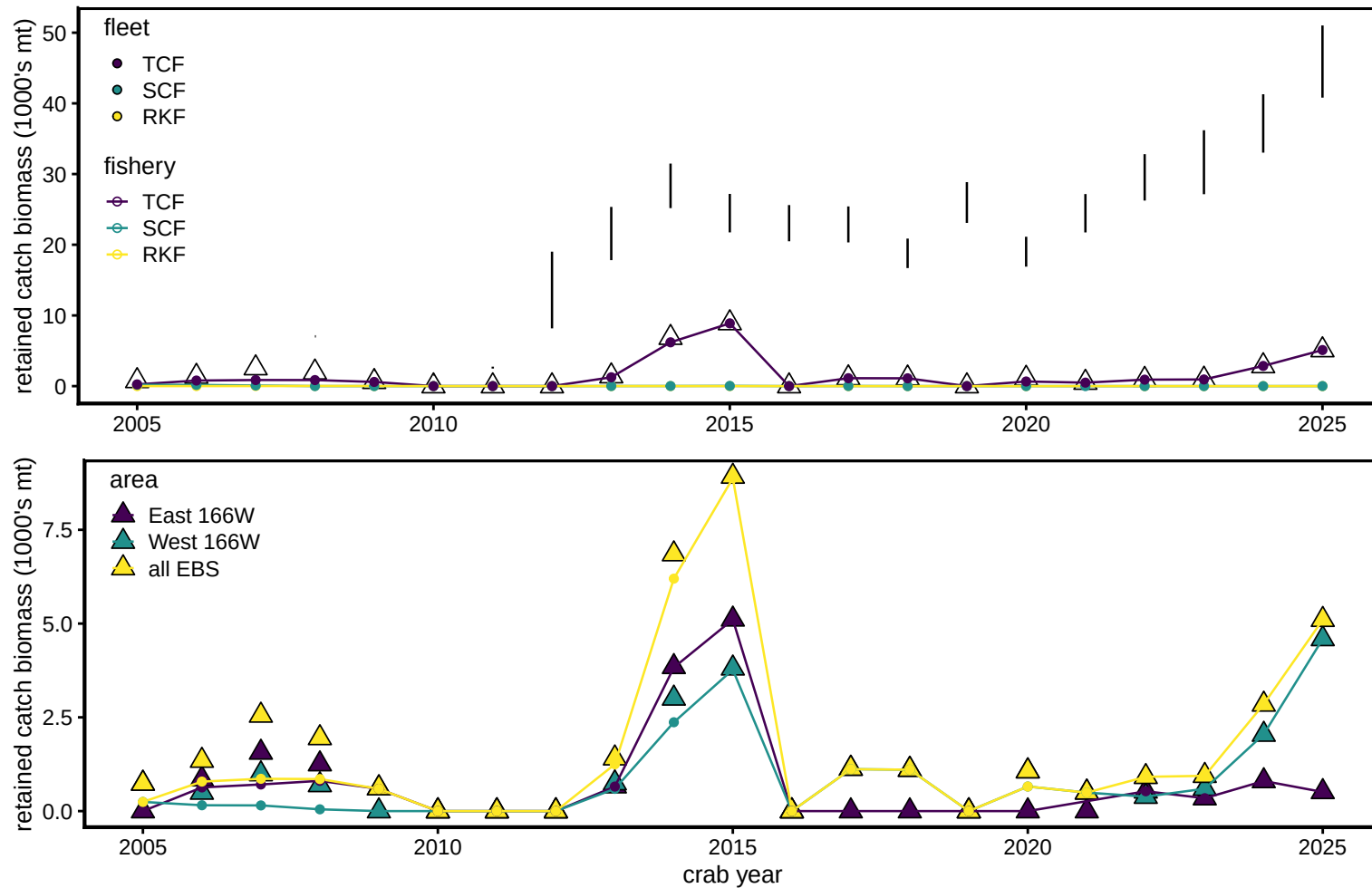


Figure 5. Upper plot: time series of retained catch biomass (1000's t) in the directed Tanner crab (TCF), snow crab (SCF), and BBRKC (RKF) fisheries since 2005. The bars indicate the OFL and ABC (upper and lower limits, respectively; values start in 2011/12); the triangles indicate the total (area-combined) TAC, points indicate the retained catch. Legal-sized Tanner crab can be incidentally-retained in the snow crab and BBRKC fisheries up to a cap of 5% the target catch. Lower plot: retained catch biomass (1000's t) by SOA management area and combined. The triangles indicate the area-combined ("all EBS") and area-specific ("East 166W", "West 166W") TACS. The directed fisheries in both SOA management areas were both closed from 2010/11 to 2012/13, as well as in 2016/17 and 2019/20. The directed fishery in the eastern area was also closed in 2005/06, 2017/18, 2018/19, 2020/21, and 2021/22.

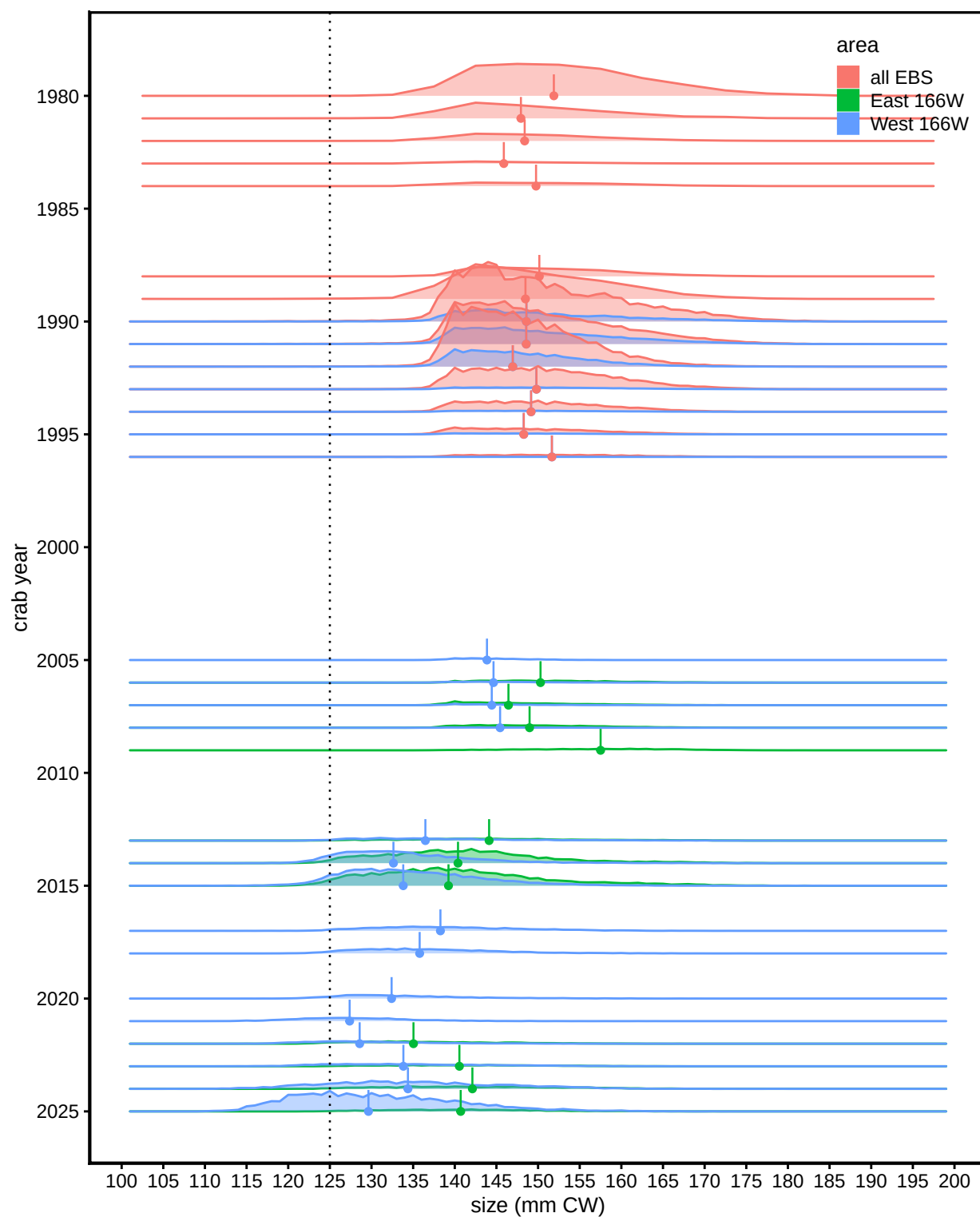


Figure 6. Retained catch size compositions, scaled to total abundance by area and year. Vertical bars and points indicate median sizes, dotted vertical line indicates recent industry-preferred size.

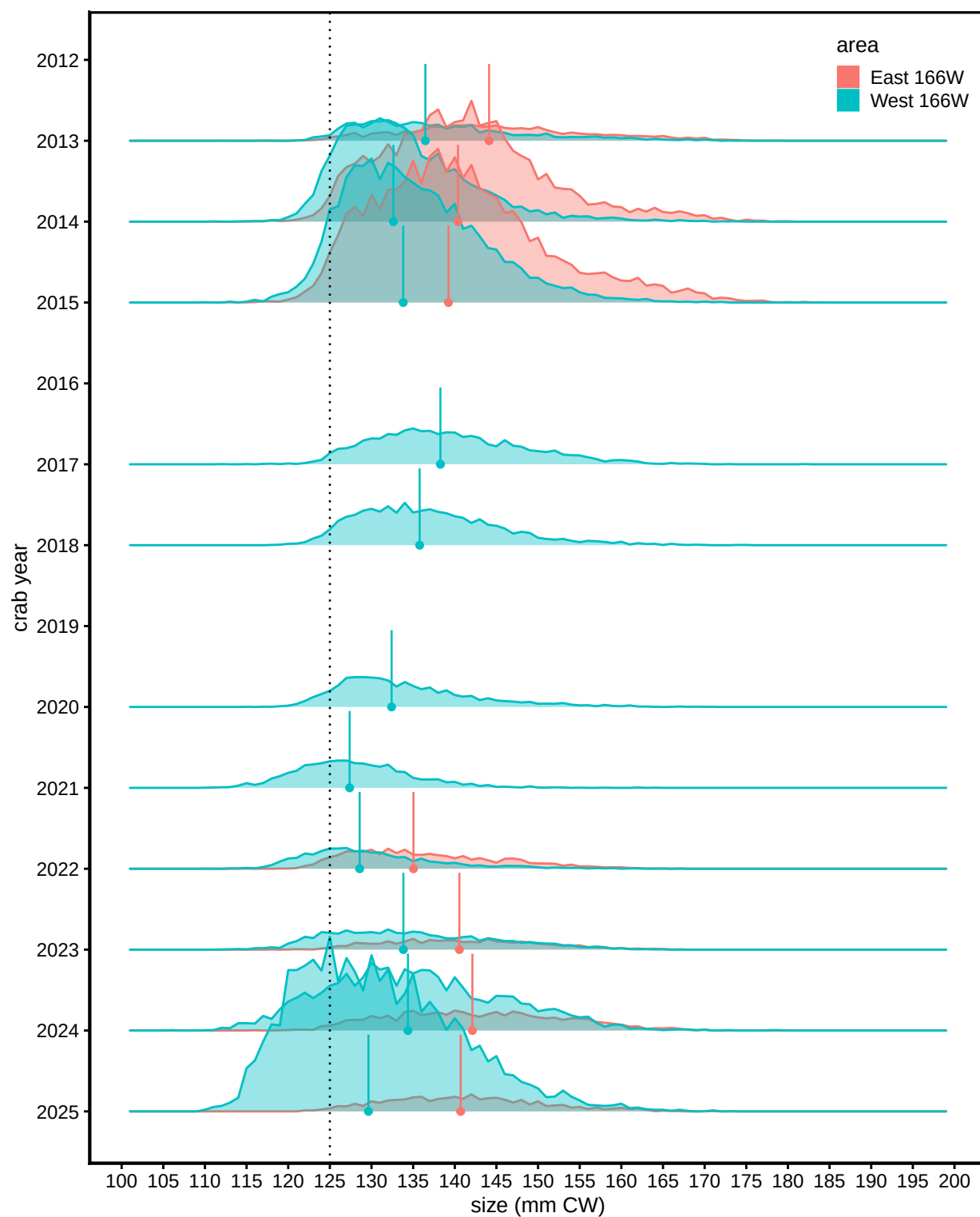


Figure 7. Retained catch size compositions, scaled to total retained abundance by area and year from recent seasons. Vertical bars and points indicate median sizes. Vertical dotted line indicates recent industry-preferred size.

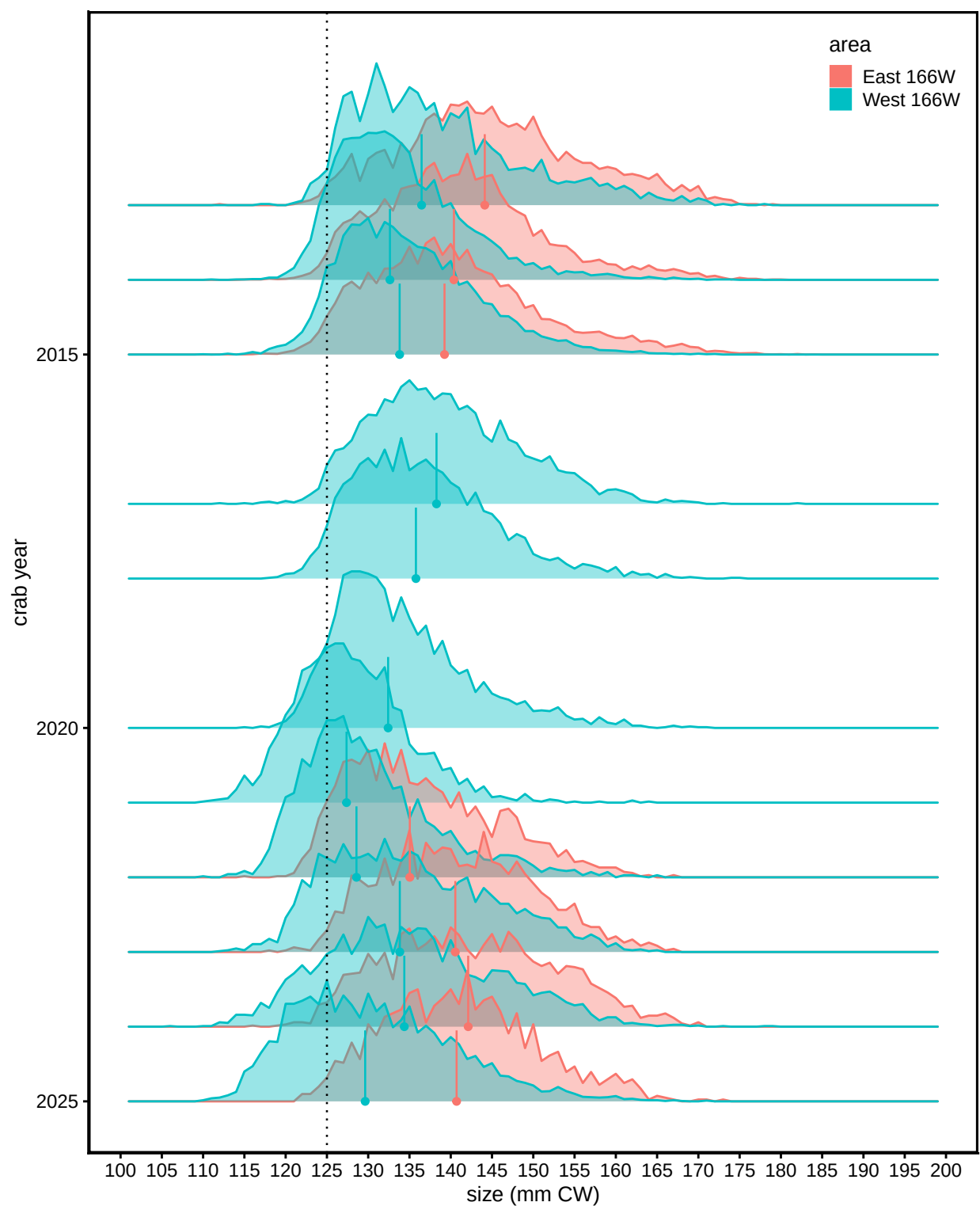


Figure 8. Retained catch size compositions from recent seasons, normalized to sum to 1 by area and year to show contrast. Vertical bars and points indicate median size. Dotted line indicates recent industry-preferred size.

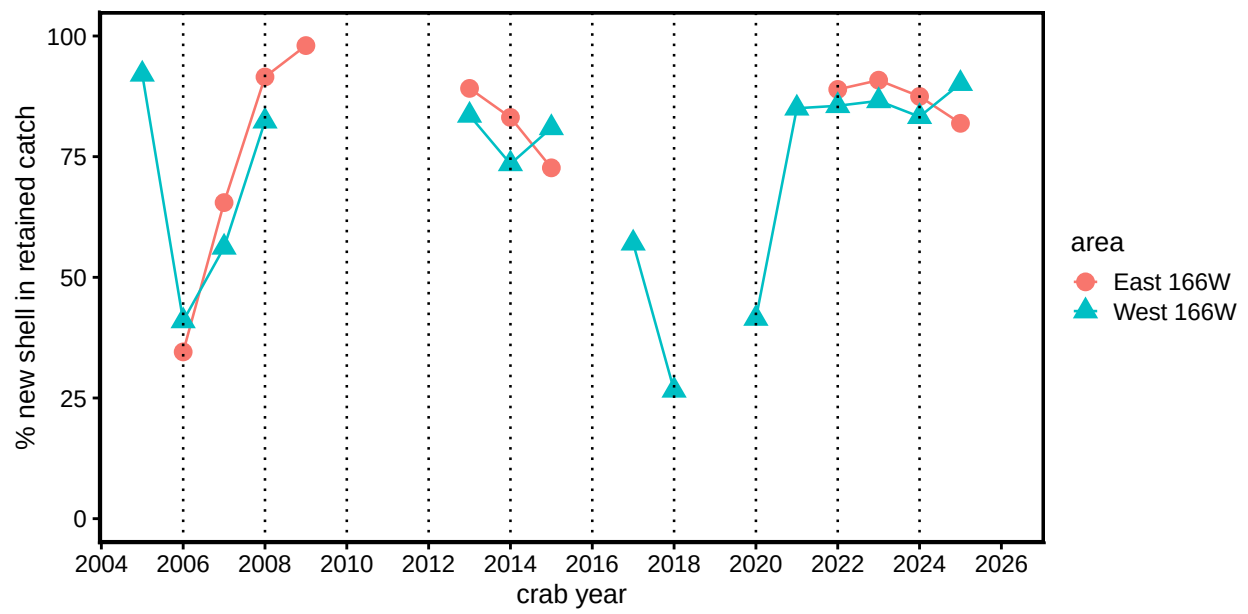


Figure 9. The fraction of new shell males in the retained catch, by management area, for the directed fishery since 2005/06.

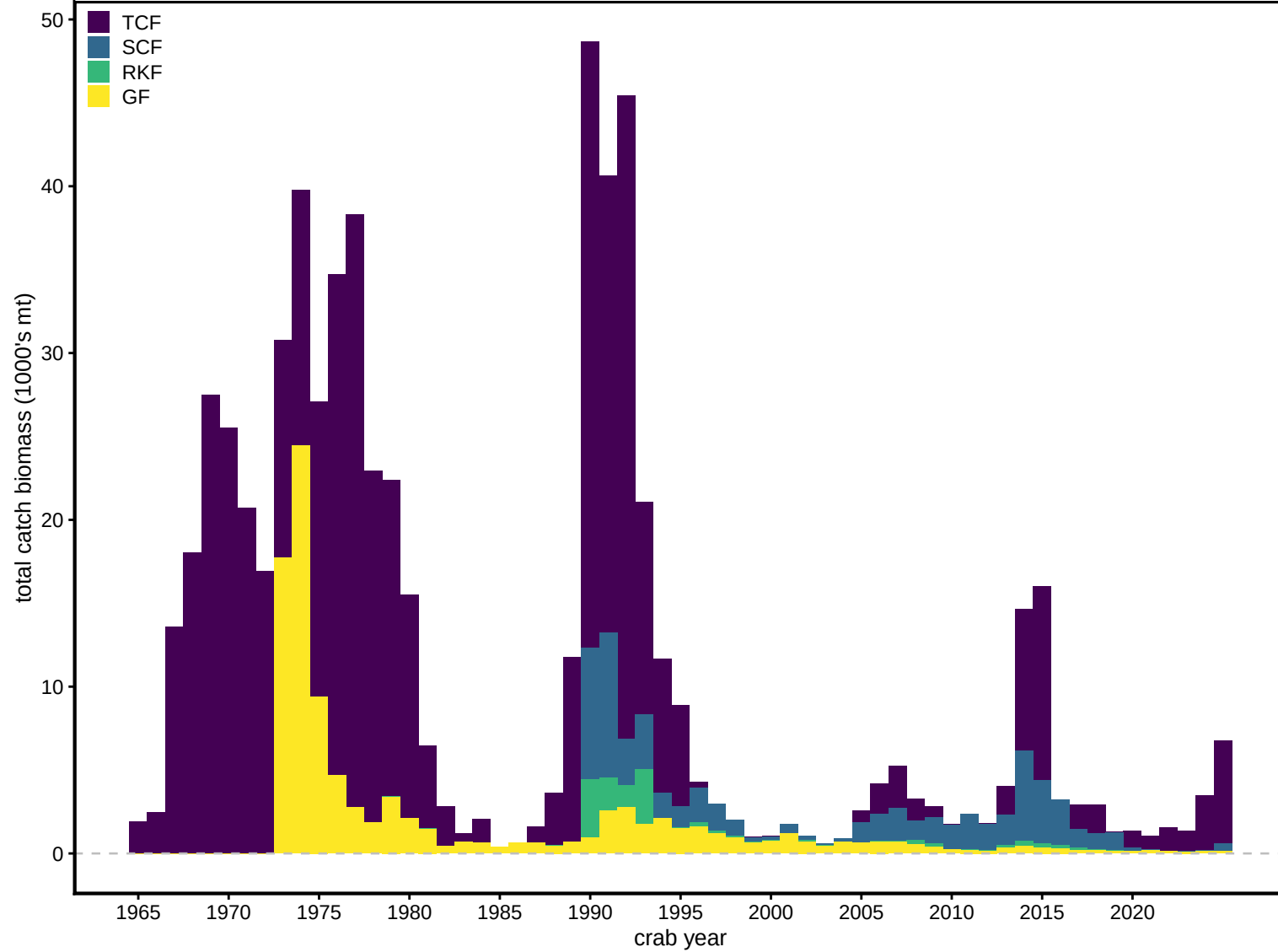


Figure 10. Total catch (retained + discards) biomass estimates for Tanner crab (sexes combined) in the directed Tanner crab (TCF), snow crab (SCF), Bristol Bay red king crab (RKF), and groundfish fisheries (GF). Values for the directed fishery prior to 1991/92 do not include bycatch. **Discard mortality rates have not been applied to these estimates.**

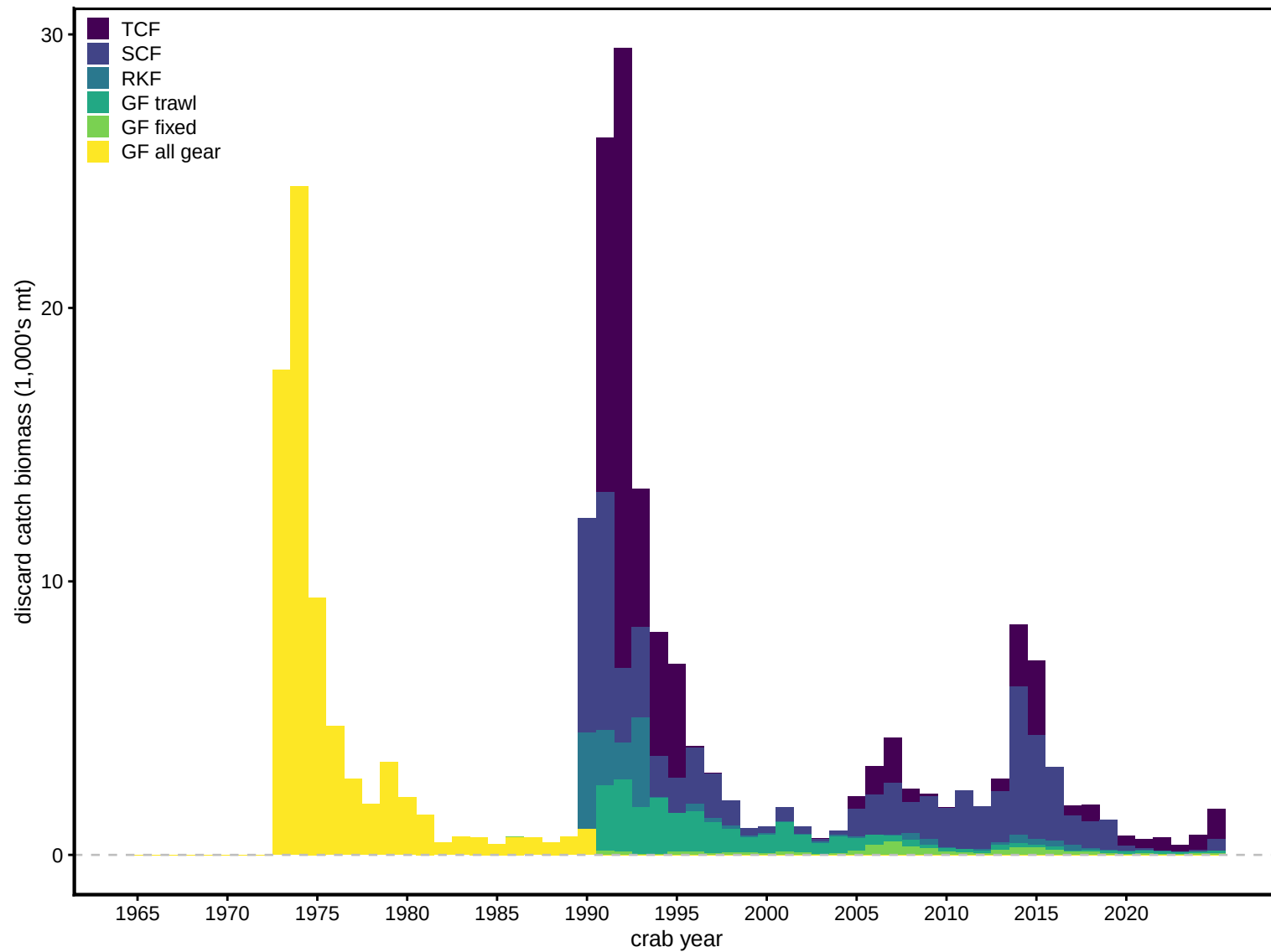


Figure 11. Discard biomass estimates for Tanner crab (sexes combined) in the directed Tanner crab (TCF), snow crab (SCF), Bristol Bay red king crab (RKF), and groundfish fisheries (GF). Discard estimates for the directed fishery were derived using the subtraction method. **Discard mortality rates have not been applied to these estimates.**

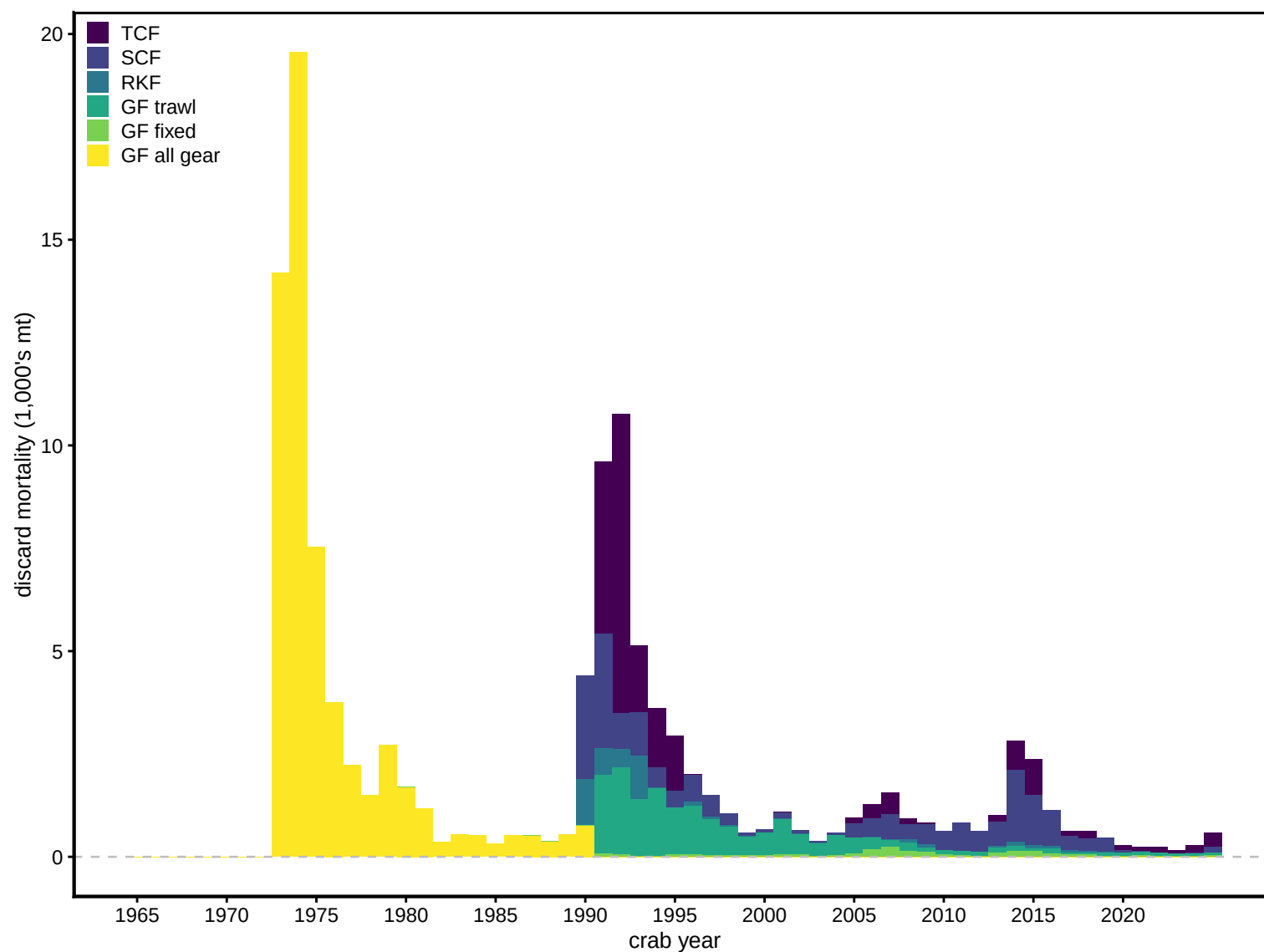


Figure 12. Discard mortality (biomass) estimates for Tanner crab (sexes combined) in the directed Tanner crab (TCF), snow crab (SCF), Bristol Bay red king crab (RKF), and groundfish fisheries (GF). Discard estimates for the directed fishery were derived using the subtraction method. **Gear-specific assumed discard mortality rates have been applied.**

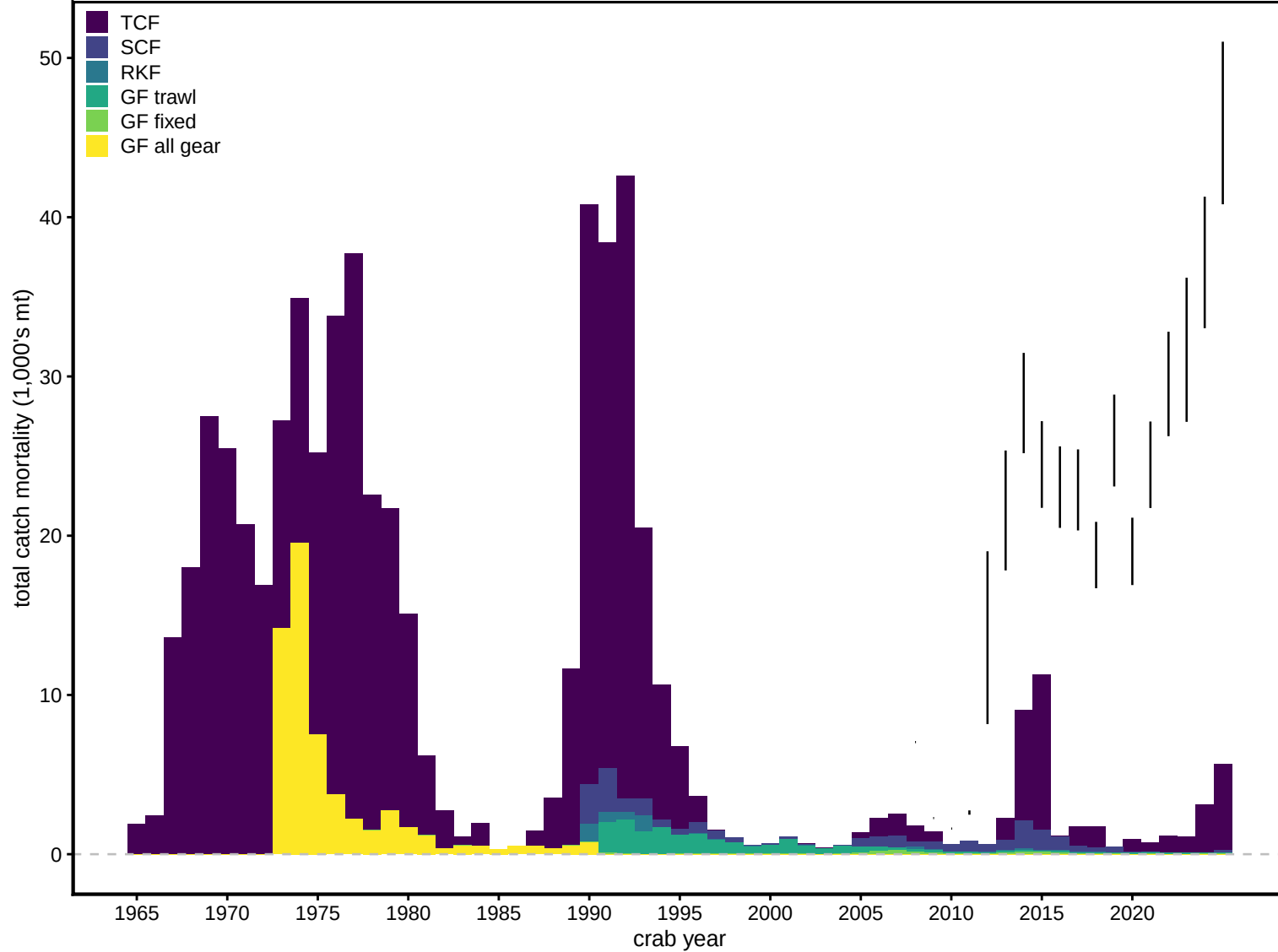


Figure 13. Total catch mortality (biomass) estimates for Tanner crab (sexes combined) in the directed Tanner crab (TCF), snow crab (SCF), Bristol Bay red king crab (RKF), and groundfish fisheries (GF). The bars indicate the Tier 3 OFL and ABC (upper and lower limits, respectively; values start in 2011/12). Values for discards in the crab fisheries are not available prior to 1991/92.

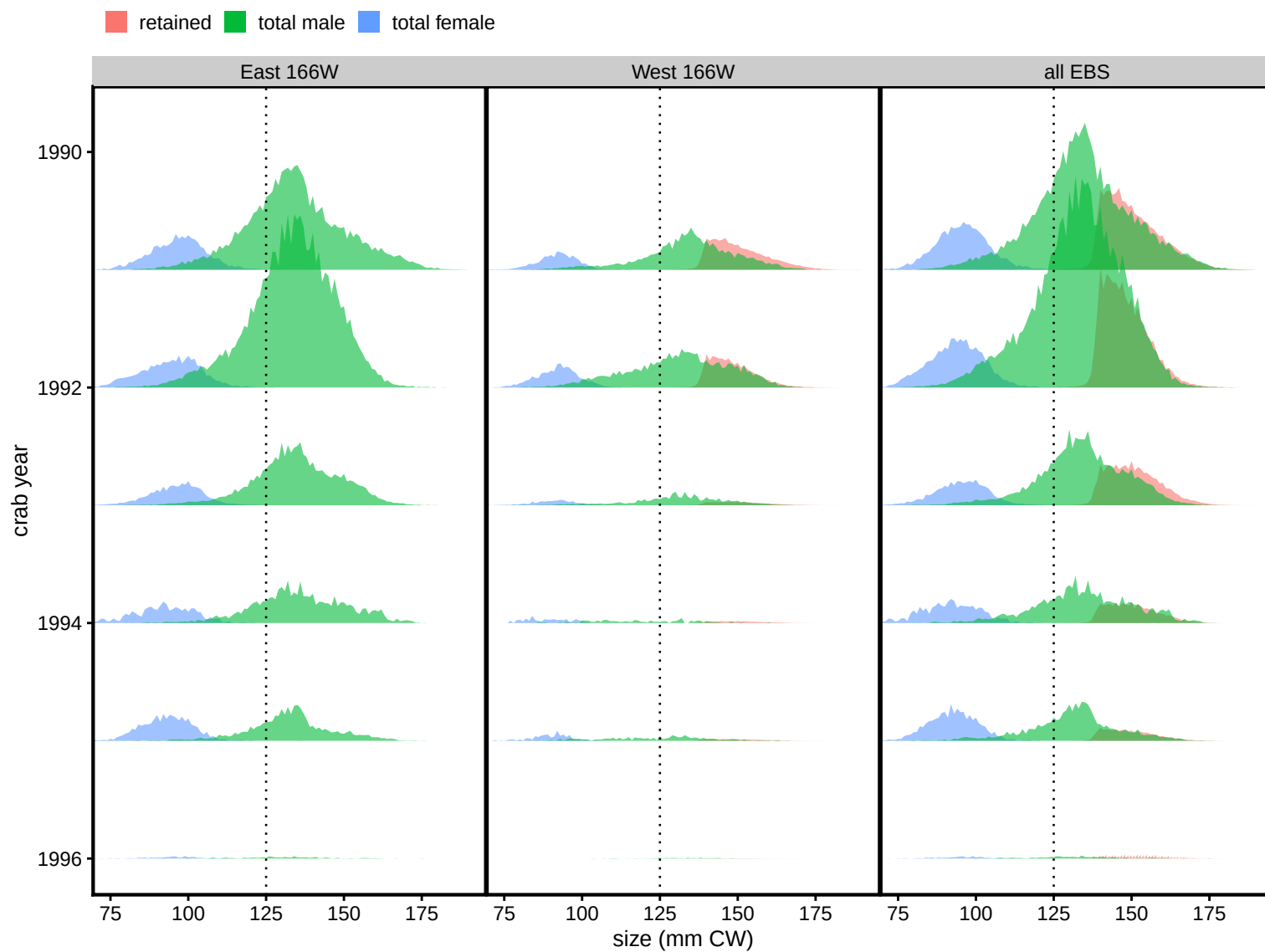


Figure 14. Comparison of expanded size compositions for retained and total catch in the directed fishery prior to 1997/98. Retained catch has already been aggregated across ADF&G management areas. Dotted line indicates recent industry-preferred size.

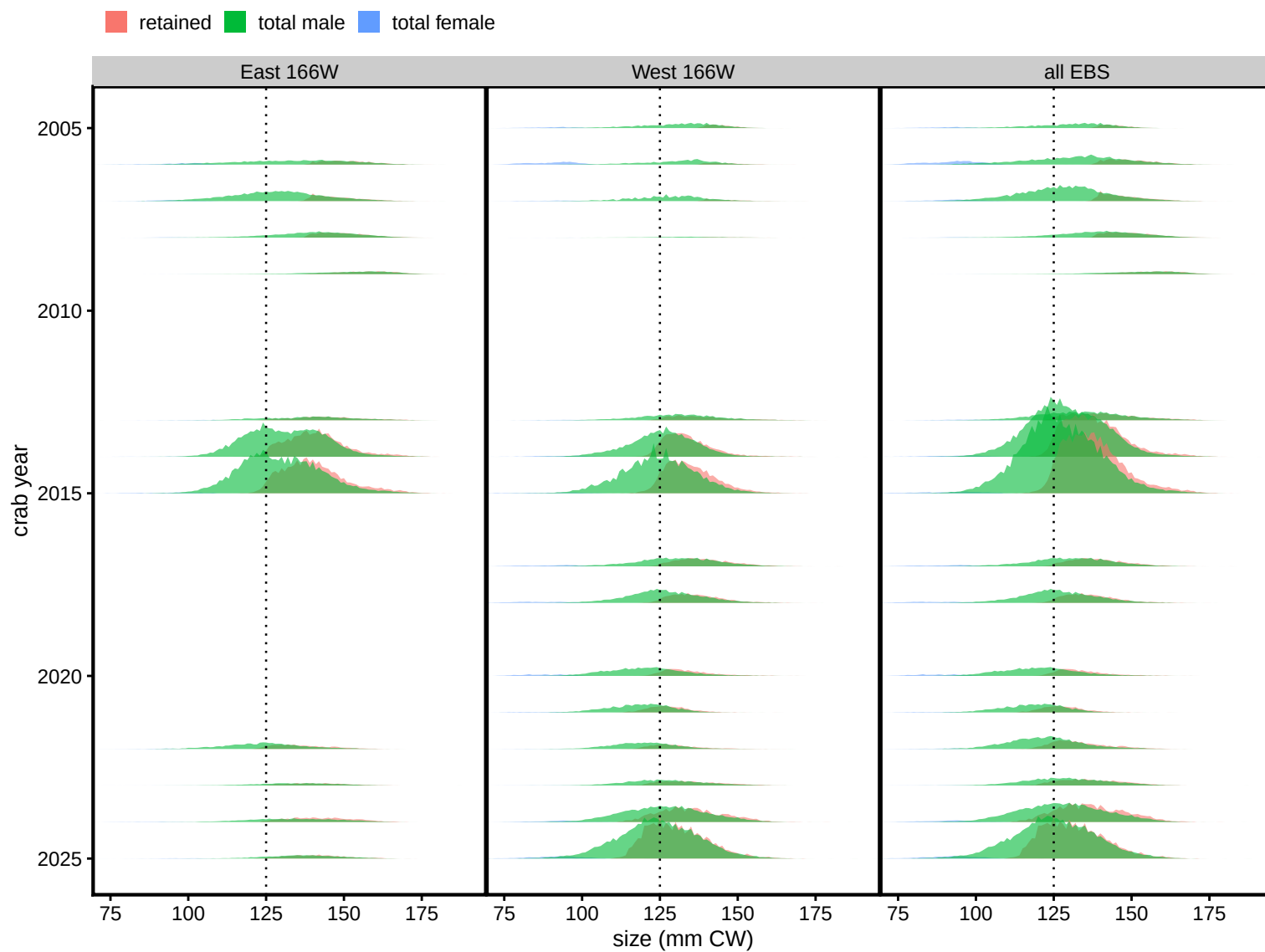


Figure 15. Comparison of expanded size compositions for retained and total catch in the directed fishery after 2004/05. Dotted line indicates recent industry-preferred size.

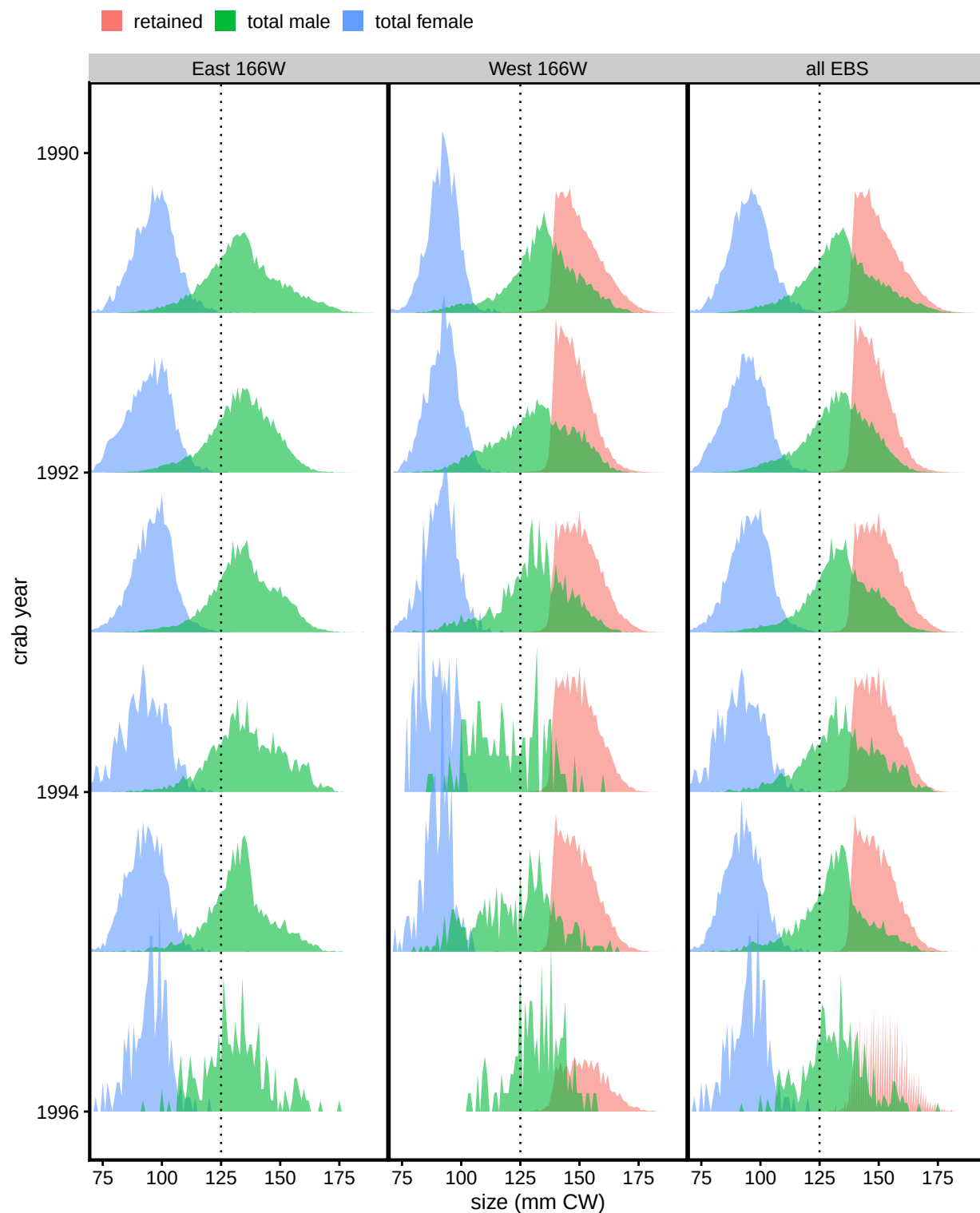


Figure 16. Comparison of *relative* size compositions for retained and total catch in the directed fishery prior to 1997/98. Individual compositions are scaled to sum to 1 across sizes. Retained catch has already been aggregated across ADF&G management areas. Dotted line indicates recent industry-preferred size.

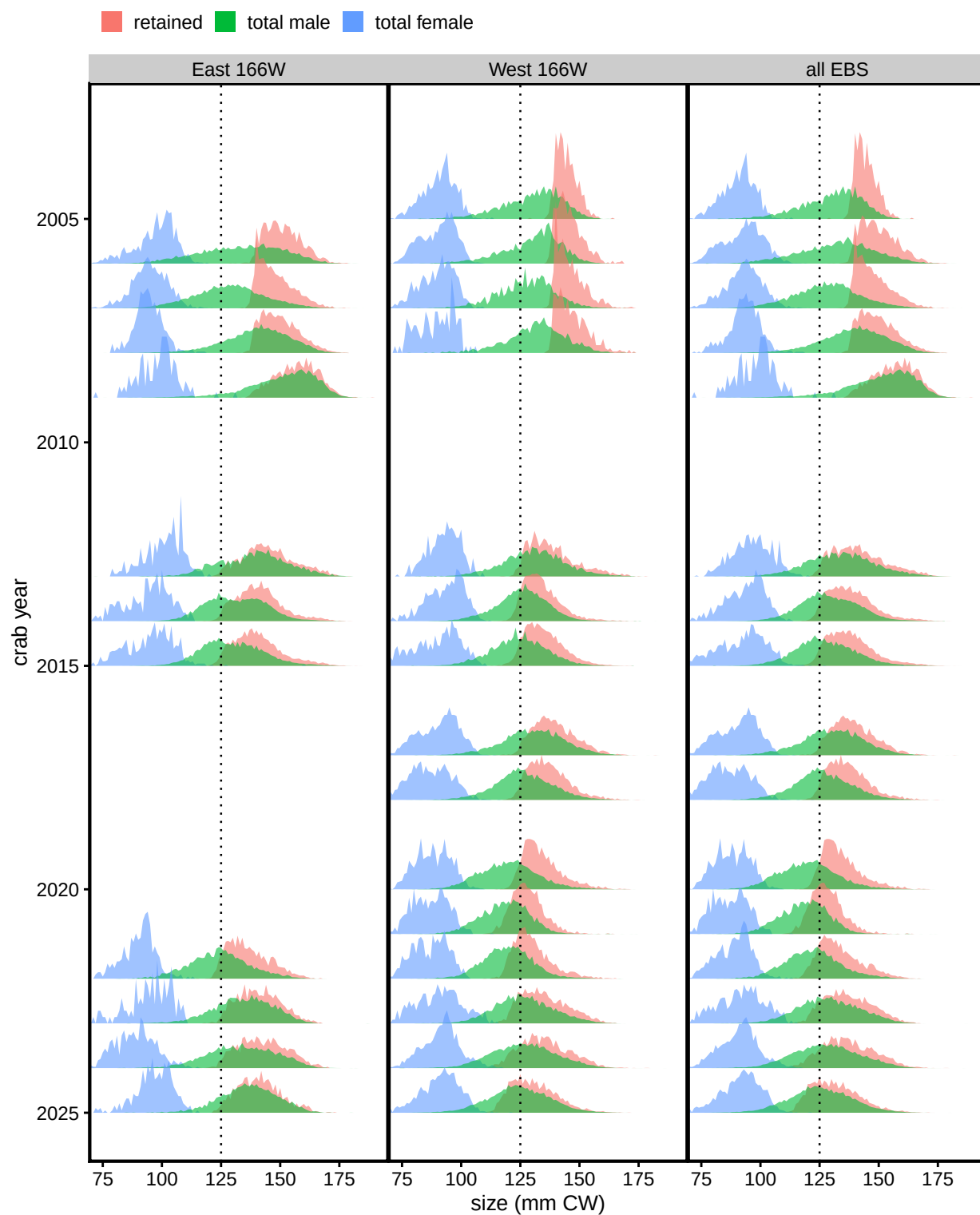


Figure 17. Comparison of *relative* size compositions for retained and total catch in the directed fishery after 2004/05. Individual compositions are scaled to sum to 1 across sizes. Dotted line indicates recent industry-preferred size.

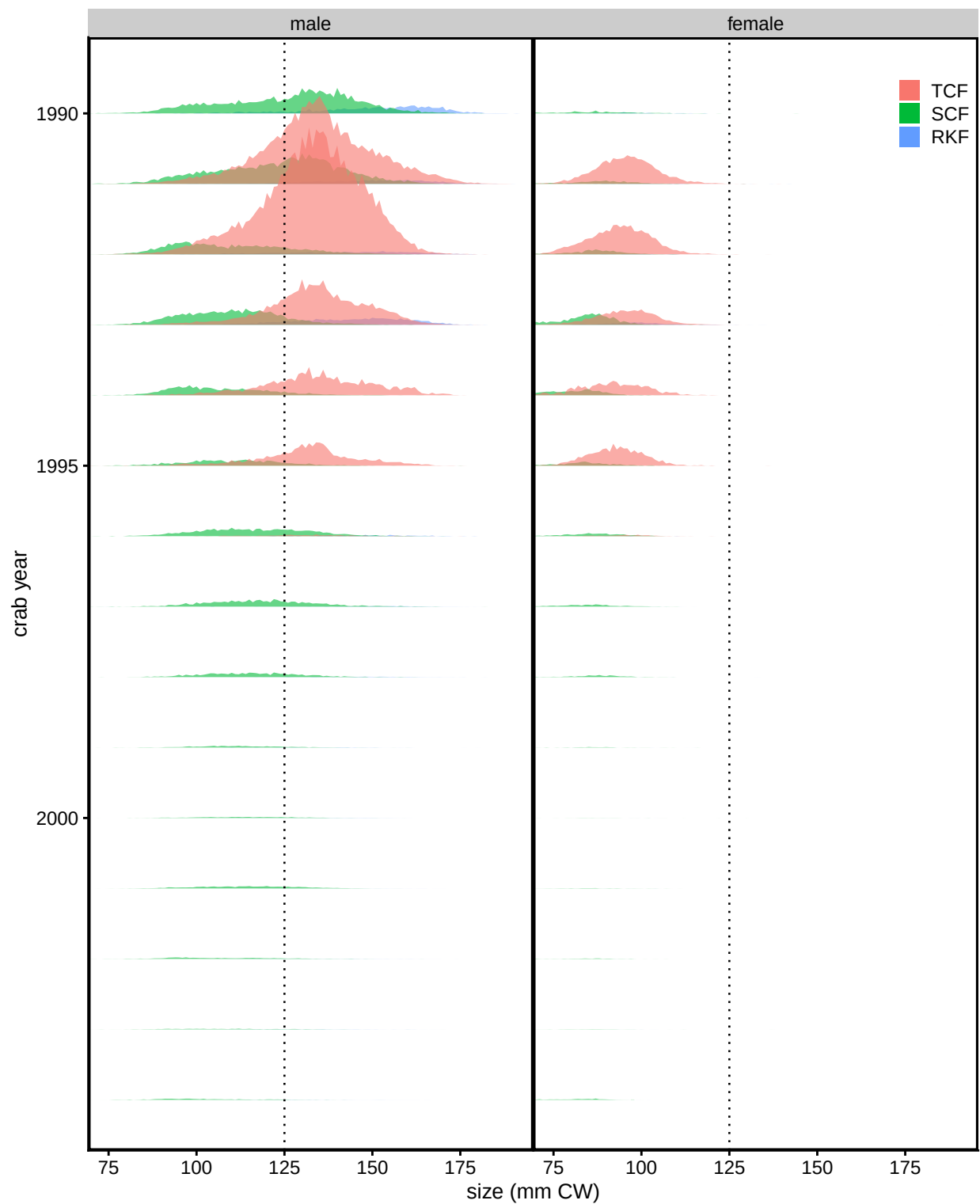


Figure 18. Comparison of expanded size compositions for total catch of Tanner crab in the crab fisheries prior to 2005/06. Catch has already been aggregated across ADF&G management areas. Dotted line indicates recent industry-preferred size. TCF: directed Tanner crab fishery; SCF: snow crab fishery; RKF: BBRKC fishery.

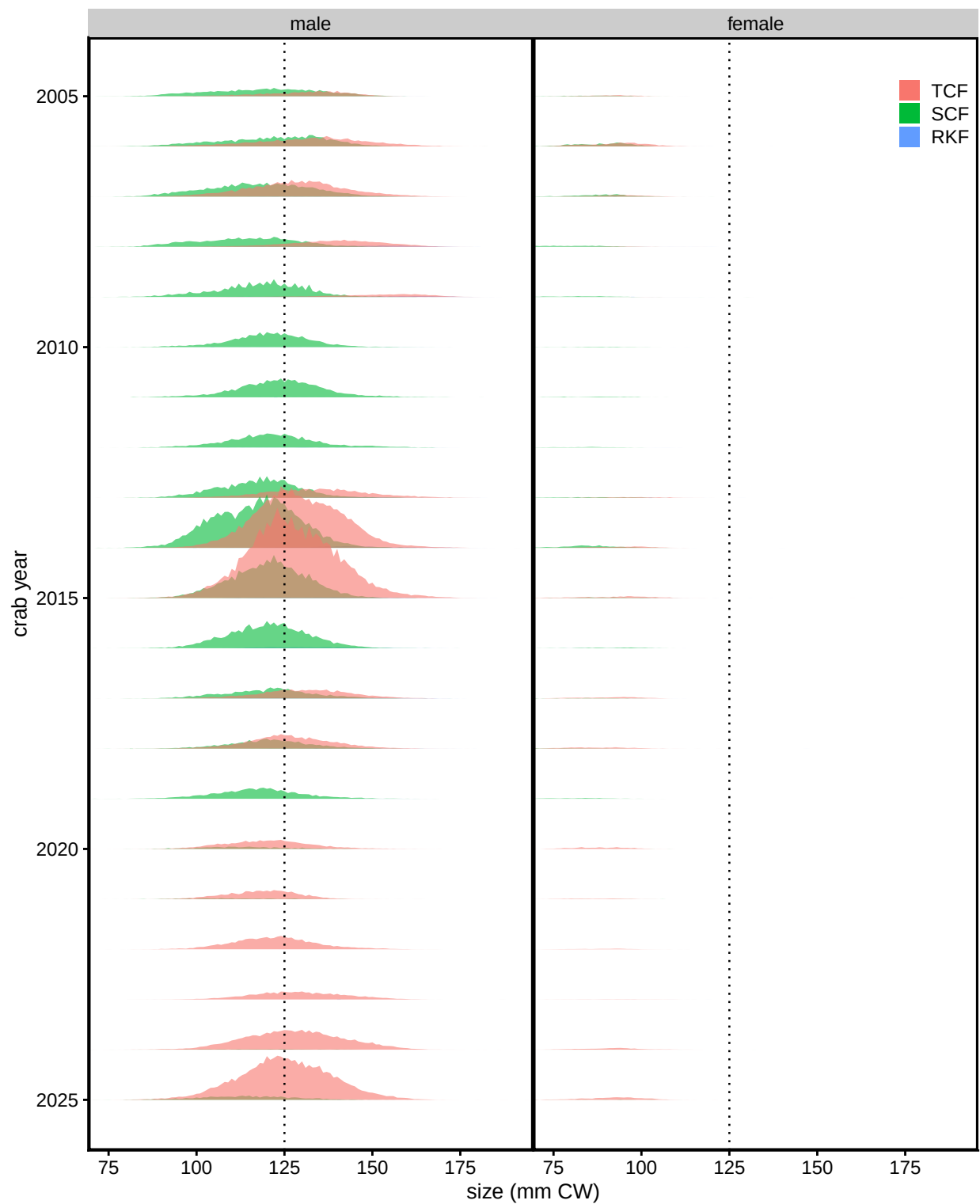


Figure 19. Comparison of expanded size compositions for total catch of Tanner crab in the crab fisheries after 2004/05. Catch has already been aggregated across ADF&G management areas. Dotted line indicates recent industry-preferred size. TCF: directed Tanner crab fishery; SCF: snow crab fishery; RKF: BBRKC fishery.

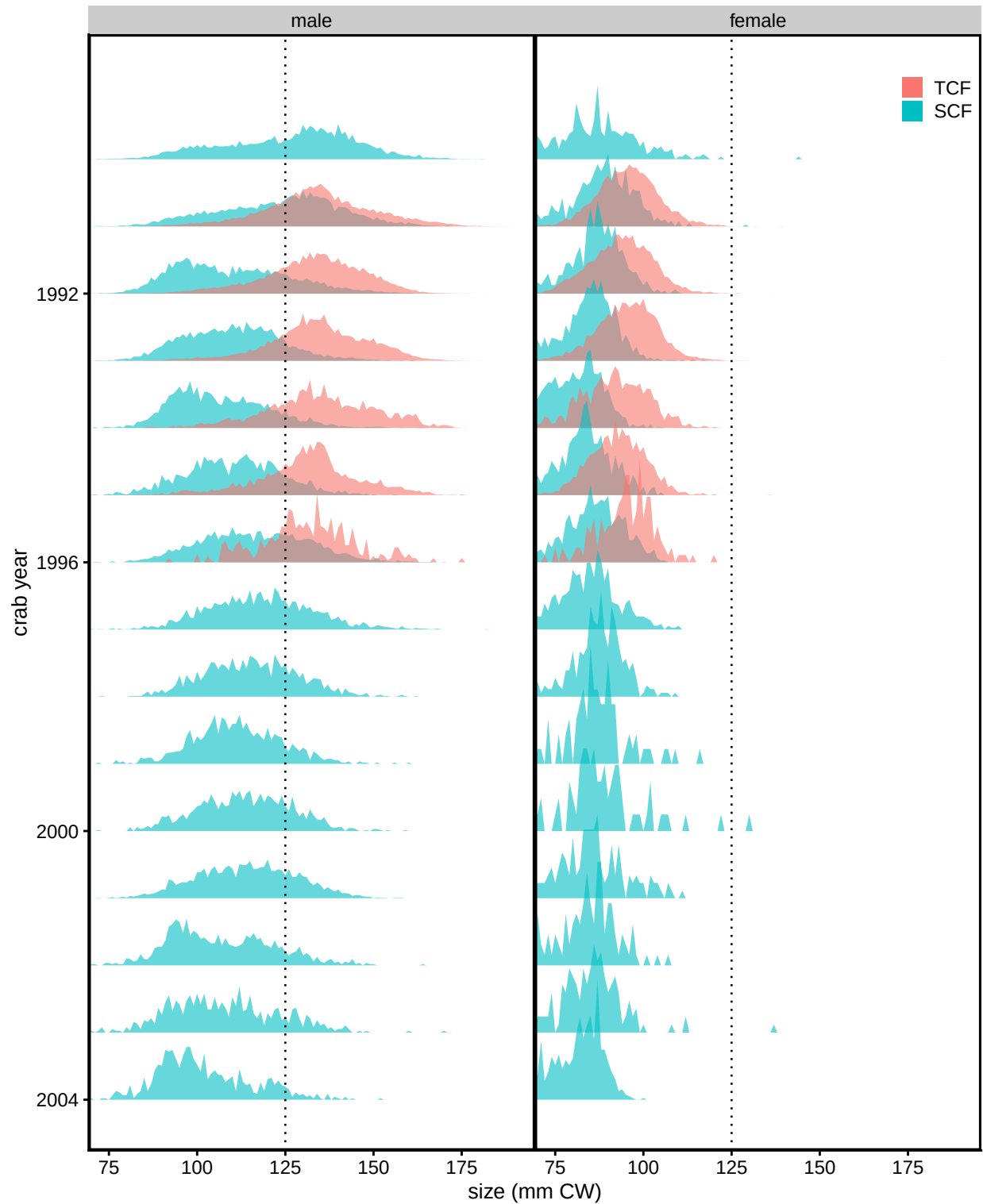


Figure 20. Comparison of *relative* size compositions for total catch of Tanner crab in the directed and snow crab fisheries prior to 2005/06. Catch has already been aggregated across ADF&G management areas. Individual compositions are scaled to sum to 1 across sizes. Dotted line indicates recent industry-preferred size. TCF: directed Tanner crab fishery; SCF: snow crab fishery.

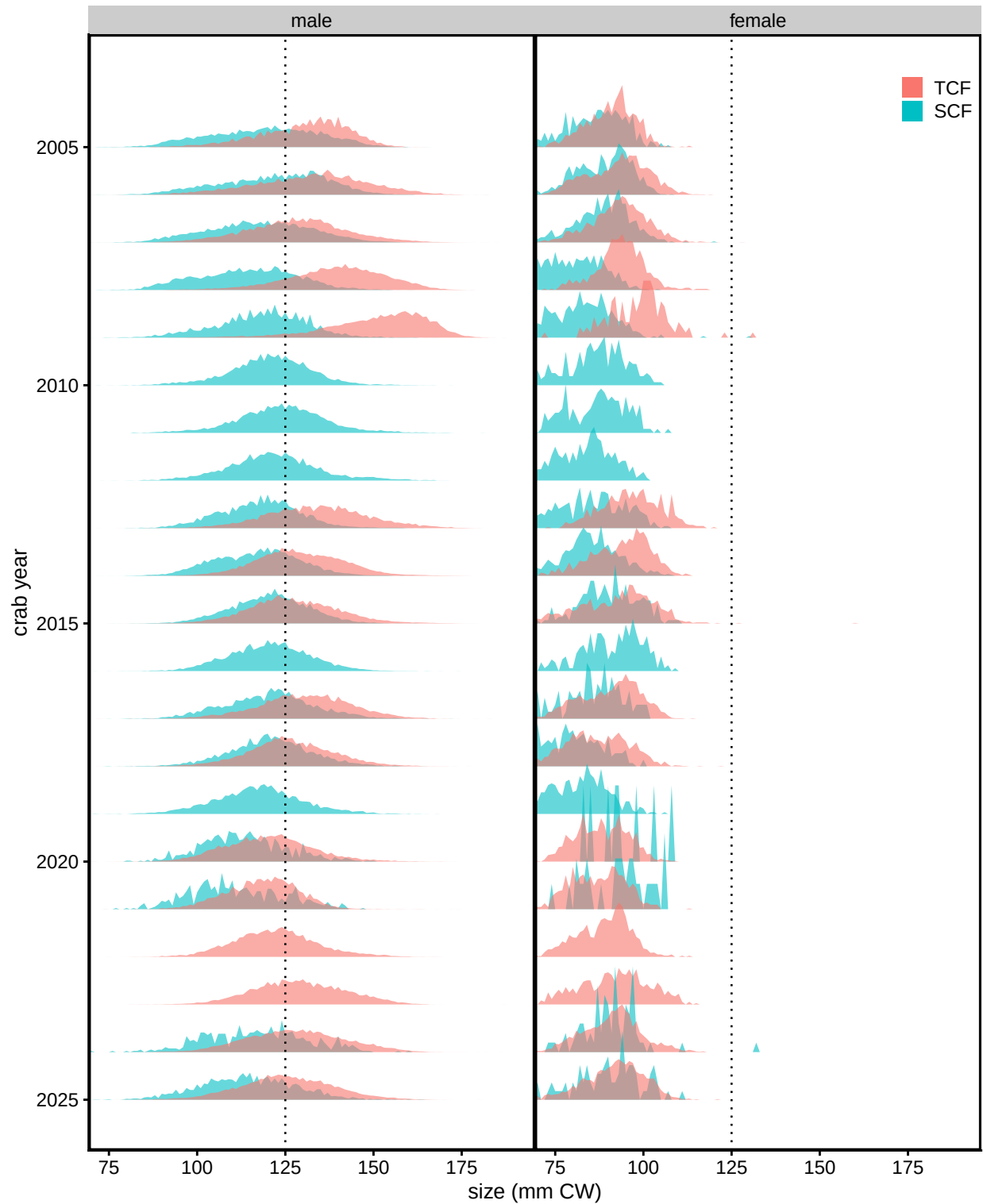


Figure 21. Comparison of *relative* size compositions for total catch of Tanner crab in the crab fisheries after 2004/05. Catch has already been aggregated across ADF&G management areas. Individual compositions are scaled to sum to 1 across sizes. Dotted line indicates recent industry-preferred size. TCF: directed Tanner crab fishery; SCF: snow crab fishery.

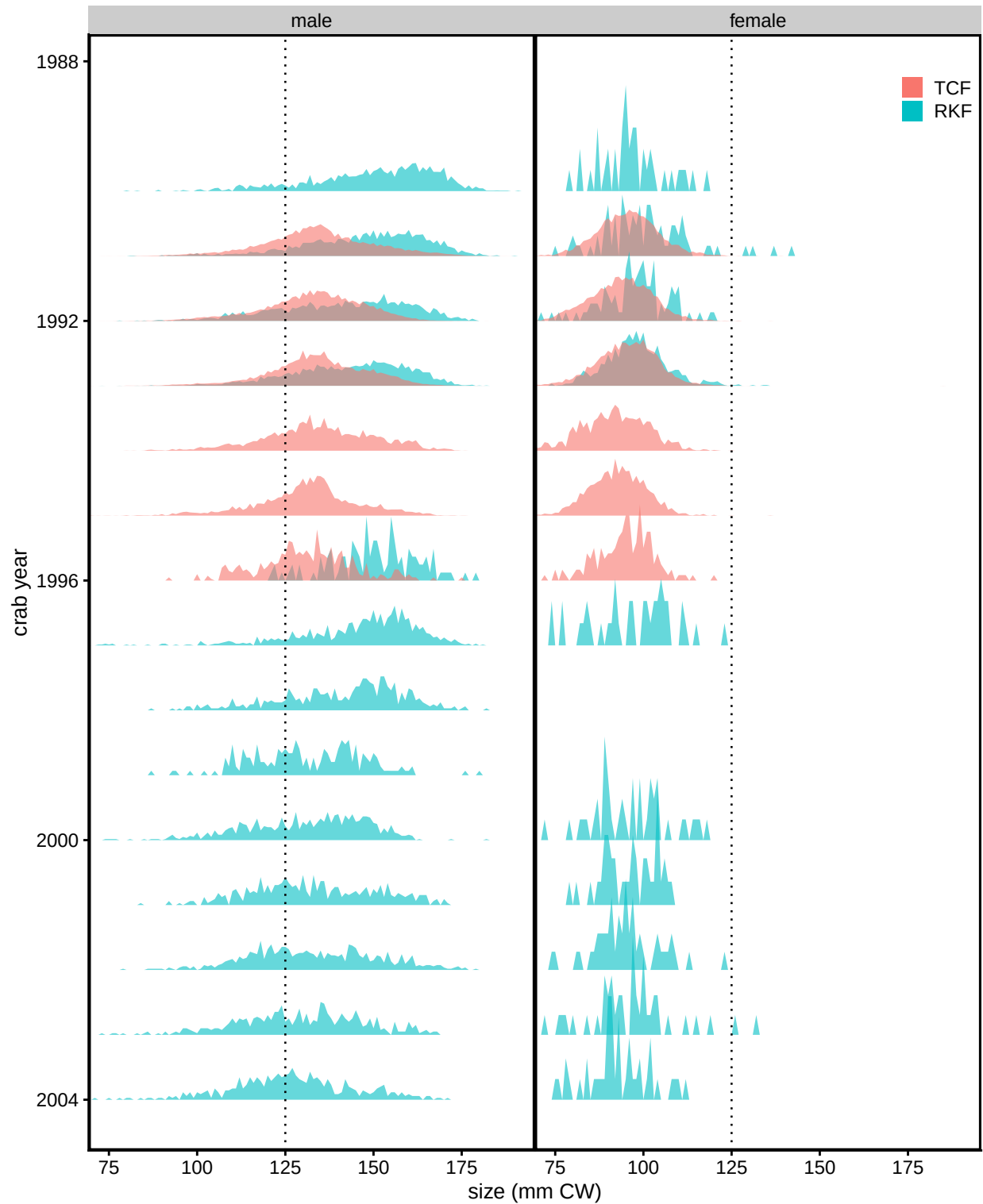


Figure 22. Comparison of *relative* size compositions for total catch of Tanner crab in the directed and BBRKC fisheries prior to 2005/06. Catch has already been aggregated across ADF&G management areas. Individual compositions are scaled to sum to 1 across sizes. Size compositions limited to a few samples are not plotted to improve clarity. Dotted line indicates recent industry-preferred size. TCF: directed Tanner crab fishery; RKF: BBRKC fishery.

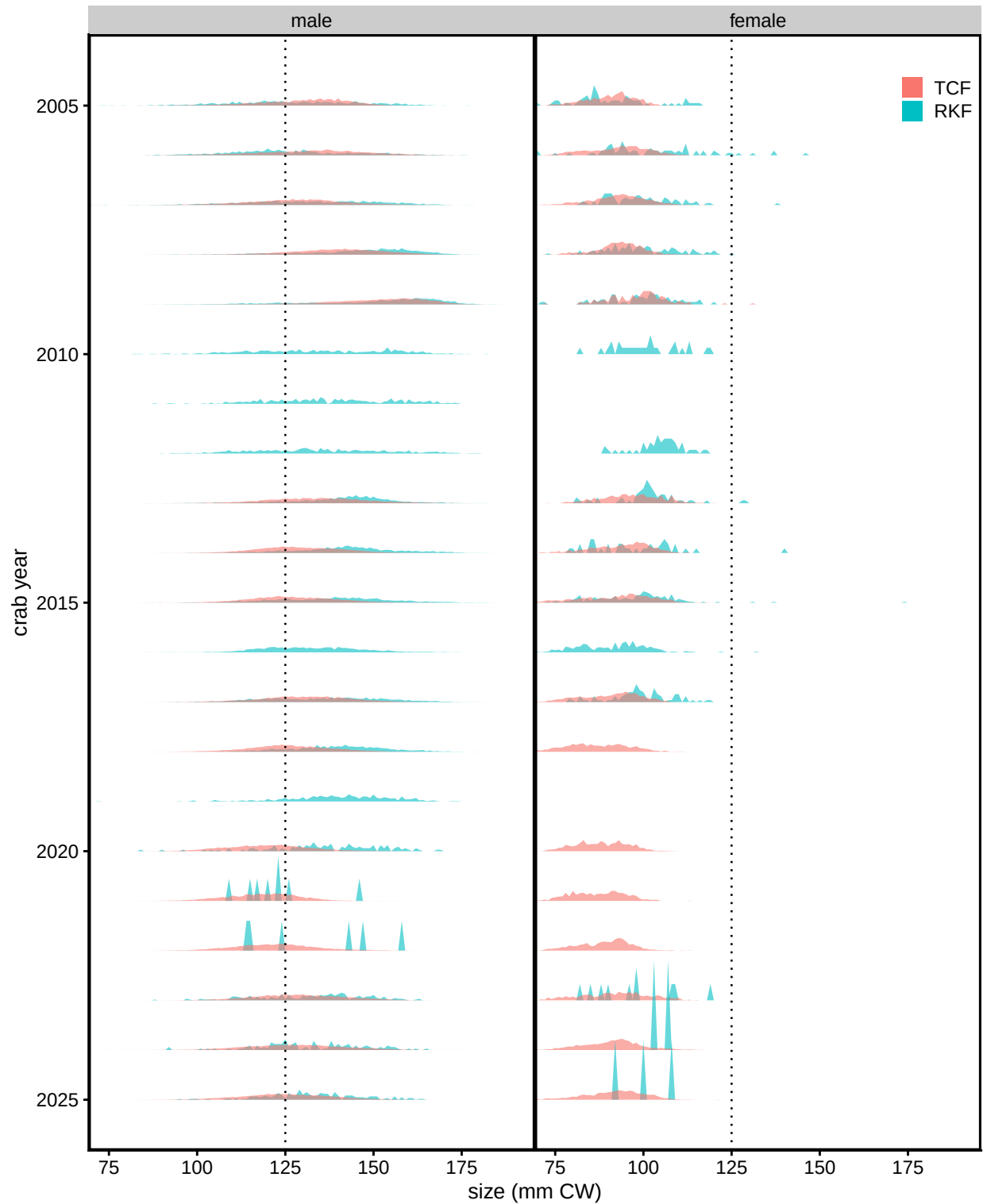


Figure 23. Comparison of *relative* size compositions for total catch of Tanner crab in the directed and BBRKC fisheries after 2004/05. Catch has already been aggregated across ADF&G management areas. Individual compositions are scaled to sum to 1 across sizes. Size compositions limited to a few samples are not plotted to improve clarity. Dotted line indicates recent industry-preferred size. TCF: directed Tanner crab fishery; RKF: BBRKC fishery.

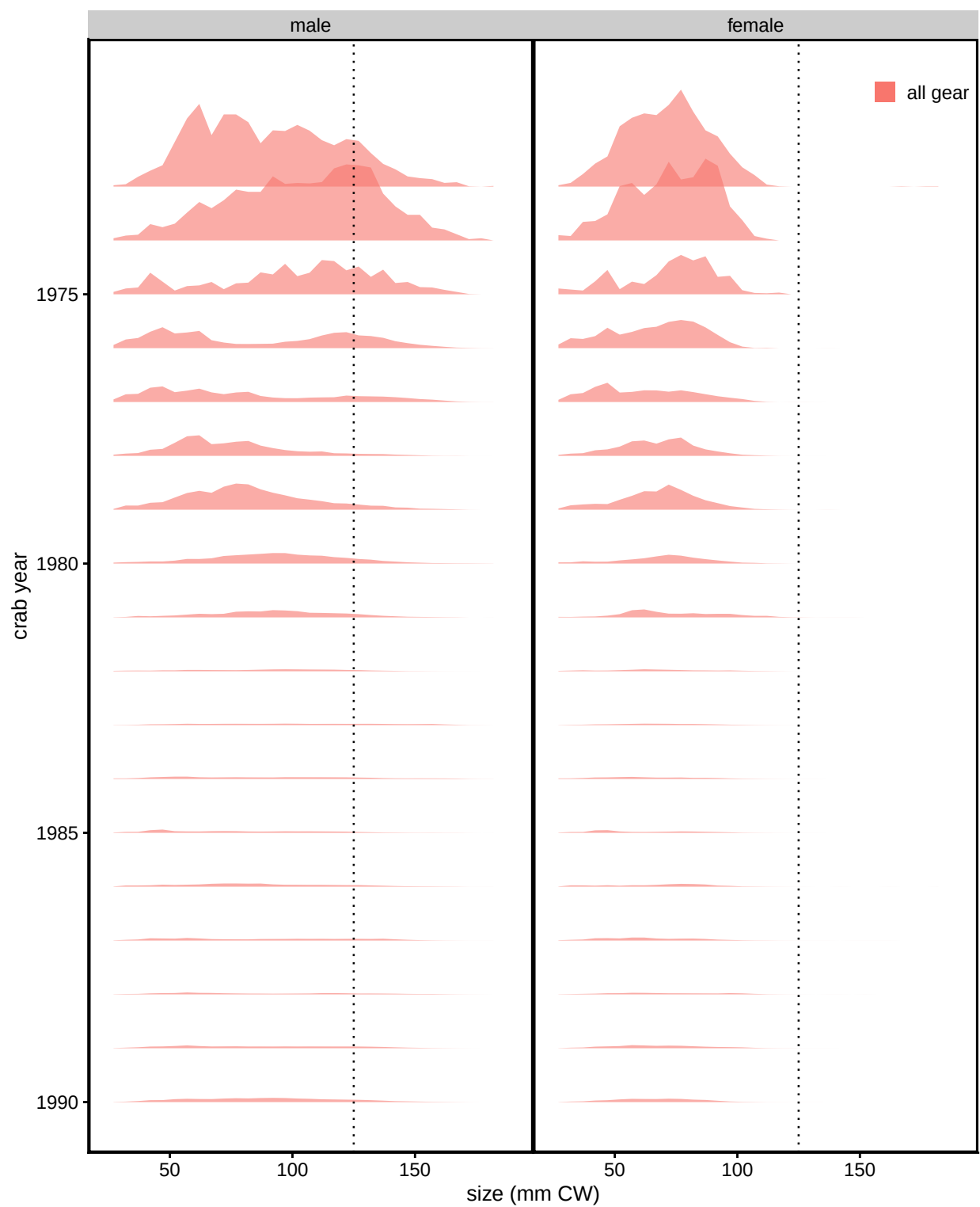


Figure 24. Expanded size compositions for total catch of Tanner crab in the groundfish fisheries prior to 1990/91. Dotted line indicates recent industry-preferred size.

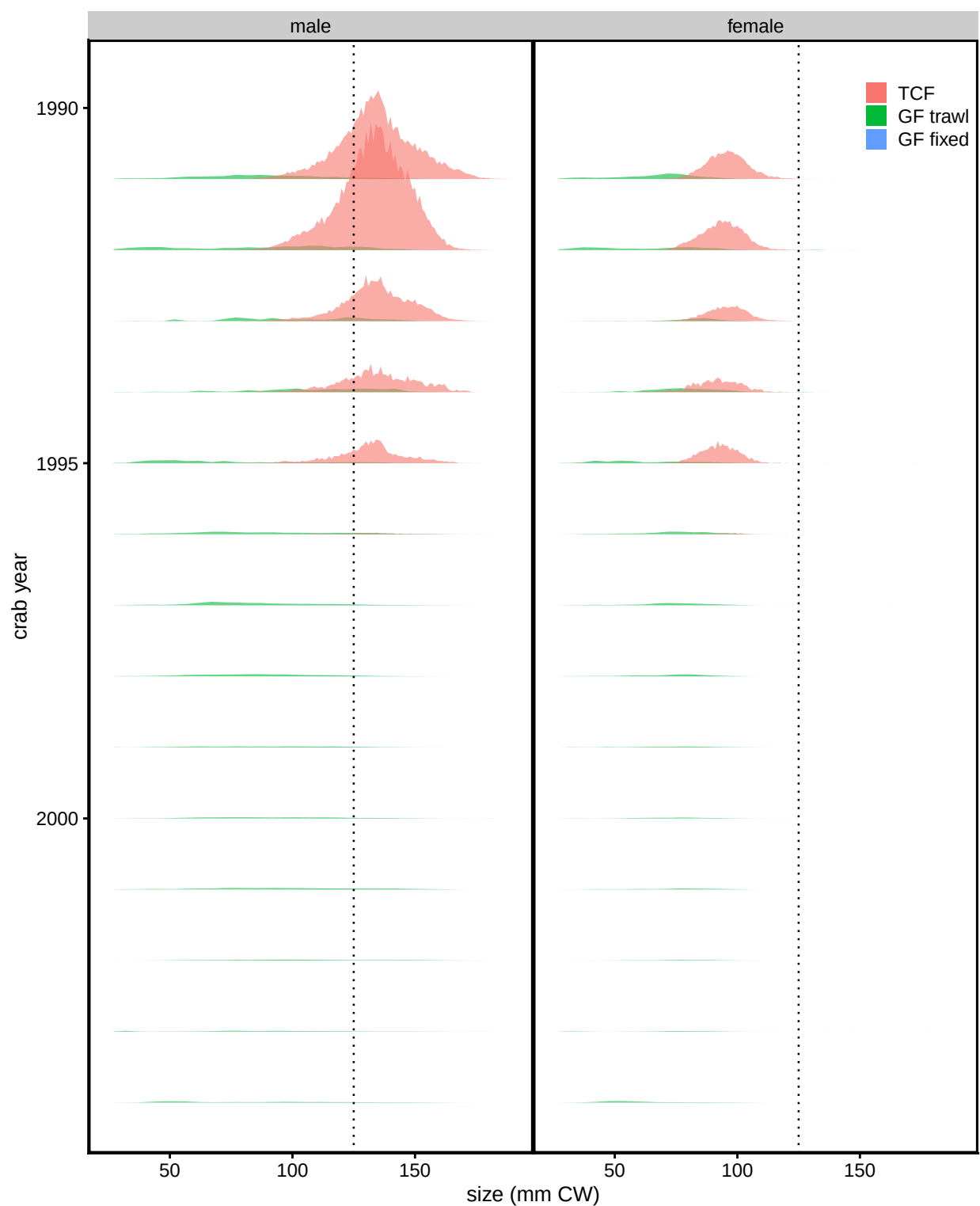


Figure 25. Comparison of expanded size compositions for total catch of Tanner crab in the directed ('TCF') and groundfish ('GF') fisheries during 1991/92-2004/05. Dotted line indicates recent industry-preferred size.

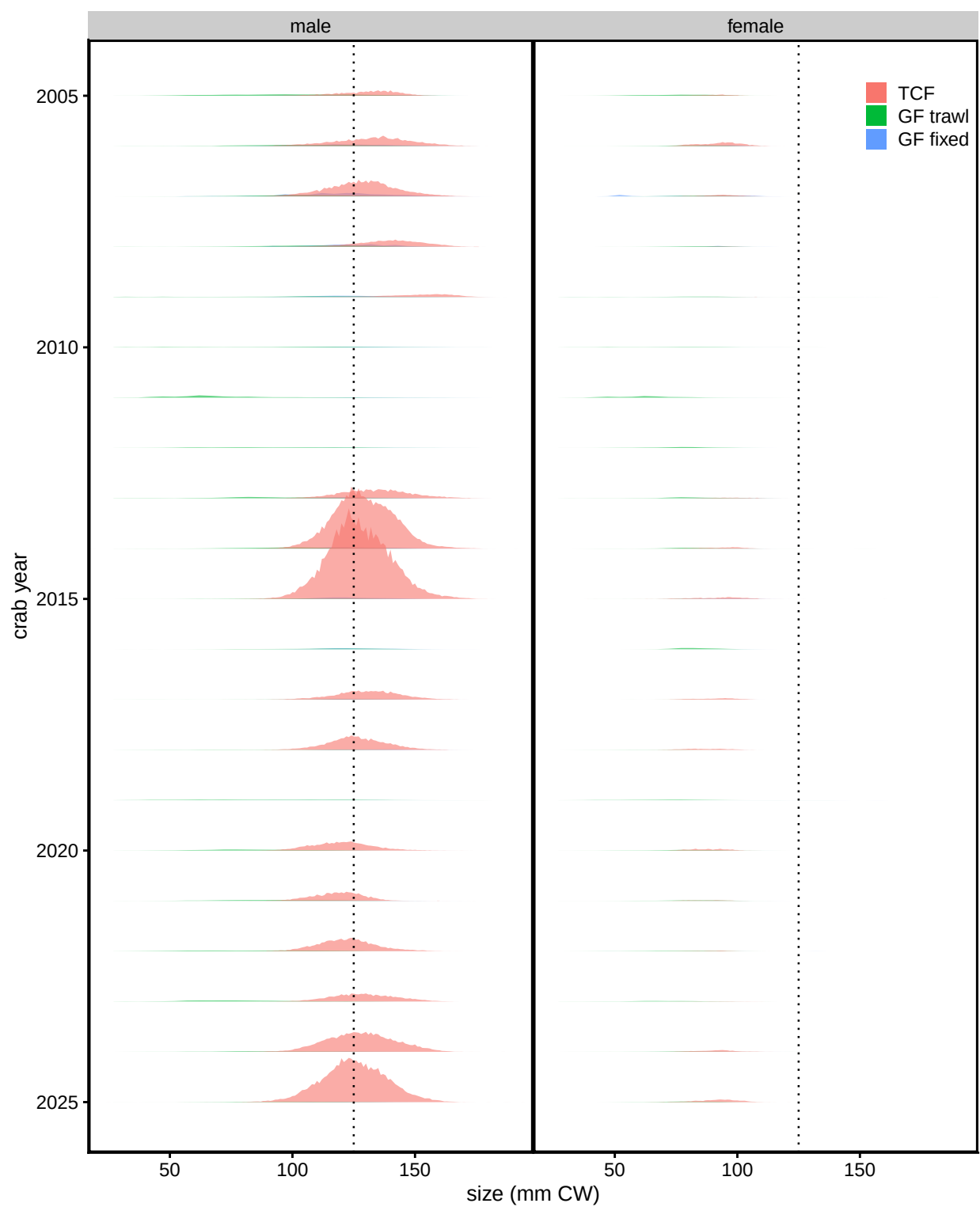


Figure 26. Comparison of expanded size compositions for total catch of Tanner crab in the directed ('TCF') and groundfish ('GF') fisheries since 2005/06. Dotted line indicates recent industry-preferred size.

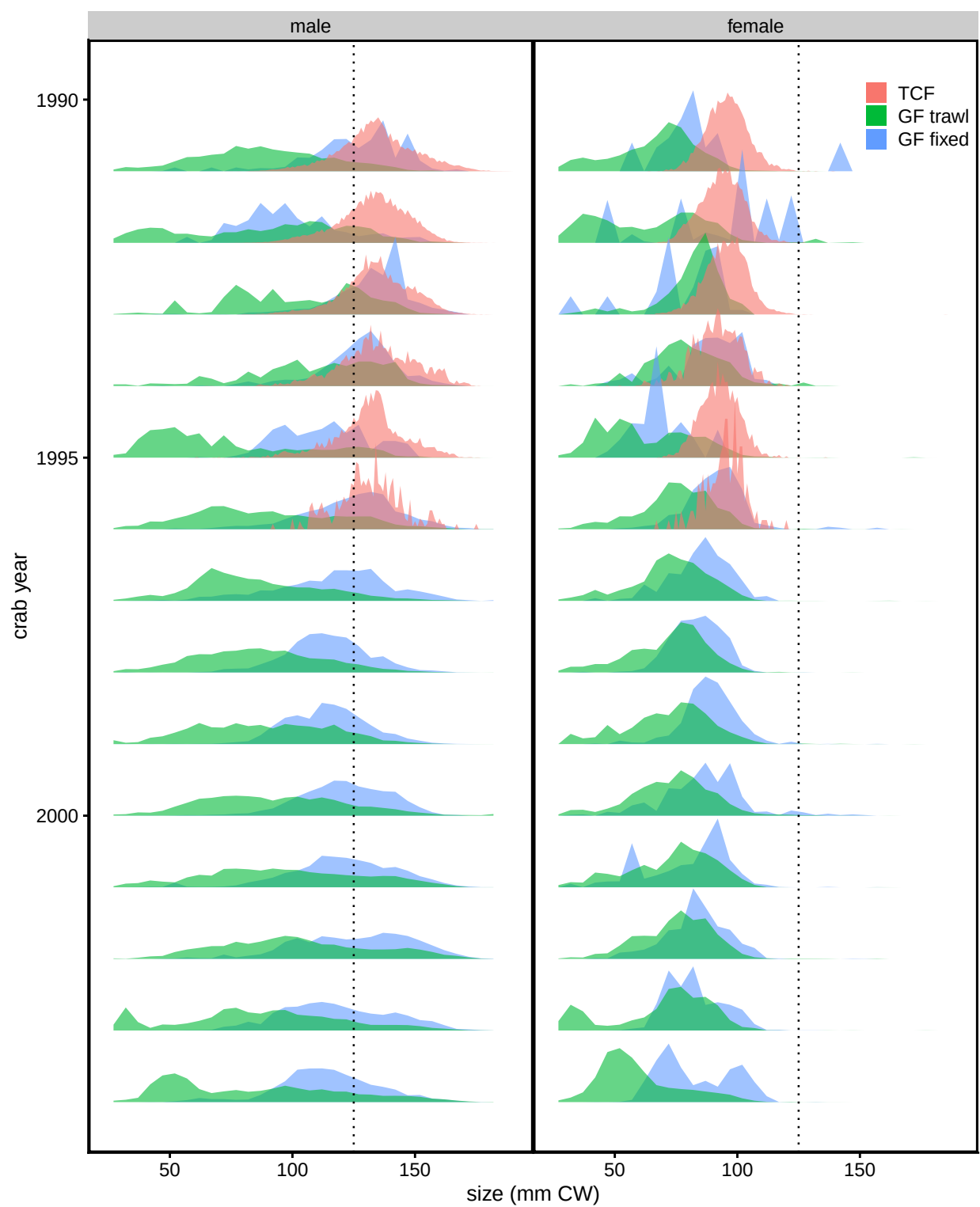


Figure 27. Comparison of *relative* size compositions for total catch of Tanner crab in the directed ('TCF') and groundfish ('GF') fisheries during 1991/92-2004/05. Dotted line indicates recent industry-preferred size.

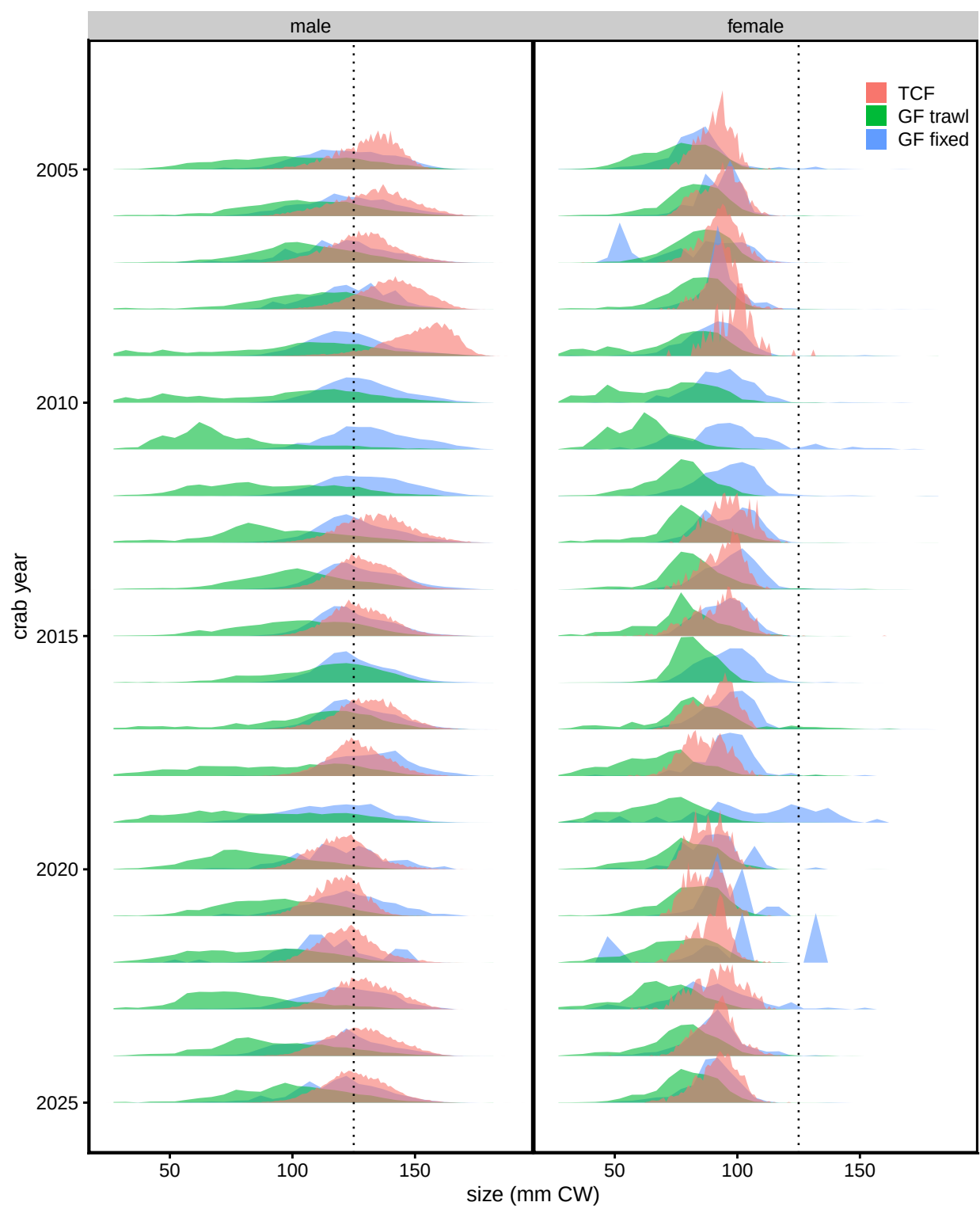


Figure 28. Comparison of *relative* size compositions for total catch of Tanner crab in the directed ('TCF') and groundfish ('GF') fisheries since 2005/06. Dotted line indicates recent industry-preferred size.

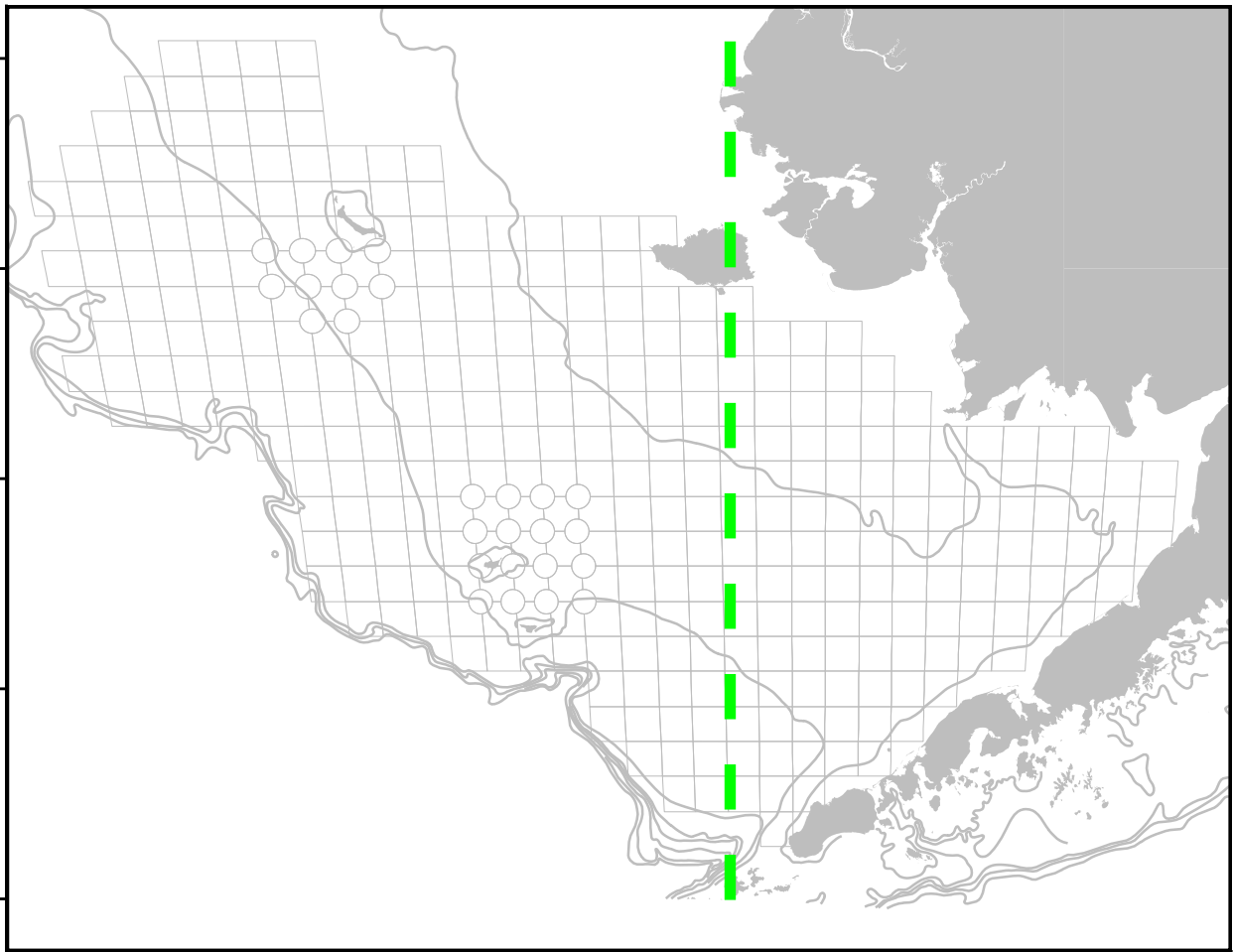


Figure 29. NMFS EBS shelf station grid (squares and circles). Hauls at the 26 so-called “corner” stations (circles) near the Pribilof Islands and St. Matthew Island were discontinued in 2024.

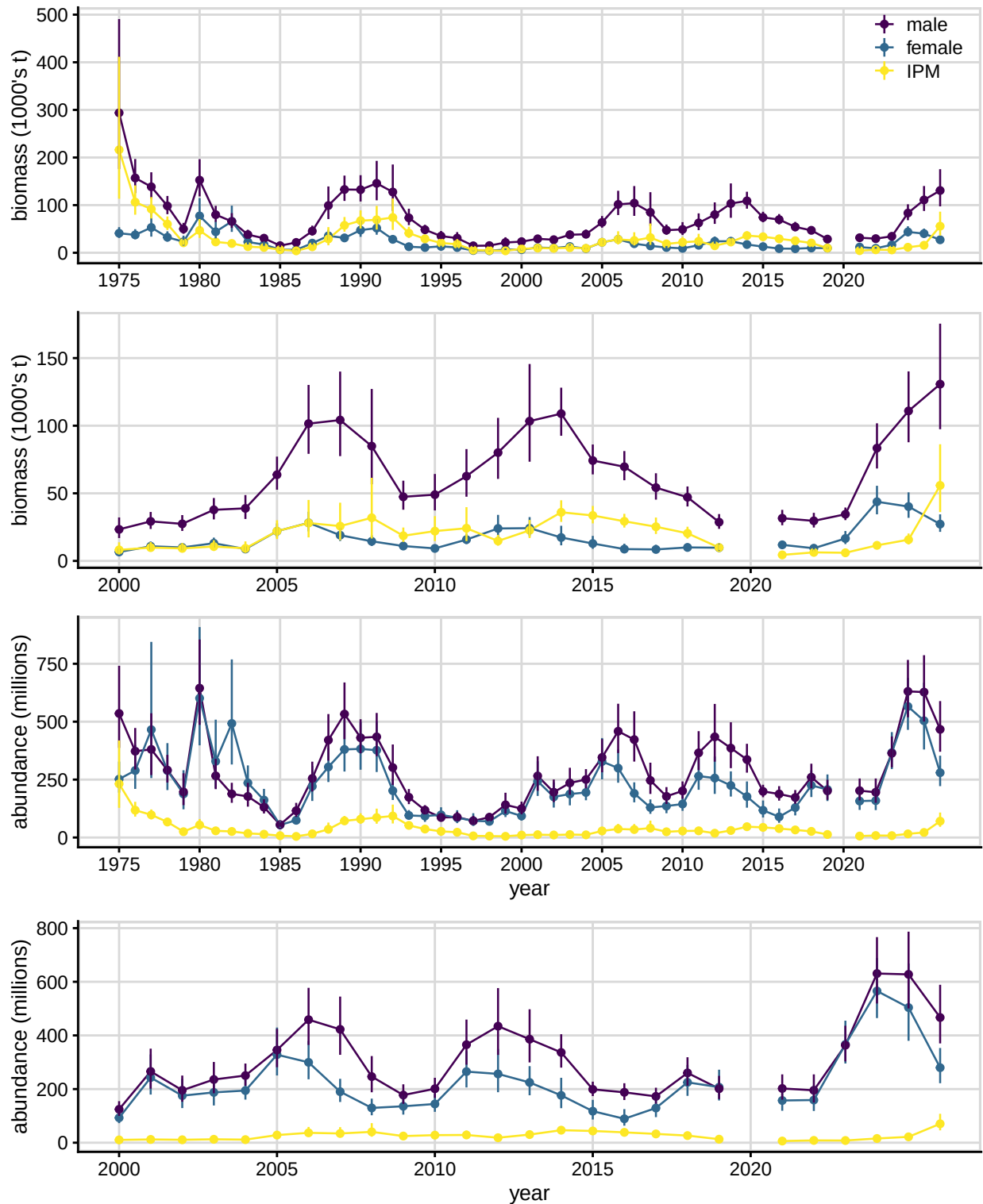


Figure 30. Annual estimates of design-based area-swept biomass (upper plots) and abundance (lower plots) from the NMFS EBS bottom trawl survey by sex. The lower plot in each pair shows the trends since 2000. The biomass/abundance trends for industry-preferred size males (> 125 mm CW; 'IPM') are also shown.

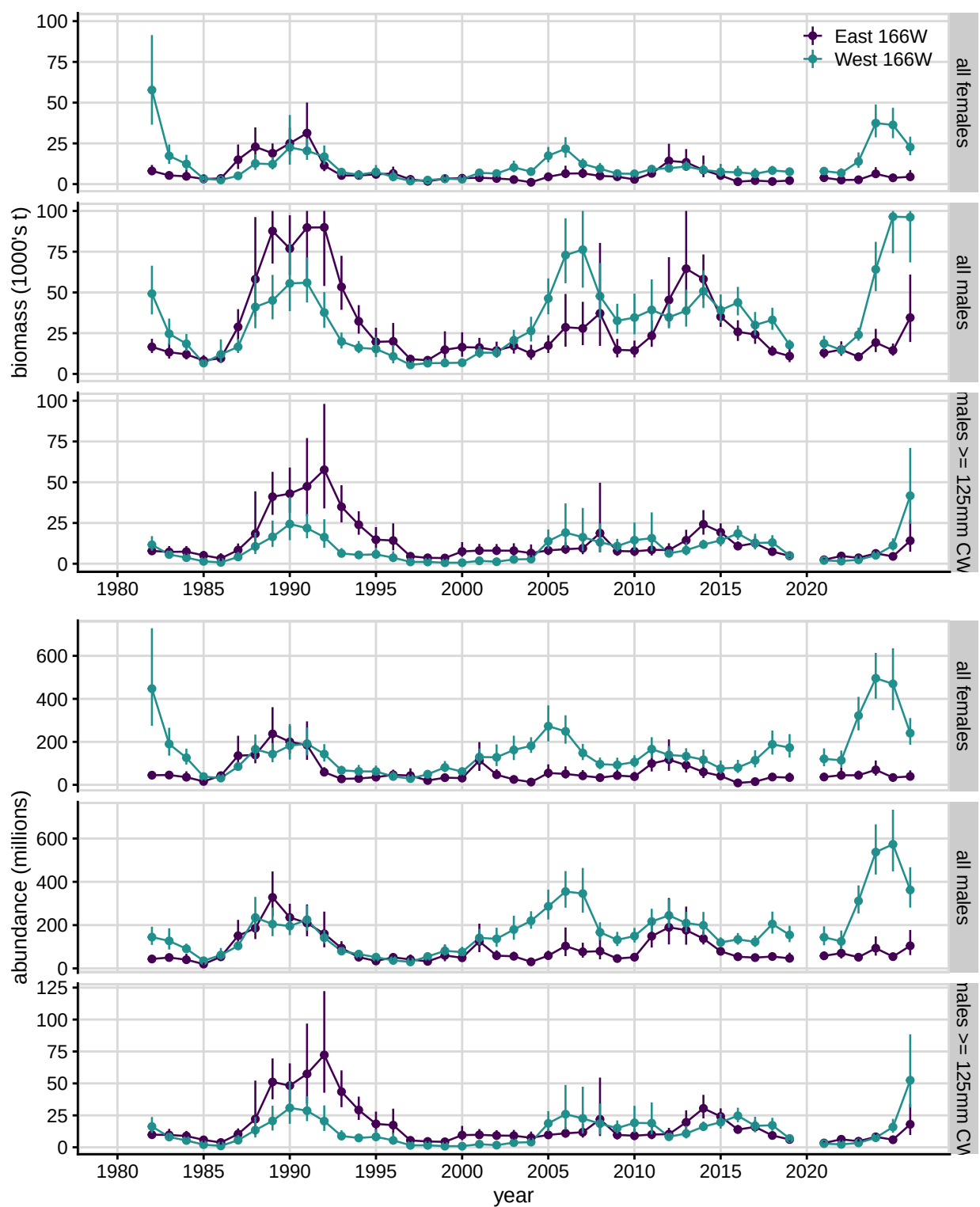


Figure 31. Annual estimates of design-based area-swept biomass (upper plots) and abundance (lower plots) from the NMFS EBS bottom trawl survey by population category and management area.

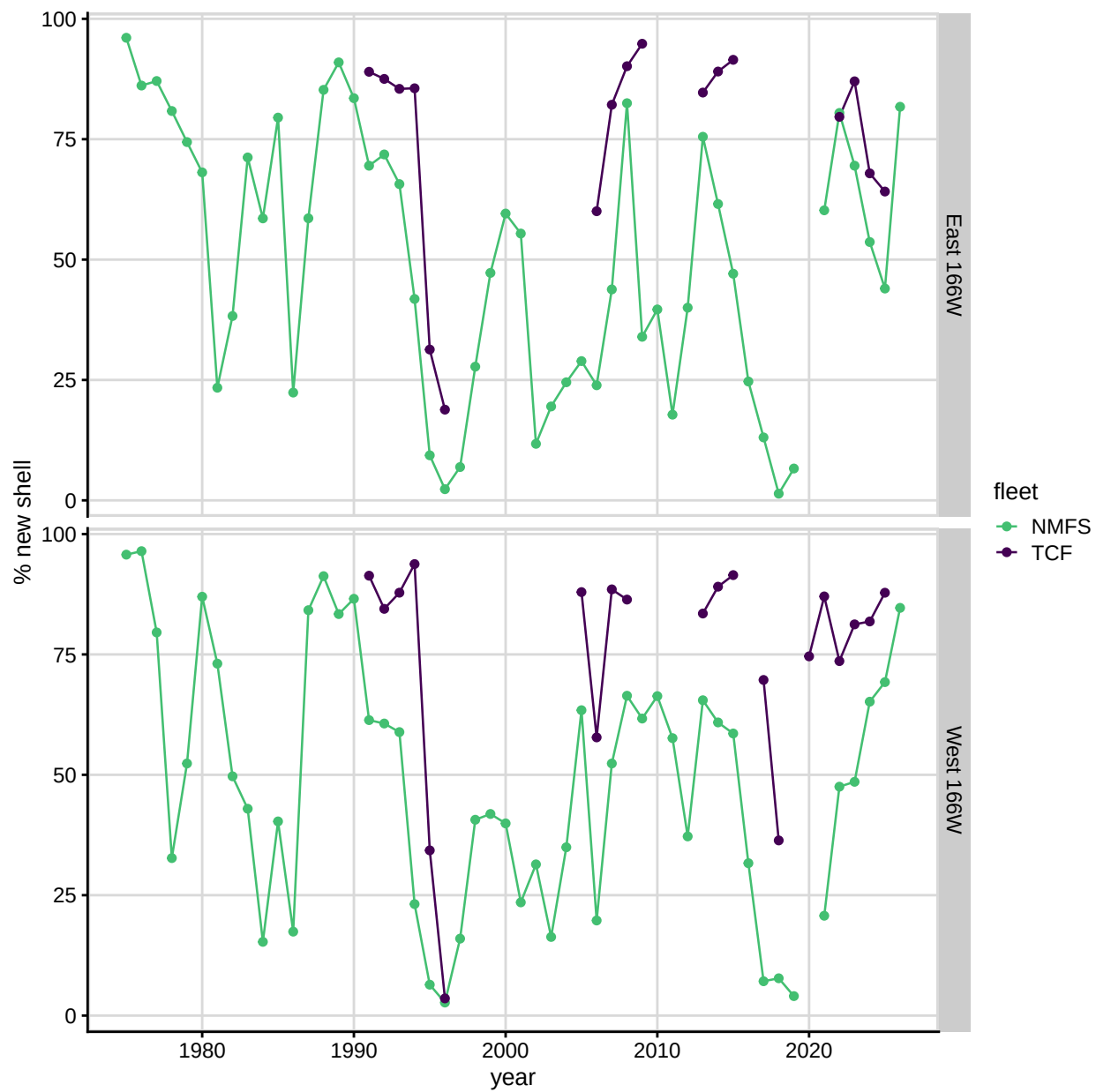


Figure 32. Comparison of the annual percent of new shell industry-preferred size males caught in the NMFS EBS shelf survey and the directed fishery ('TCF'), by ADF&G management area. The survey values have been lagged a year to align visually with the fishery values.

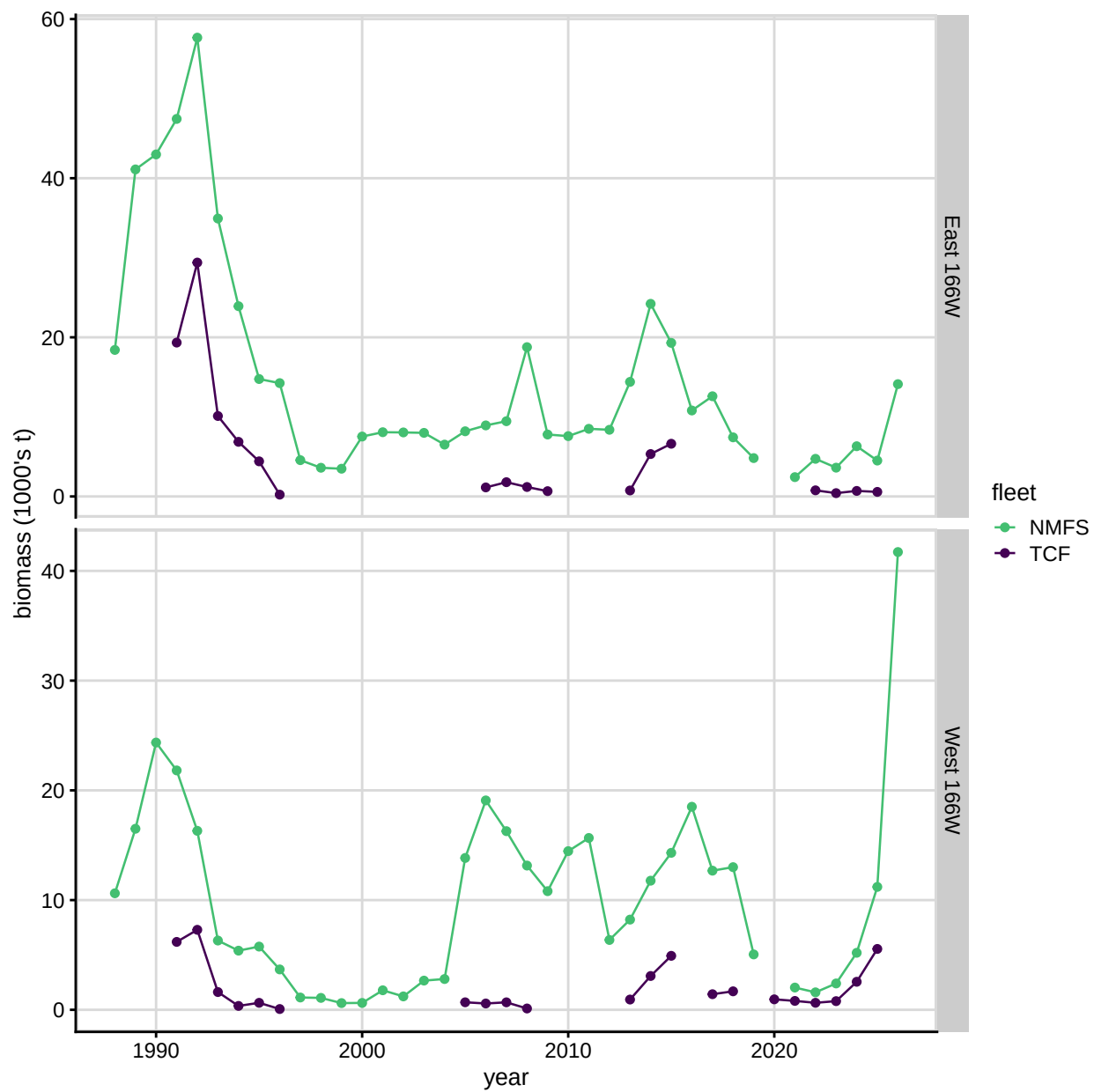


Figure 33. Comparison of the biomass of industry-preferred size males estimated from the NMFS EBS shelf survey and caught in the directed fishery ('TCF'), by ADF&G management area.

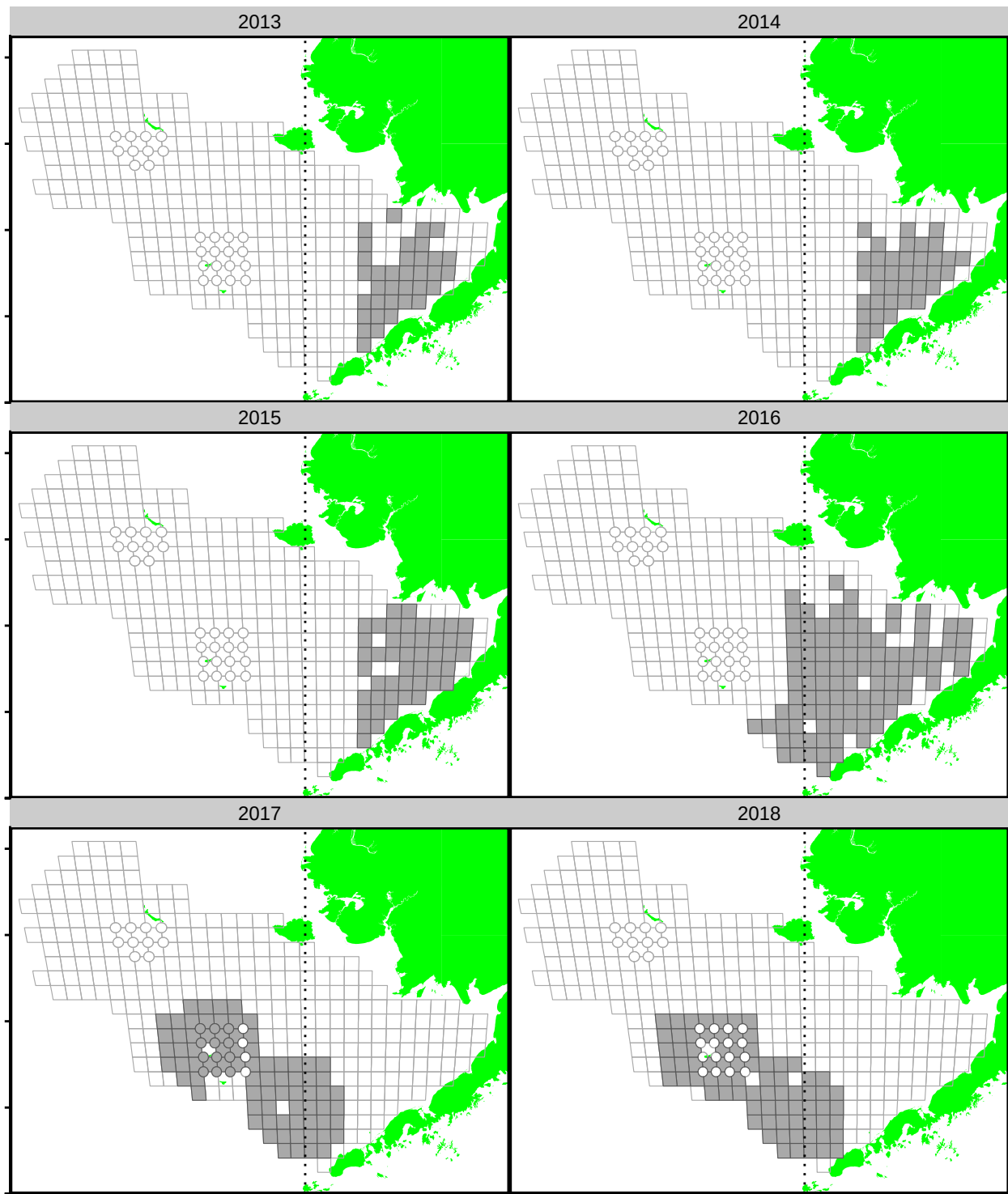


Figure 34. Annual spatial footprints of the BSFRF-NMFS collaborative side-by-side (SBS) Tanner crab catchability studies (2013-2018). BSFRF SBS tows were made in parallel to standard NMFS survey tows at a (different) subset of standard NMFS stations each year of the study. The BSFRF vessel used a modified nephrops bottom trawl assumed to capture all crab within the area swept.

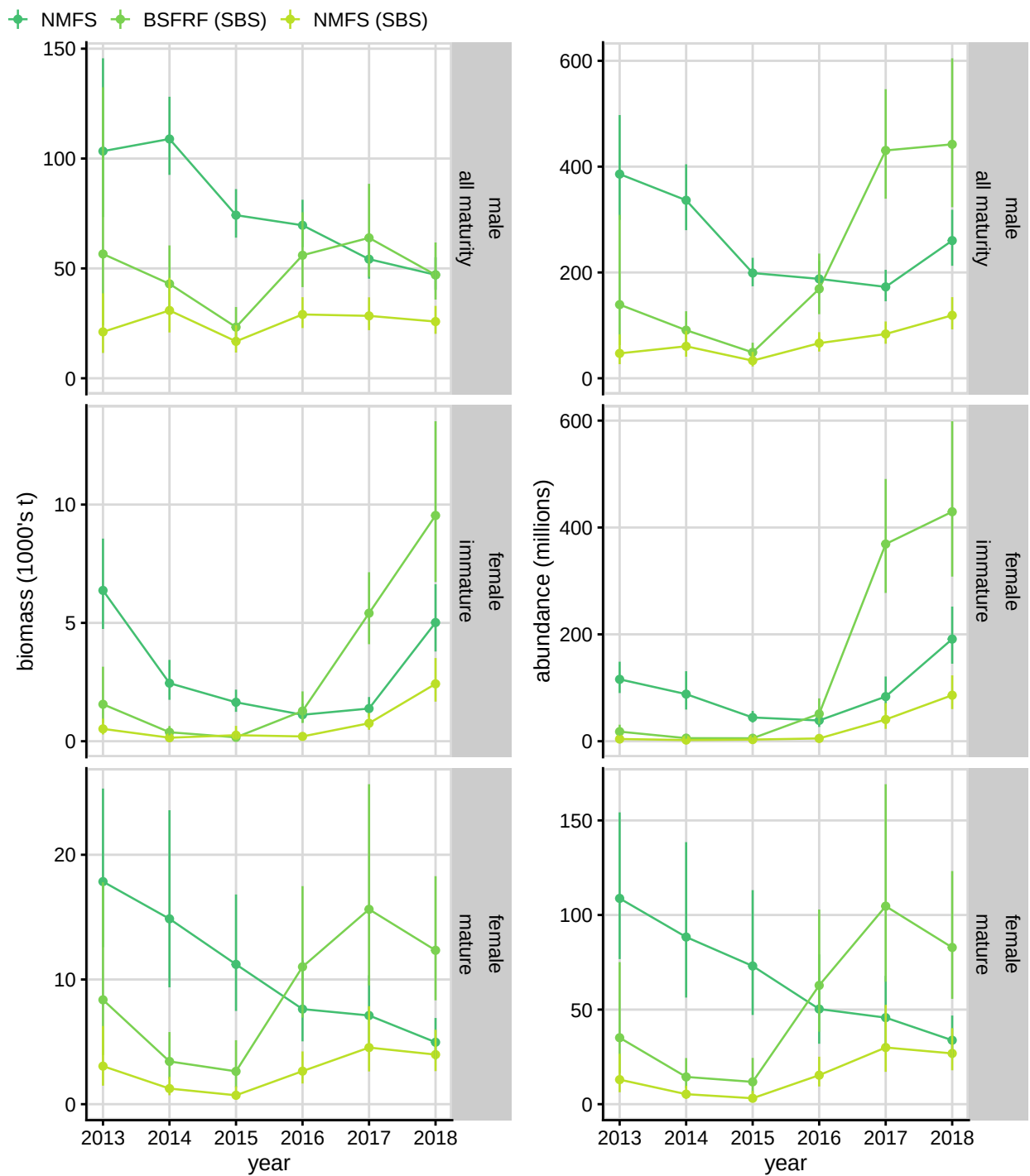


Figure 35. Comparison of estimates of area-swept biomass (left column) and abundance (right column) from the BSFRF-NMFS cooperative side-by-side (SBS) catchability studies and the full NMFS survey in 2013-2018. The SBS studies had different spatial footprints each year, so annual changes in biomass do not necessarily reflect underlying population trends.

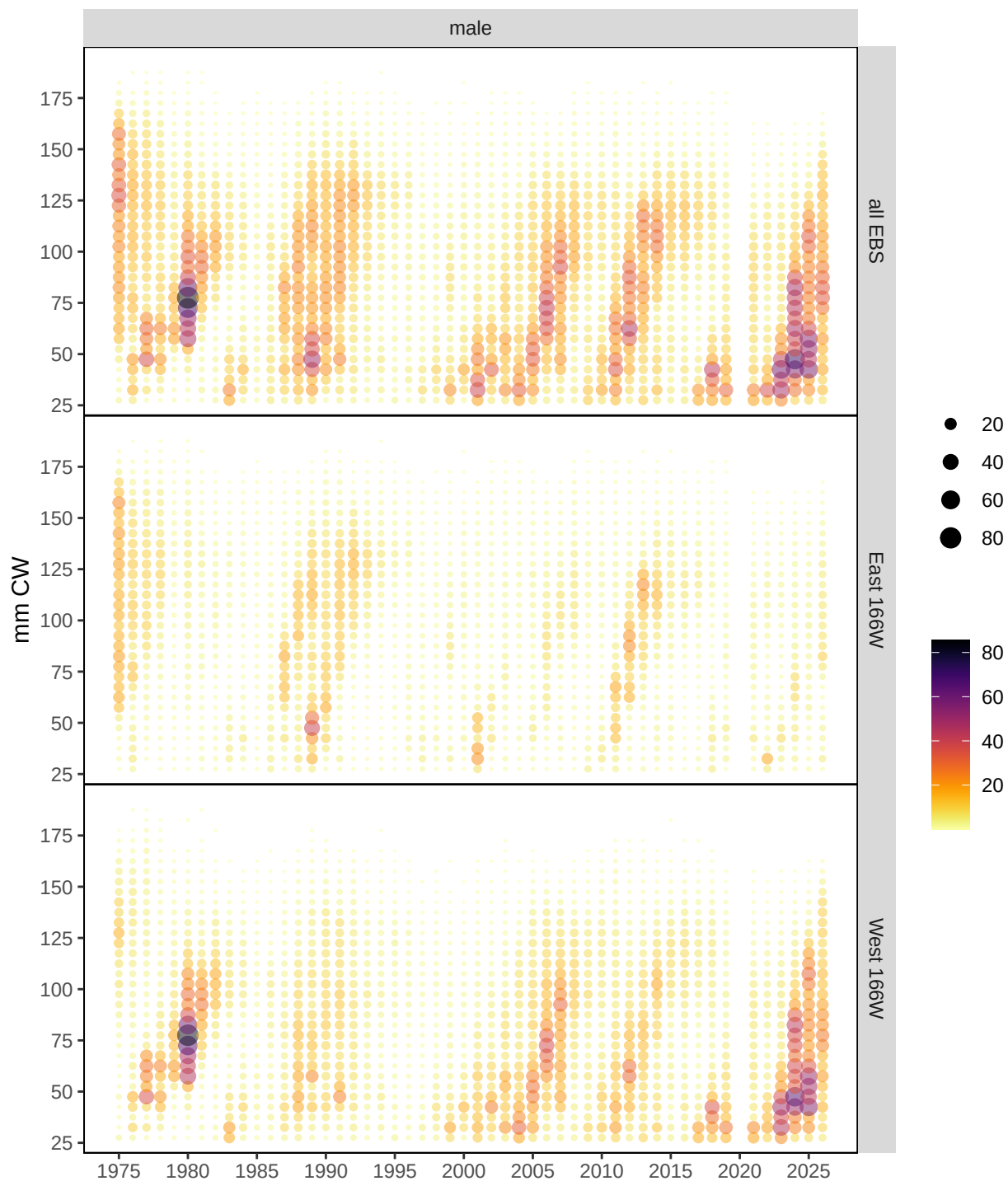


Figure 36. Annual size compositions, by 5-mm CW bin, from the NMFS EBS shelf bottom trawl survey for males by ADF&G management area for 1975-2026 as a bubble plot. The size compositions are truncated for crab < 25 mm CW.

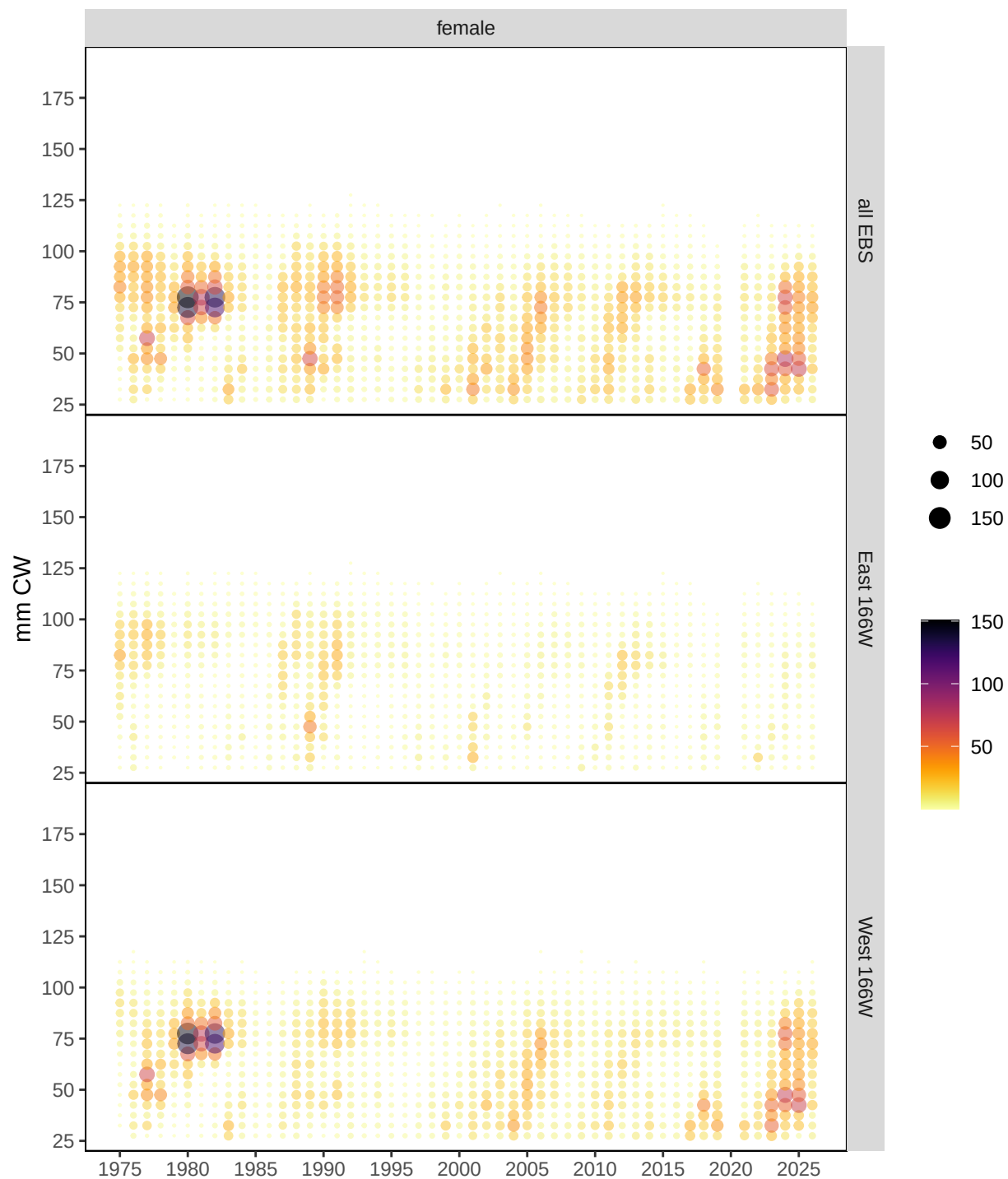


Figure 37. Annual size compositions, by 5-mm CW bin, from the NMFS EBS shelf bottom trawl survey for females by ADF&G management area for 1975-2026 as a bubble plot. The size compositions are truncated for crab < 25 mm CW.

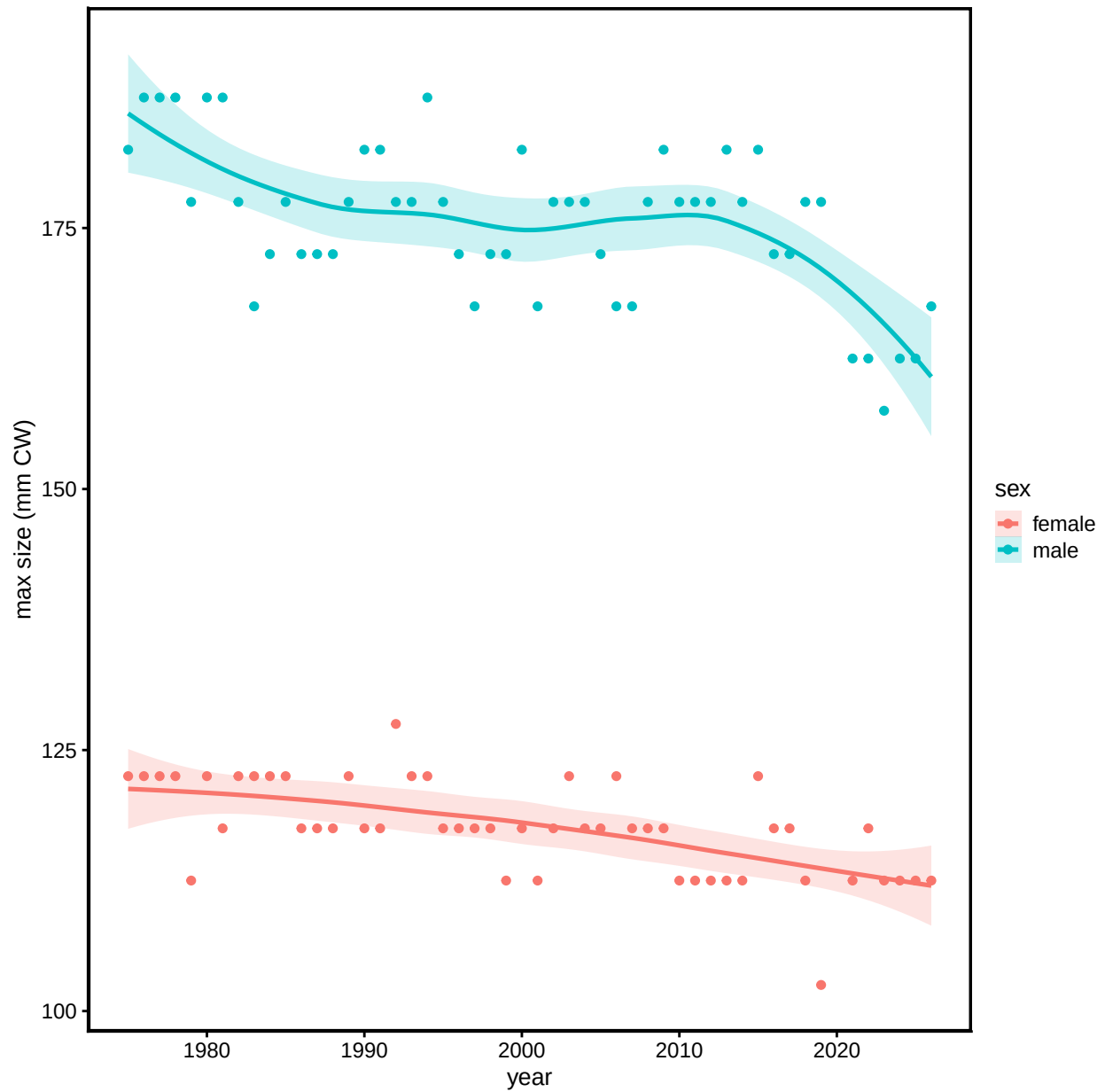


Figure 38. Maximum size in the annual 5-mm CW binned size compositions from the NMFS EBS shelf bottom trawl survey by sex for 1975-2026. Circles: annual values; lines and shading: loess-smoothed trends.



Figure 39. Comparison of size compositions from the SBS catchability study and the corresponding full NMFS EBS shelf survey. The size compositions are truncated for crab < 25 mm CW.

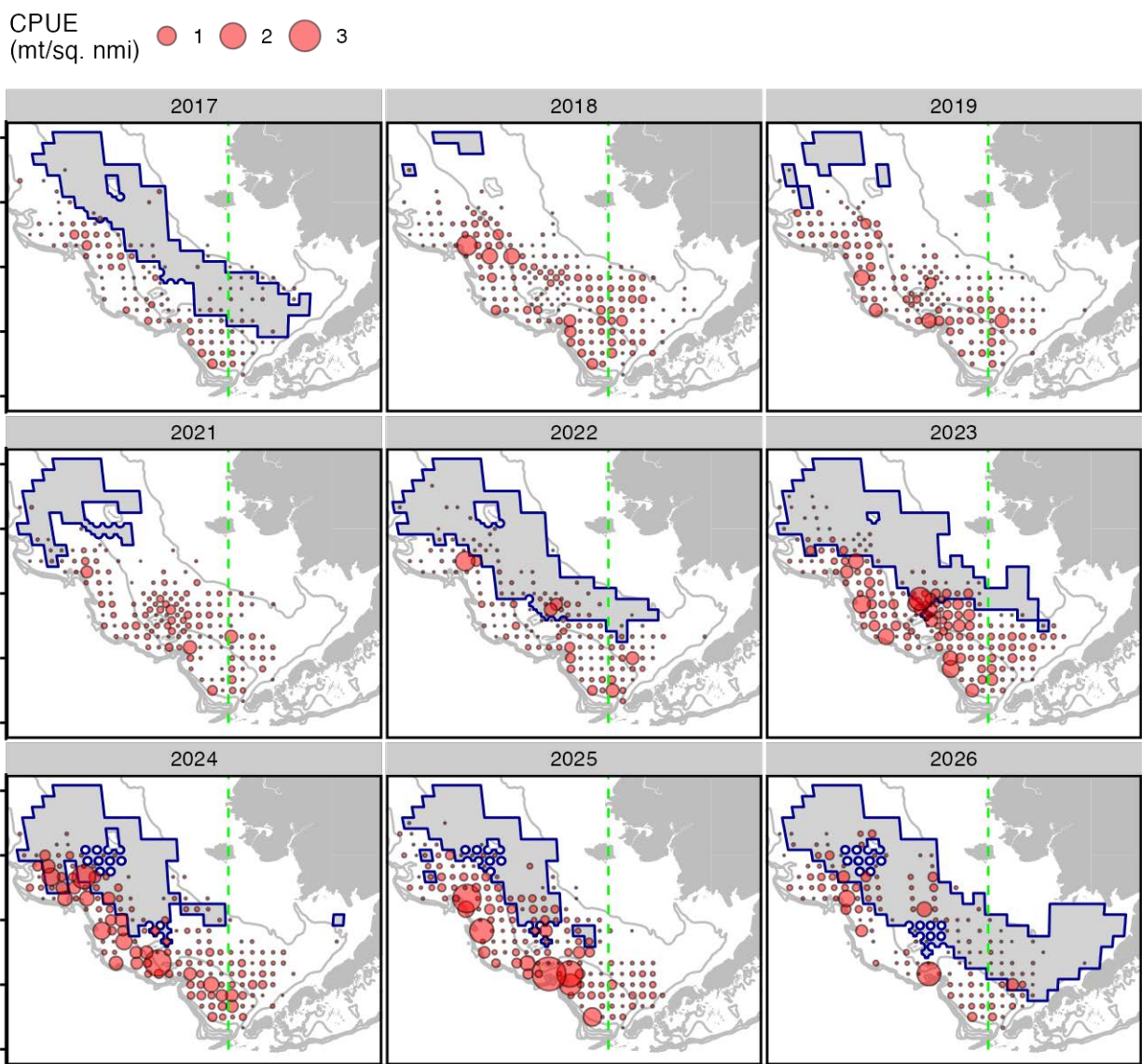


Figure 40. Spatial CPUE of small males (< 60 mm CW) in the NMFS EBS survey. The grey area with blue outline indicates the summer cod pool.

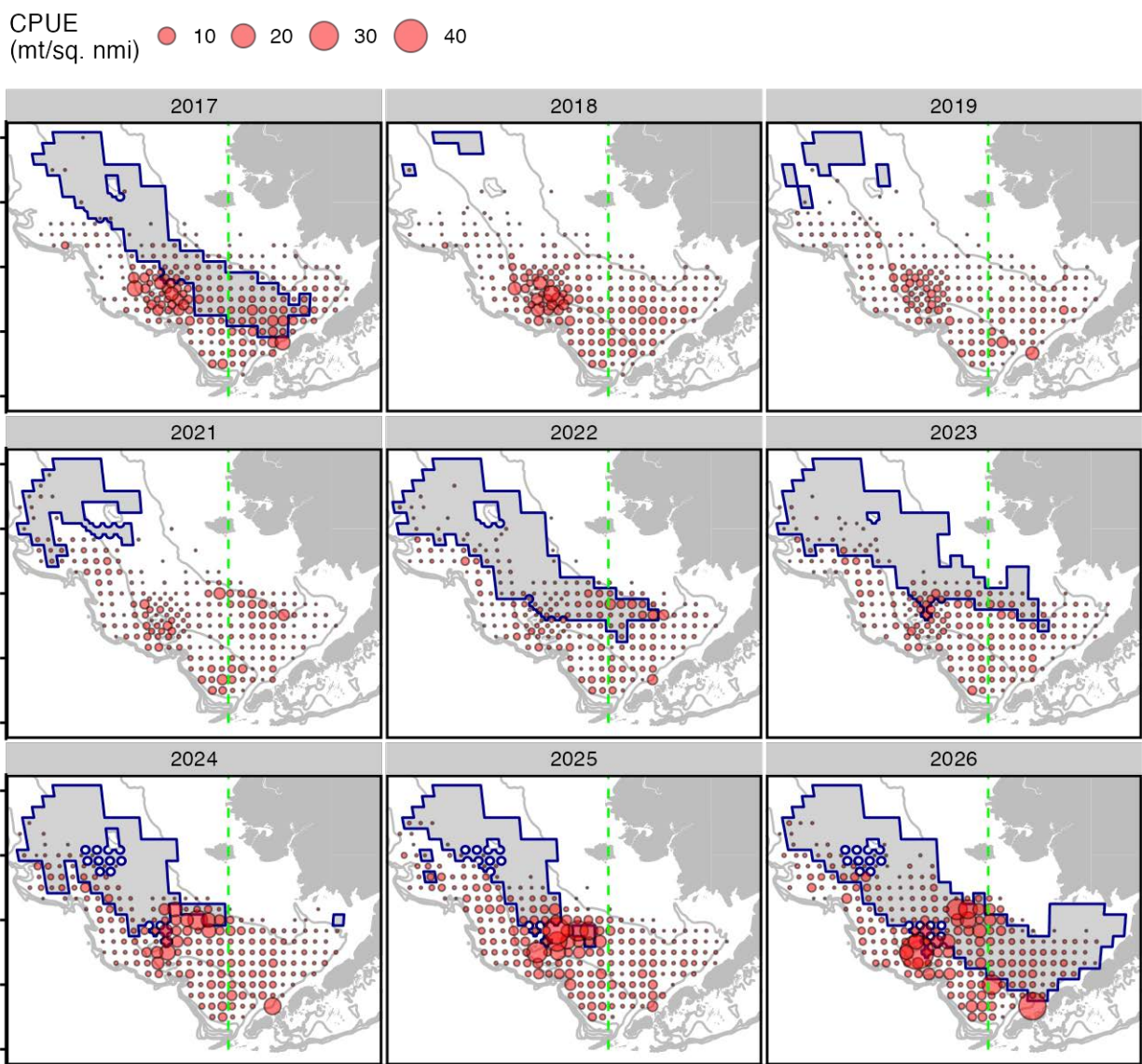


Figure 41. Spatial CPUE of large males (> 60 mm CW) in the NMFS EBS survey. The grey area with blue outline indicates the summer cod pool.

CPUE
(mt/sq. nmi) ● 10 ● 20

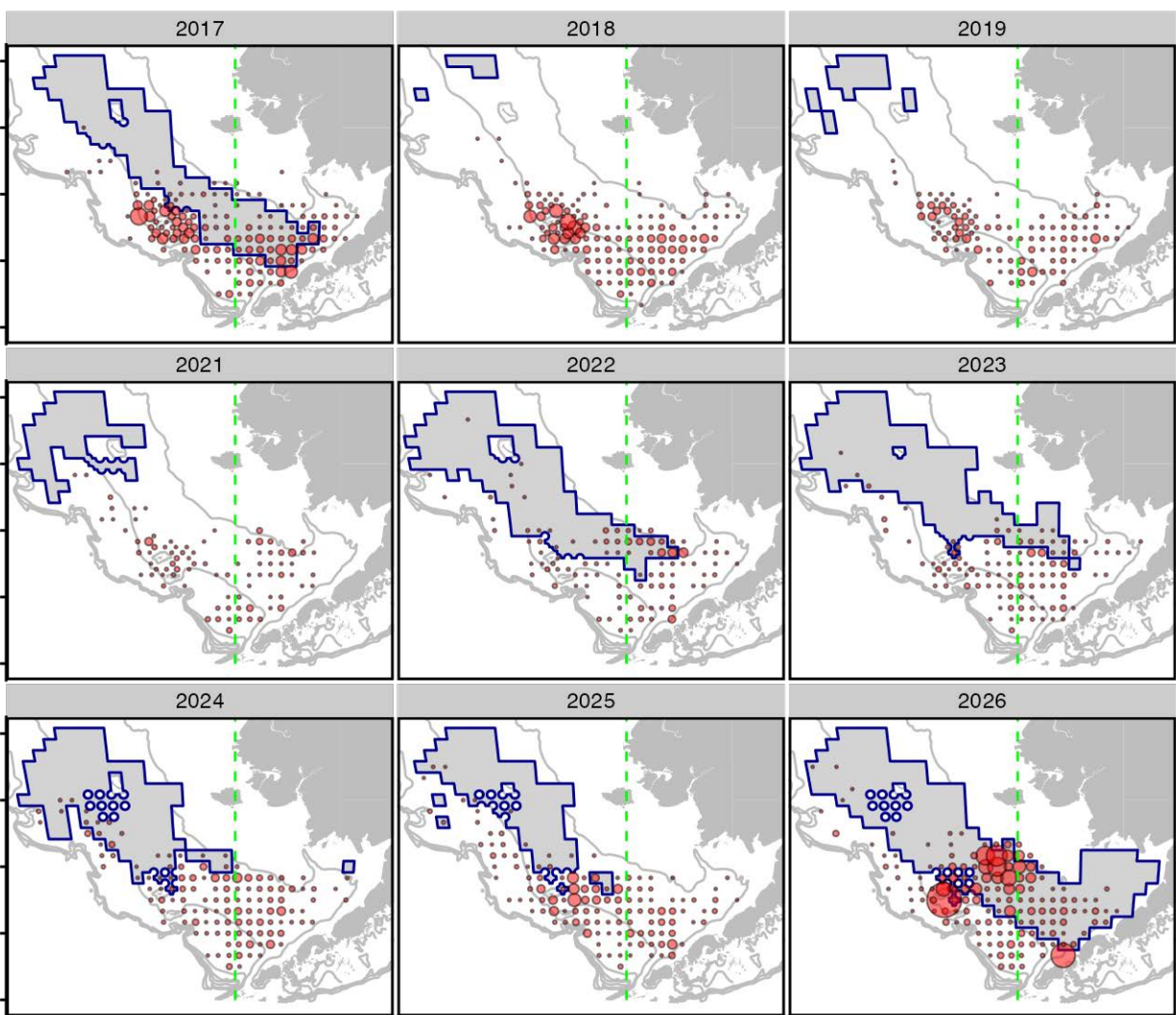


Figure 42. Spatial CPUE of industry-preferred (≥ 125 mm CW) in the NMFS EBS survey. The grey area with blue outline indicates the summer cod pool.

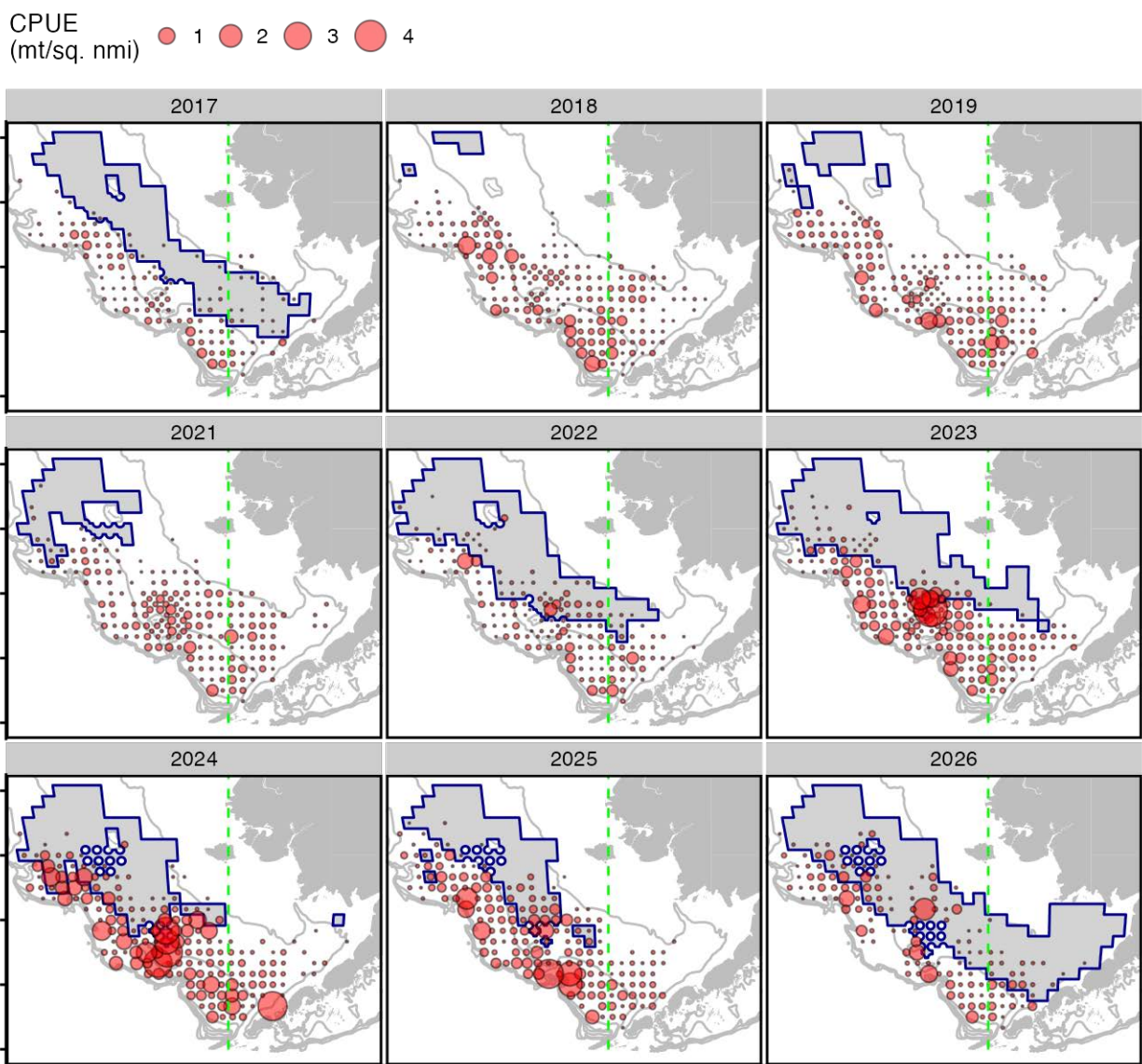


Figure 43. Spatial CPUE of immature females in the NMFS EBS survey. The grey area with blue outline indicates the summer cod pool.

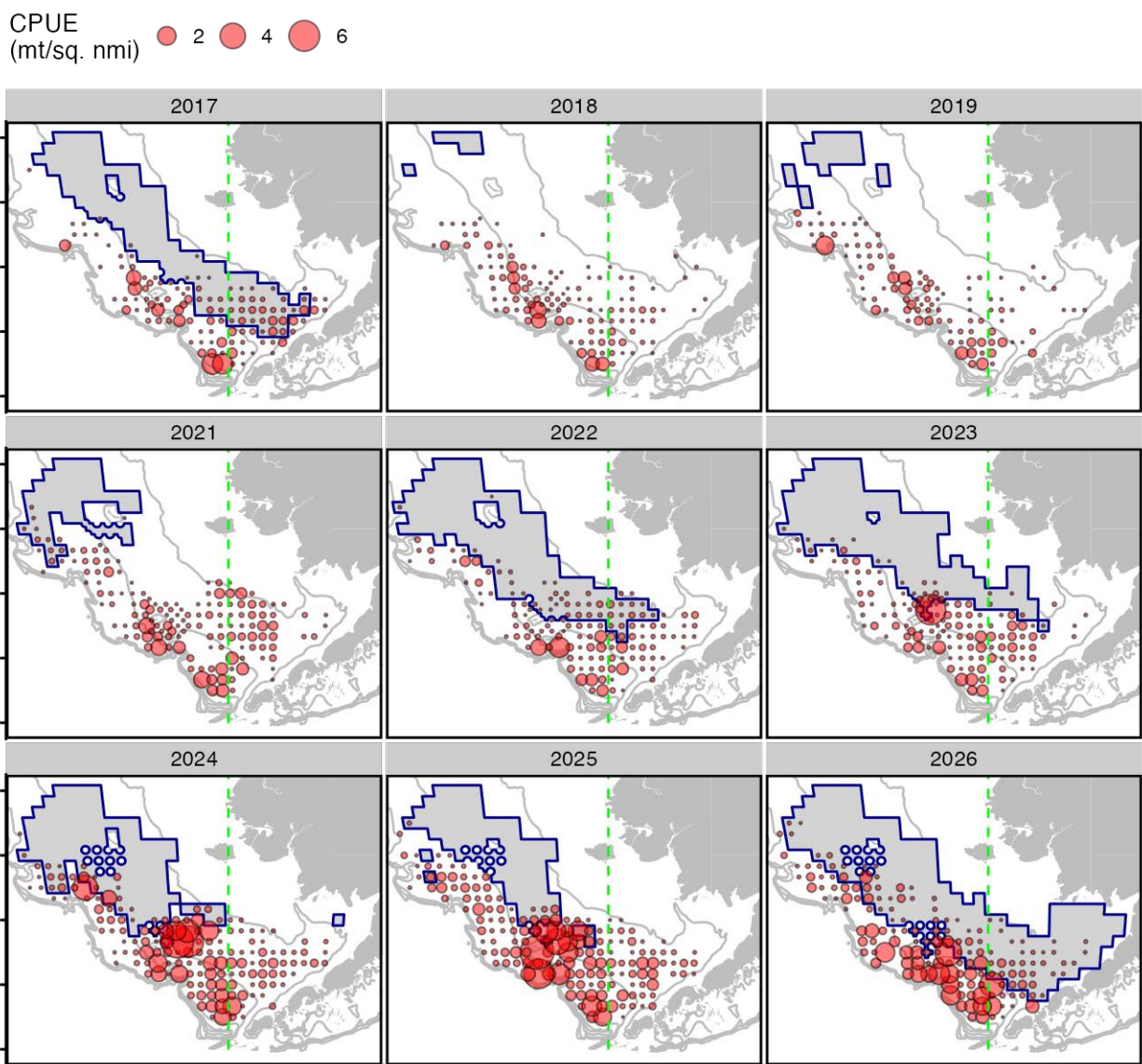


Figure 44. Spatial CPUE of mature females in the NMFS EBS survey. The grey area with blue outline indicates the summer cod pool.

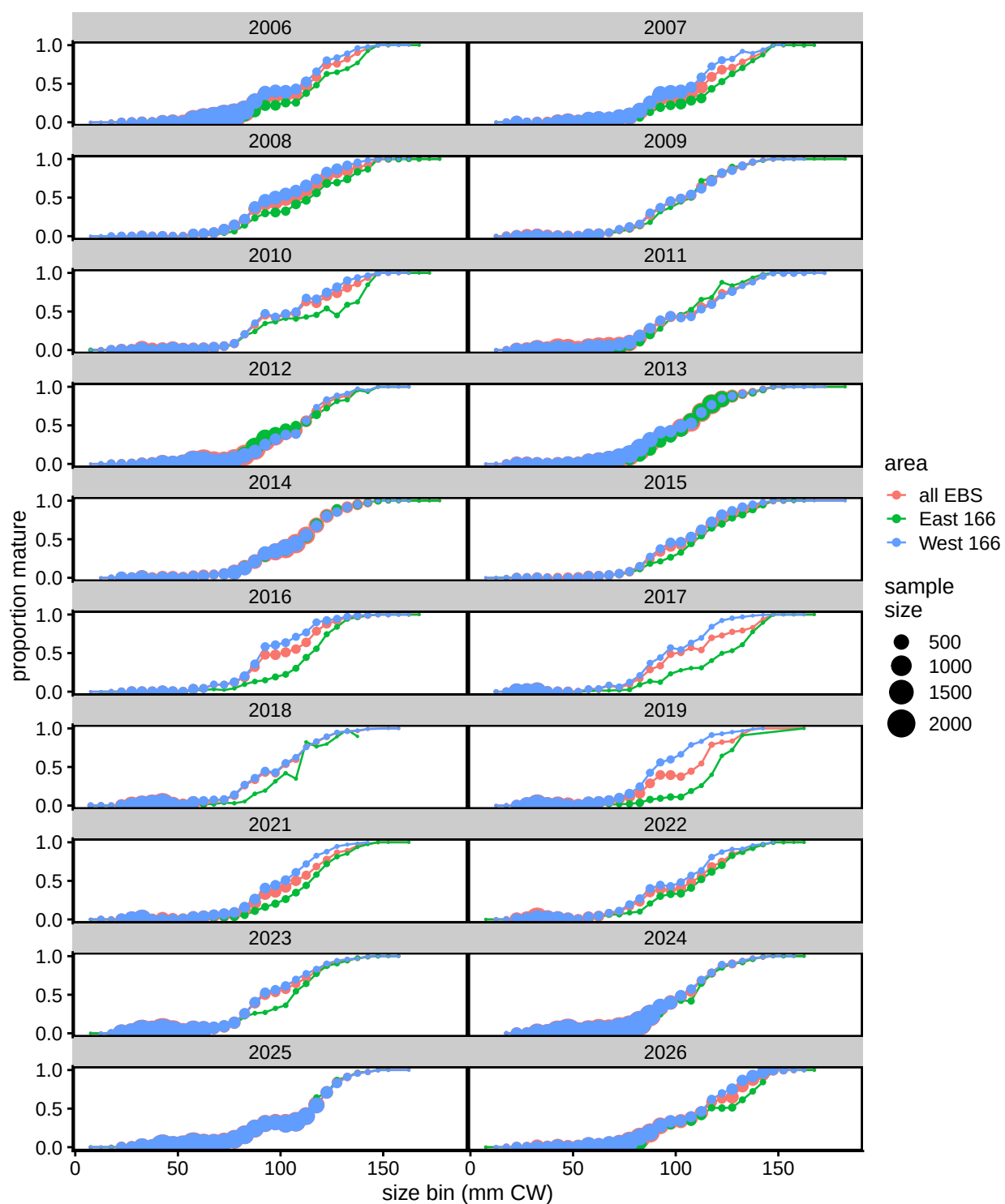


Figure 45. Estimates of the proportion of mature new shell males in the NMFS EBS shelf survey, by 5 mm CW size bin, based on male crab with chela height/carapace width measurements taken with 0.1 mm precision. Symbol size (area) indicates the number of crab measured. Chela heights for Tanner crab are not measured every year.

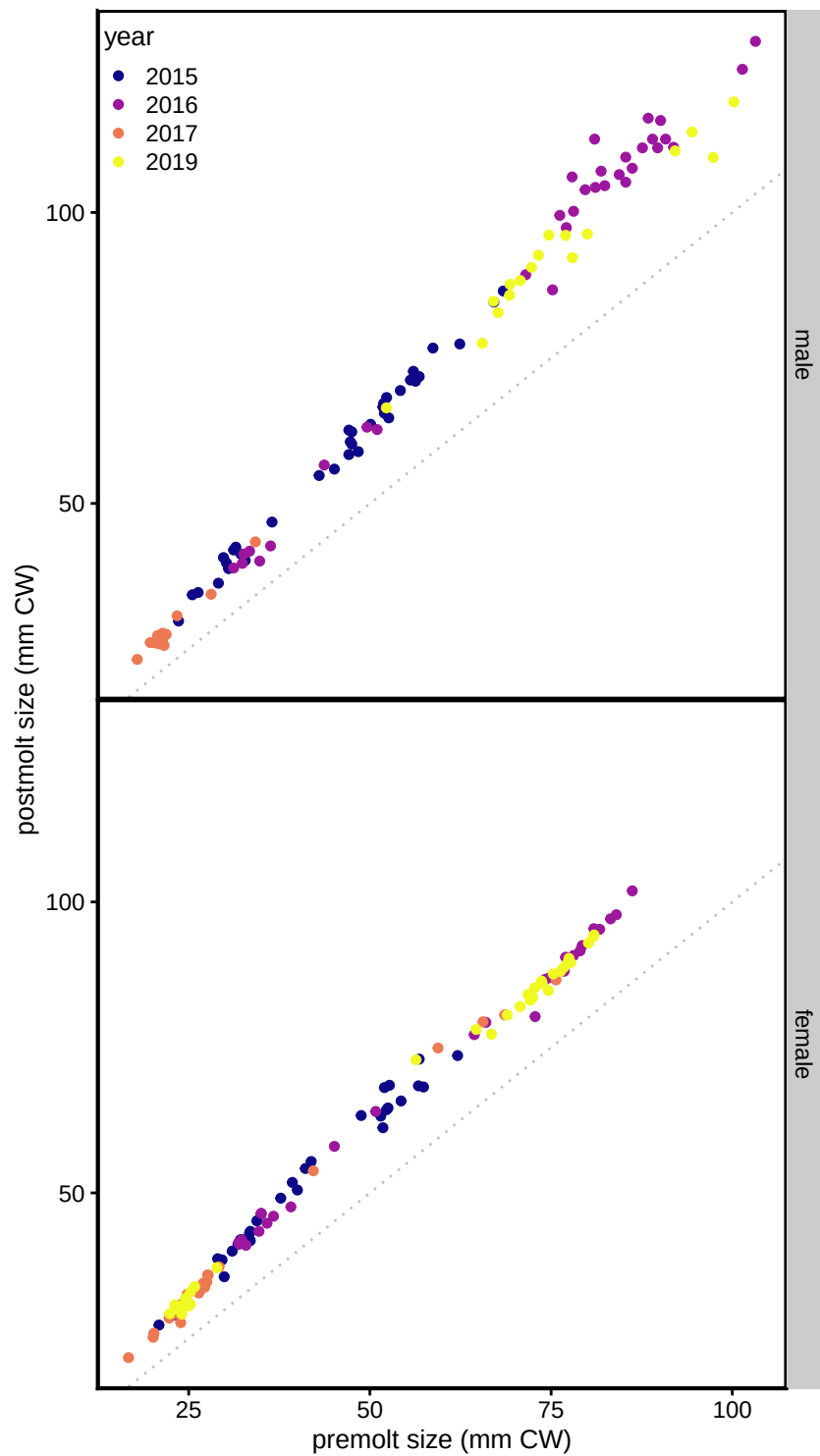


Figure 46. Molt increment data collected collaboratively by NMFS, BSFRF, and ADF&G. Symbol color denotes collection year. Dotted line indicates no growth (i.e., post-molt size = pre-molt size).

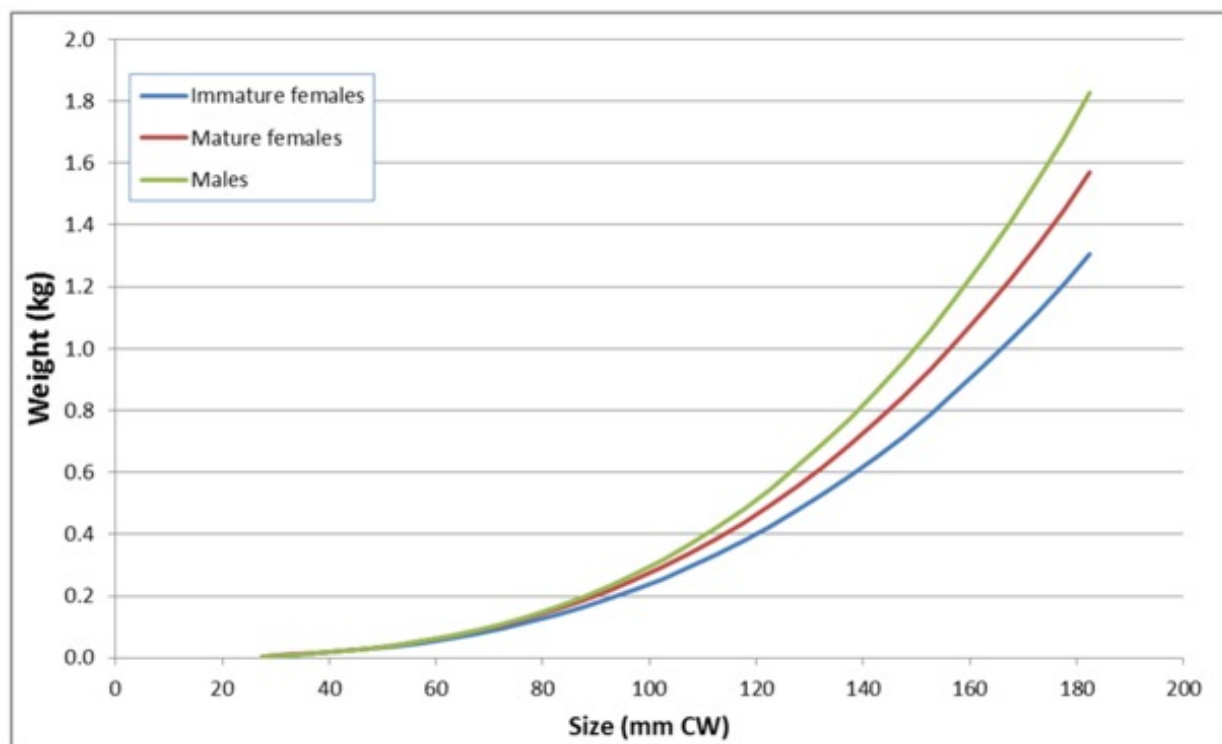


Figure 47. Size-weight relationships for Tanner crab.

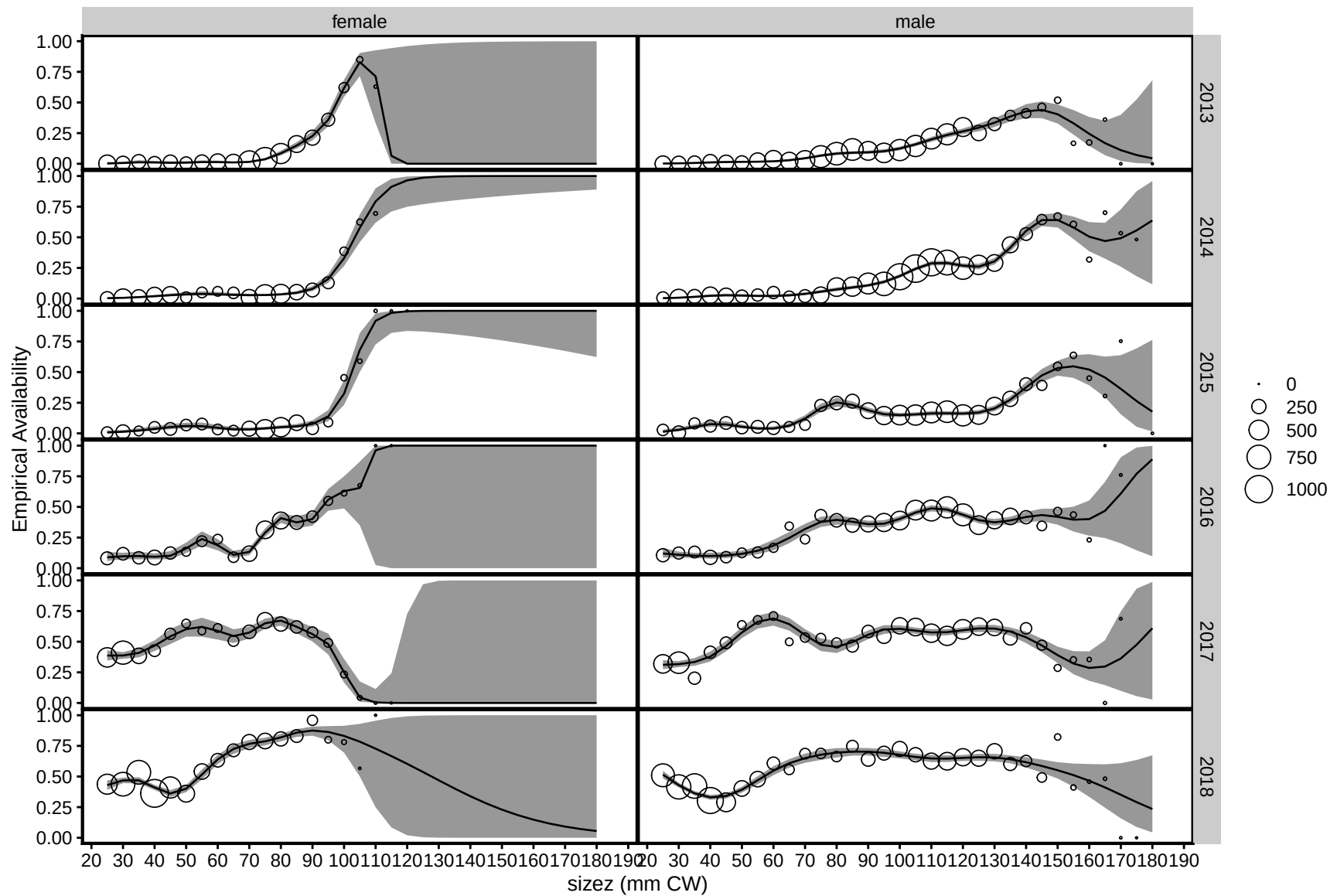


Figure 48. Empirical availability curves for BSFRF SBS data. Circles: “raw” empirical availability estimates. Size: total number of individual crab sampled. Lines/fills: smooth GAM model fits to “raw” data, with 95% confidence intervals.

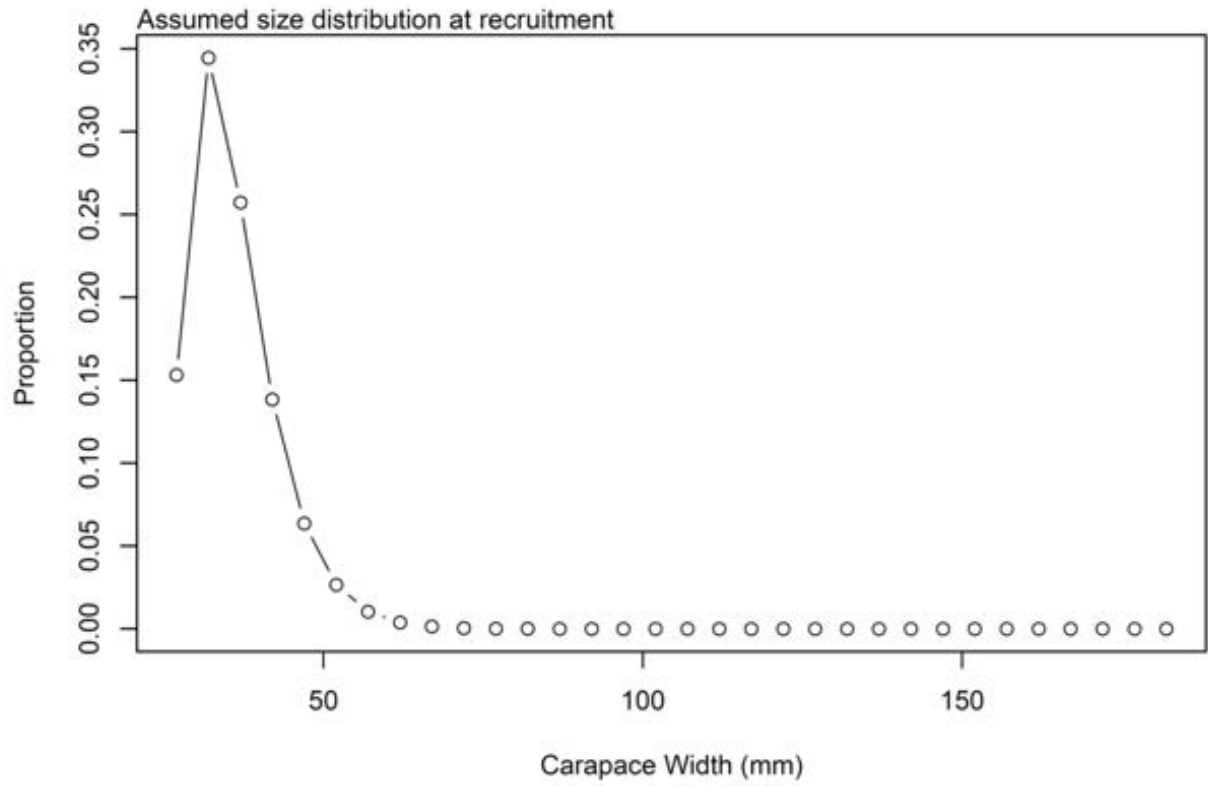


Figure 49. The nominal shape (a truncated gamma distribution) for the assumed size distribution of Tanner crab at recruitment to the model.

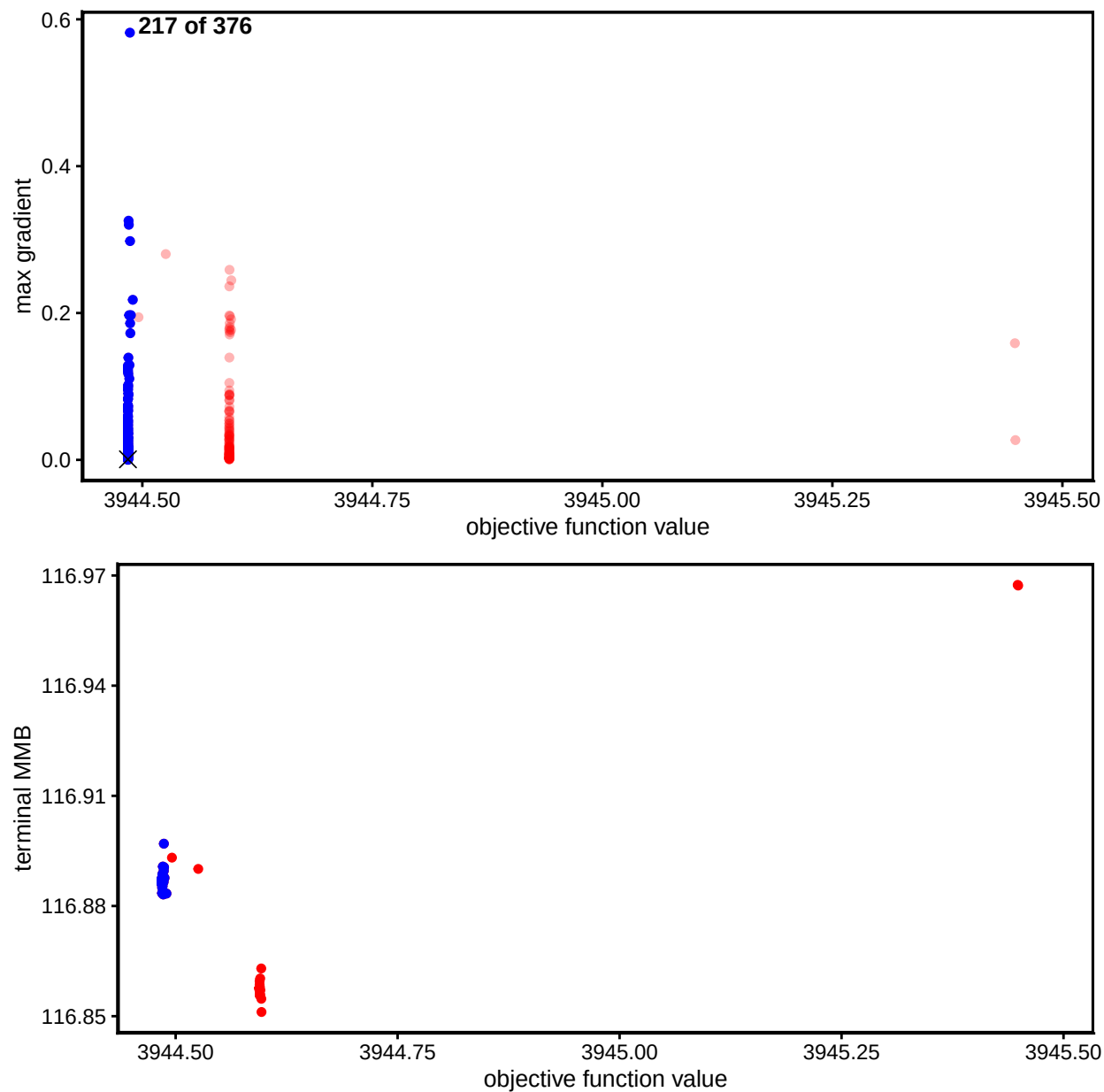


Figure 50. Results from 400 jitter runs for 22.03d5 (2026). Of these, 217 appear to have converged to the MLE (blue dots). The minimum objective function found was 3,944.48; the maximum gradient for that model run was 0.000754. 24 failed to finish.

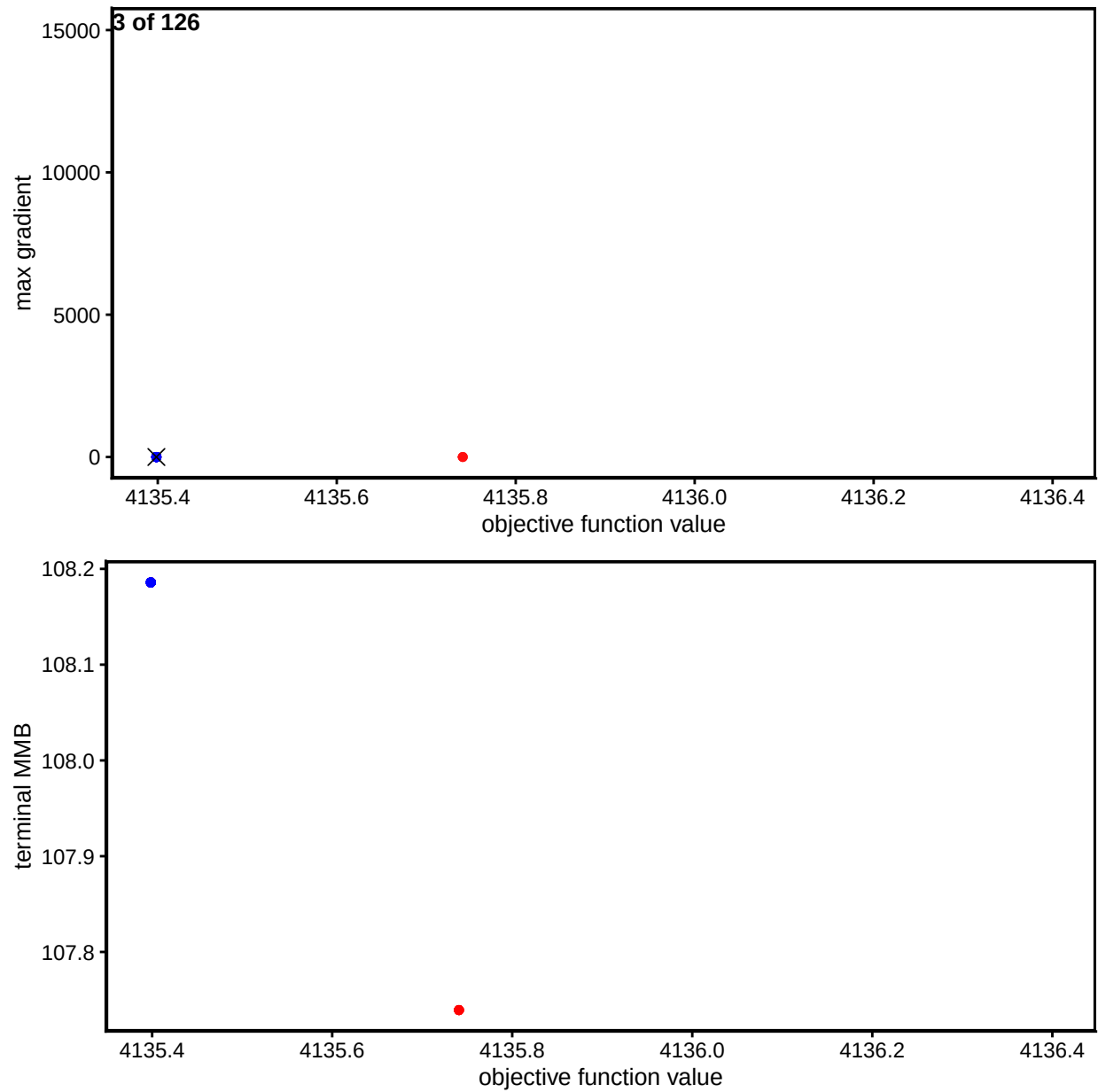


Figure 51. Results from 400 jitter runs for 22.03d5 (GMACS). Of these, 3 appear to have converged to the MLE (blue dots). The minimum objective function found was 4,135.40; the maximum gradient for that model run was 0.0966. 274 failed to finish.

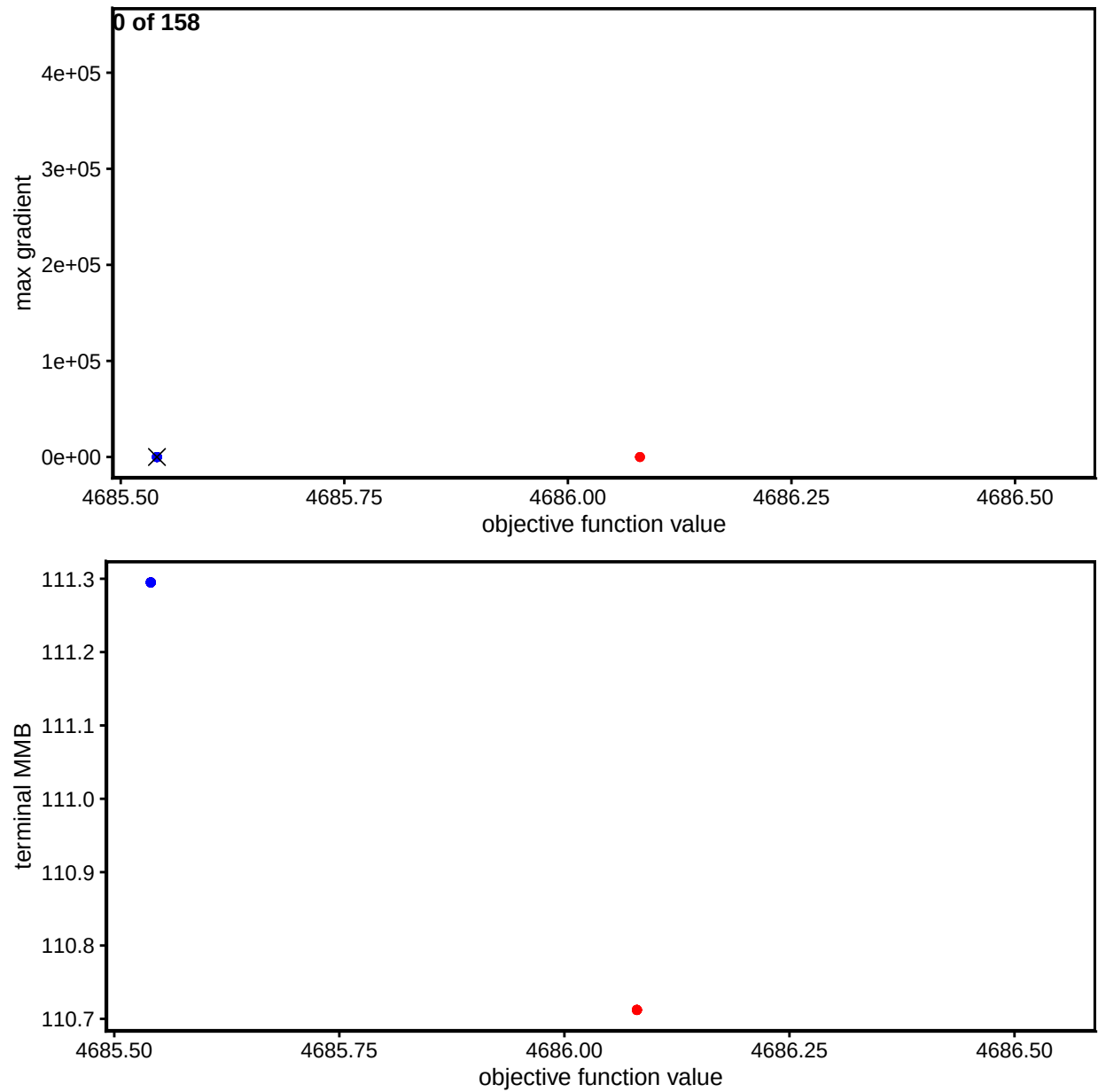


Figure 52. Results from 400 jitter runs for 26.02 (GMACS). Of these, 0 appear to have converged to the MLE (blue dots). The minimum objective function found was 4,685.54; the maximum gradient for that model run was 0.144. 242 failed to finish.

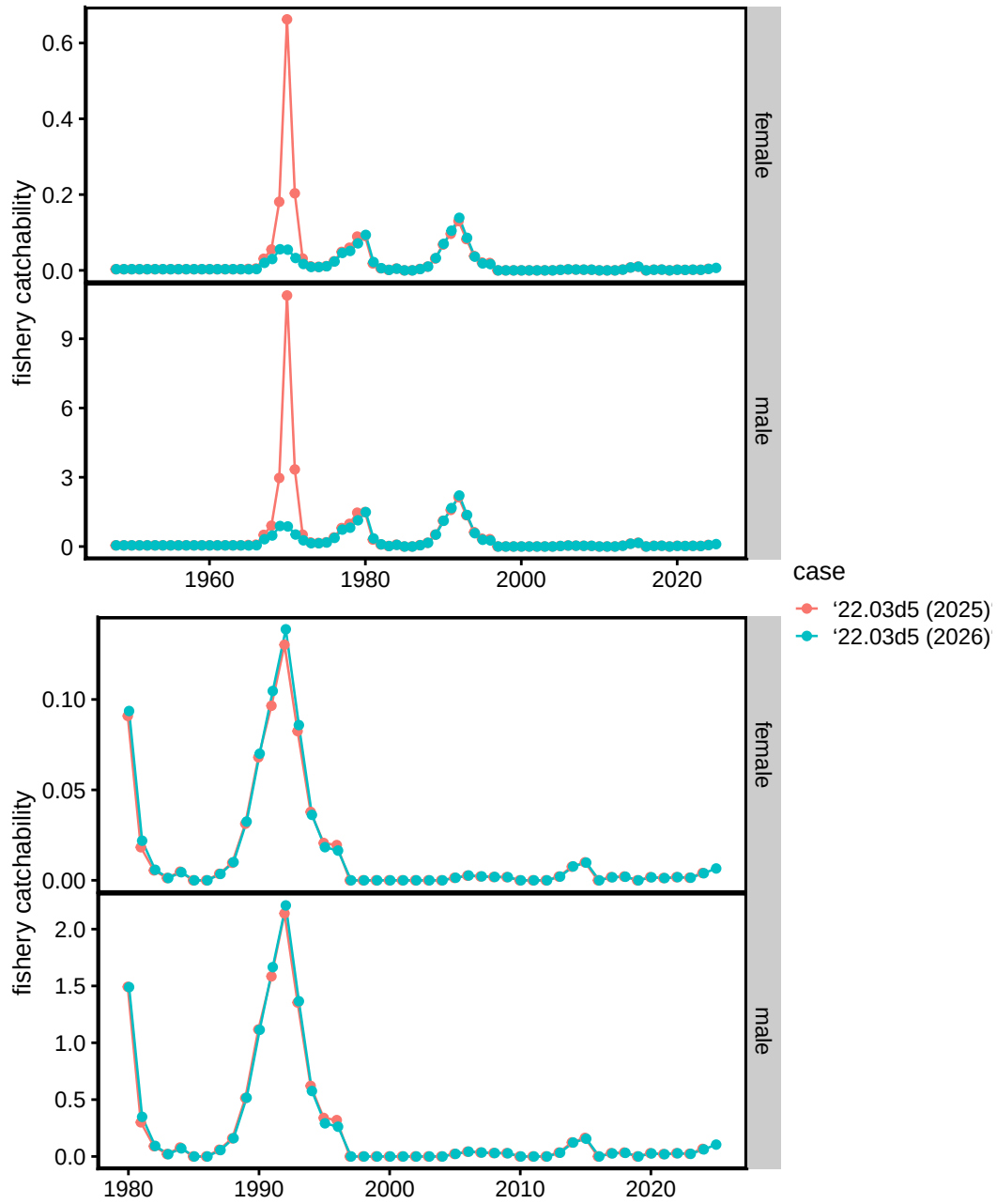


Figure 53. Estimated fully-selected capture rates (not mortality) in the directed fishery. The lower pair of plots show the estimated time series since 1980. Preferred model is 22.03d5 (2026).

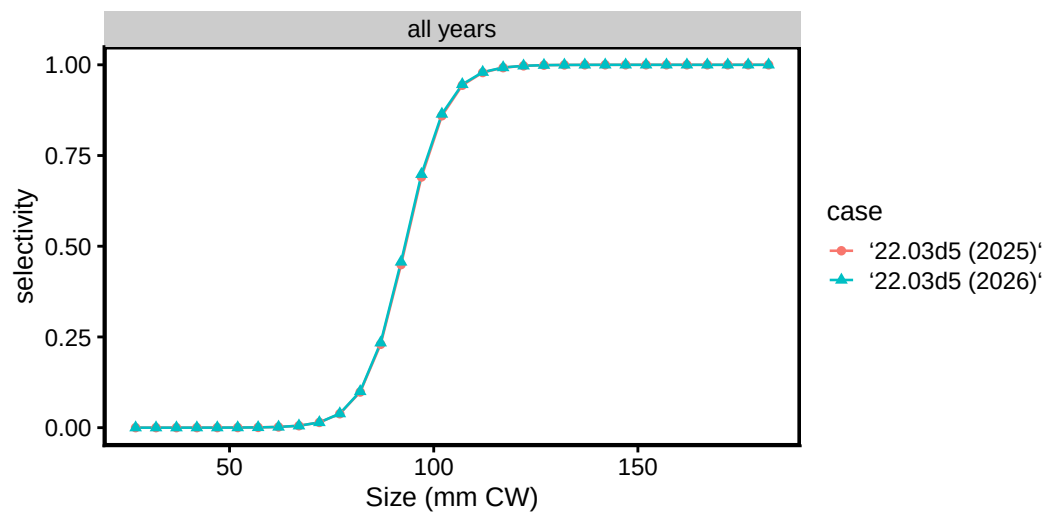


Figure 54. Estimated selectivity for females in the directed fishery for all years. Preferred model is 22.03d5 (2026).

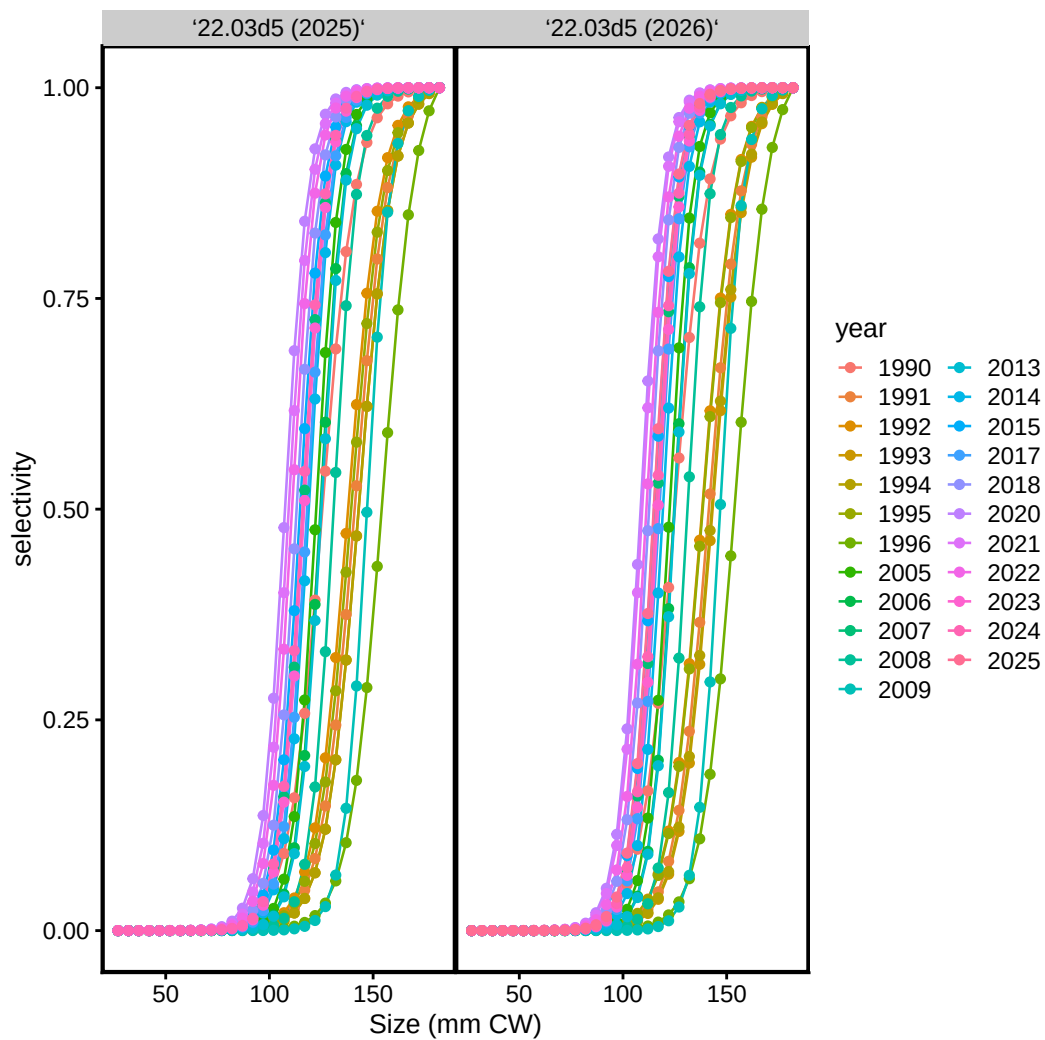


Figure 55. Estimated selectivity curves for males in the directed fishery, faceted by model scenario. Curves labelled 1990 applies to all years before 1991. Others apply in the year indicated in the legend. Preferred model is 22.03d5 (2026).

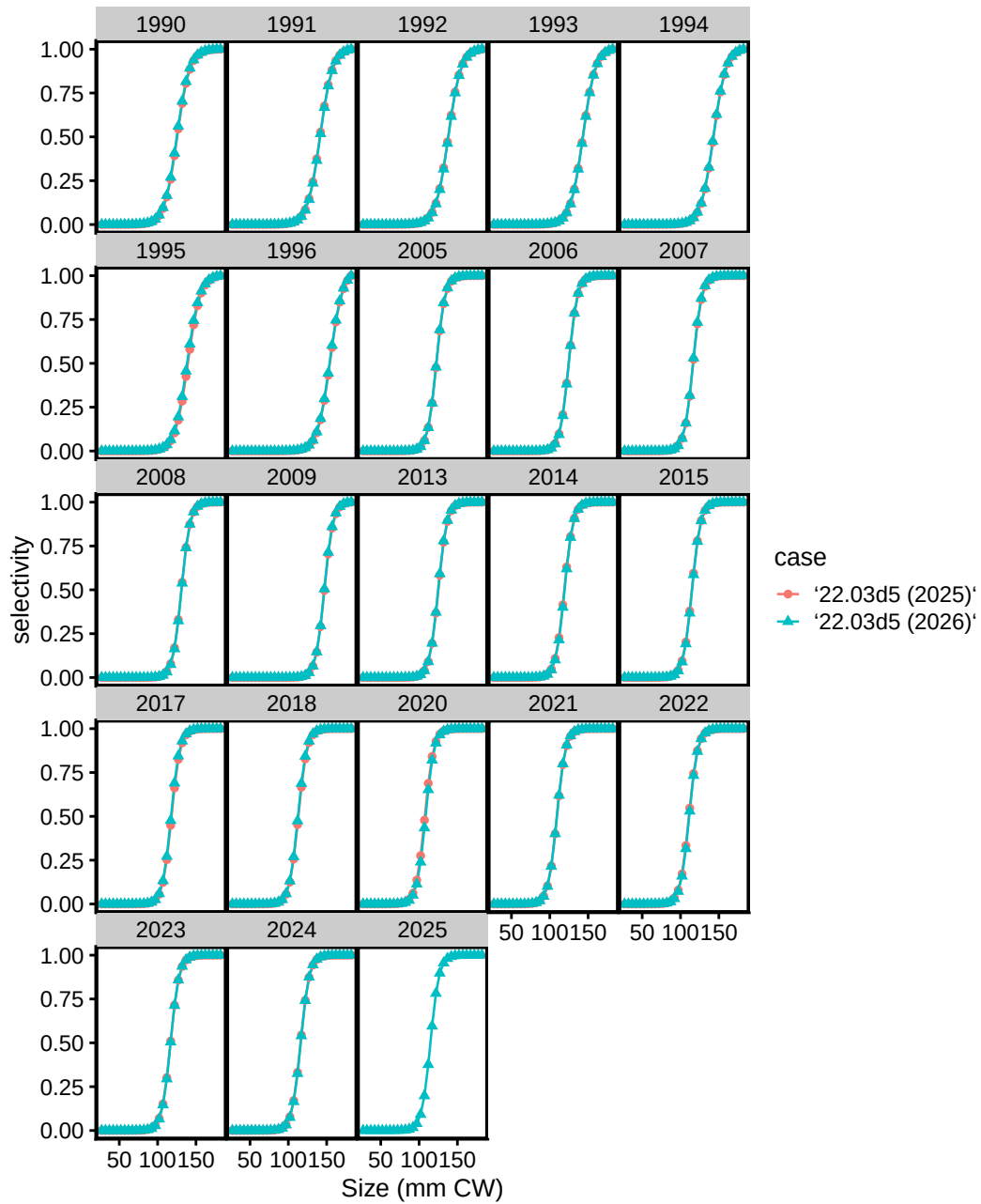


Figure 56. Estimated selectivity curves for males in the directed fishery by year. Curve labelled 1990 applies to all years before 1991. Others apply in the year indicated in the panel. Preferred model is 22.03d5 (2026).

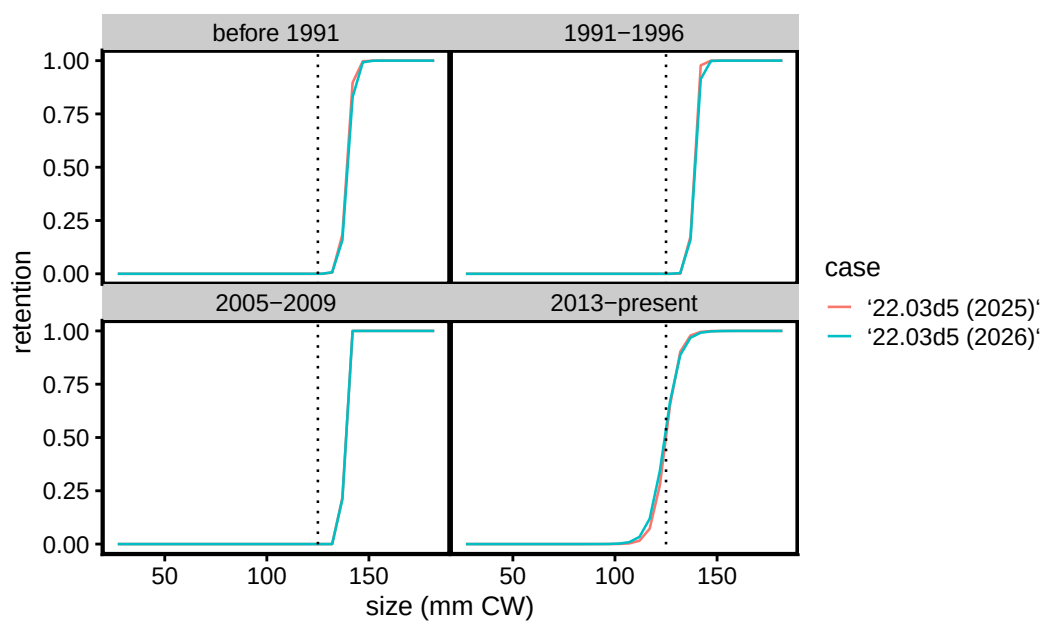


Figure 57. TCSAM02 models estimated retention curves for males in the directed fishery by time block. The dotted line indicates the current industry-preferred size (125 mm CW). Preferred model is 22.03d5 (2026).

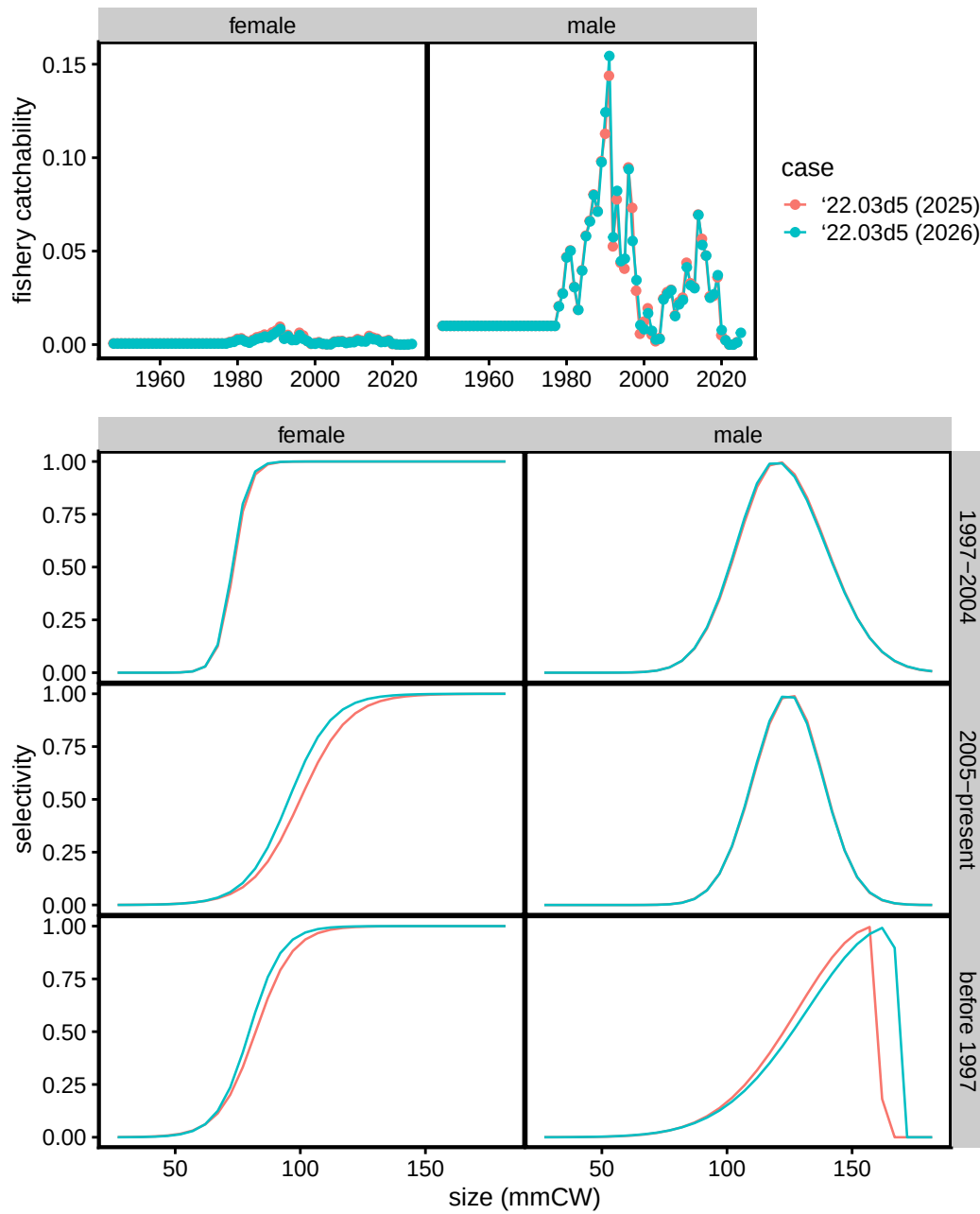


Figure 58. TCSAM02 models estimated fully-selected bycatch capture rates (not mortality) and selectivity functions in the snow crab fishery. Time blocks for selectivity functions are labelled: 1) before 1997; 2) 1997-2004; 3) 2005-present. Preferred model is 22.03d5 (2026).

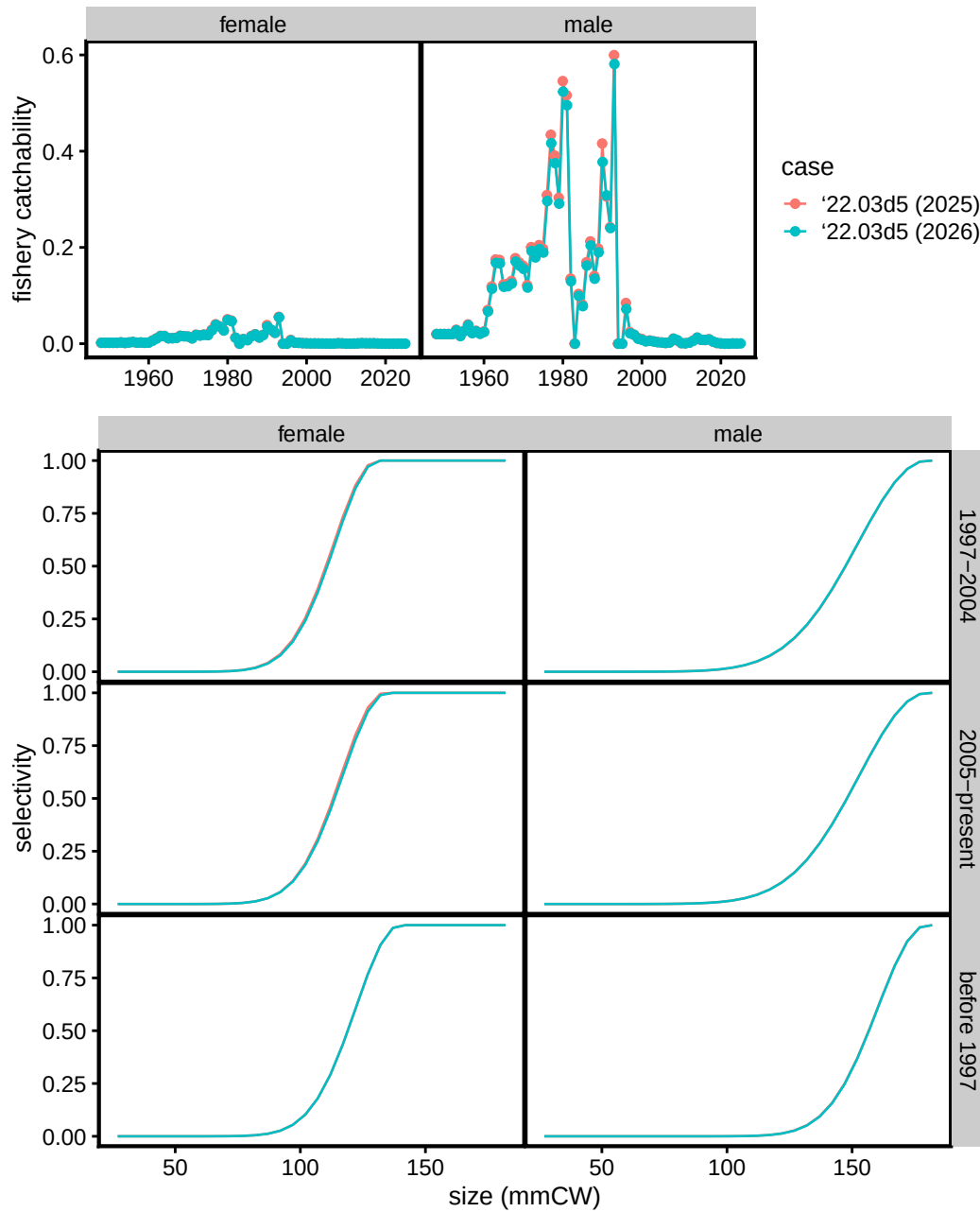


Figure 59. TCSAM02 models estimated fully-selected bycatch capture rates (not mortality) and selectivity functions in the BBRKC fishery. Time blocks for selectivity functions are 1) before 1997; 2) 1997-2004; 3) 2005-present. Preferred model is 22.03d5 (2026).

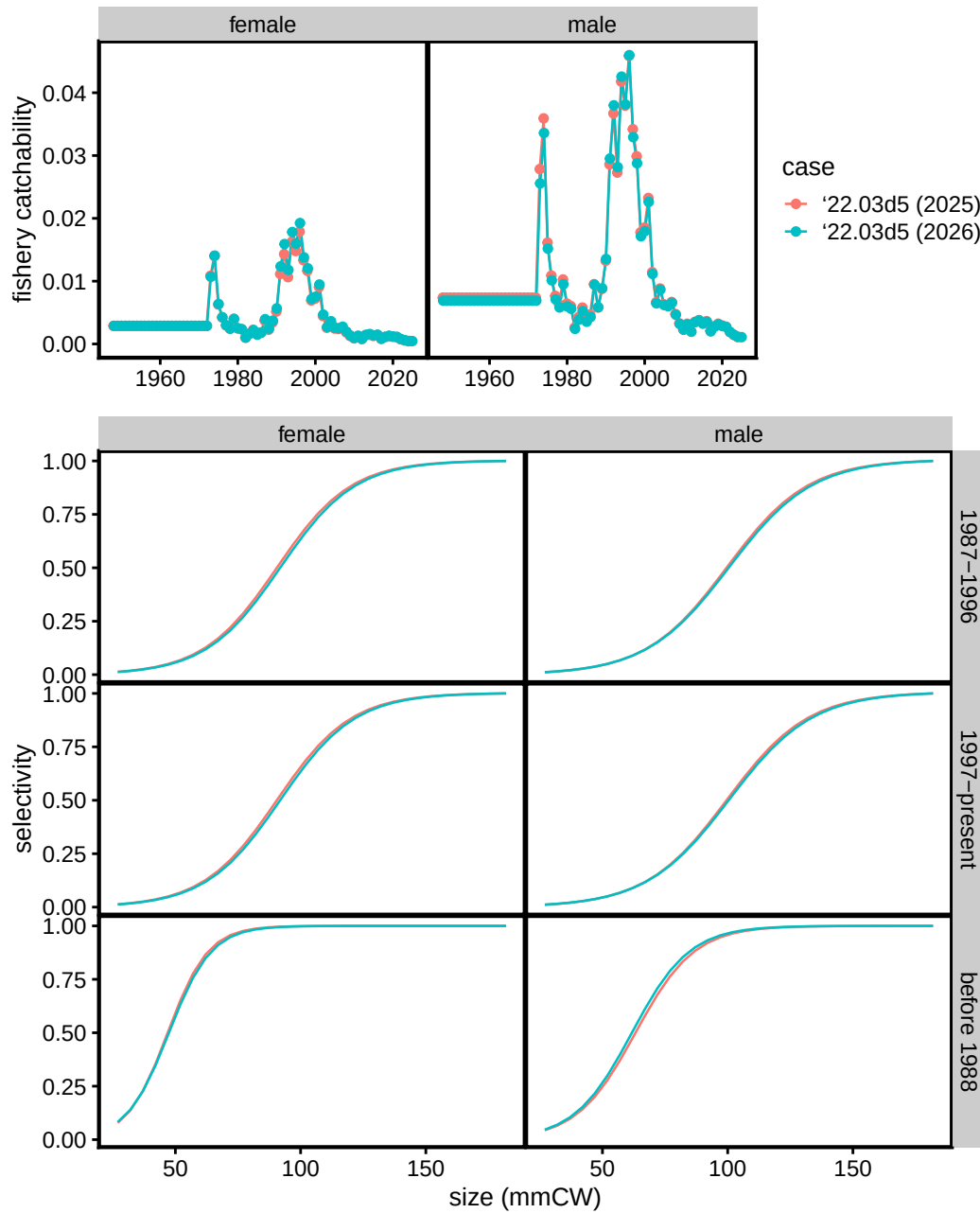


Figure 60. TCSAM02 models estimated fully-selected bycatch capture rates (not mortality) and selectivity functions in the groundfish fisheries. Time blocks for selectivity functions are : 1) before 1988; 2) 1987-1996; 3) 1997-present. Preferred model is 22.03d5 (2026).

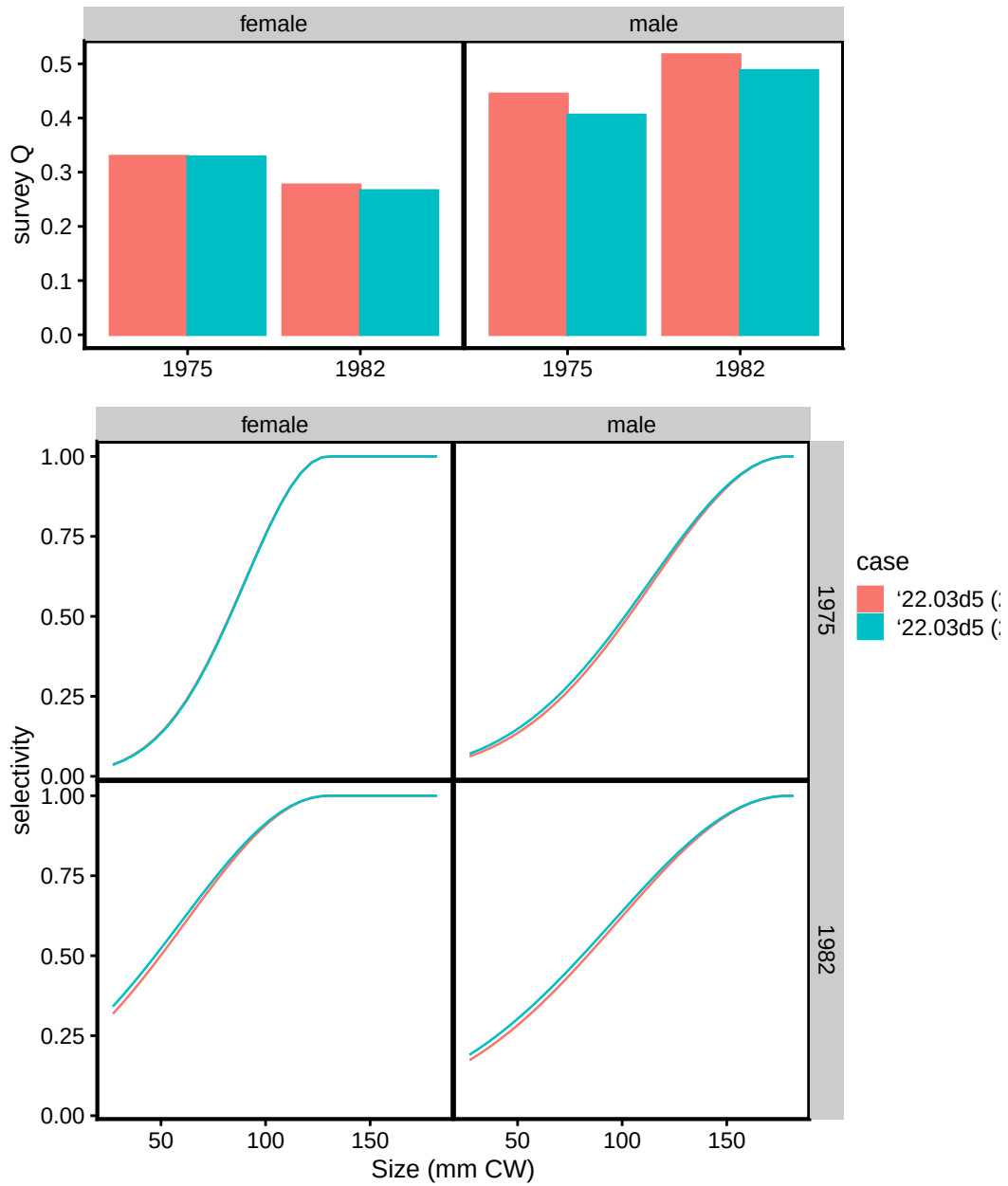


Figure 61. Estimated NMFS EBS Survey fully-selected catchability (survey Q's) and selectivity functions by sex for different time periods. 1975: 1975-1981; 1982: 1982-current. Preferred model is 22.03d5 (2026).

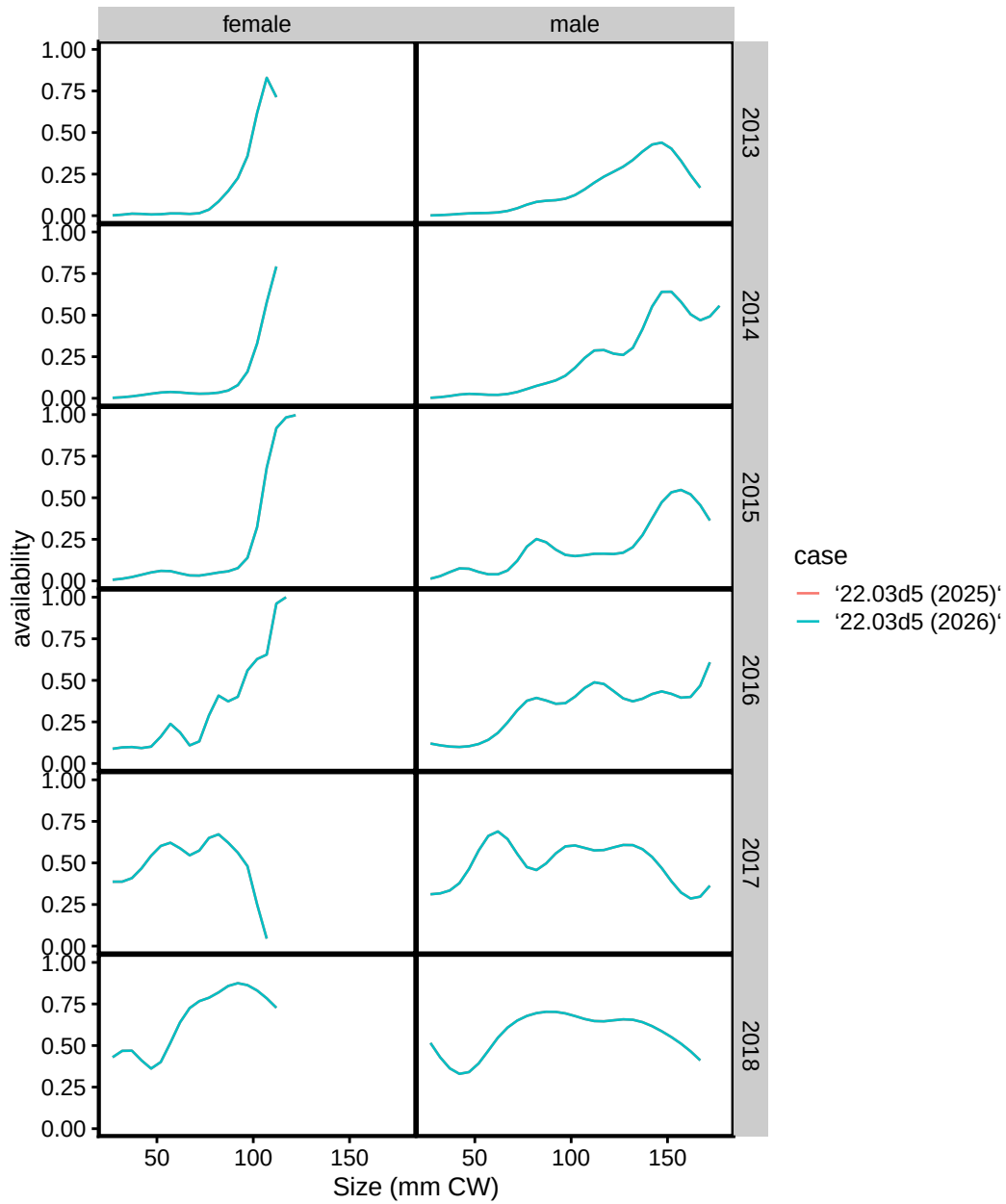


Figure 62. Annual sex-specific availability curves assumed for the BSFRF side-by-side (SBS) survey data. The availability curves were estimated outside the TCSAM02 models. Preferred model is 22.03d5 (2026).

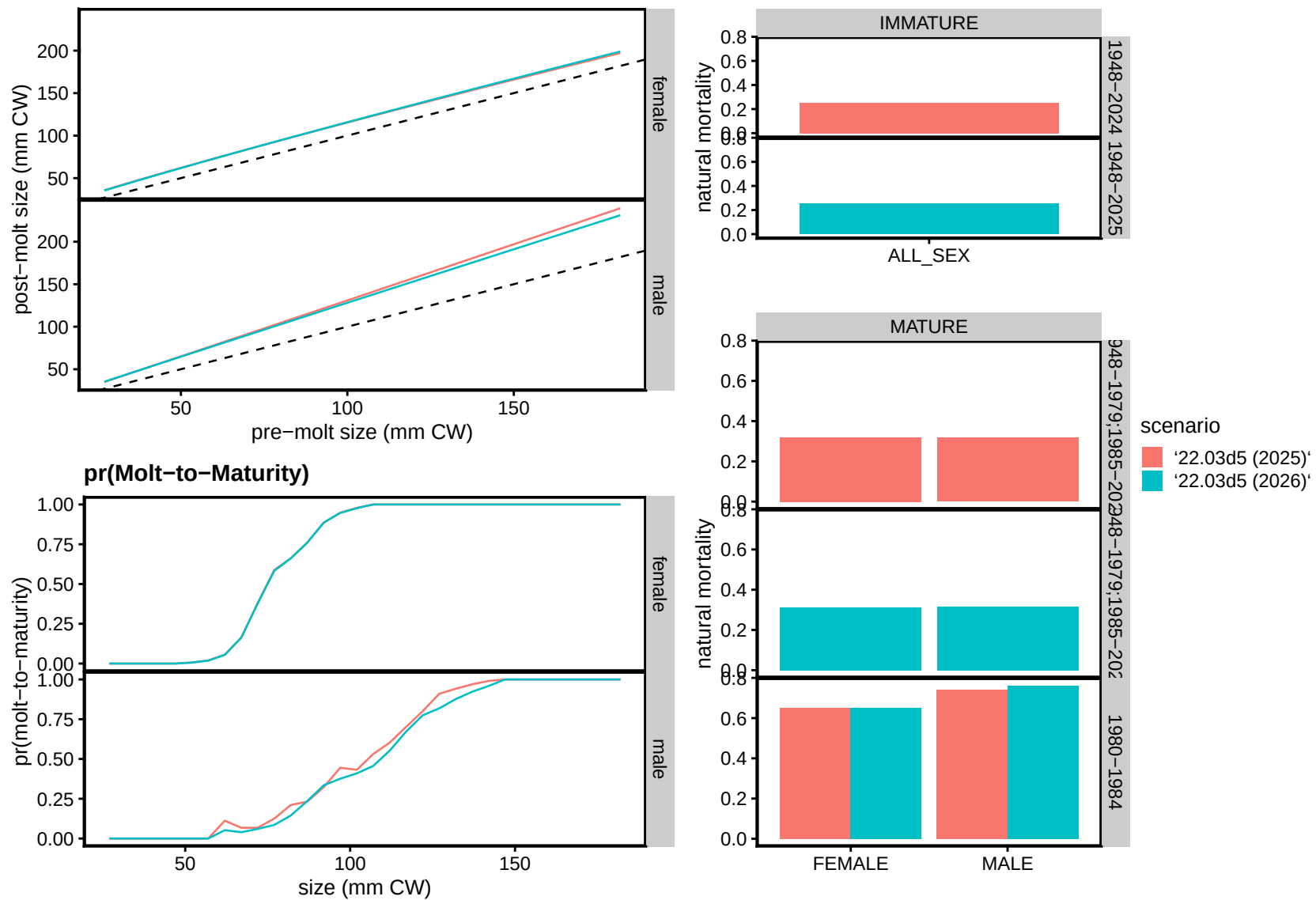


Figure 63. Estimated population processes. Plots in upper lefthand quadrant: sex-specific mean growth; plots in lower lefthand quadrant: sex-specific probability of the molt-to-maturity (i.e., terminal molt); plots in righthand column: natural mortality rates, by maturity state and sex. Preferred model is 22.03d5 (2026).

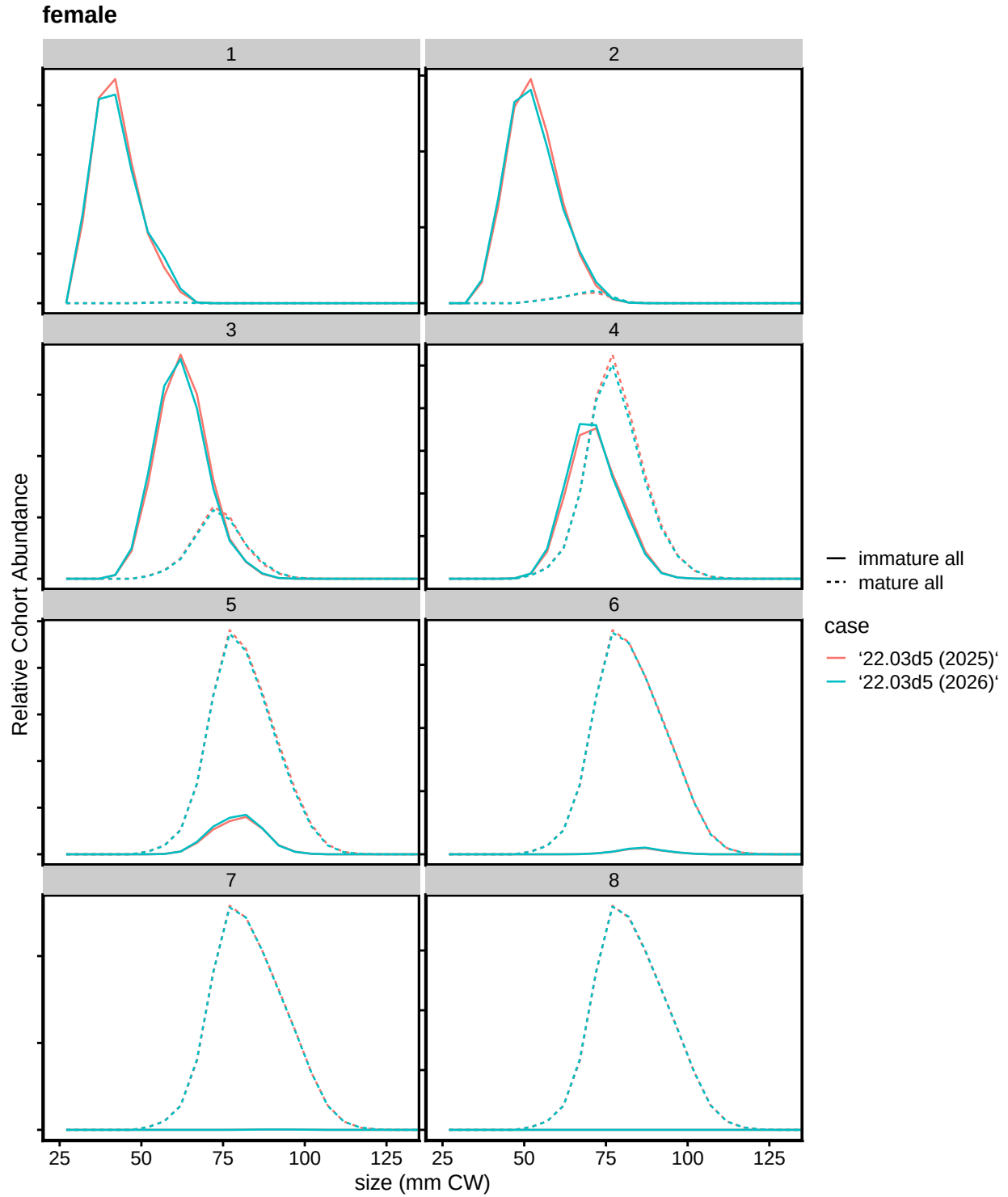


Figure 64. Estimated annual cohort progression for female crab based on rates from final model year (by age; individual scales are relative). Preferred model is 22.03d5 (2026).

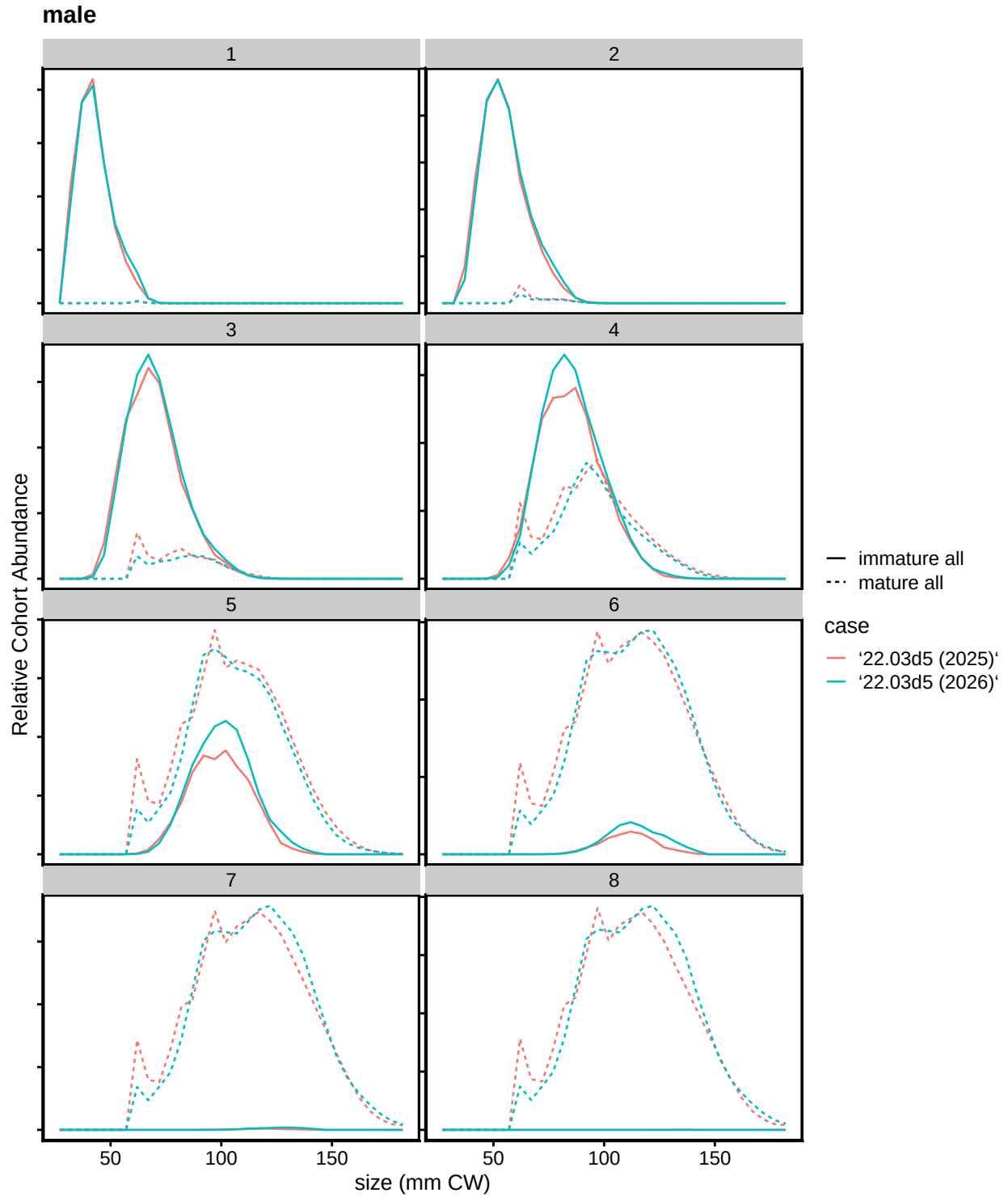


Figure 65. Estimated annual cohort progression for male crab based on rates from final model year (by age; individual scales are relative). Preferred model is 22.03d5 (2026).

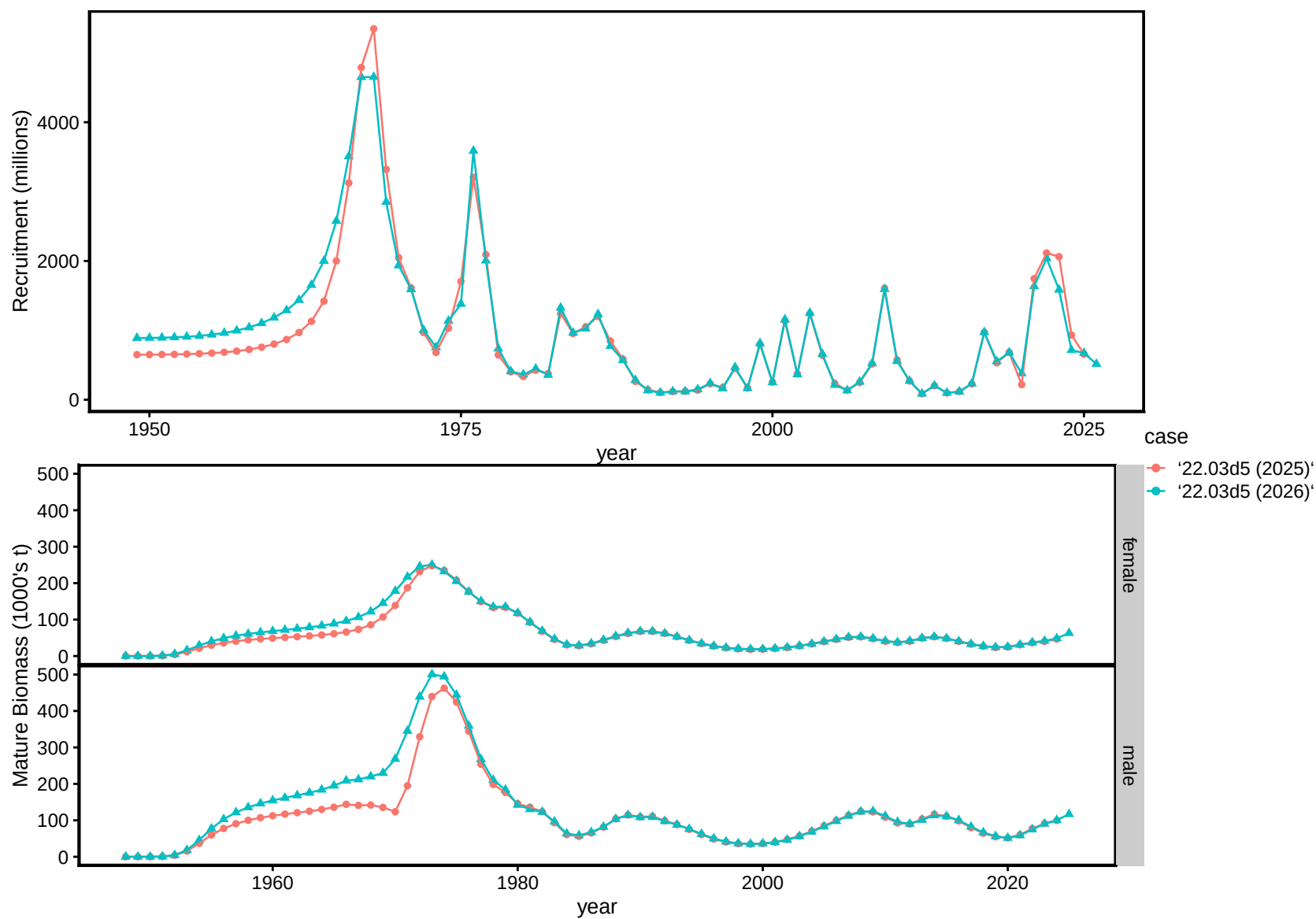


Figure 66. Estimated recruitment and mature biomass time series (all years). Upper plot: recruitment; lower plots: sex-specific mature biomass-at-mating. Preferred model is 22.03d5 (2026).

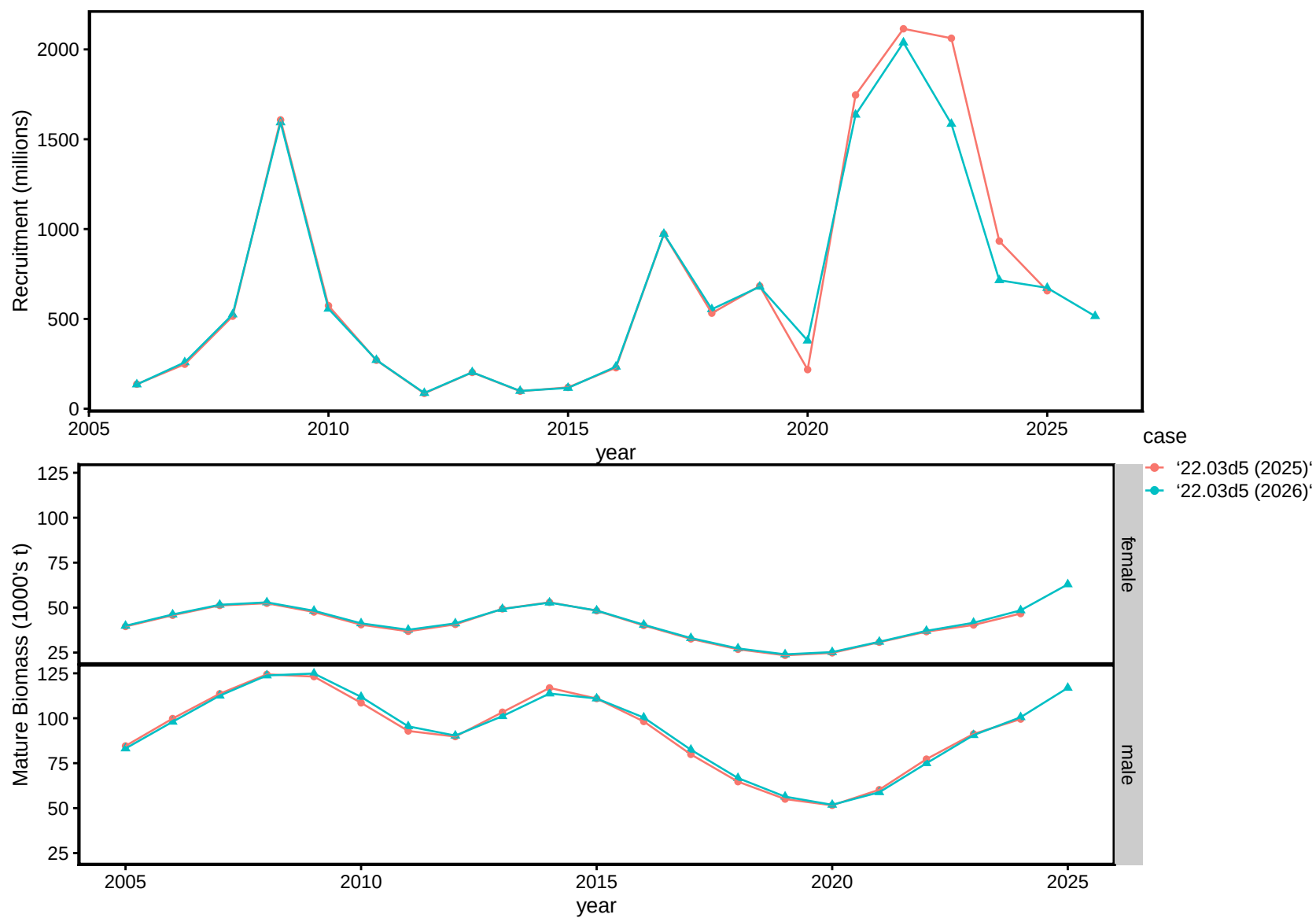


Figure 67. Estimated recruitment and mature biomass time series (recent years). Upper plot: recruitment; lower plots: sex-specific mature biomass-at-mating. Preferred model is 22.03d5 (2026).

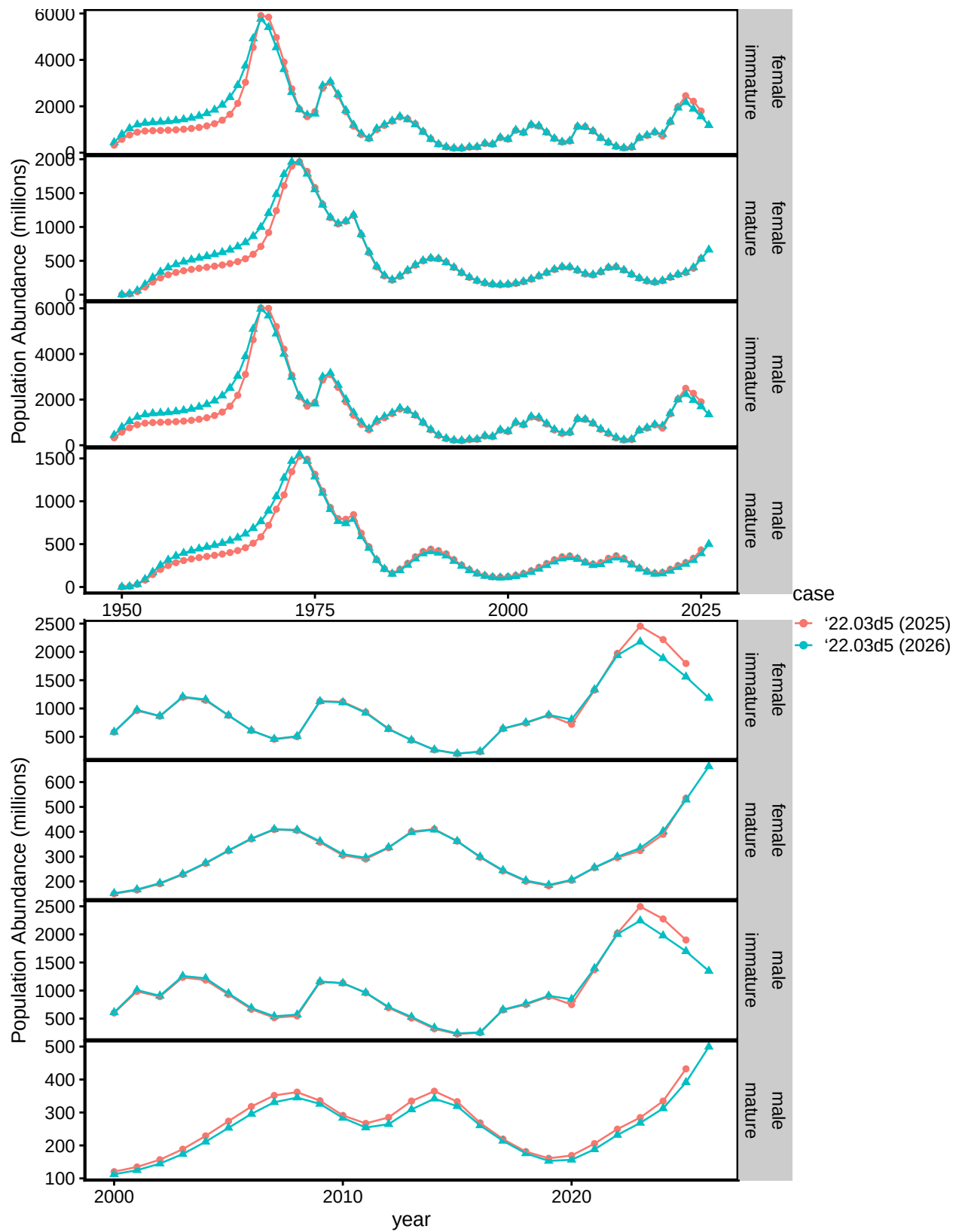


Figure 68. Estimated population abundance trends, by sex and maturity state. Upper plots: all years; lower plots: recent years. Preferred model is 22.03d5 (2026).

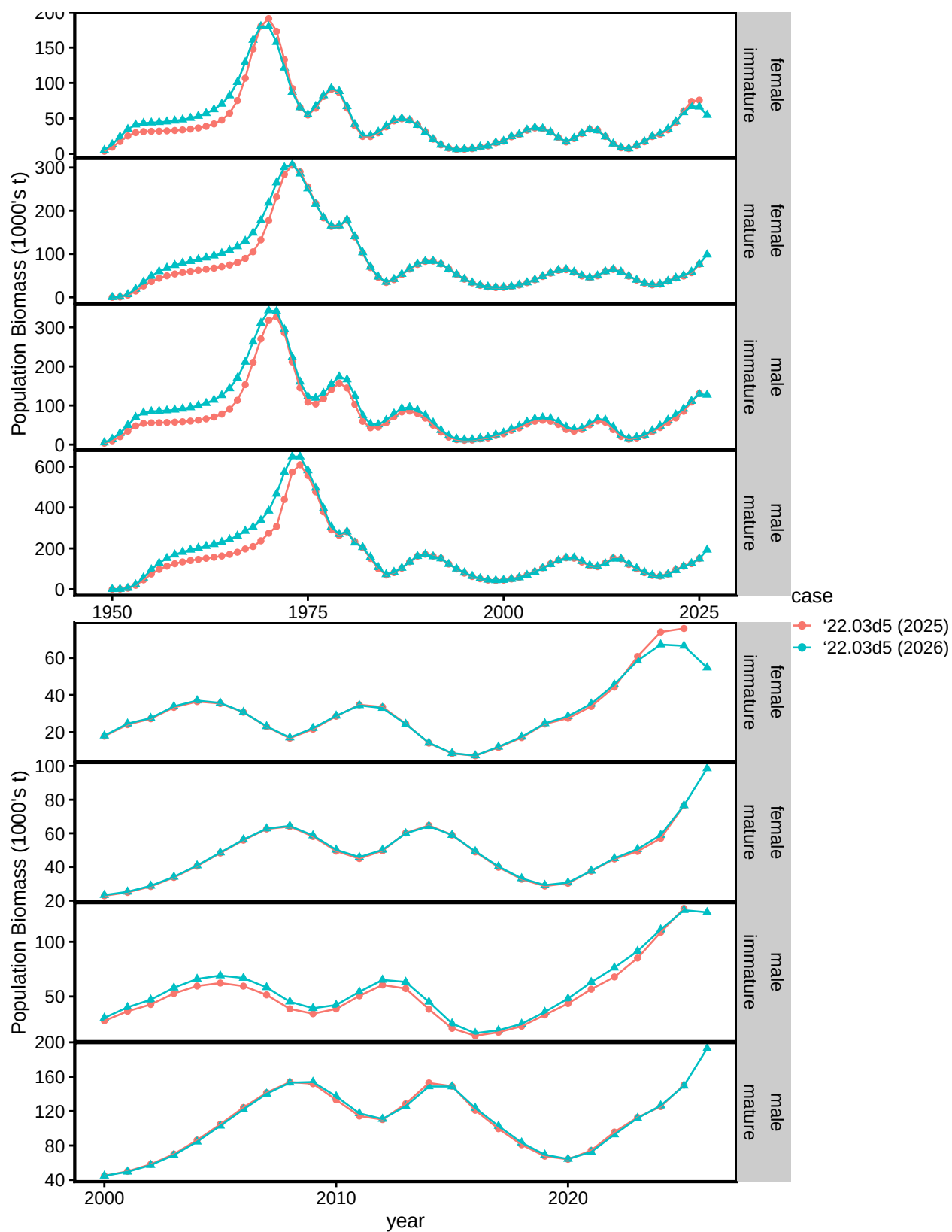


Figure 69. Estimated population biomass trends, by sex and maturity state. Upper plots: all years; lower plots: recent years. Preferred model is 22.03d5 (2026).

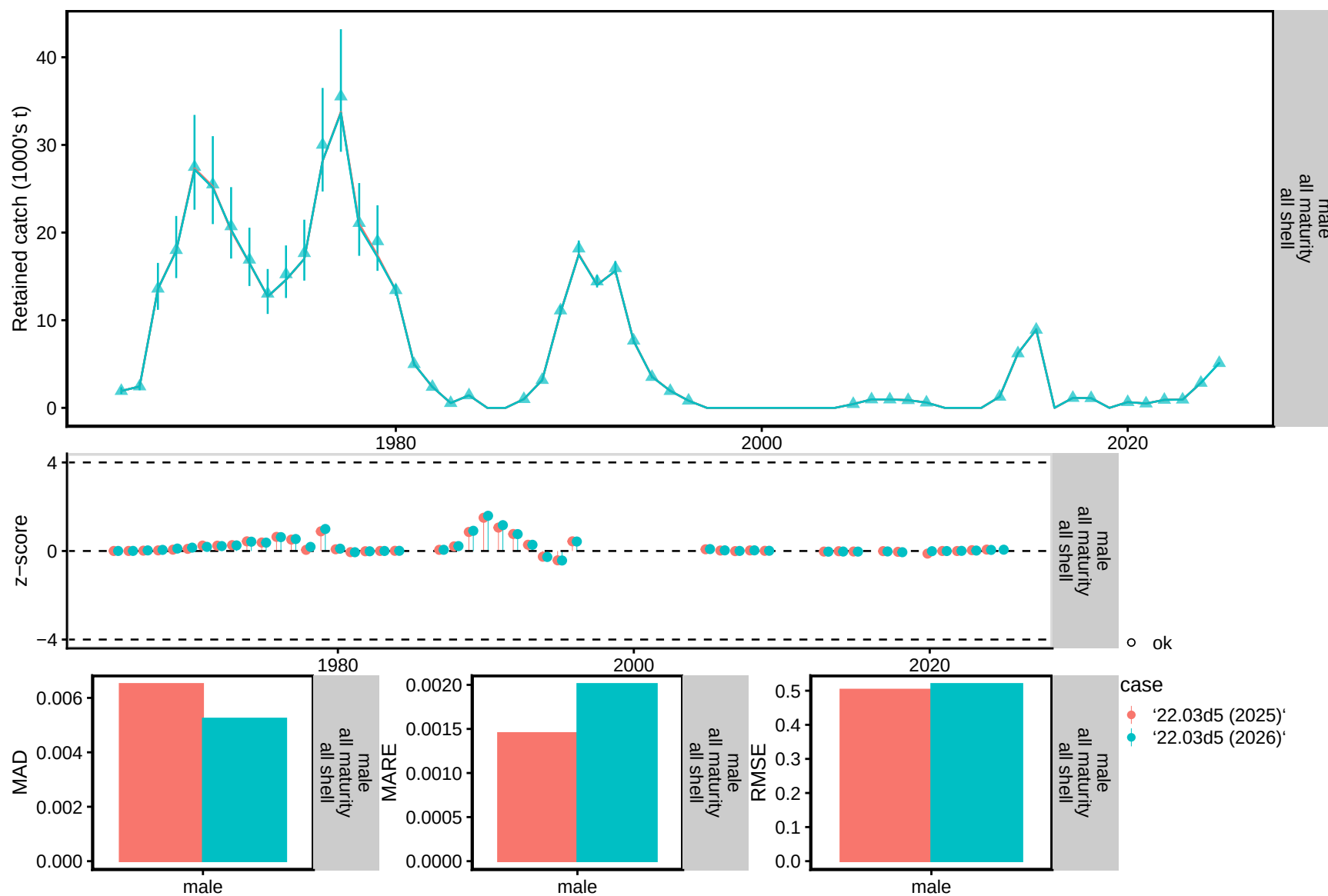


Figure 70. TCSAM02 models fits to retained catch biomass in the directed fishery (upper two rows) and residuals analysis plots (lower two rows). Confidence intervals are 95%.

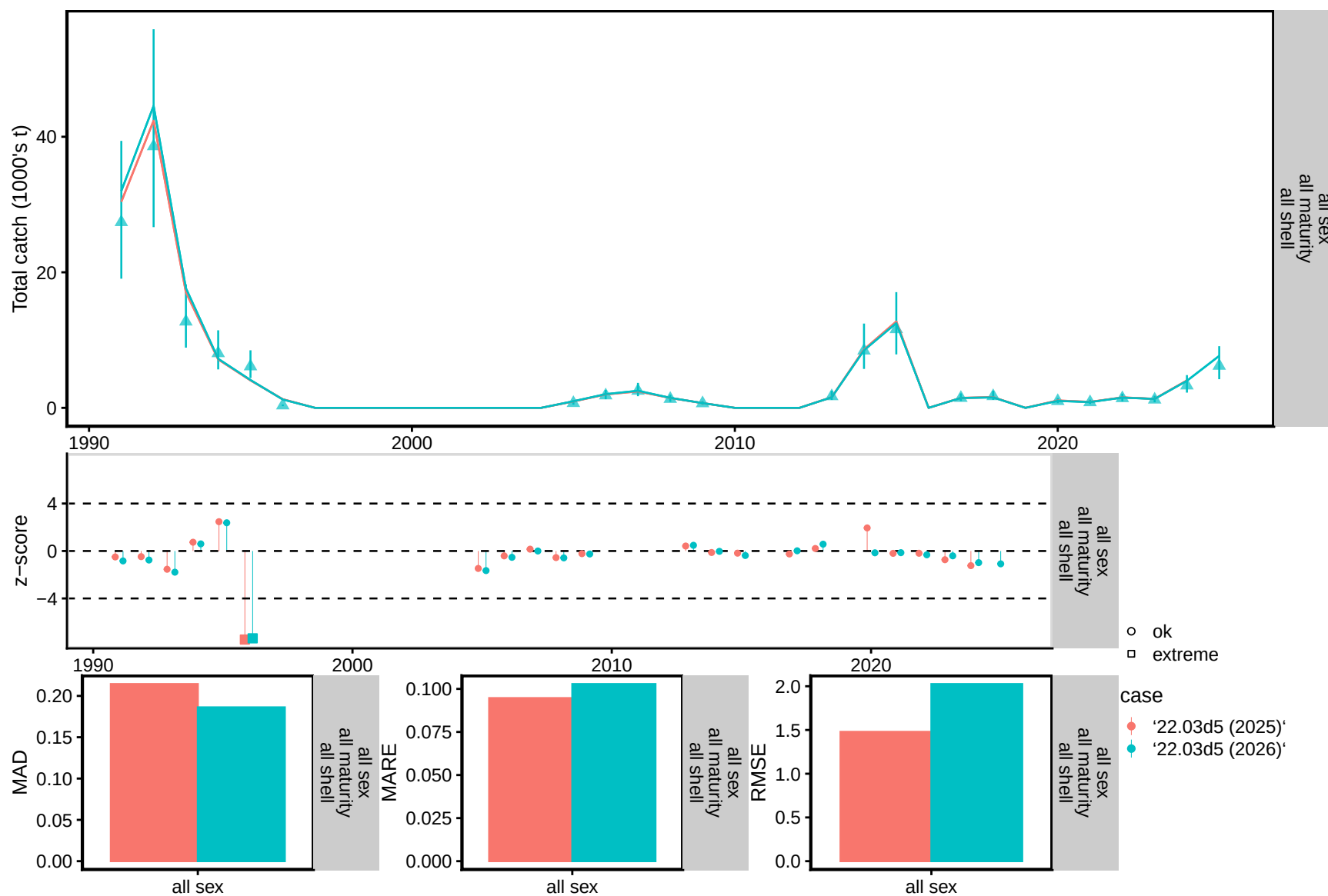


Figure 71. TCSAM02 models fits to total catch biomass of all crab in the TCF fishery (upper row) and residuals analysis plots (lower two rows). Confidence intervals are 95%.

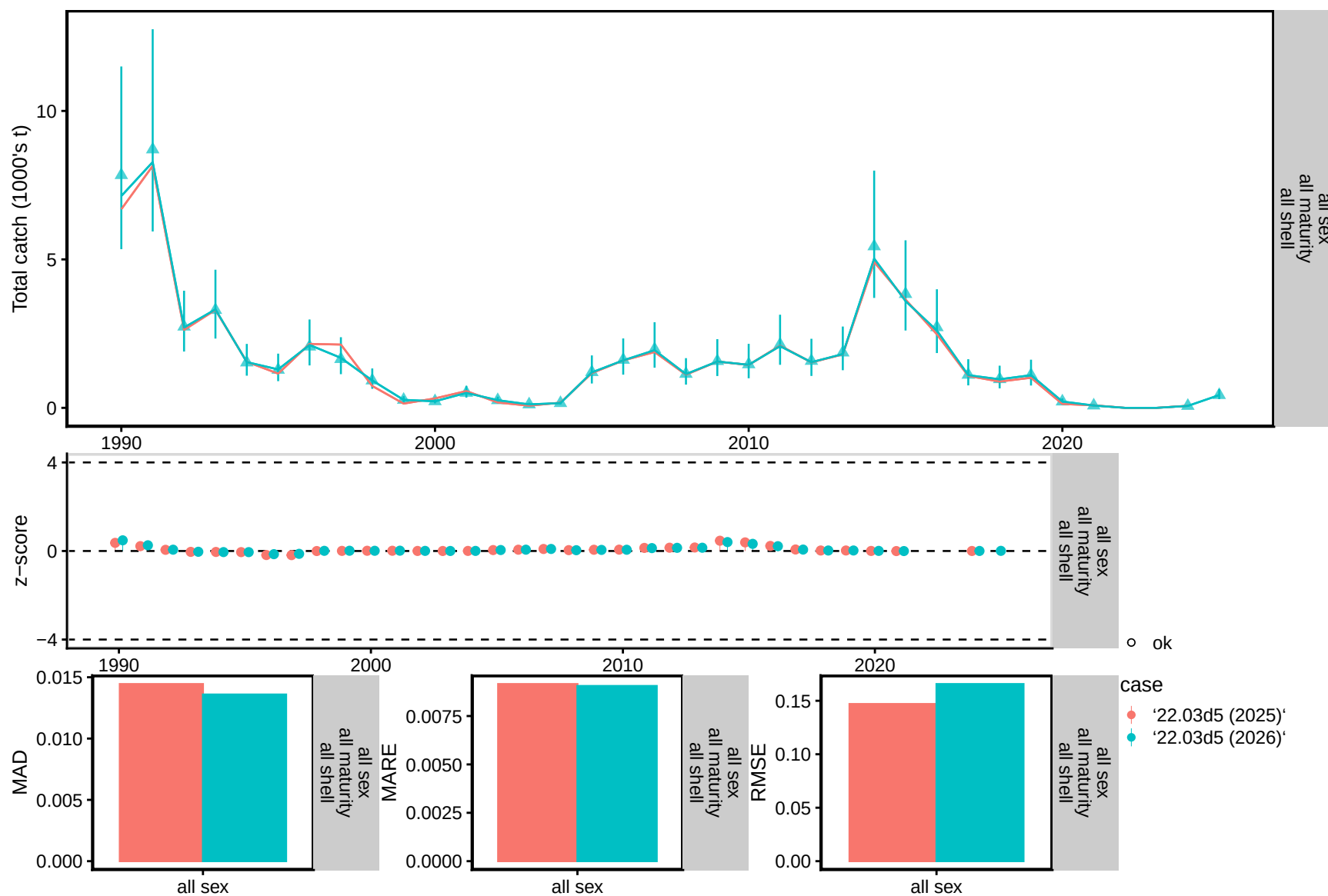


Figure 72. TCSAM02 models fits to total catch biomass of all crab in the SCF fishery (upper row) and residuals analysis plots (lower two rows). Confidence intervals are 95%.

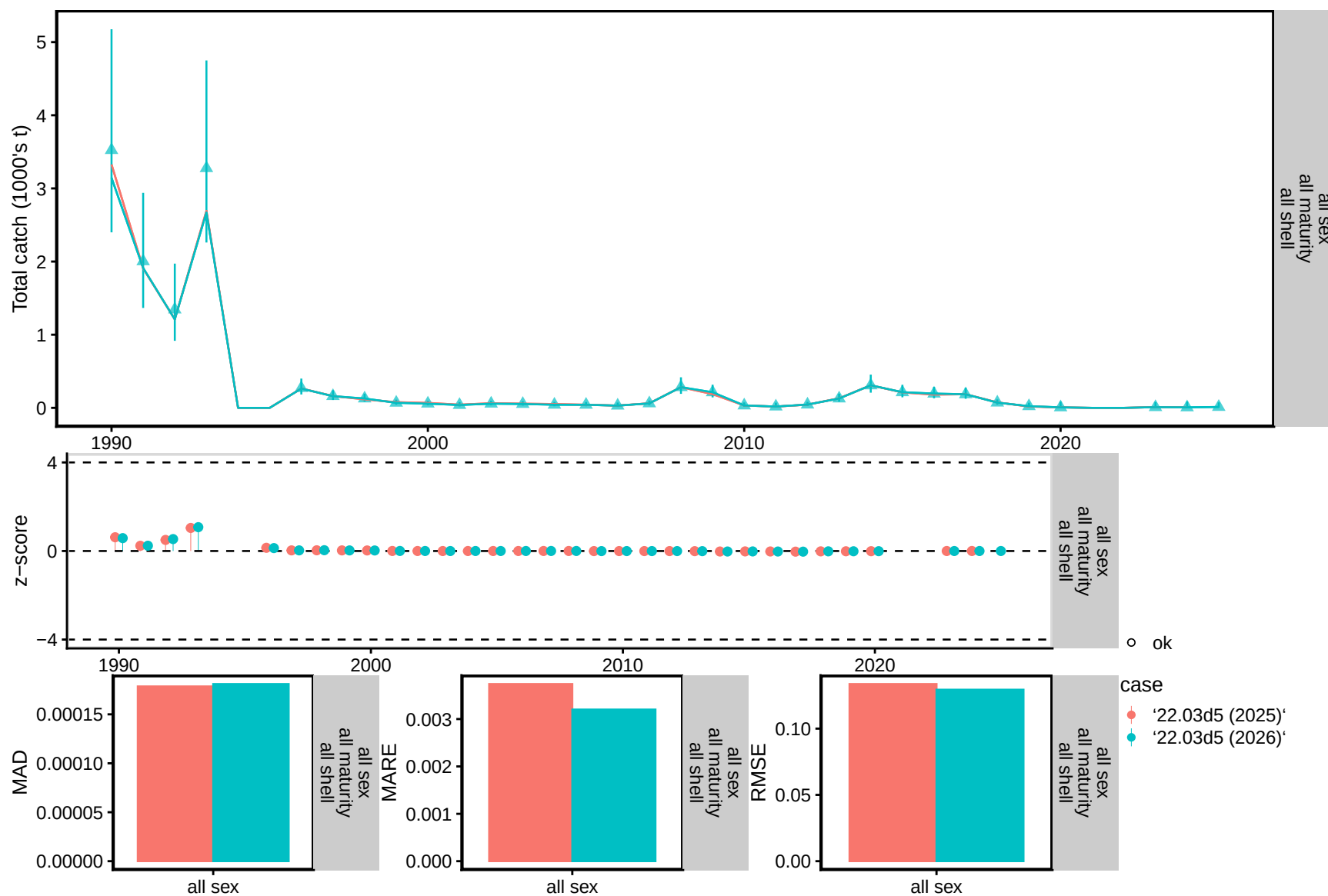


Figure 73. TCSAM02 models fits to total catch biomass of all crab in the RKF fishery (upper row) and residuals analysis plots (lower two rows). Confidence intervals are 95%.

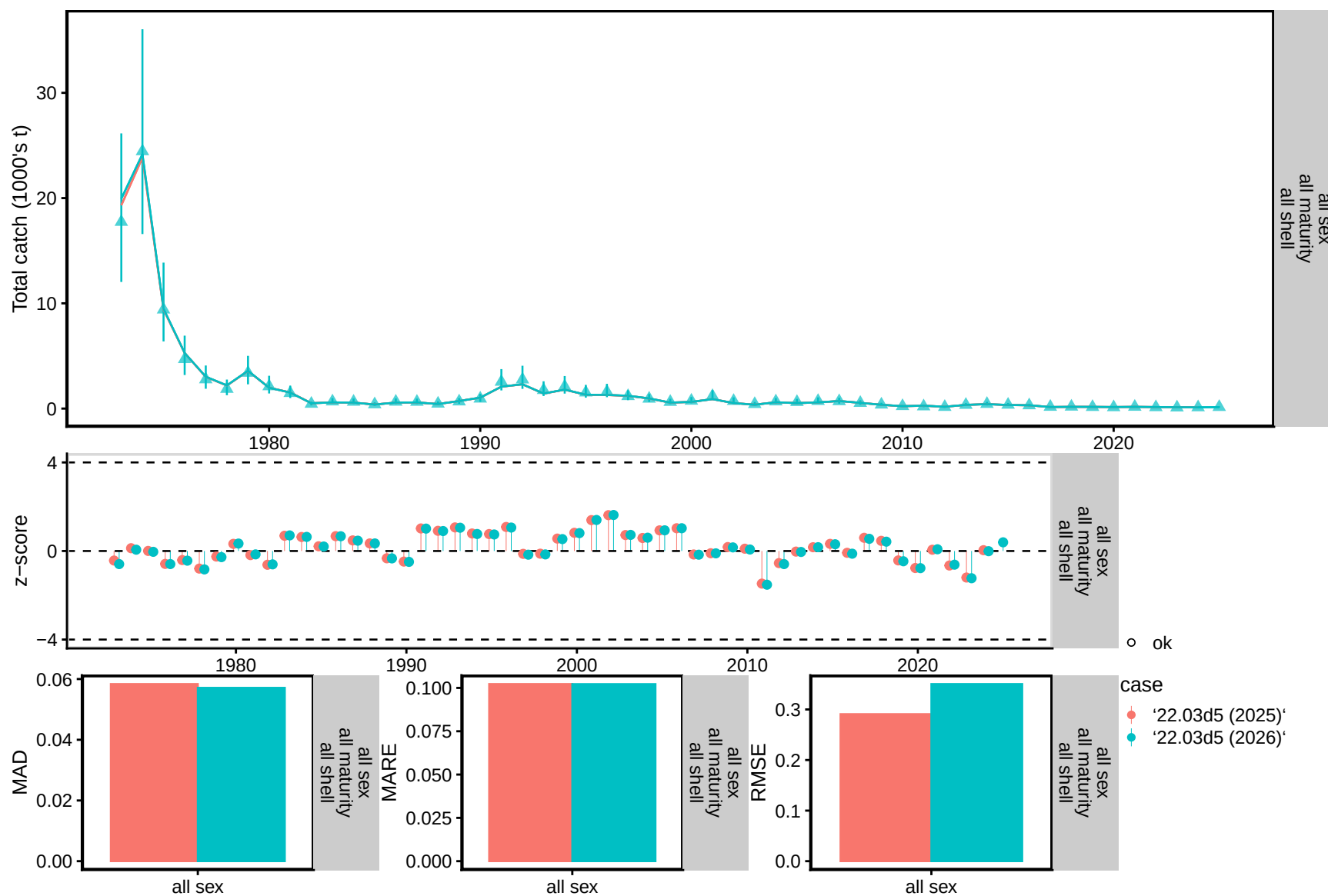


Figure 74. TCSAM02 models fits to total catch biomass of all crab in the GF All fishery (upper row) and residuals analysis plots (lower two rows). Confidence intervals are 95%.

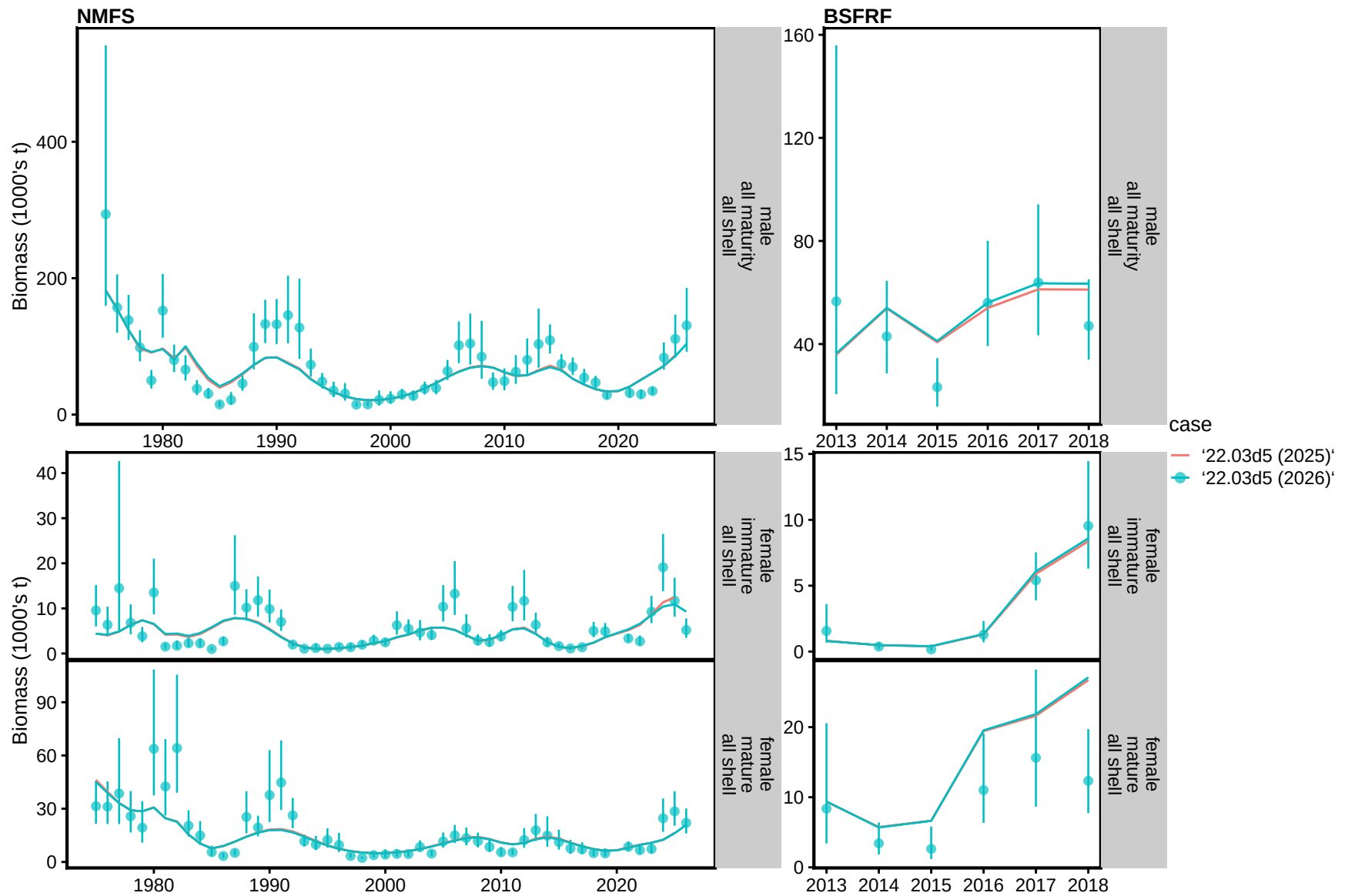


Figure 75. TCSAM02 models fits to time series of all male (upper graph), immature female (center graph), and mature female (lower plot) biomass from the NMFS EBS shelf bottom trawl survey (left column) and the BSFRF SBS trawl survey (right column). Confidence intervals are 95%.

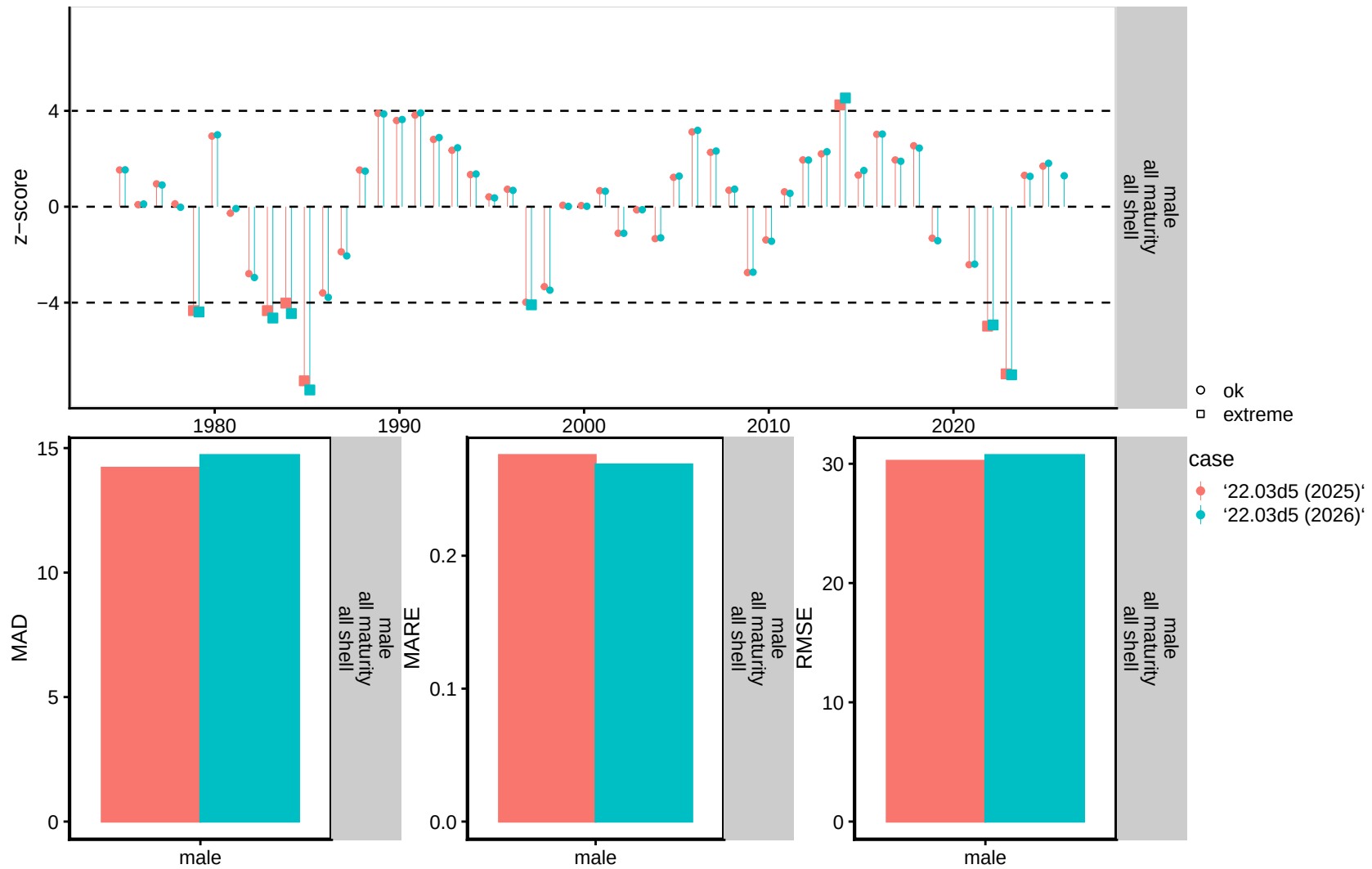


Figure 76. TCSAM02 models residuals analysis by model scenario for fits to male biomass in the NMFS EBS bottom trawl survey. Upper row: annual z-scores; bottom row: 1) MAD: median absolute deviations, 2) MARE: median absolute relative error; 3) RMSE: root mean square error.

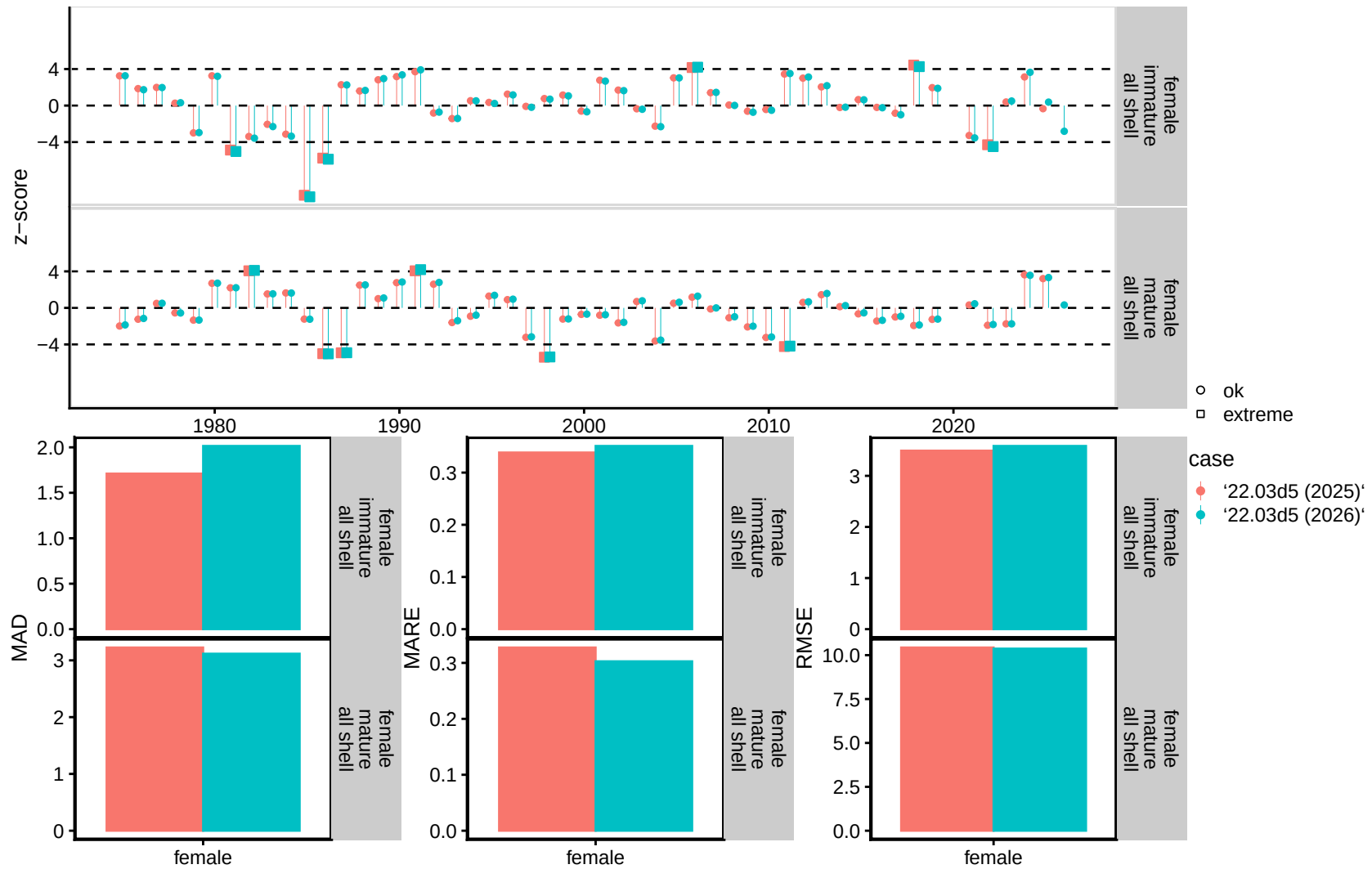


Figure 77. TCSAM02 models residuals analysis by model scenario for fits to female biomass in the NMFS EBS bottom trawl survey. Upper row: annual z-scores; bottom row: 1) MAD: median absolute deviations, 2) MARE: median absolute relative error; 3) RMSE: root mean square error.

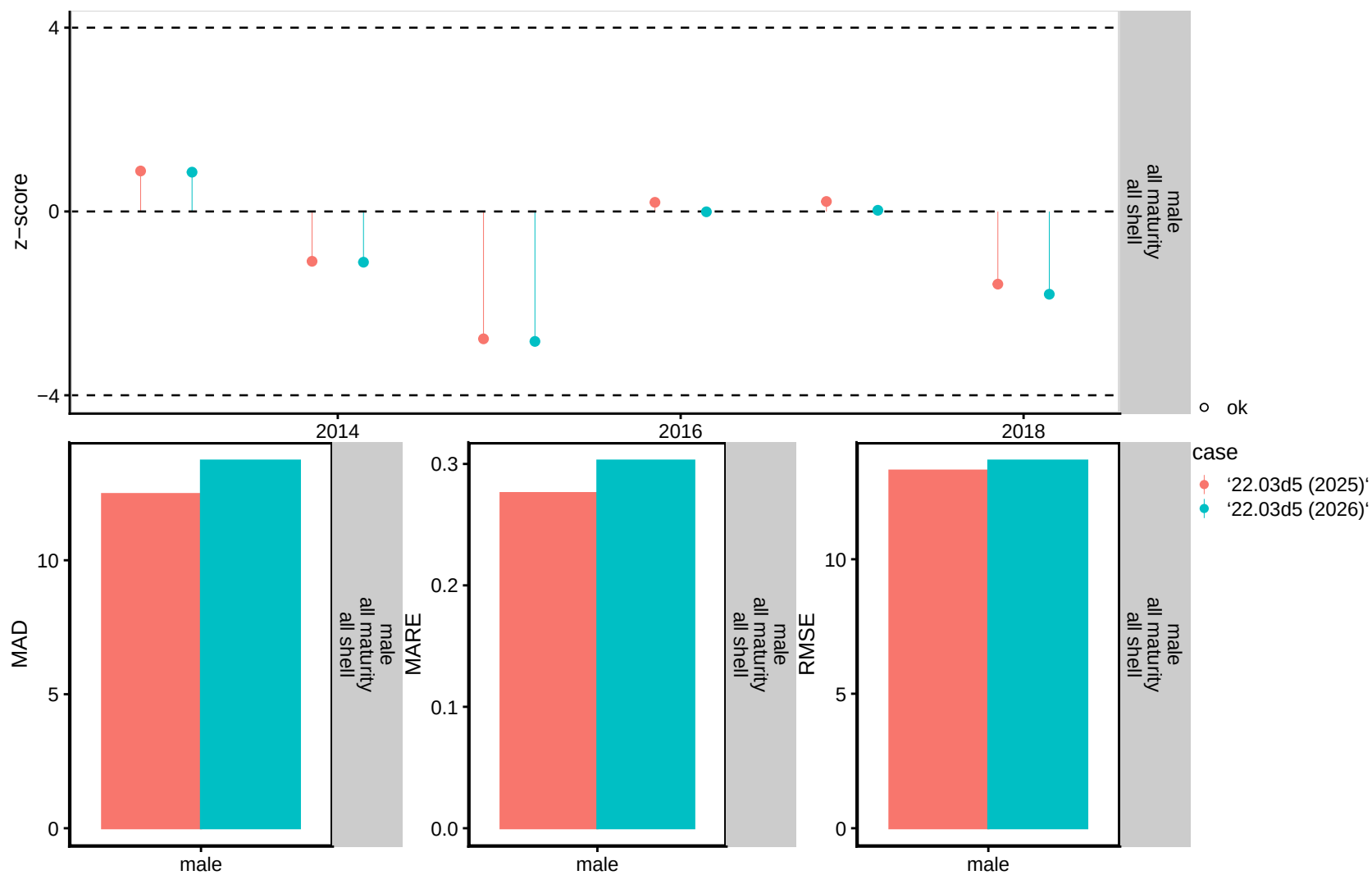


Figure 78. TCSAM02 models residuals analysis by model scenario for fits to male biomass in the BSFRF SBS bottom trawl survey. Upper row: annual z-scores; bottom row: 1) MAD: median absolute deviations, 2) MARE: median absolute relative error; 3) RMSE: root mean square error.

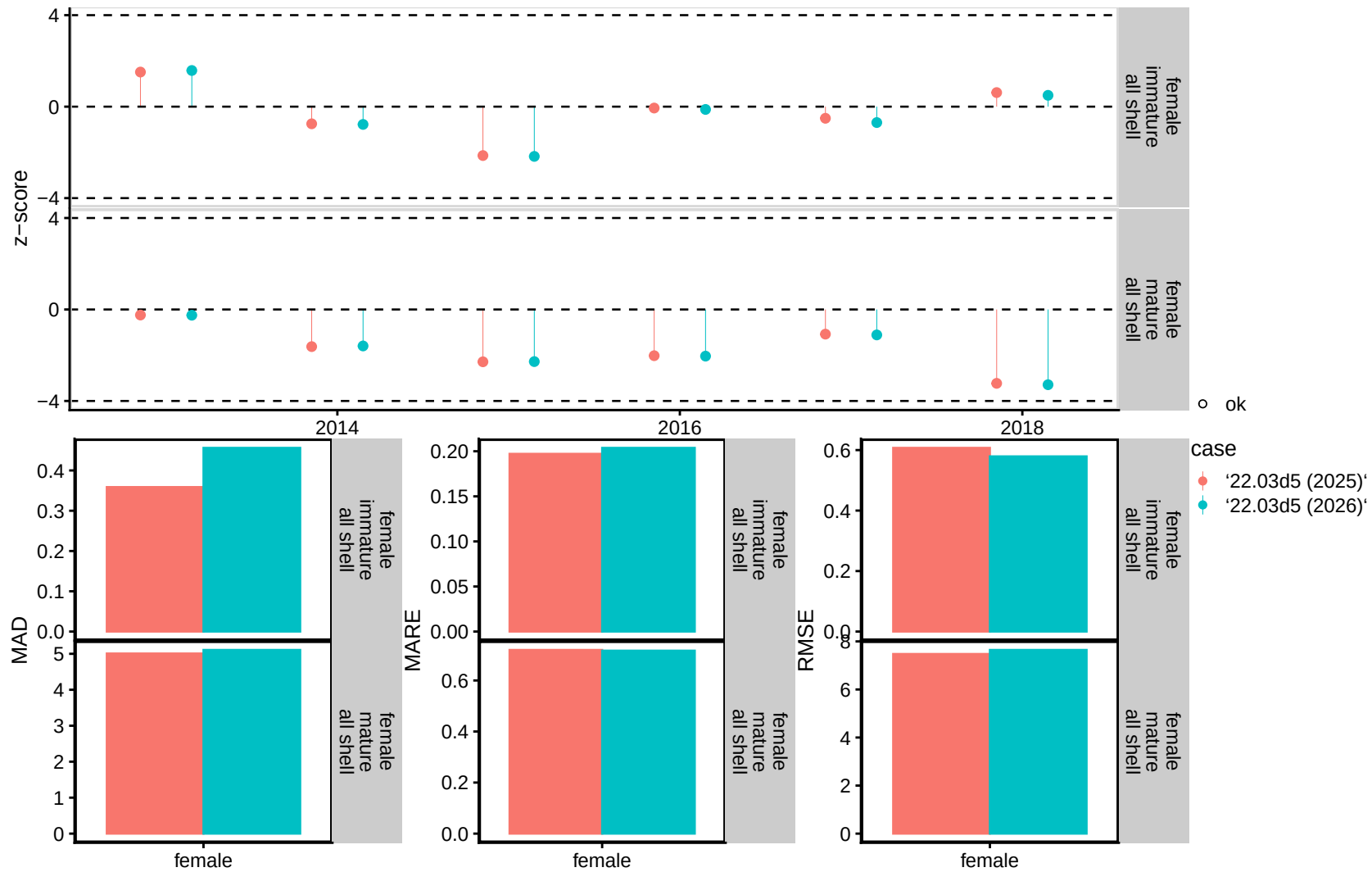


Figure 79. TCSAM02 models residuals analysis by model scenario for fits to female biomass in the BSFRF SBS bottom trawl survey. Upper row: annual z-scores; bottom row: 1) MAD: median absolute deviations, 2) MARE: median absolute relative error; 3) RMSE: root mean square error.

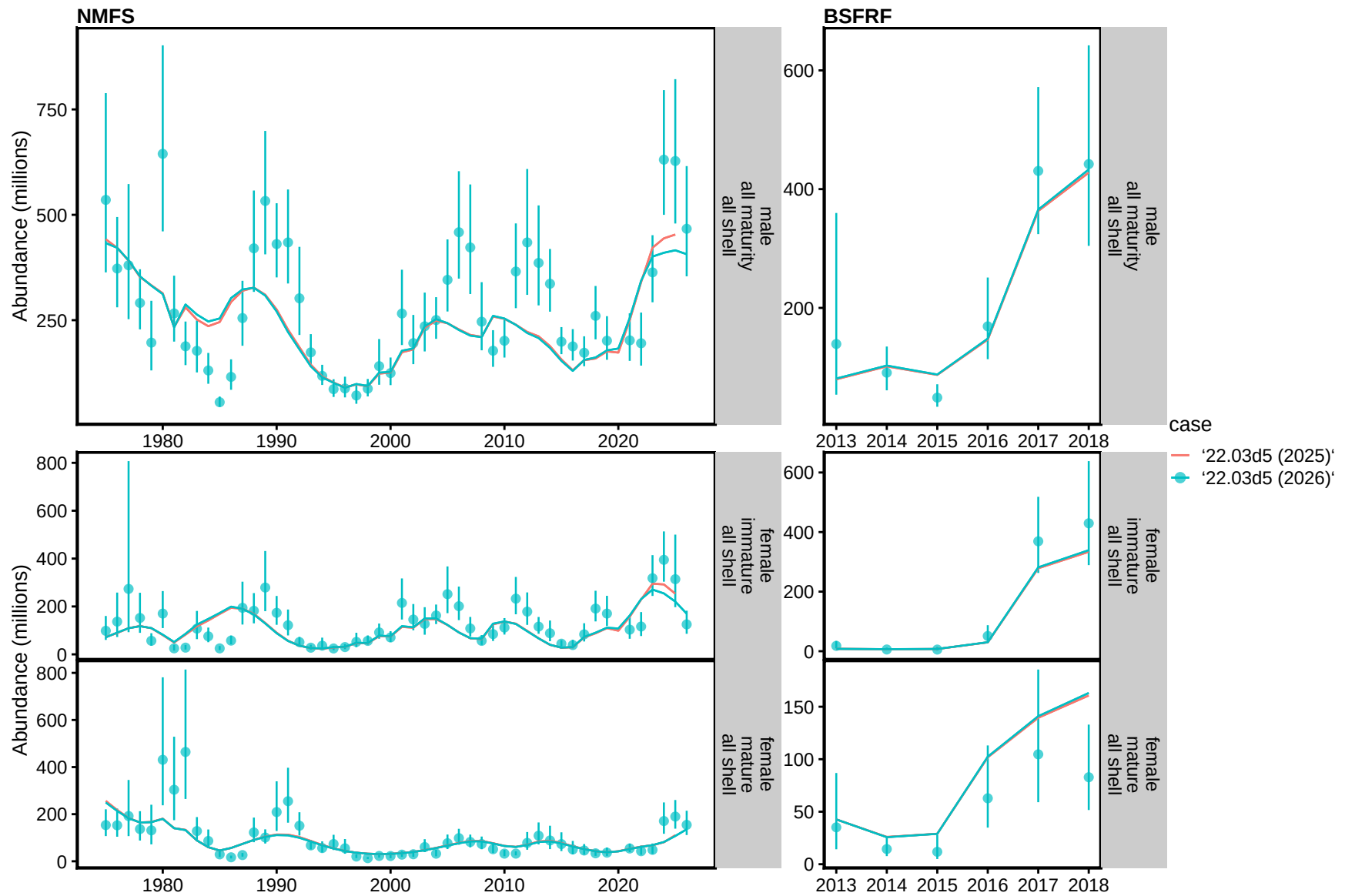


Figure 80. TCSAM02 models fits to time series of all male (upper graph), immature female (center graph), and mature female (lower plot) abundance from the NMFS EBS shelf bottom trawl survey (left column) and the BSFRF SBS trawl survey (right column). Note that these fits are not included in the model objective function and simply provide a diagnostic check. Confidence intervals are 95%.

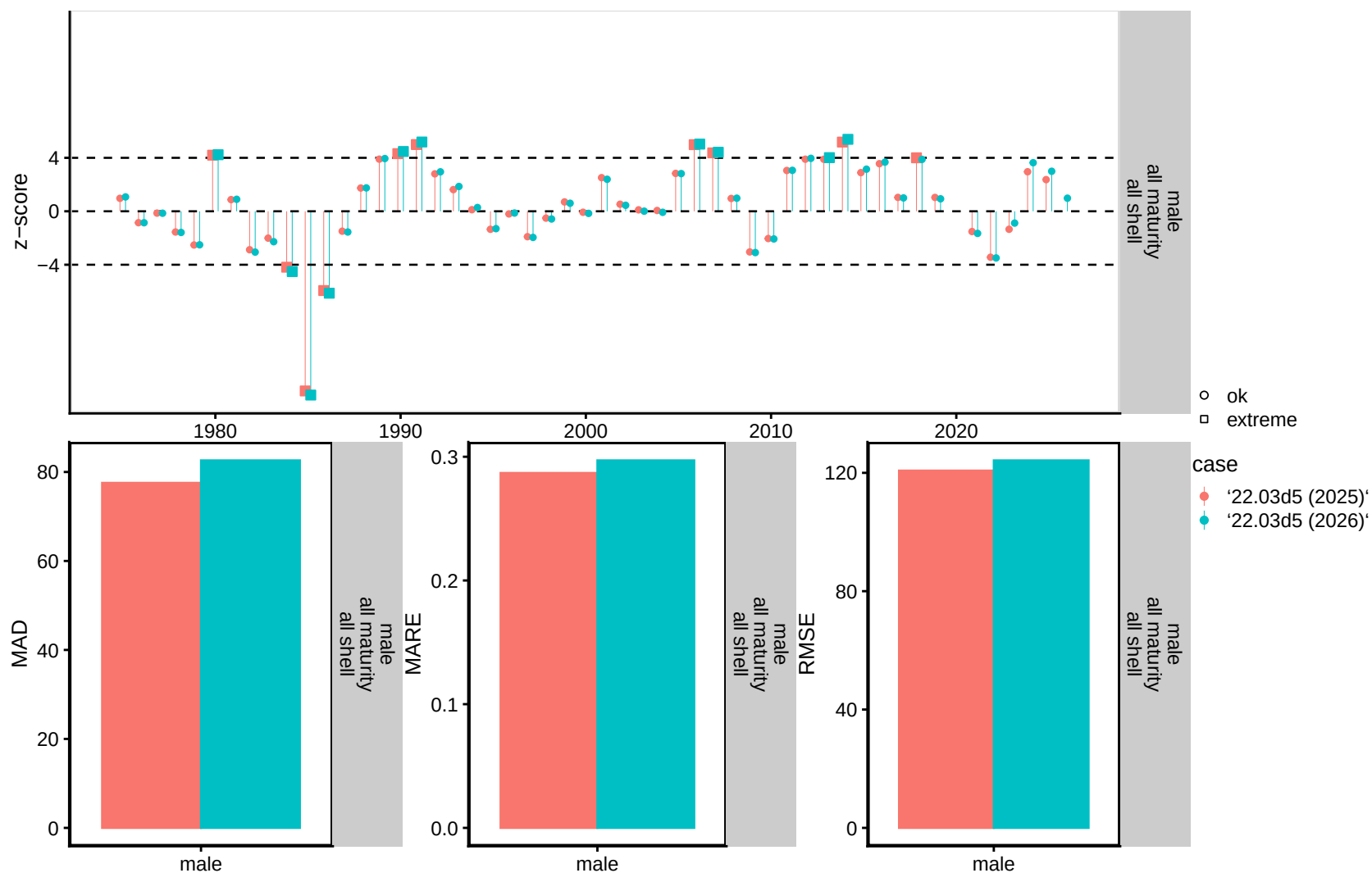


Figure 81. TCSAM02 models residuals analysis by model scenario for fits to male abundance in the NMFS EBS bottom trawl survey. Upper row: annual z-scores; bottom row: 1) MAD: median absolute deviations, 2) MARE: median absolute relative error; 3) RMSE: root mean square error.

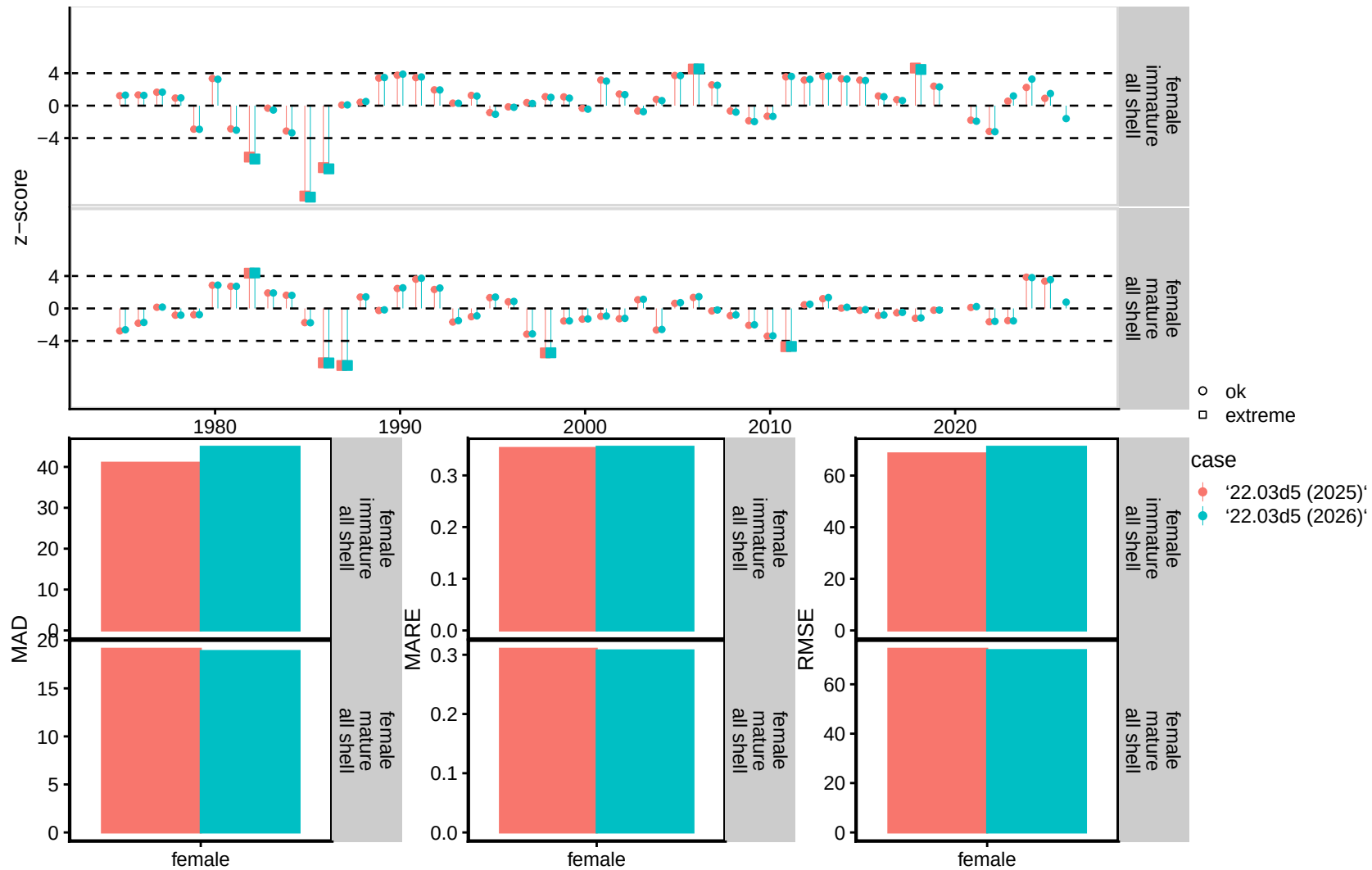


Figure 82. TCSAM02 models residuals analysis by model scenario for fits to female abundance in the NMFS EBS bottom trawl survey. Upper row: annual z-scores; bottom row: 1) MAD: median absolute deviations, 2) MARE: median absolute relative error; 3) RMSE: root mean square error.

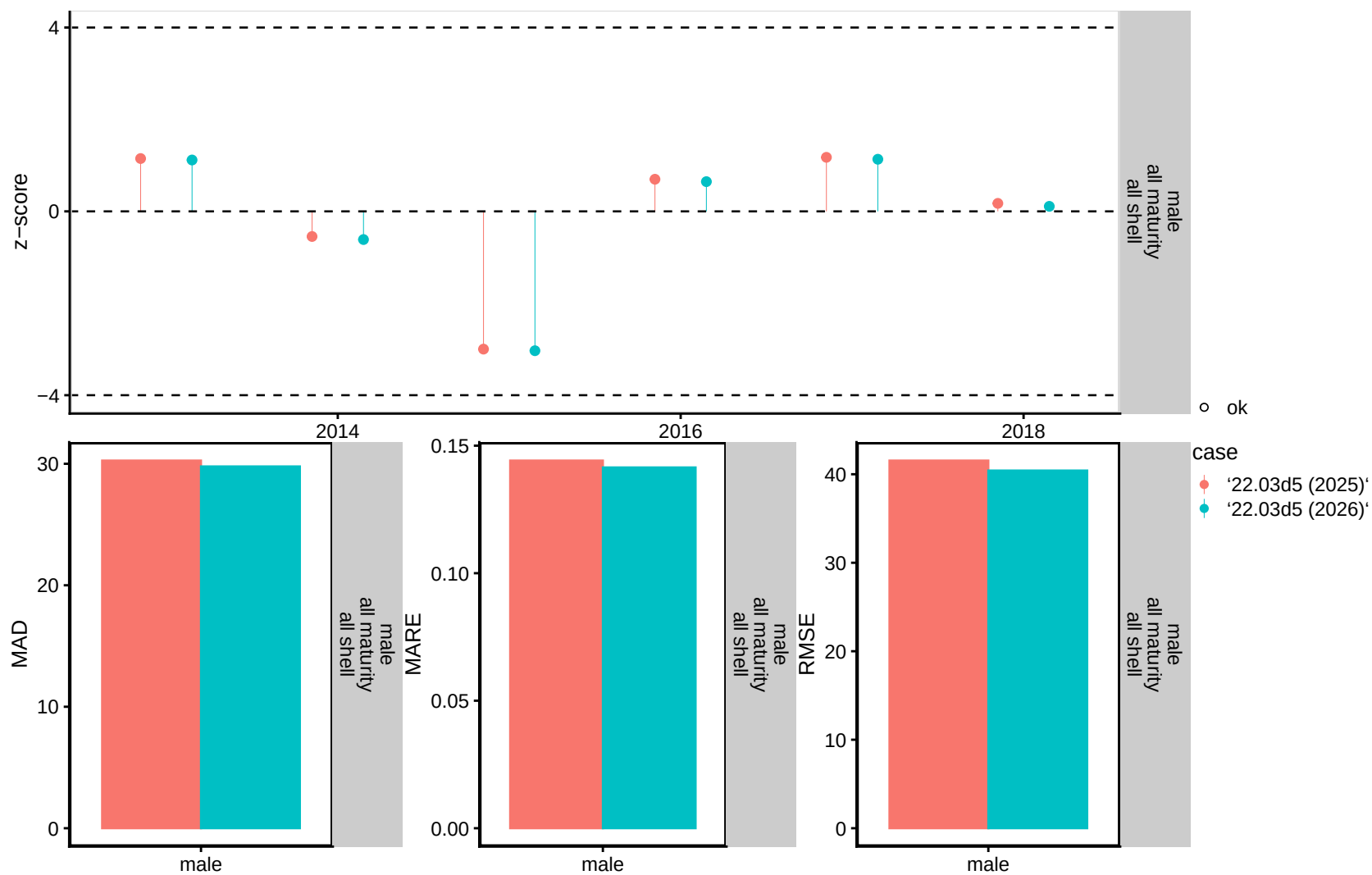


Figure 83. TCSAM02 models residuals analysis by model scenario for fits to male abundance in the BSFRF SBS bottom trawl survey. Upper row: annual z-scores; bottom row: 1) MAD: median absolute deviations, 2) MARE: median absolute relative error; 3) RMSE: root mean square error.

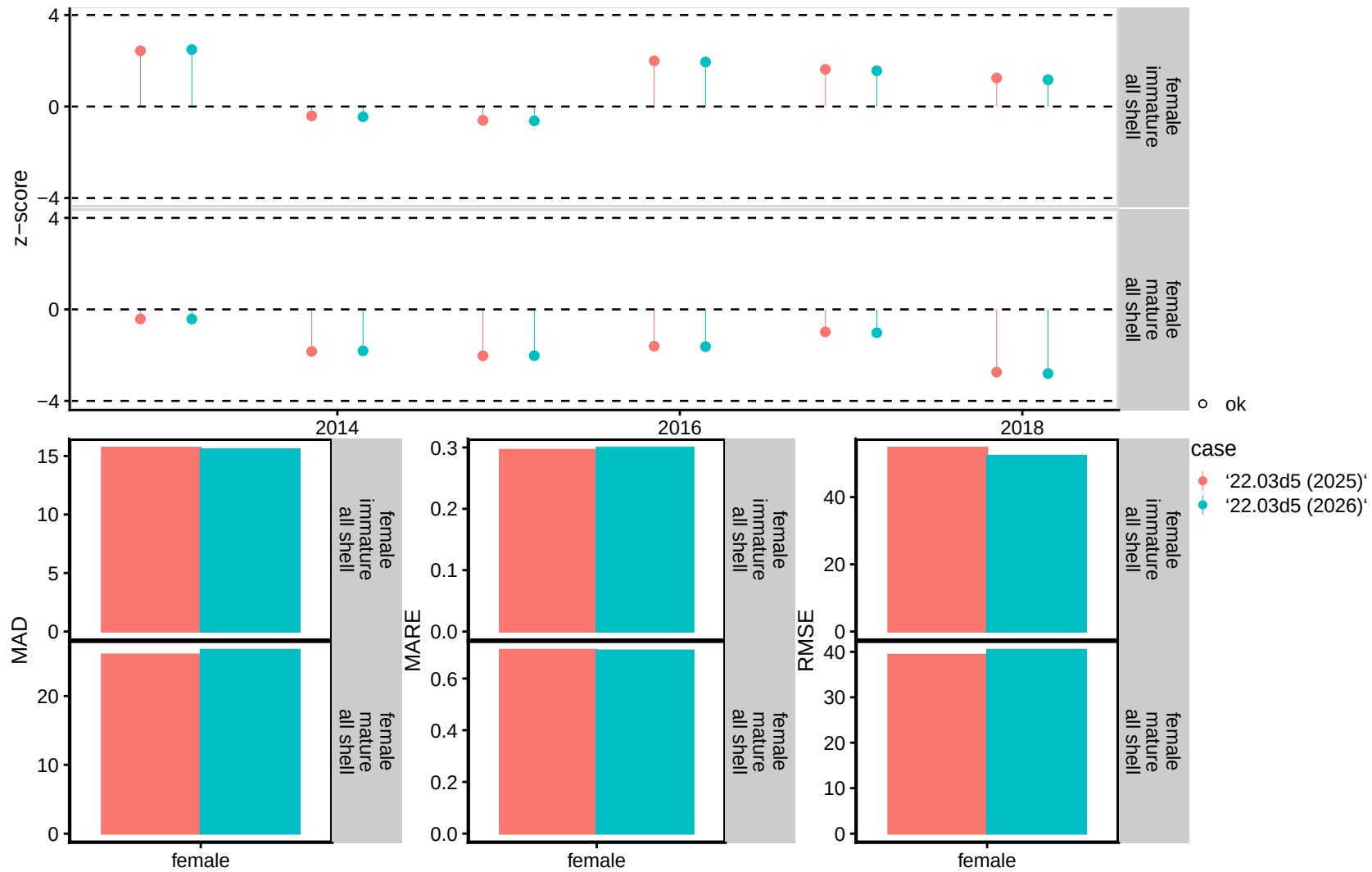


Figure 84. TCSAM02 models residuals analysis by model scenario for fits to female abundance in the BSFRF SBS bottom trawl survey. Upper row: annual z-scores; bottom row: 1) MAD: median absolute deviations, 2) MARE: median absolute relative error; 3) RMSE: root mean square error.

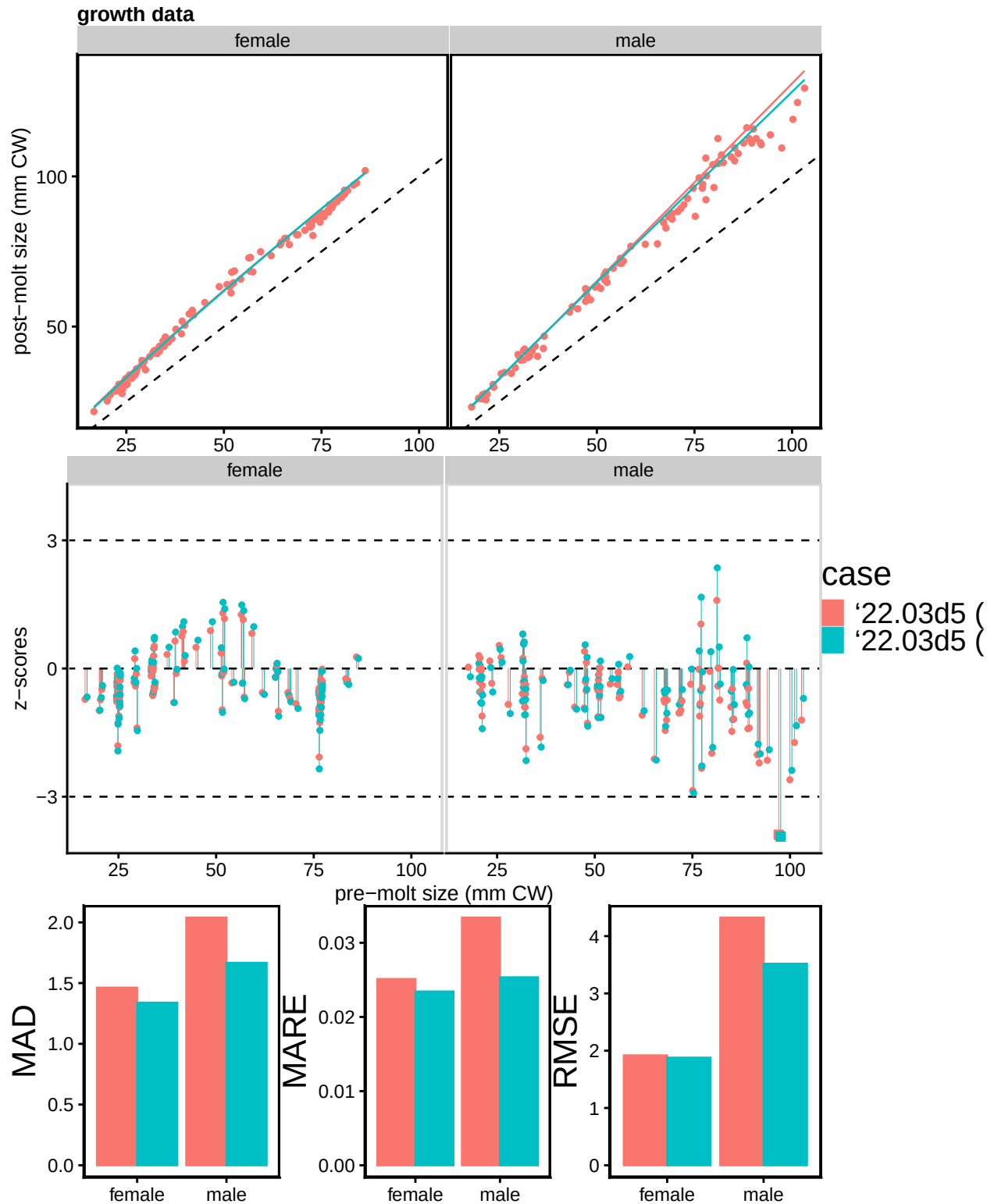


Figure 85. TCSAM02 models fits and residuals analysis by model scenario for fits to molt increment data. Upper row: fits to data; center row: annual z-scores; bottom row: 1) MAD: median absolute deviations, 2) MARE: median absolute relative error; 3) RMSE: root mean square error.

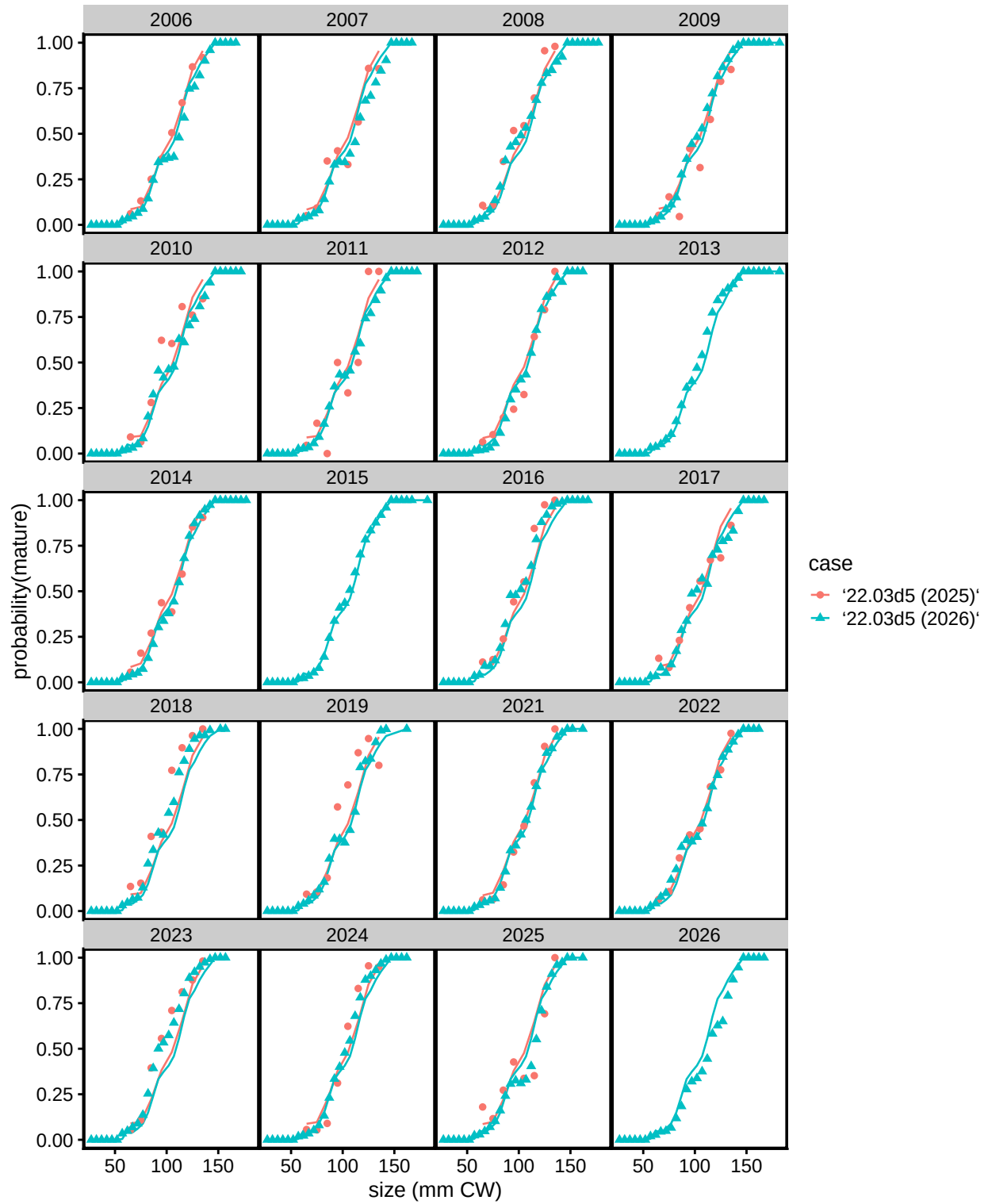


Figure 86. TCSAM02 models fits to maturity ogive data by model scenario and year.

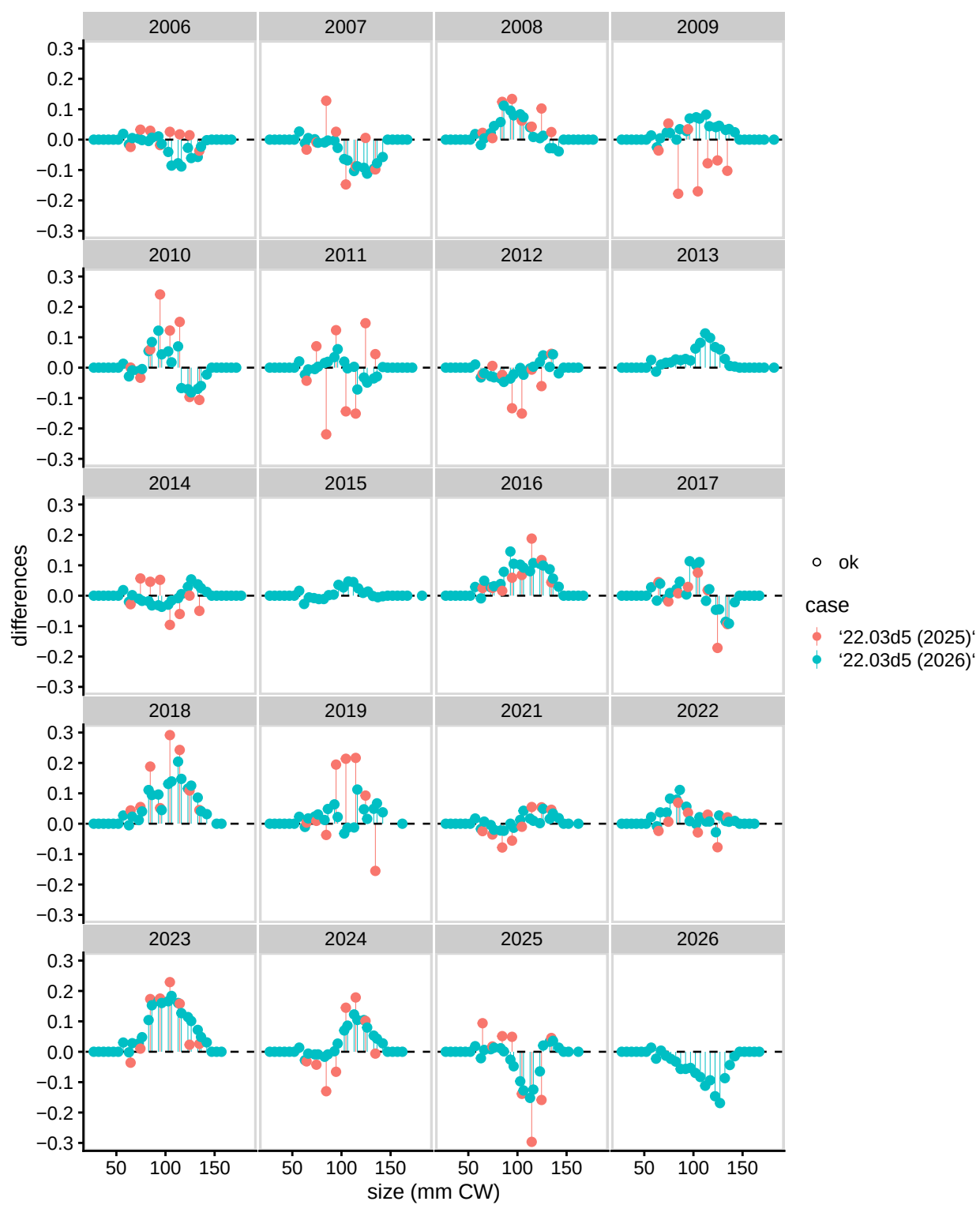


Figure 87. TCSAM02 models residuals analysis for maturity ogive data, by model scenario and year.

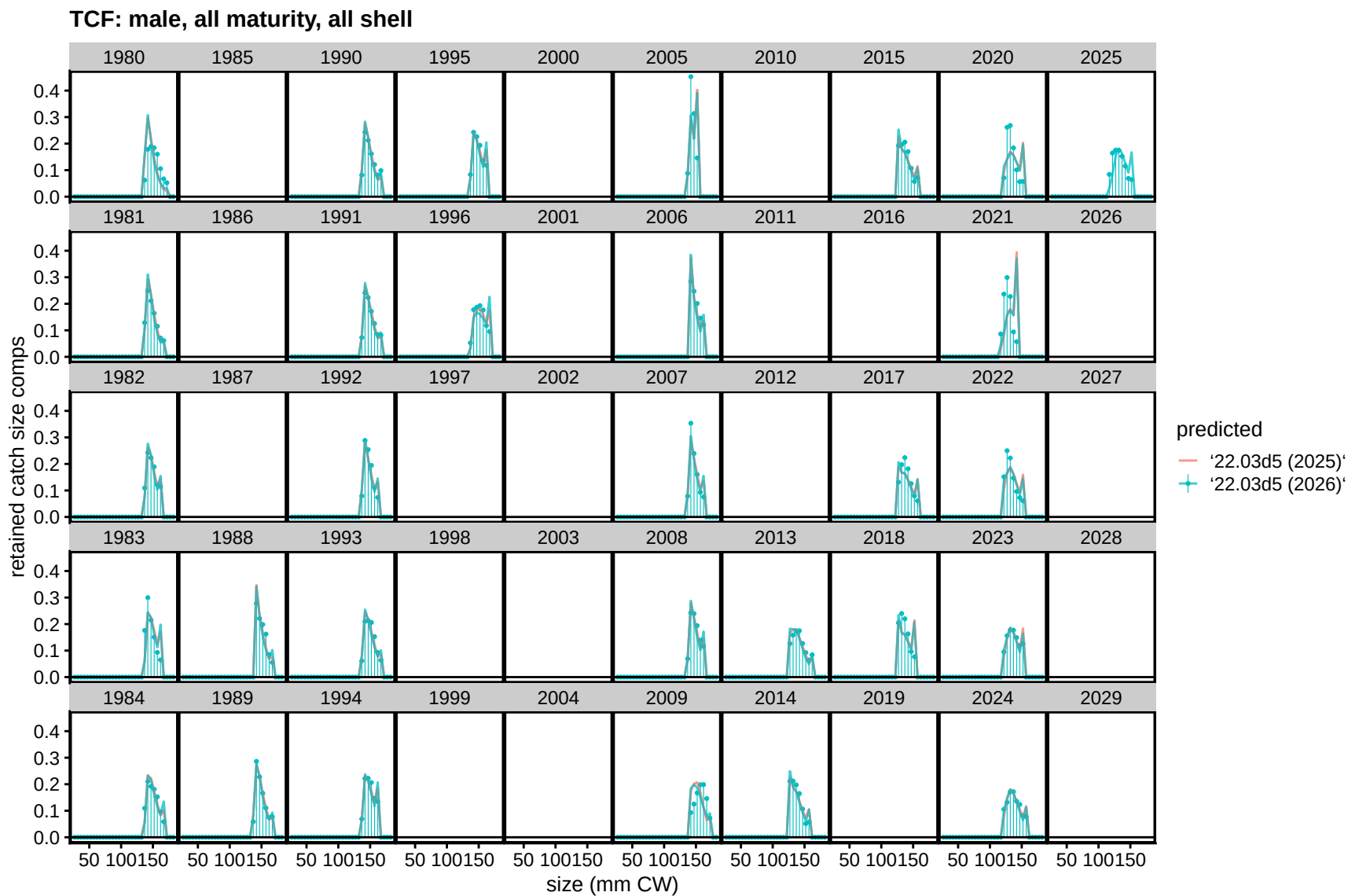


Figure 88. TCSAM02 models fits to retained catch size compositions in the directed fishery. Preferred model is 22.03d5 (2026).

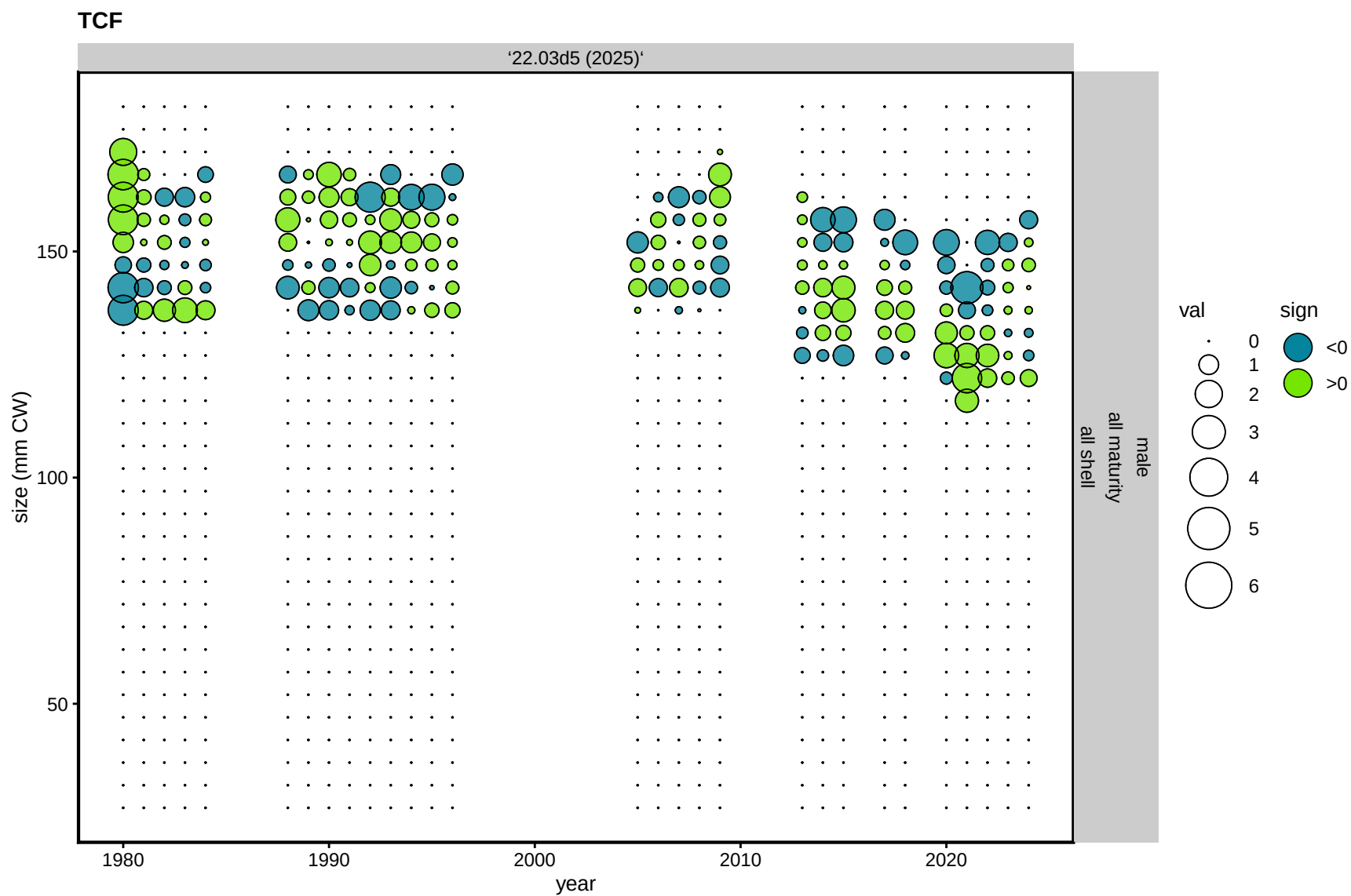


Figure 89. Pearson's residuals for fits to retained catch size composition data. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X' to facilitate identification.

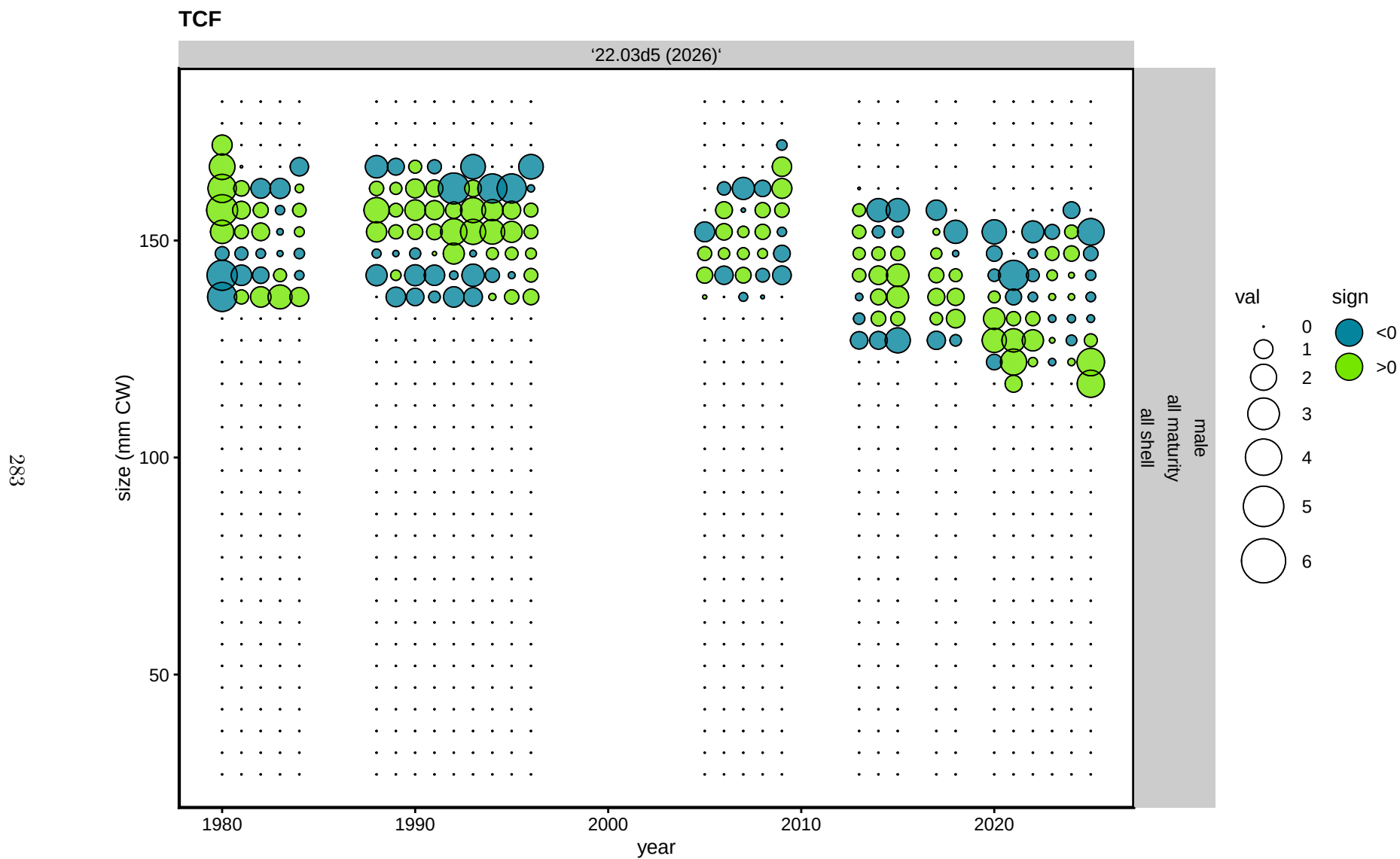


Figure 90. Pearson's residuals for fits to retained catch size composition data. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X' to facilitate identification.

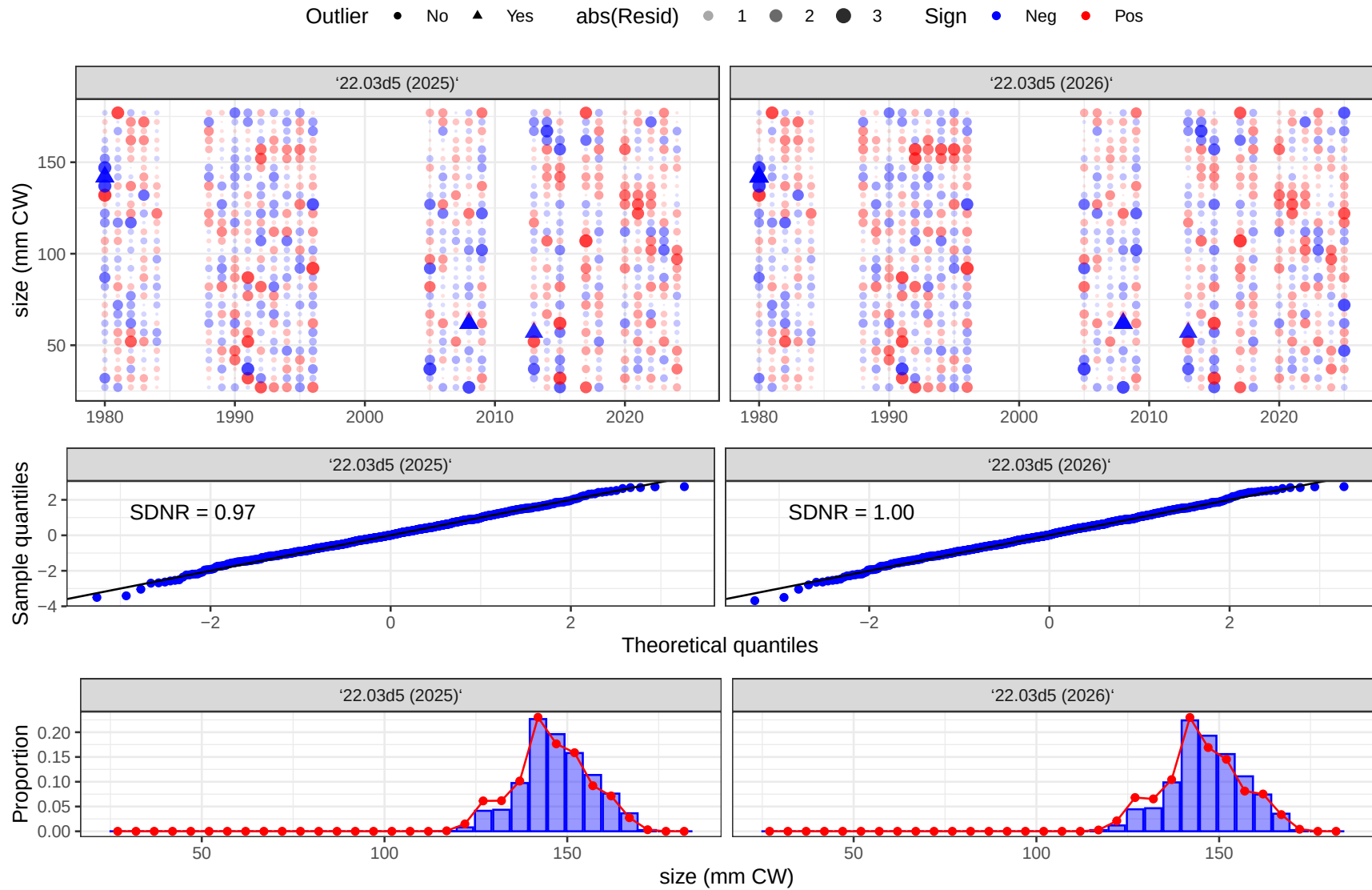


Figure 91. OSA residuals for TCSAM02 models fit to male retained catch size compositions from the directed fishery.

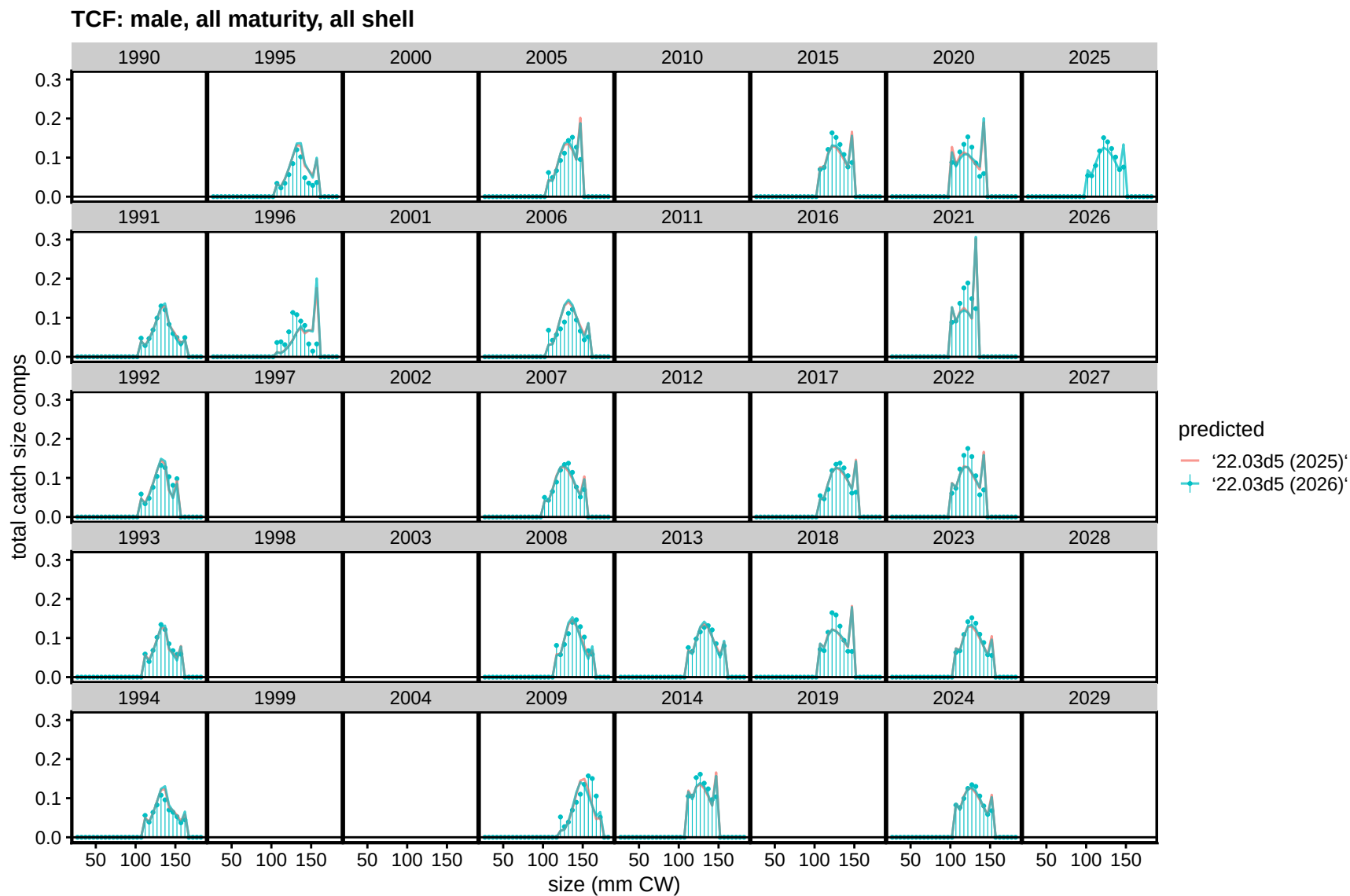


Figure 92. TCSAM02 models fits to total catch size compositions in the TCF fishery.

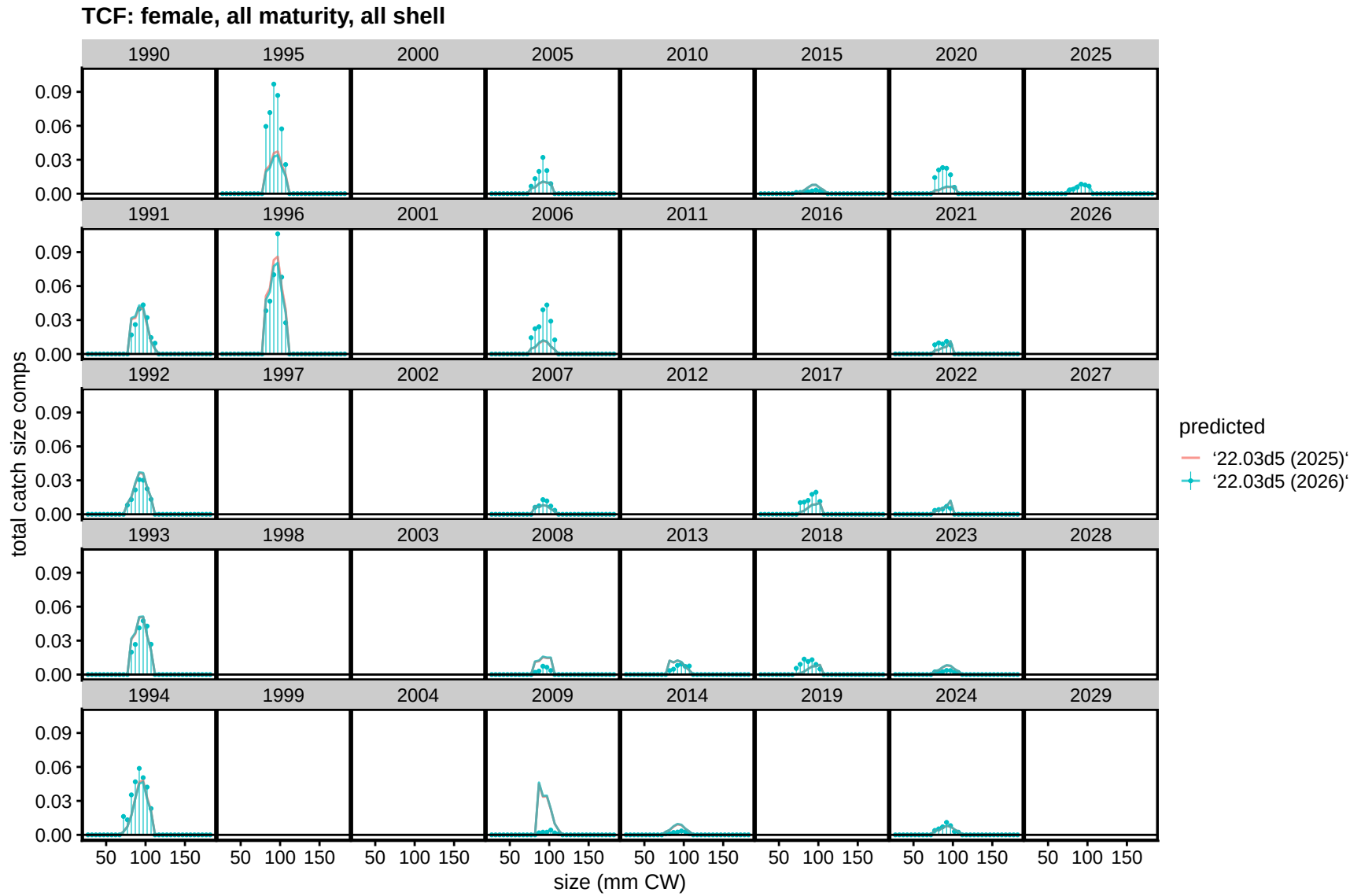


Figure 93. TCSAM02 models fits to total catch size compositions in the TCF fishery.

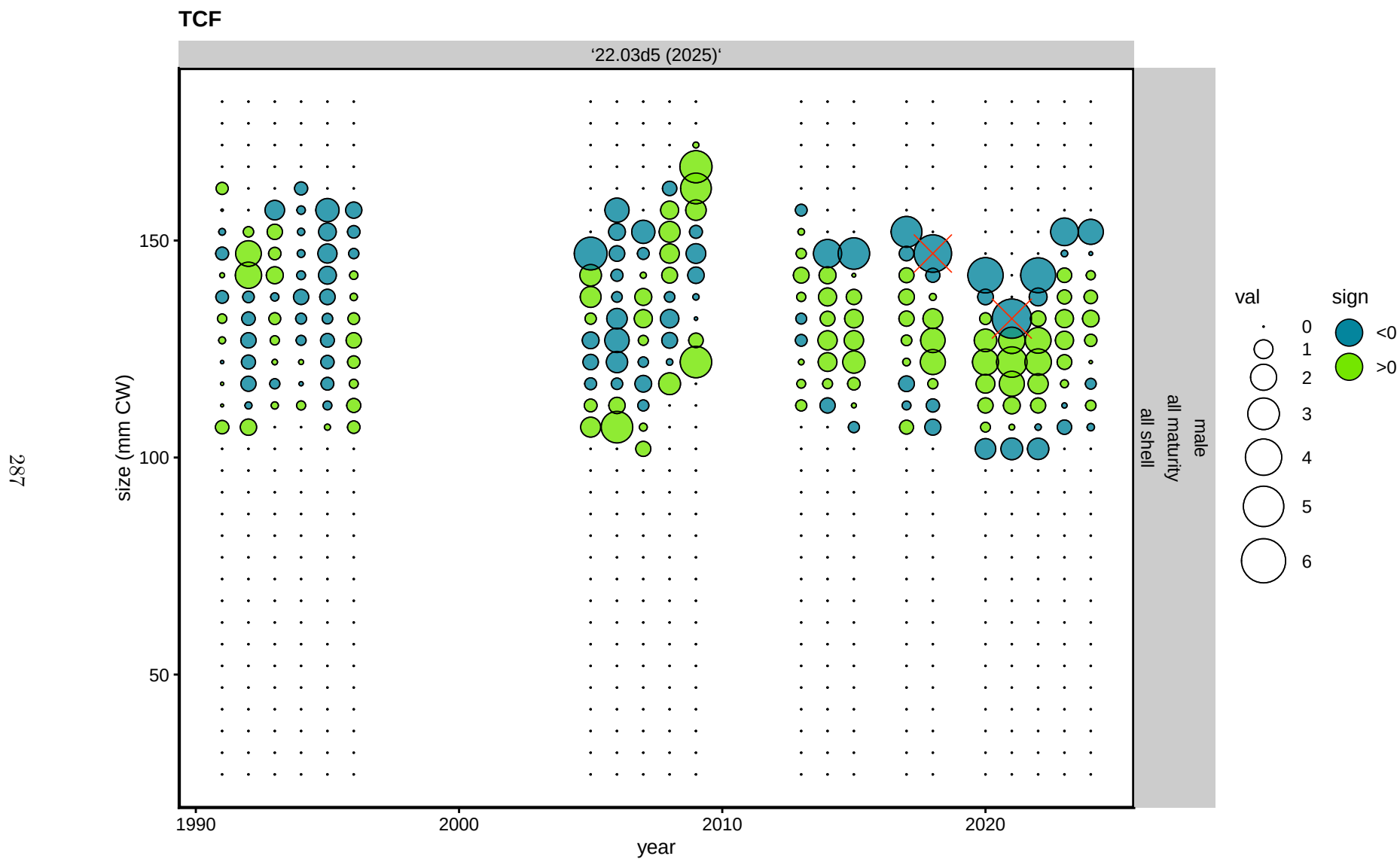


Figure 94. Pearson's residuals for fits to total catch size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X' to facilitate identification.

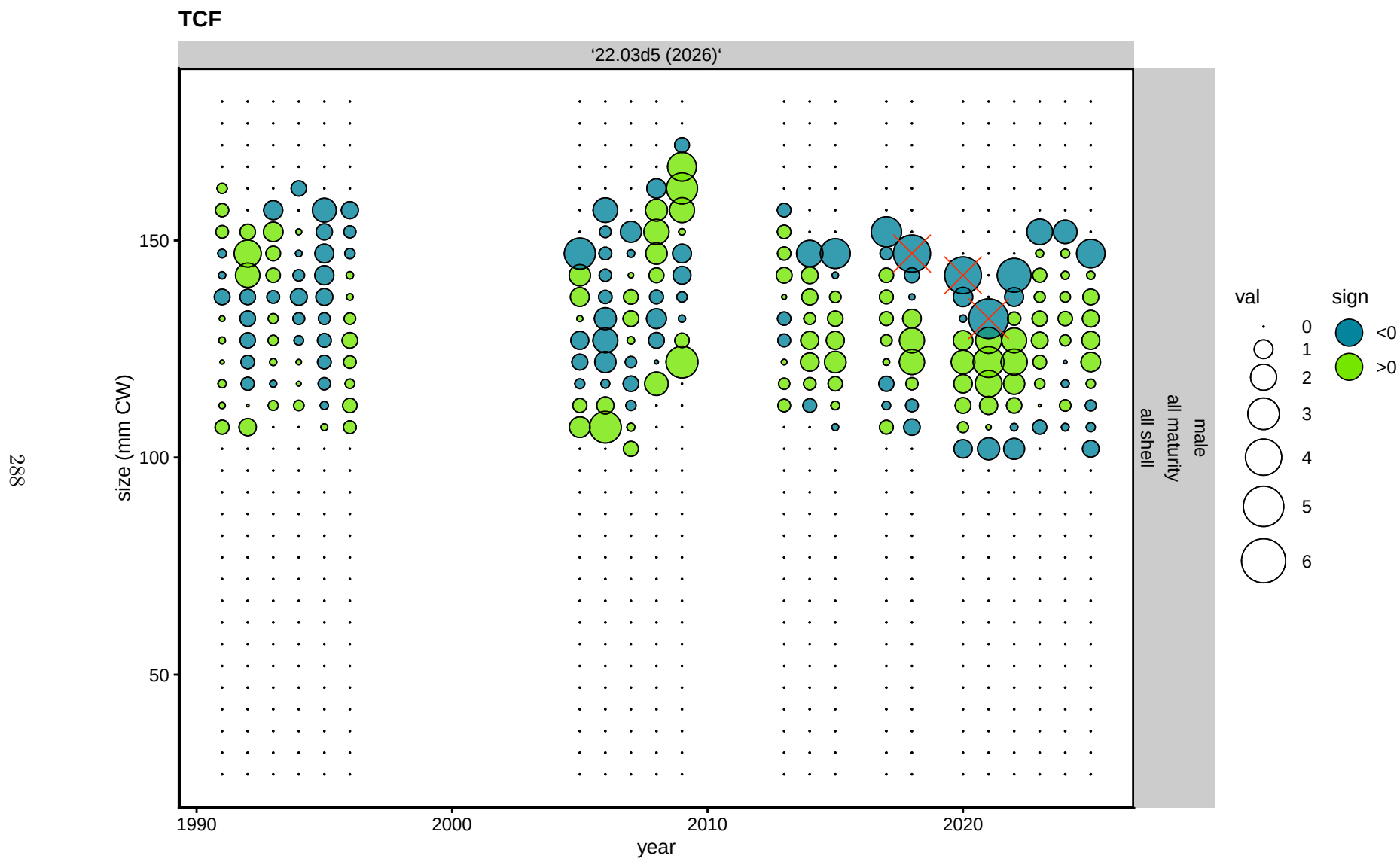


Figure 95. Pearson's residuals for fits to total catch size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X' to facilitate identification.

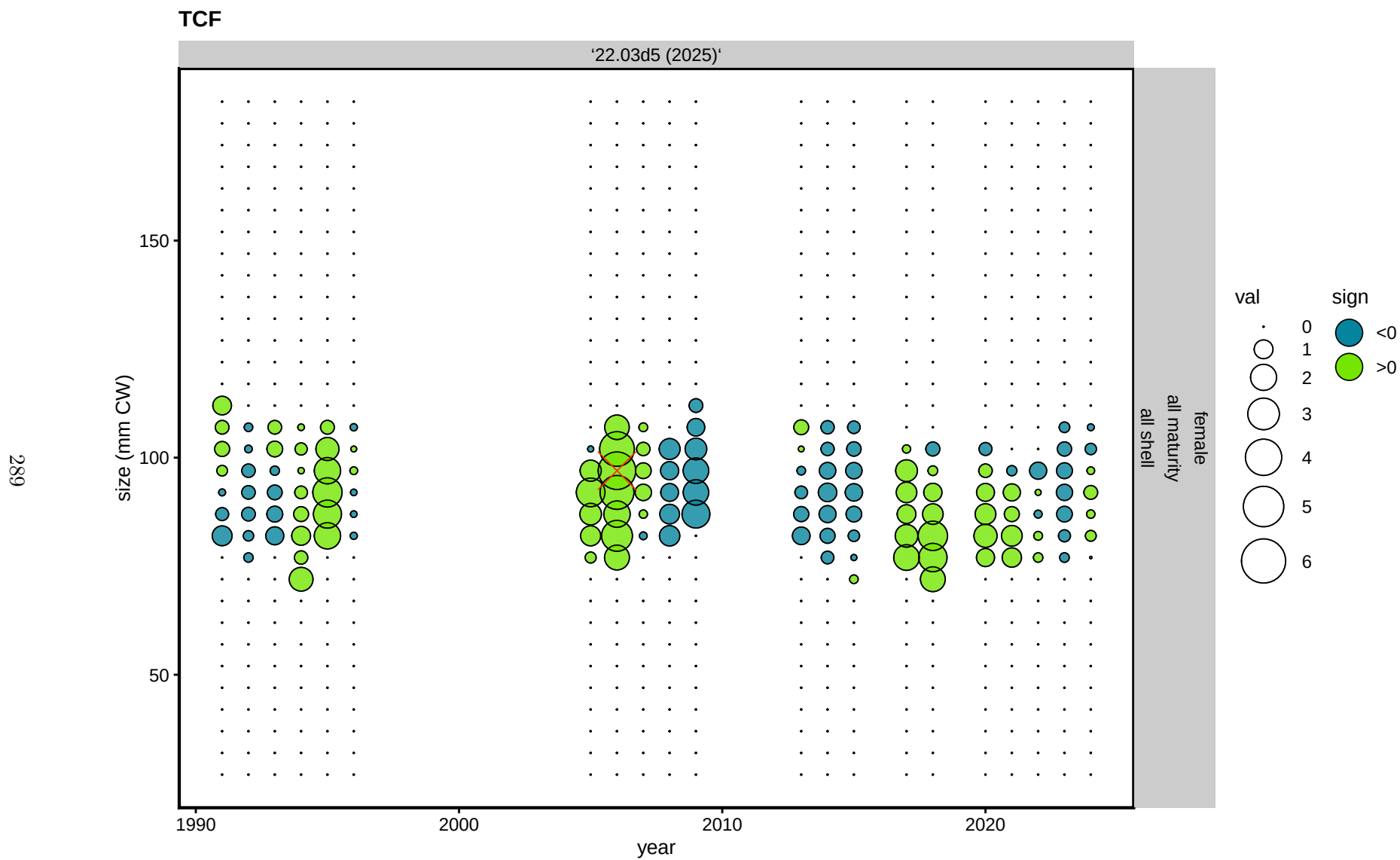


Figure 96. Pearson's residuals for fits to total catch size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X' to facilitate identification.

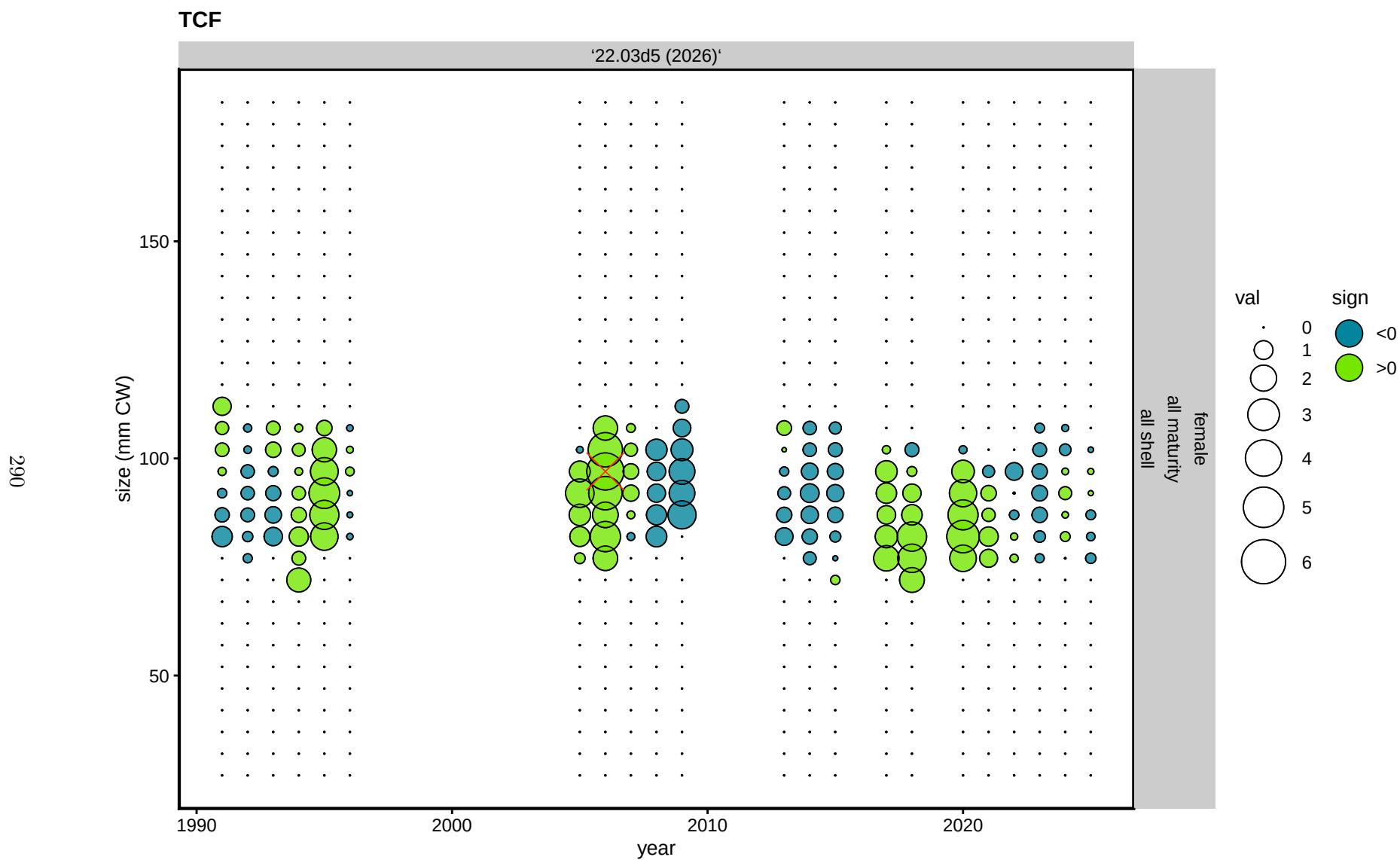


Figure 97. Pearson's residuals for fits to total catch size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X' to facilitate identification.

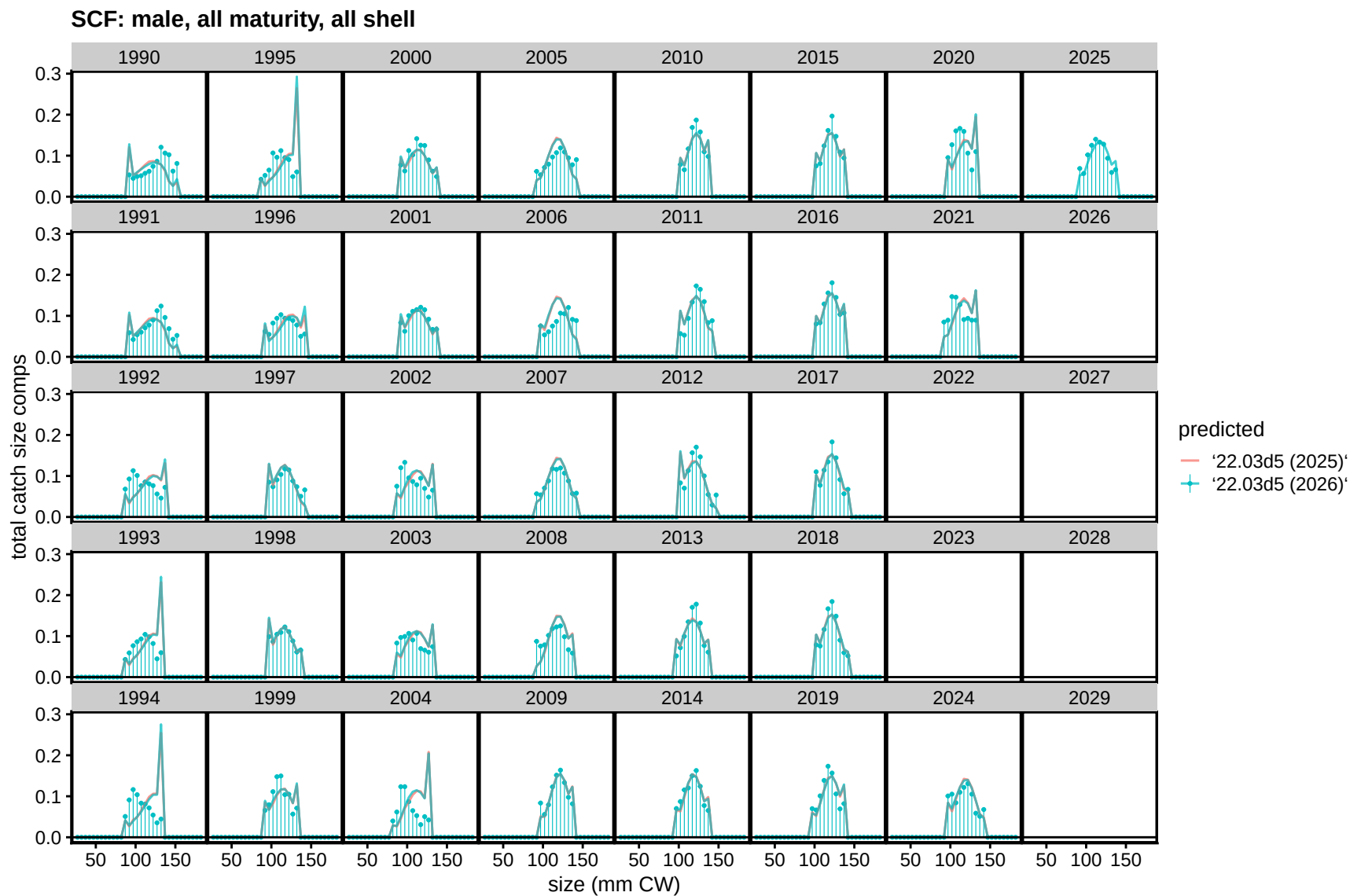


Figure 98. TCSAM02 models fits to total catch size compositions in the SCF fishery.

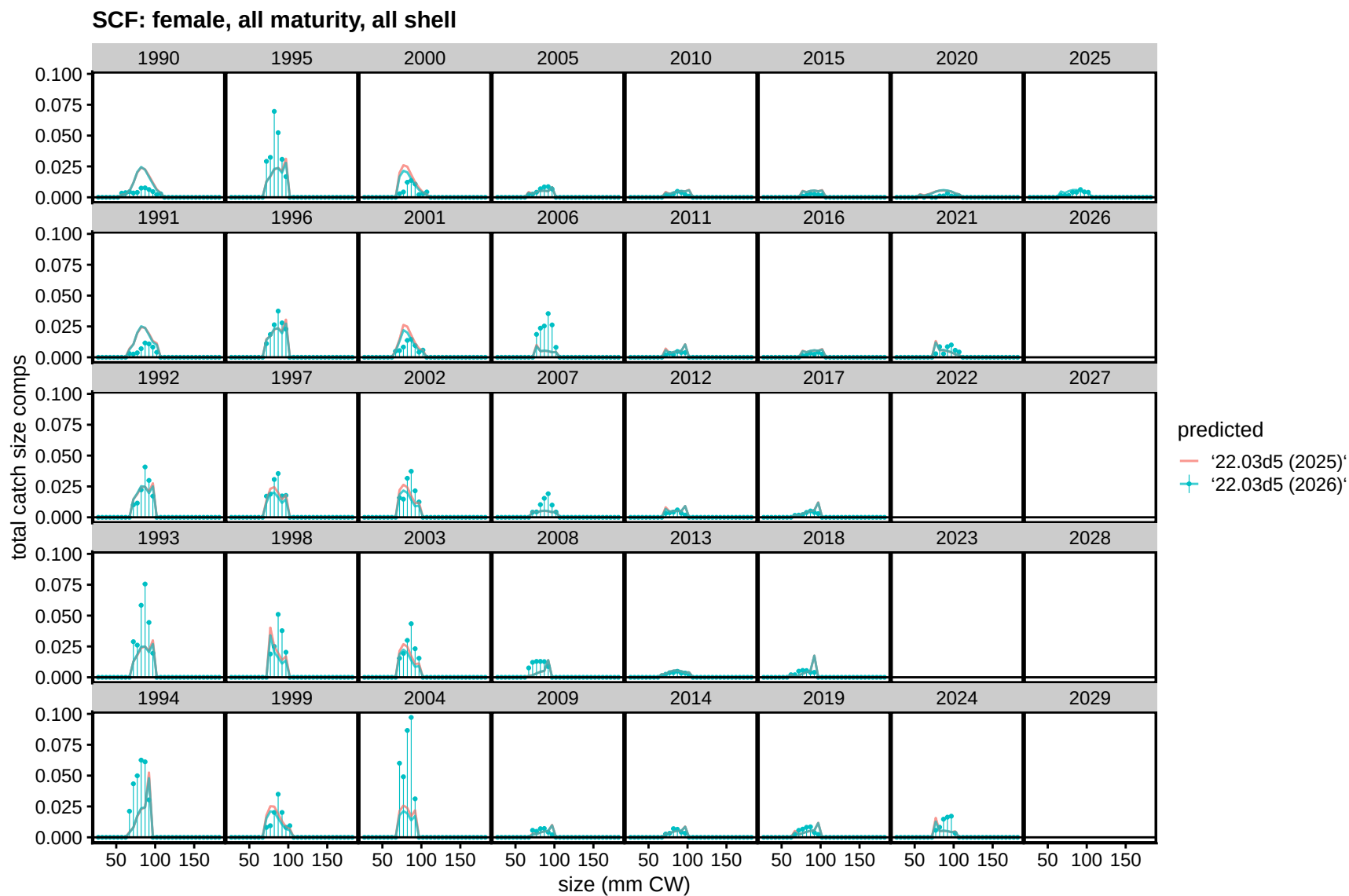


Figure 99. TCSAM02 models fits to total catch size compositions in the SCF fishery.



Figure 100. Pearson's residuals for fits to total catch size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X' to facilitate identification.



Figure 101. Pearson's residuals for fits to total catch size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X' to facilitate identification.

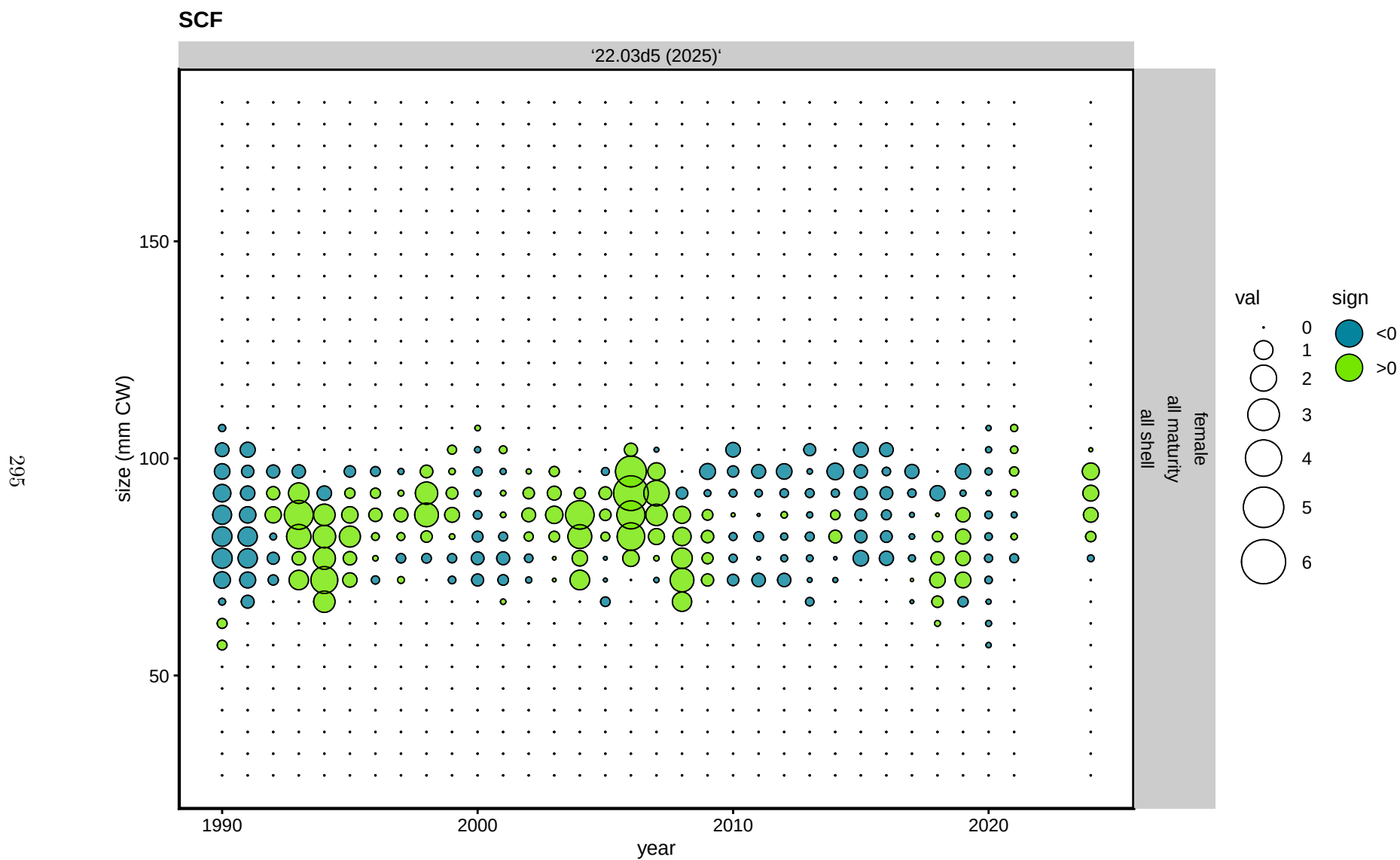


Figure 102. Pearson's residuals for fits to total catch size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X' to facilitate identification.

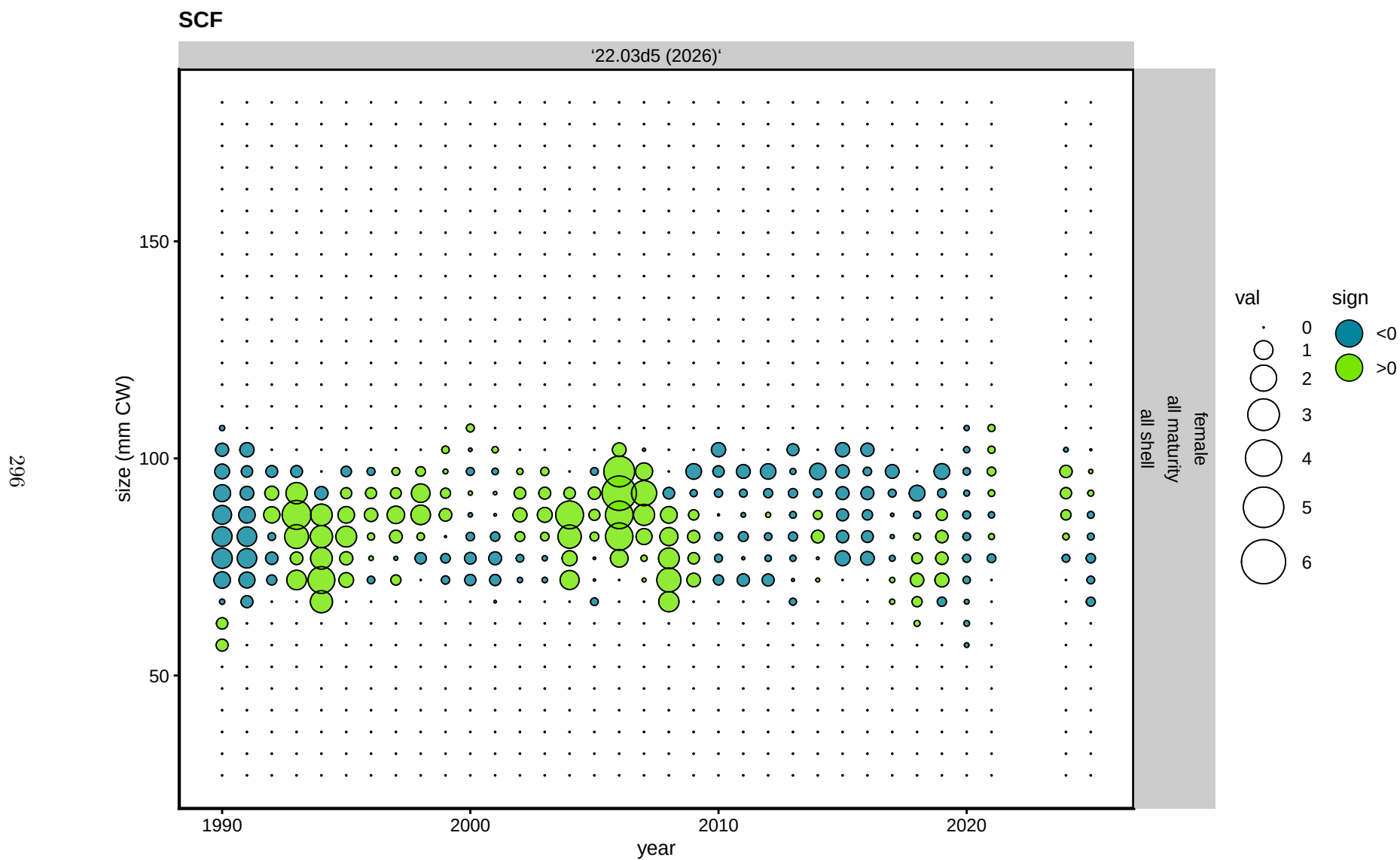


Figure 103. Pearson's residuals for fits to total catch size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X' to facilitate identification.

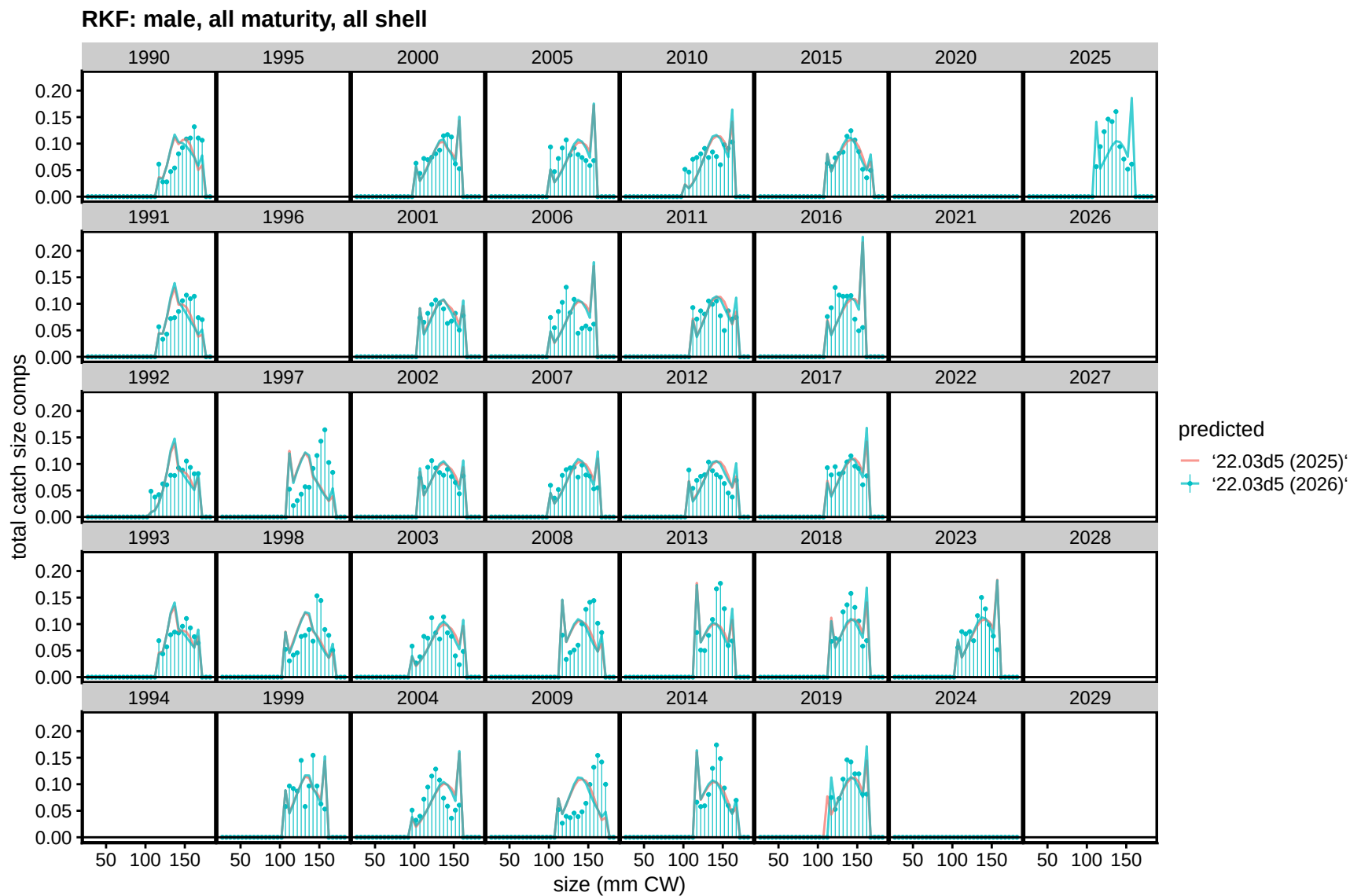


Figure 104. TCSAM02 models fits to total catch size compositions in the RKF fishery.

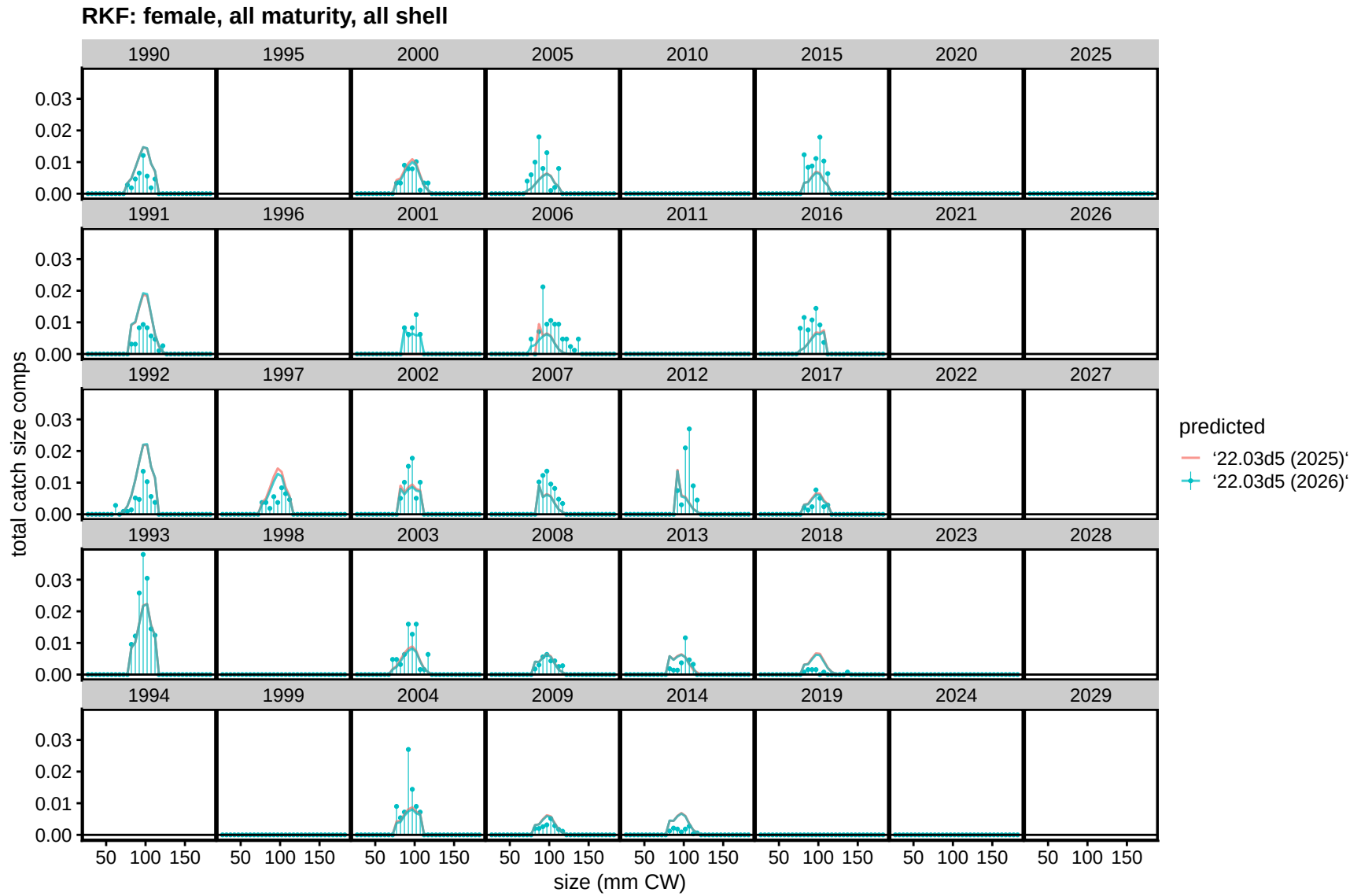


Figure 105. TCSAM02 models fits to total catch size compositions in the RKF fishery.

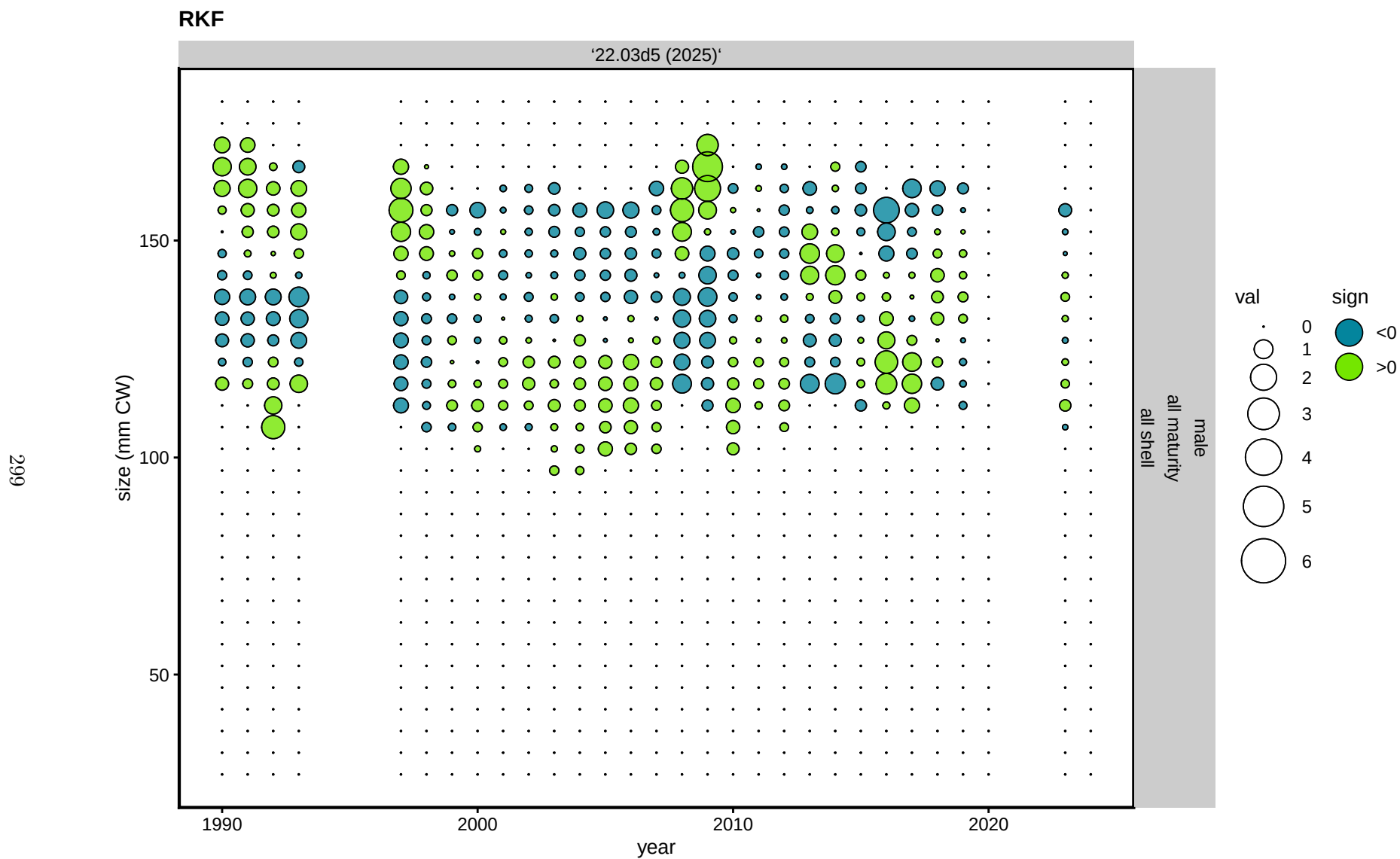


Figure 106. Pearson's residuals for fits to total catch size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X' to facilitate identification.

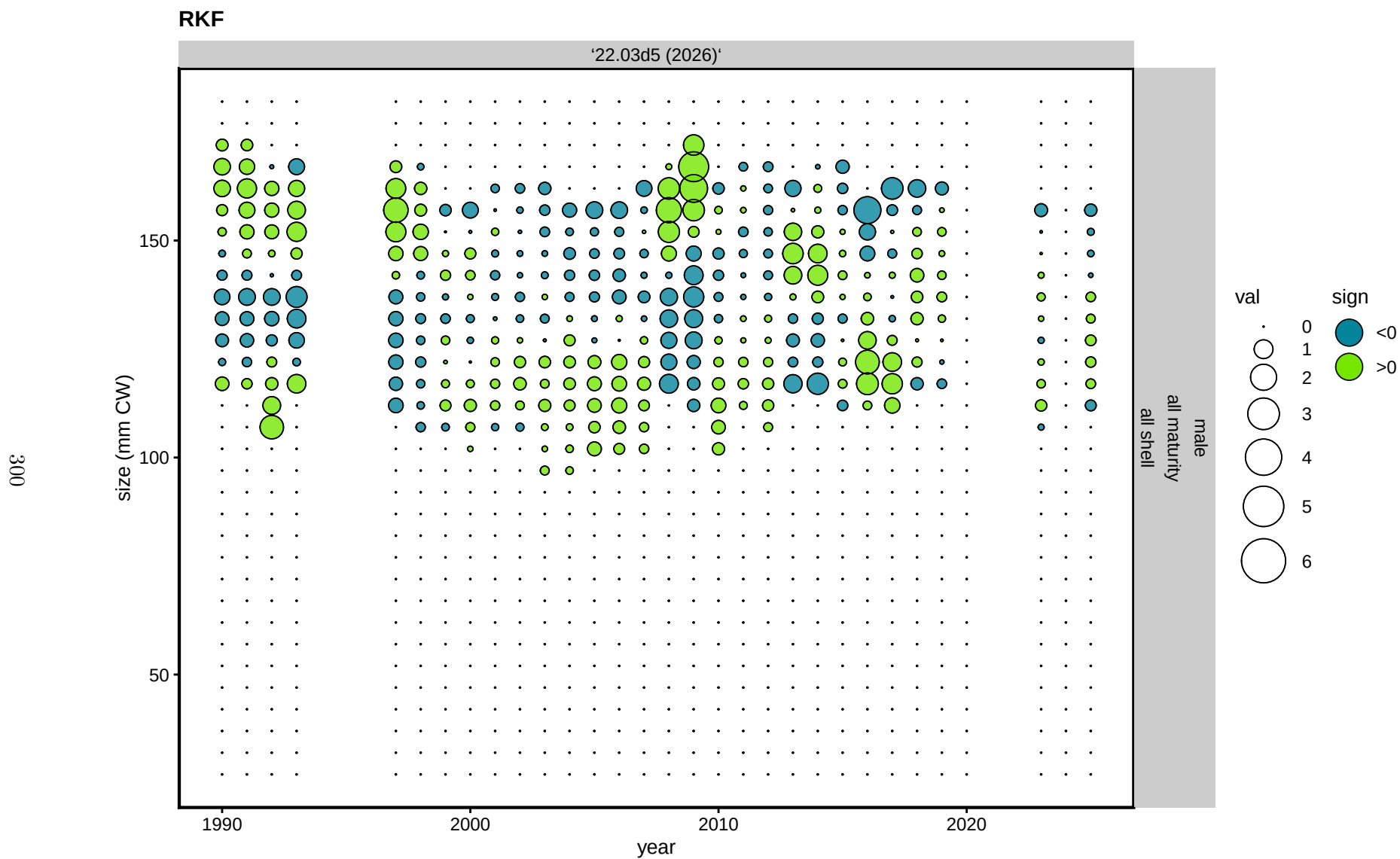


Figure 107. Pearson's residuals for fits to total catch size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X' to facilitate identification.

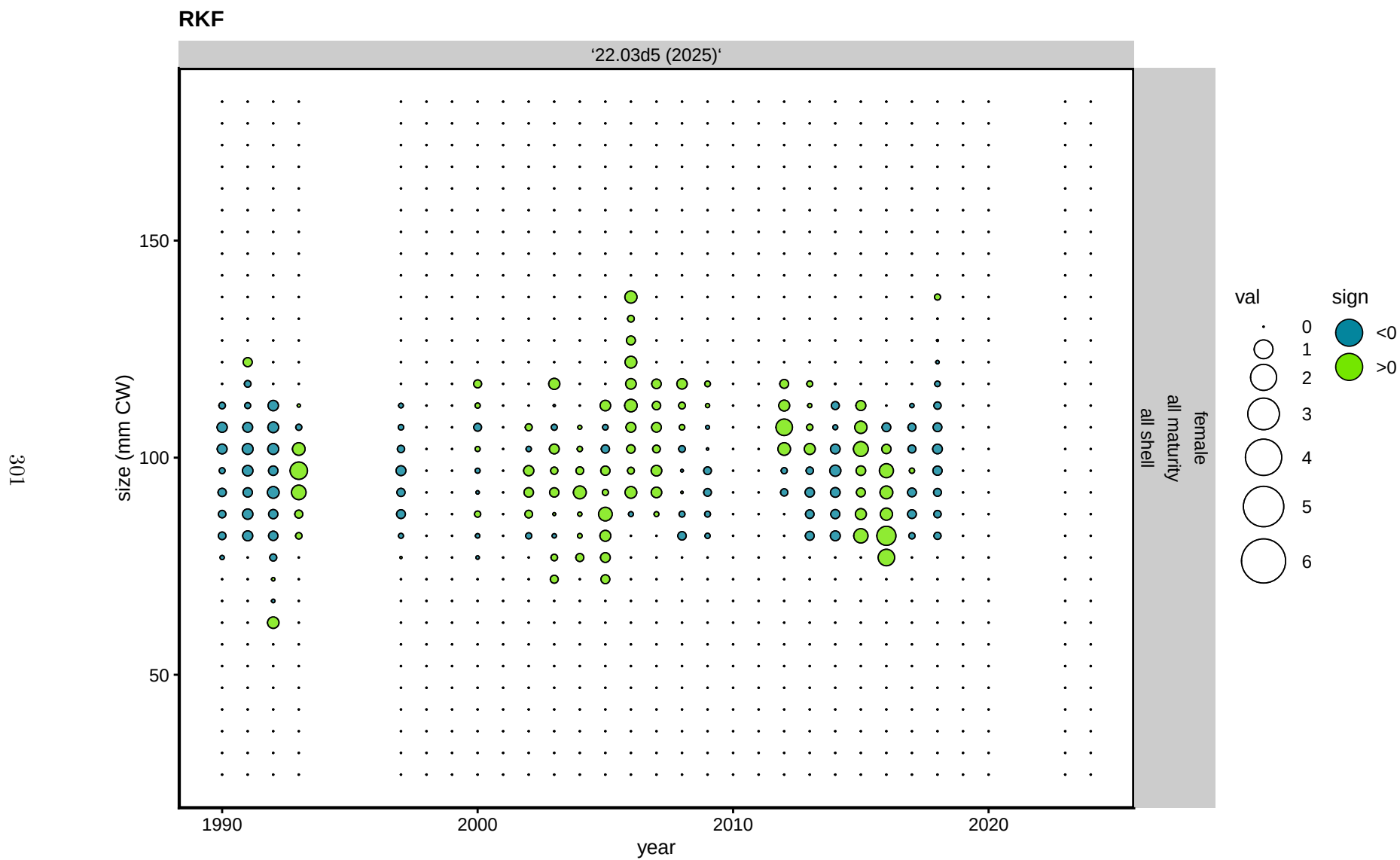


Figure 108. Pearson's residuals for fits to total catch size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X' to facilitate identification.



Figure 109. Pearson's residuals for fits to total catch size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X' to facilitate identification.

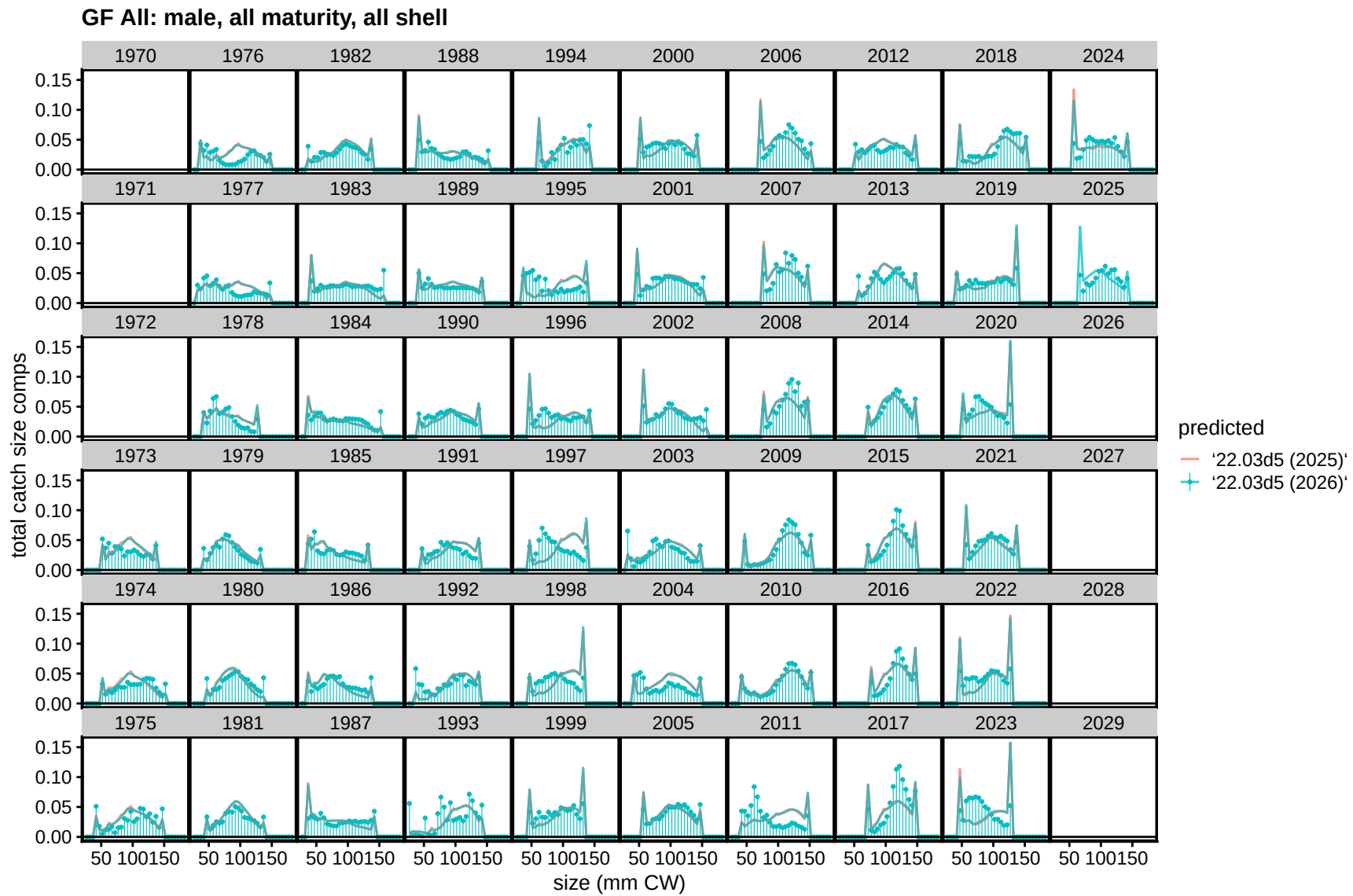


Figure 110. TCSAM02 models fits to total catch size compositions in the GF All fishery.

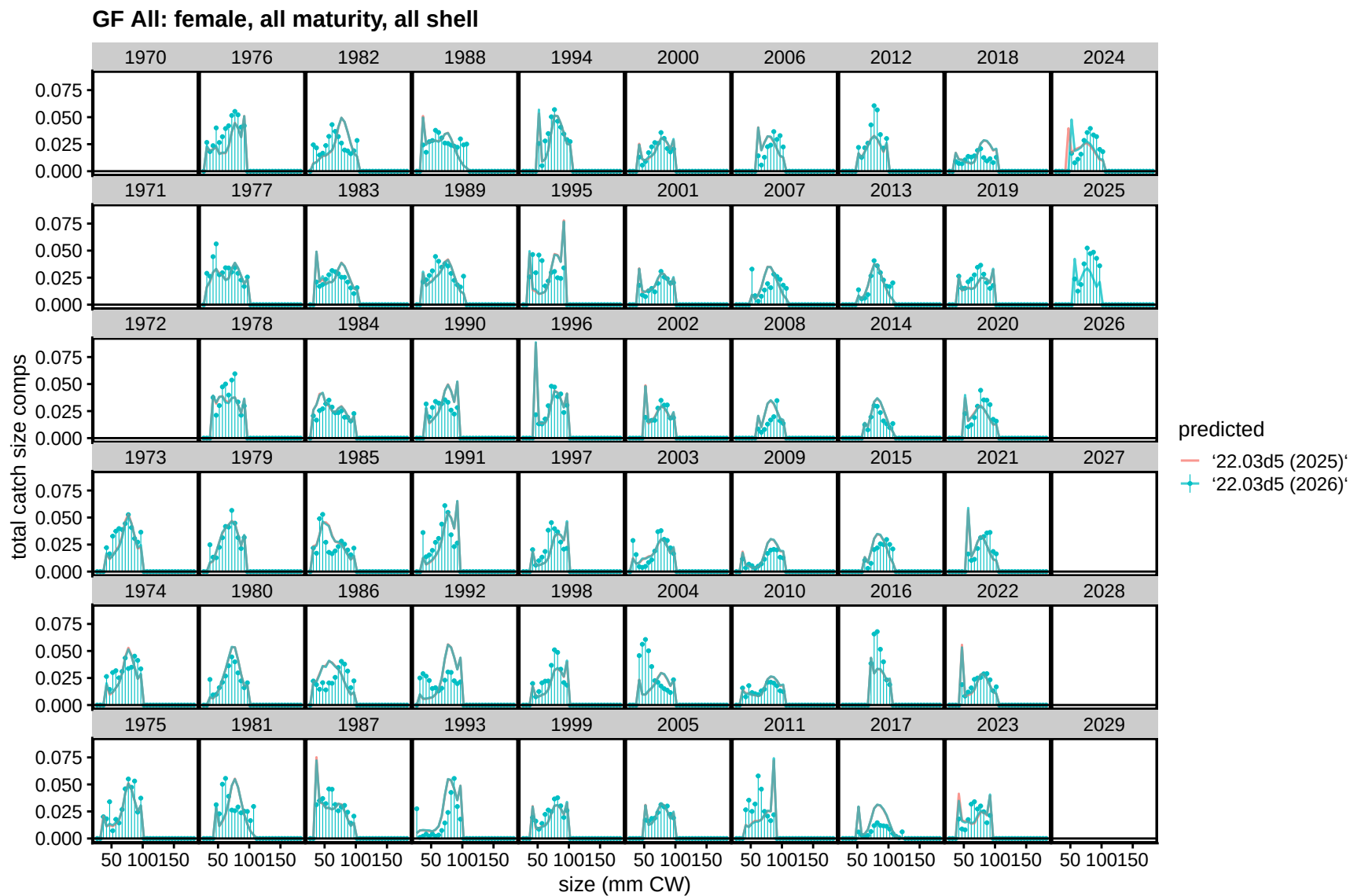


Figure 111. TCSAM02 models fits to total catch size compositions in the GF All fishery.

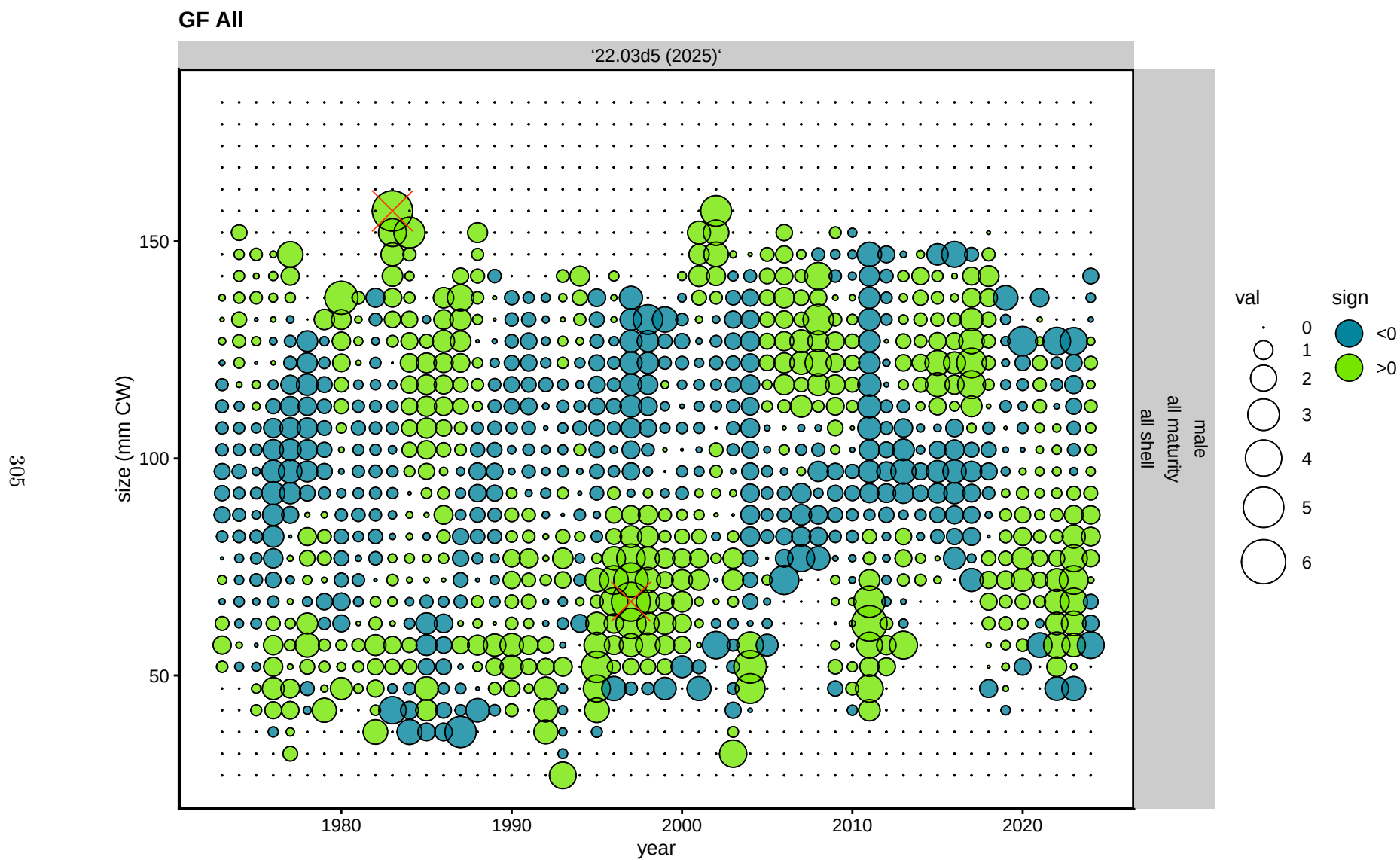


Figure 112. Pearson's residuals for fits to total catch size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X' to facilitate identification.

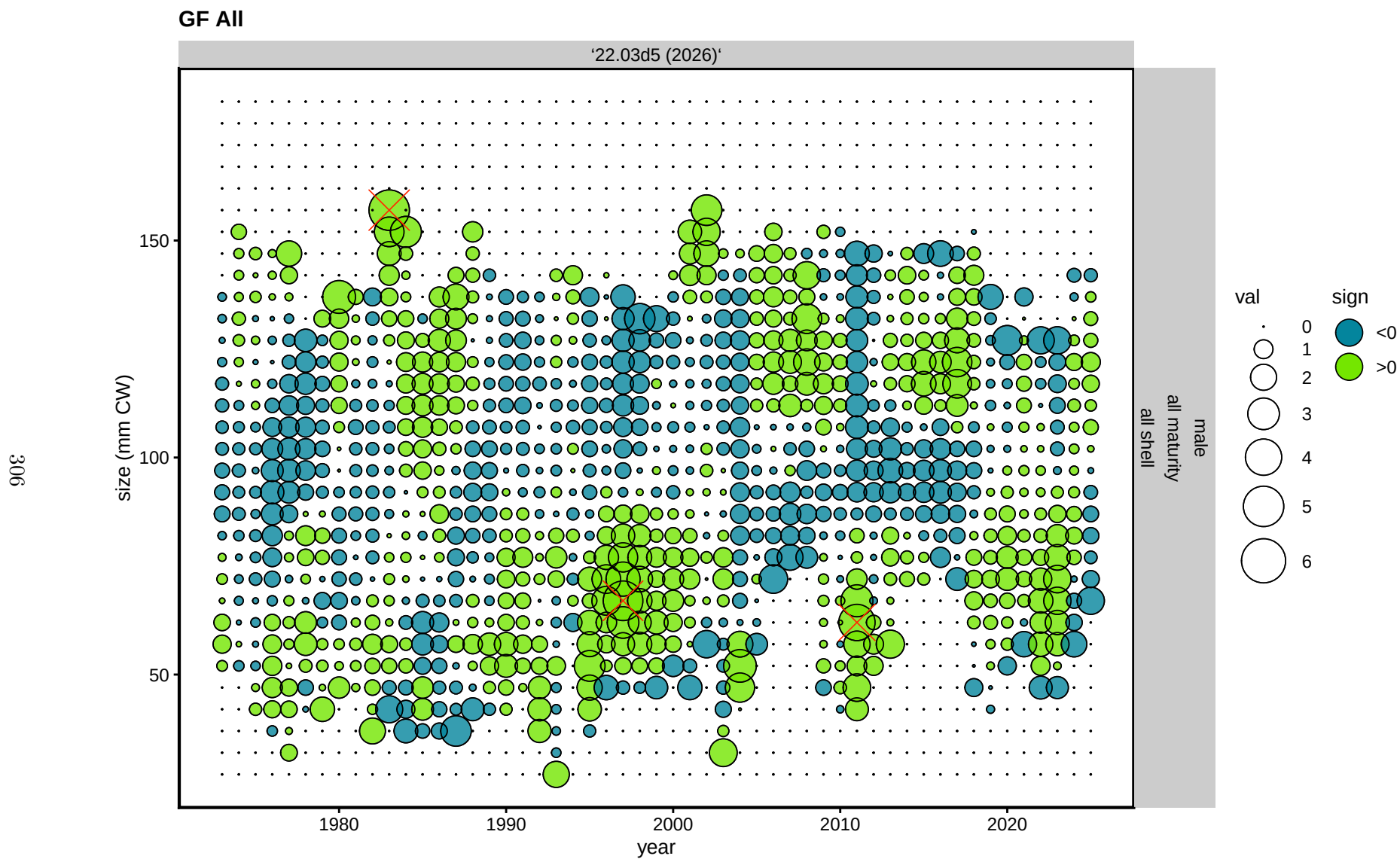


Figure 113. Pearson's residuals for fits to total catch size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X' to facilitate identification.

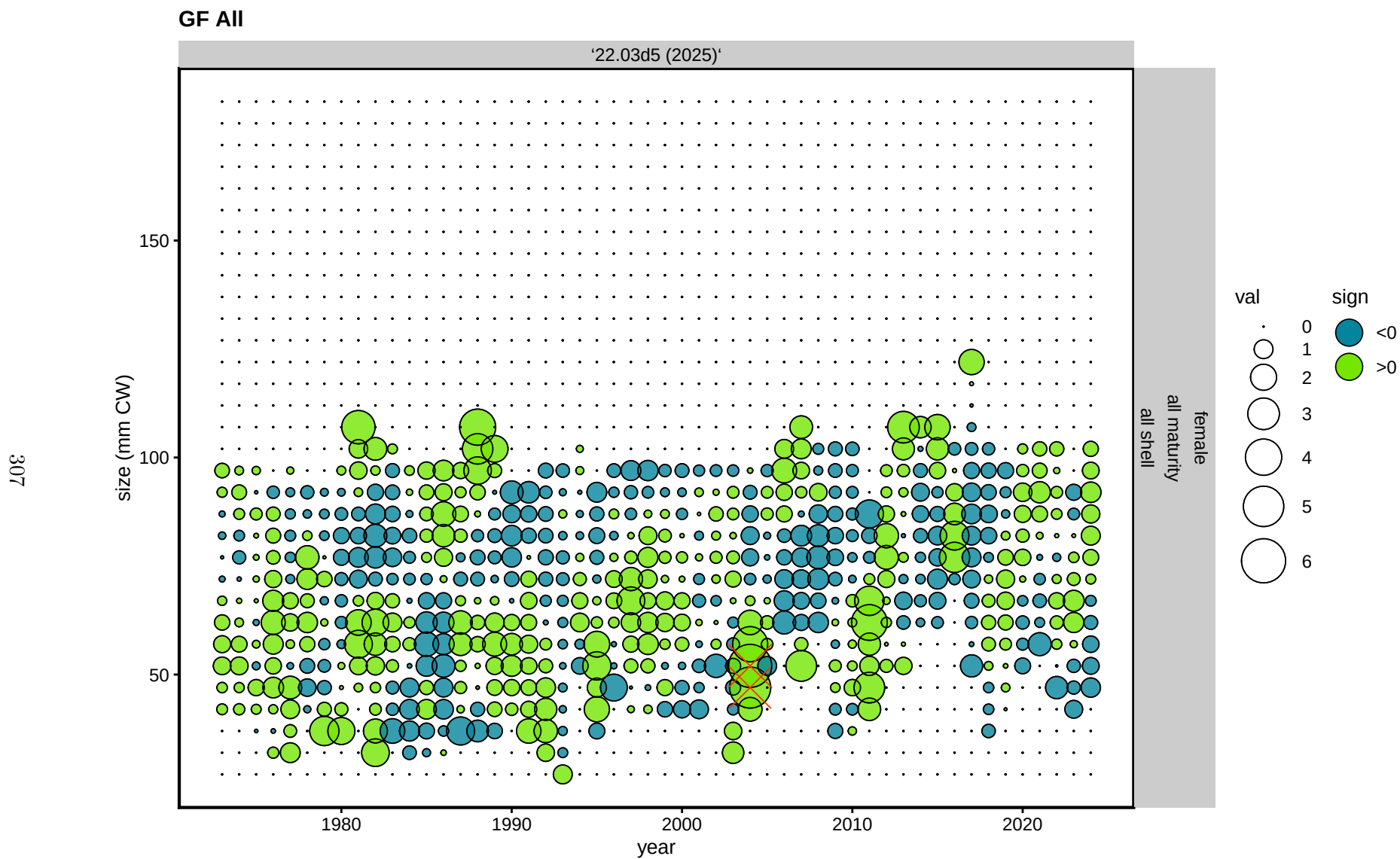


Figure 114. Pearson's residuals for fits to total catch size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X' to facilitate identification.

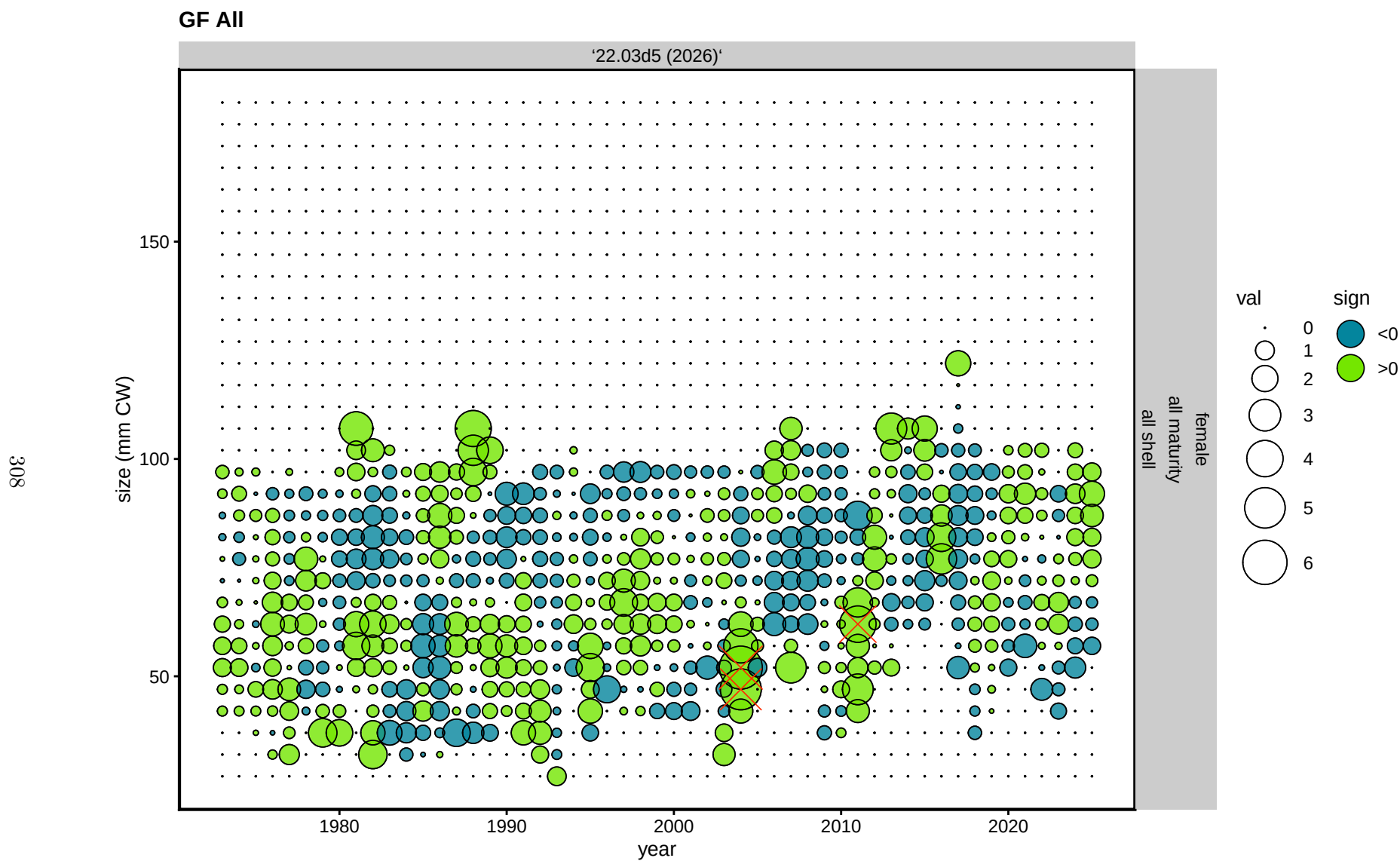


Figure 115. Pearson's residuals for fits to total catch size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X' to facilitate identification.

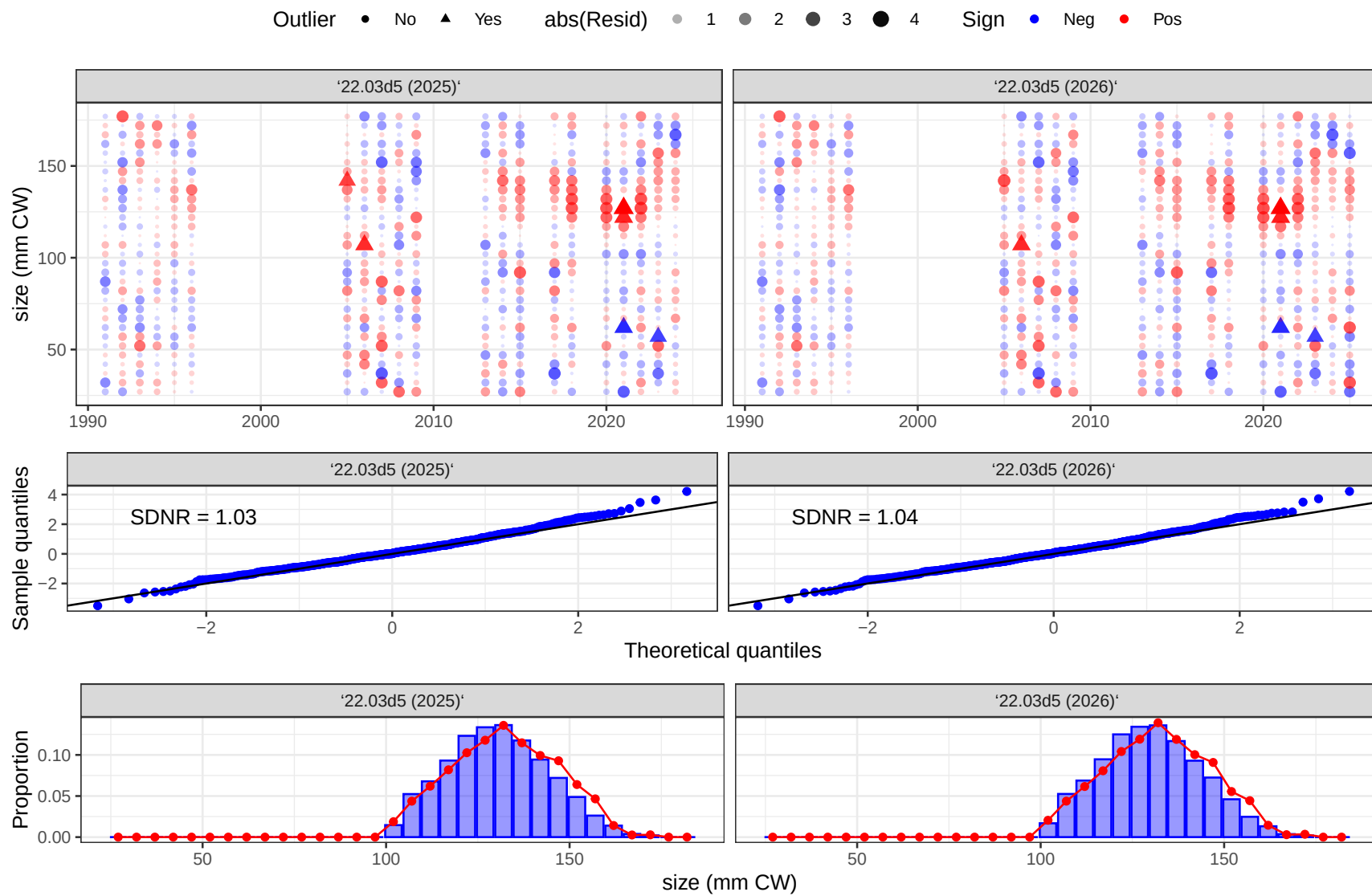


Figure 116. OSA residuals for TCSAM02 models fit to male size compositions from the TCF fishery.

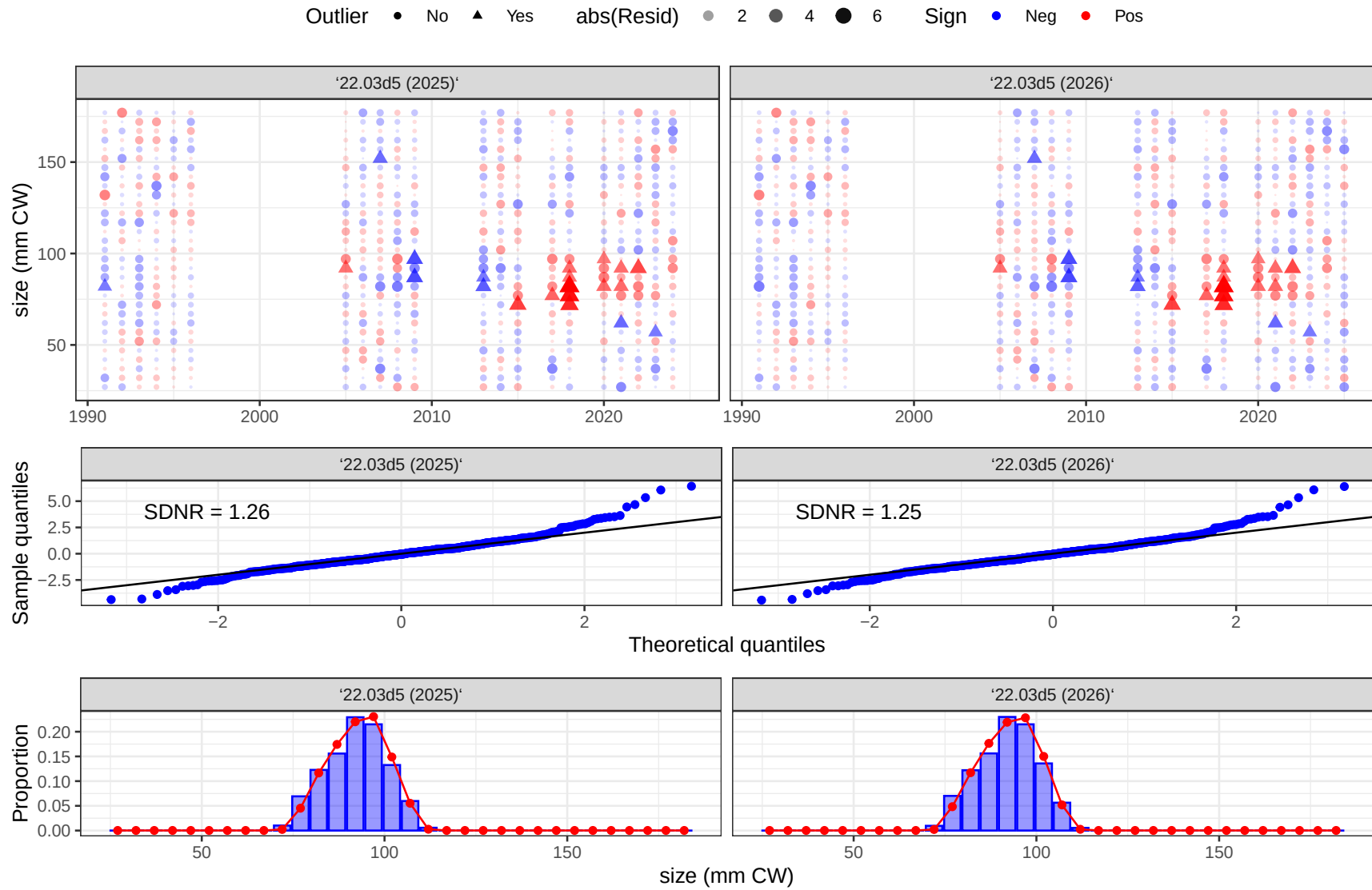


Figure 117. OSA residuals for TCSAM02 models fit to female size compositions from the TCF fishery.

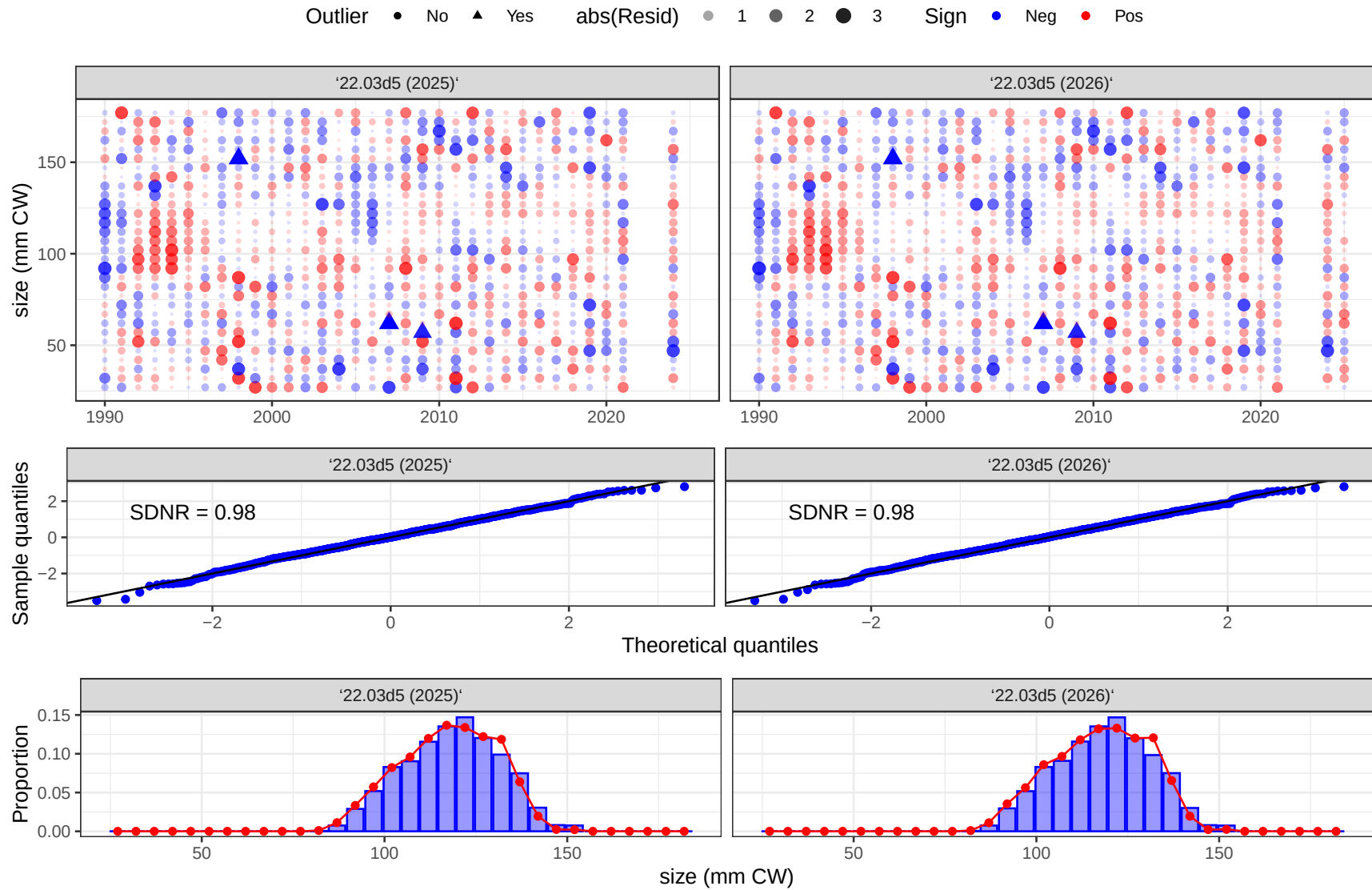


Figure 118. OSA residuals for TCSAM02 models fit to male size compositions from the SCF fishery.

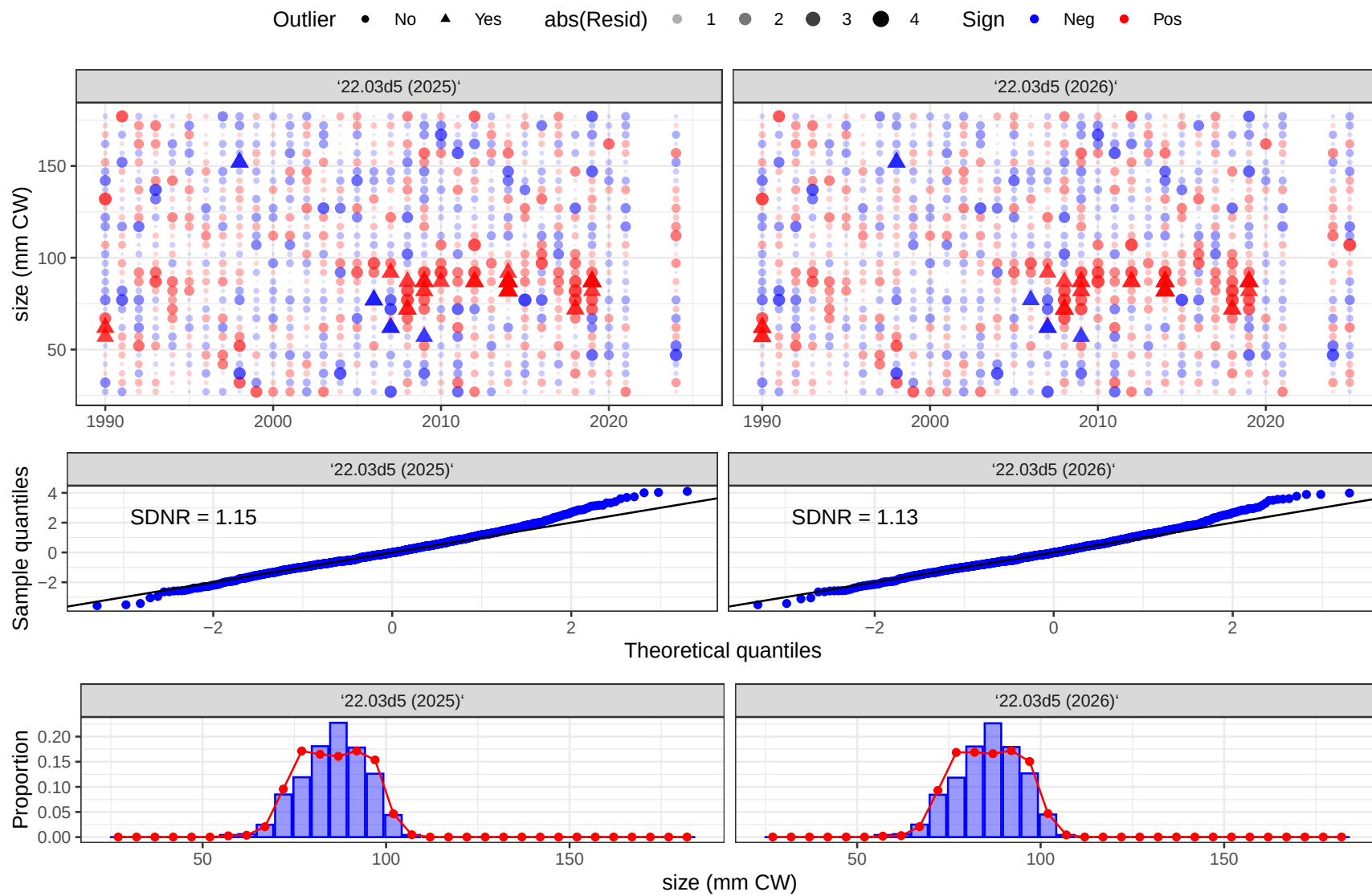


Figure 119. OSA residuals for TCSAM02 models fit to female size compositions from the SCF fishery.

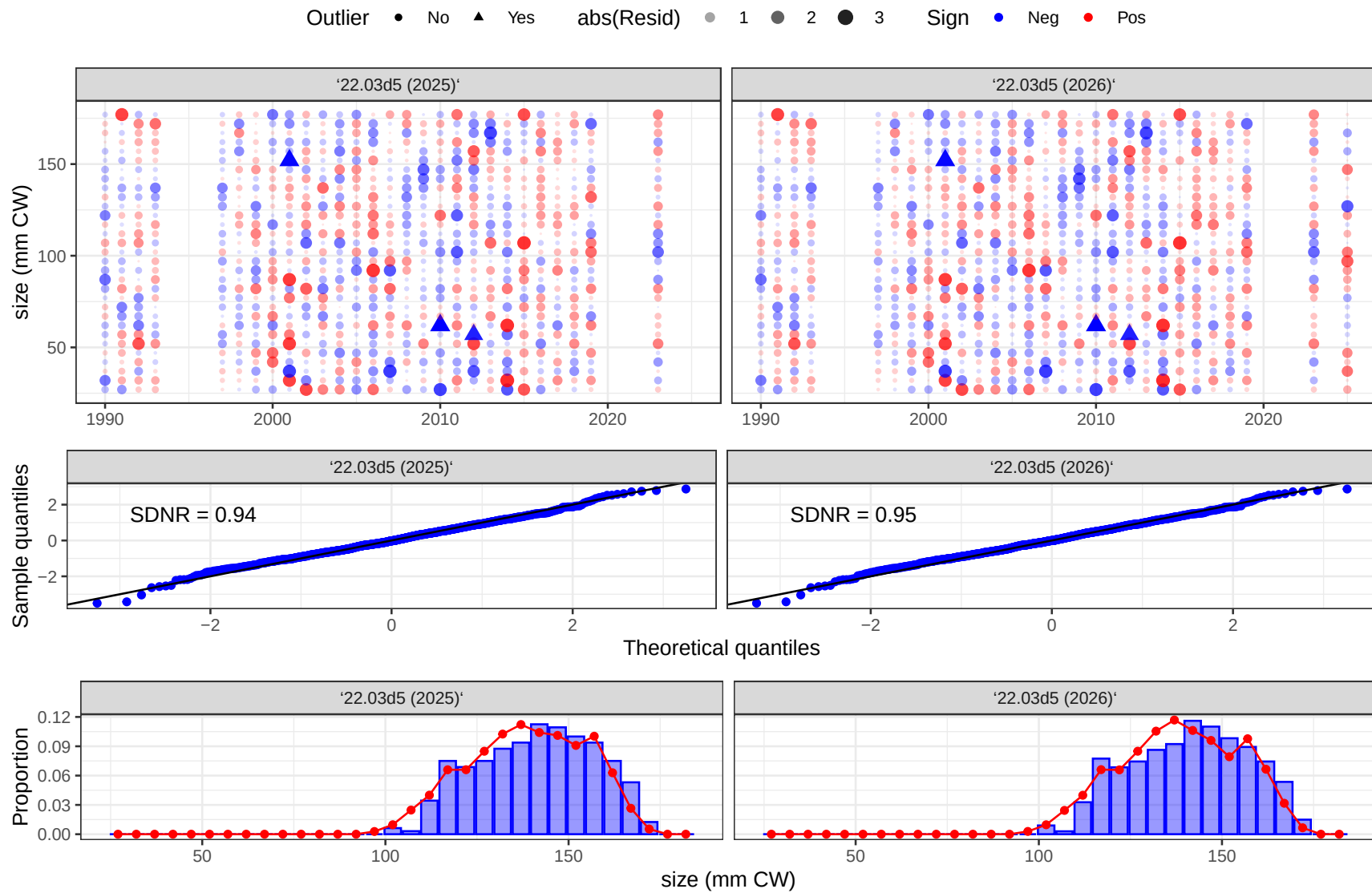


Figure 120. OSA residuals for TCSAM02 models fit to male size compositions from the RKF fishery.

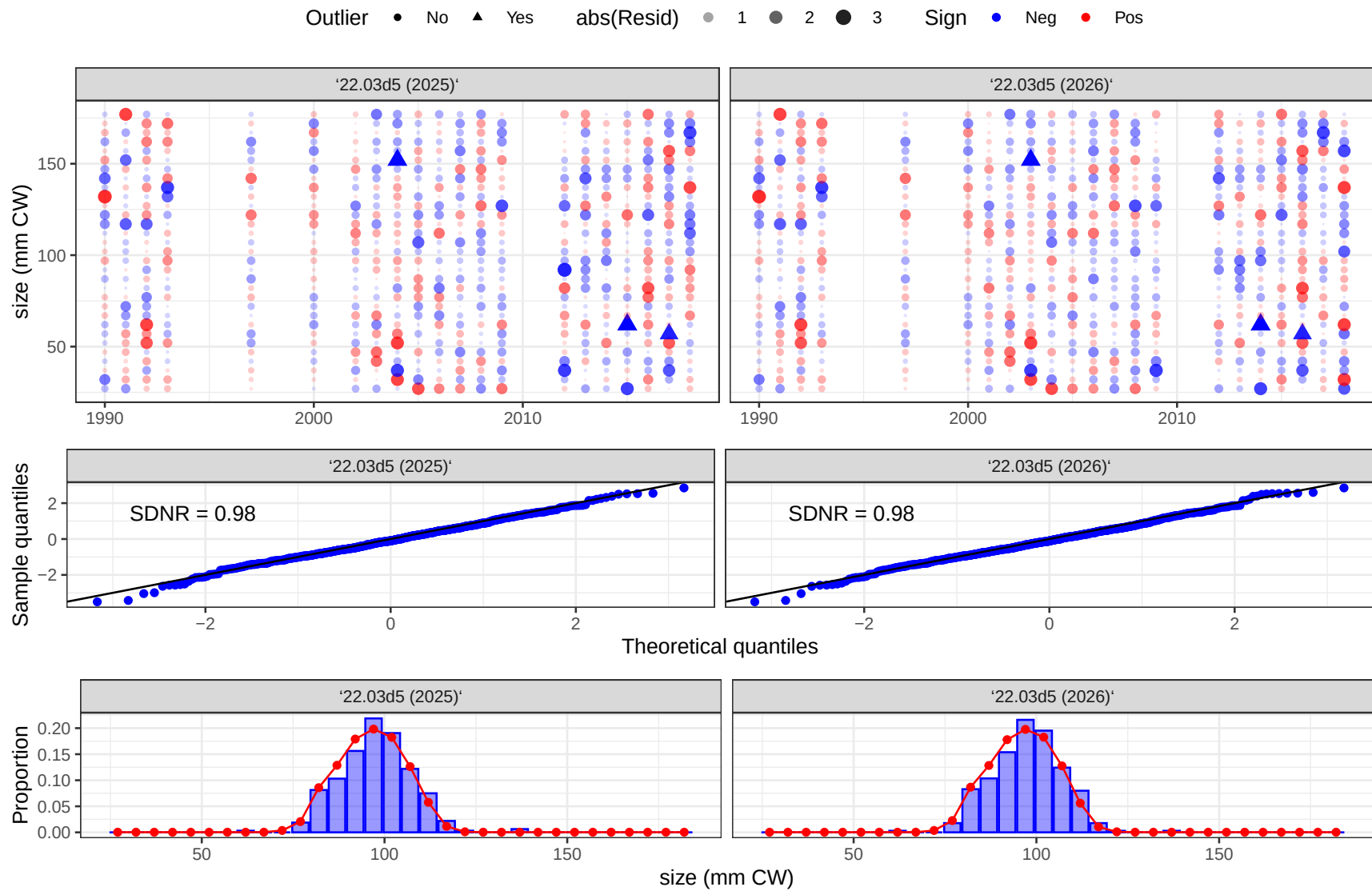


Figure 121. OSA residuals for TCSAM02 models fit to female size compositions from the RKF fishery.

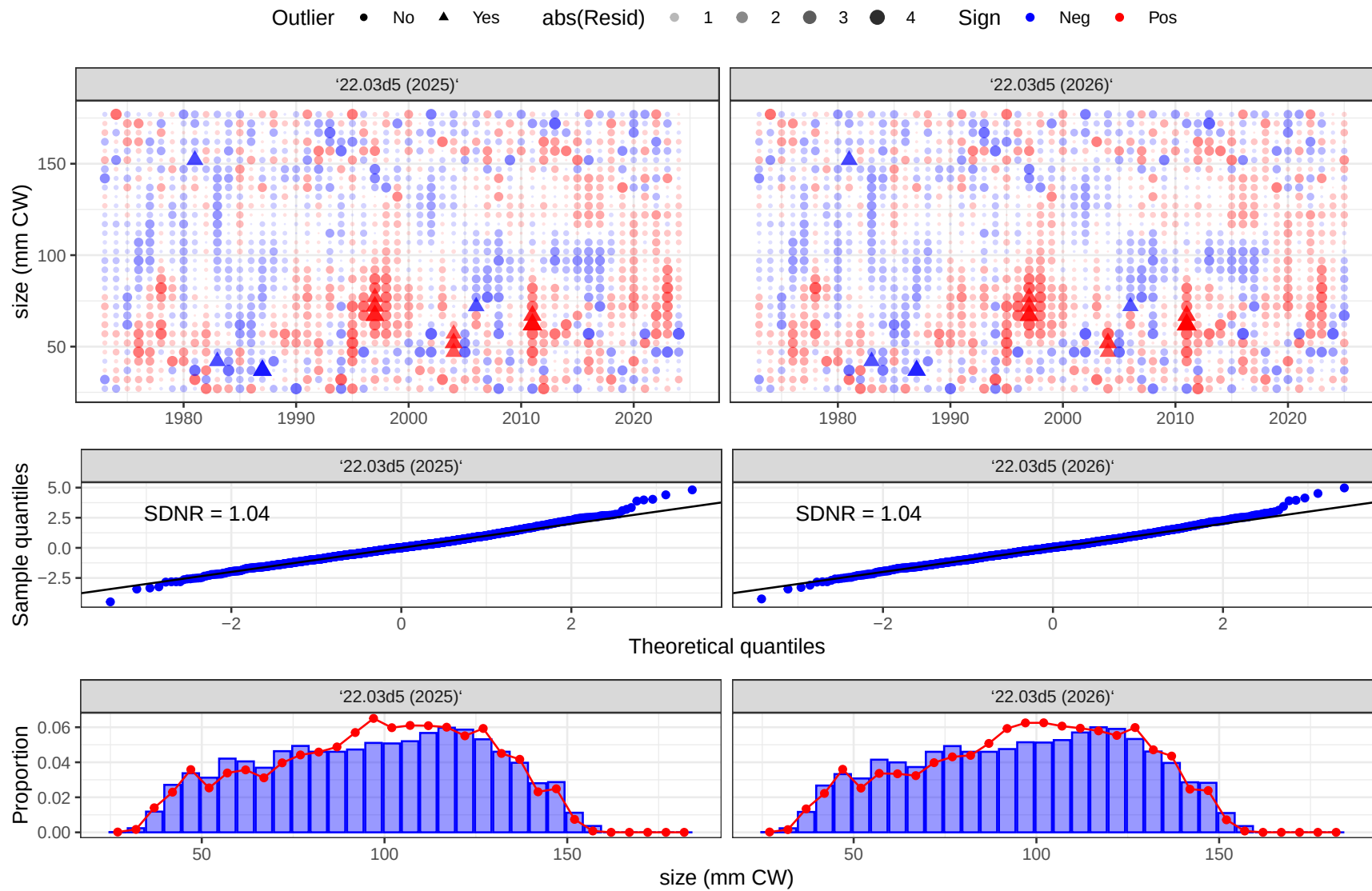


Figure 122. OSA residuals for TCSAM02 models fit to male size compositions from the GF All fishery.

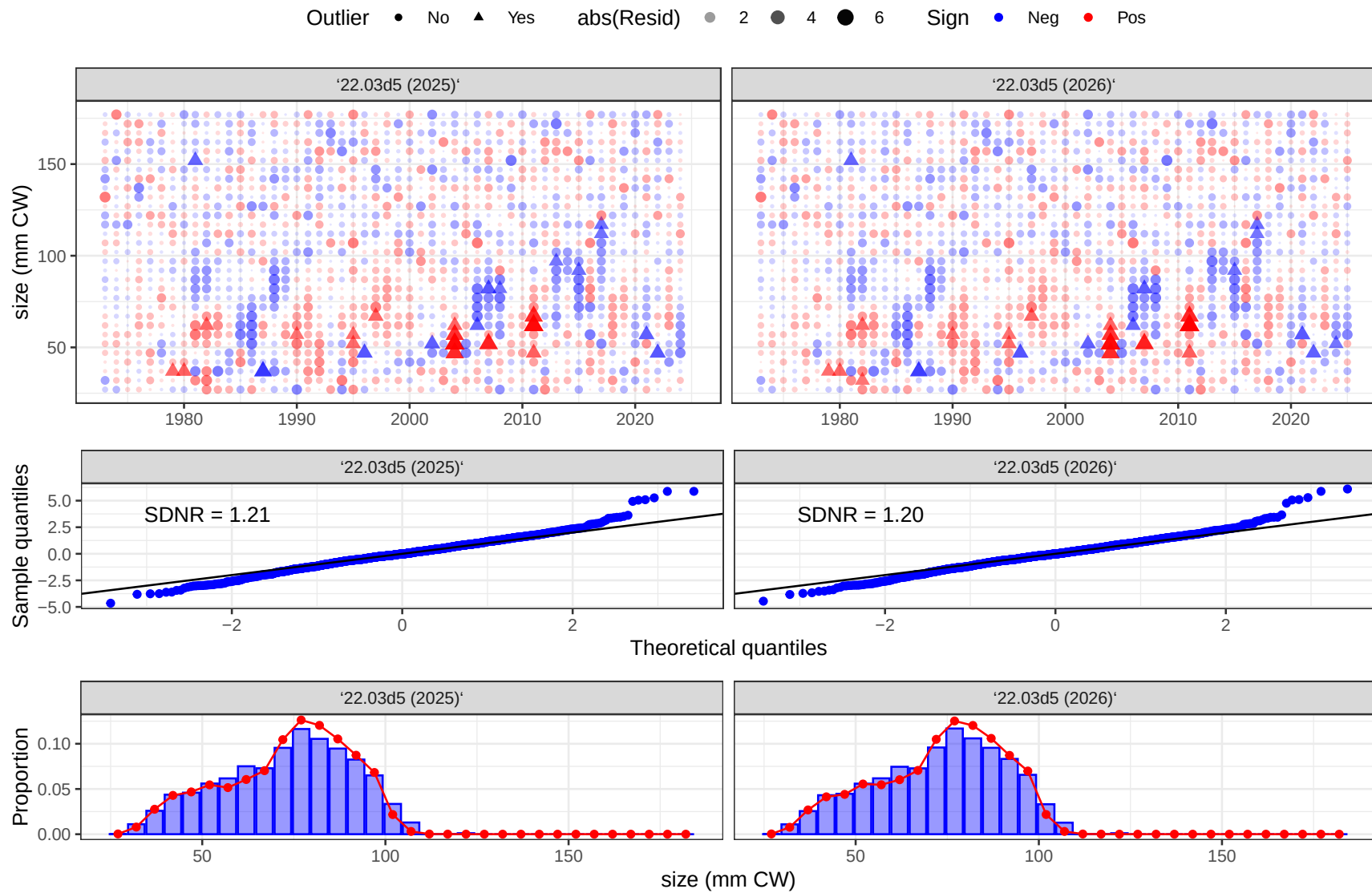


Figure 123. OSA residuals for TCSAM02 models fit to female size compositions from the GF All fishery.

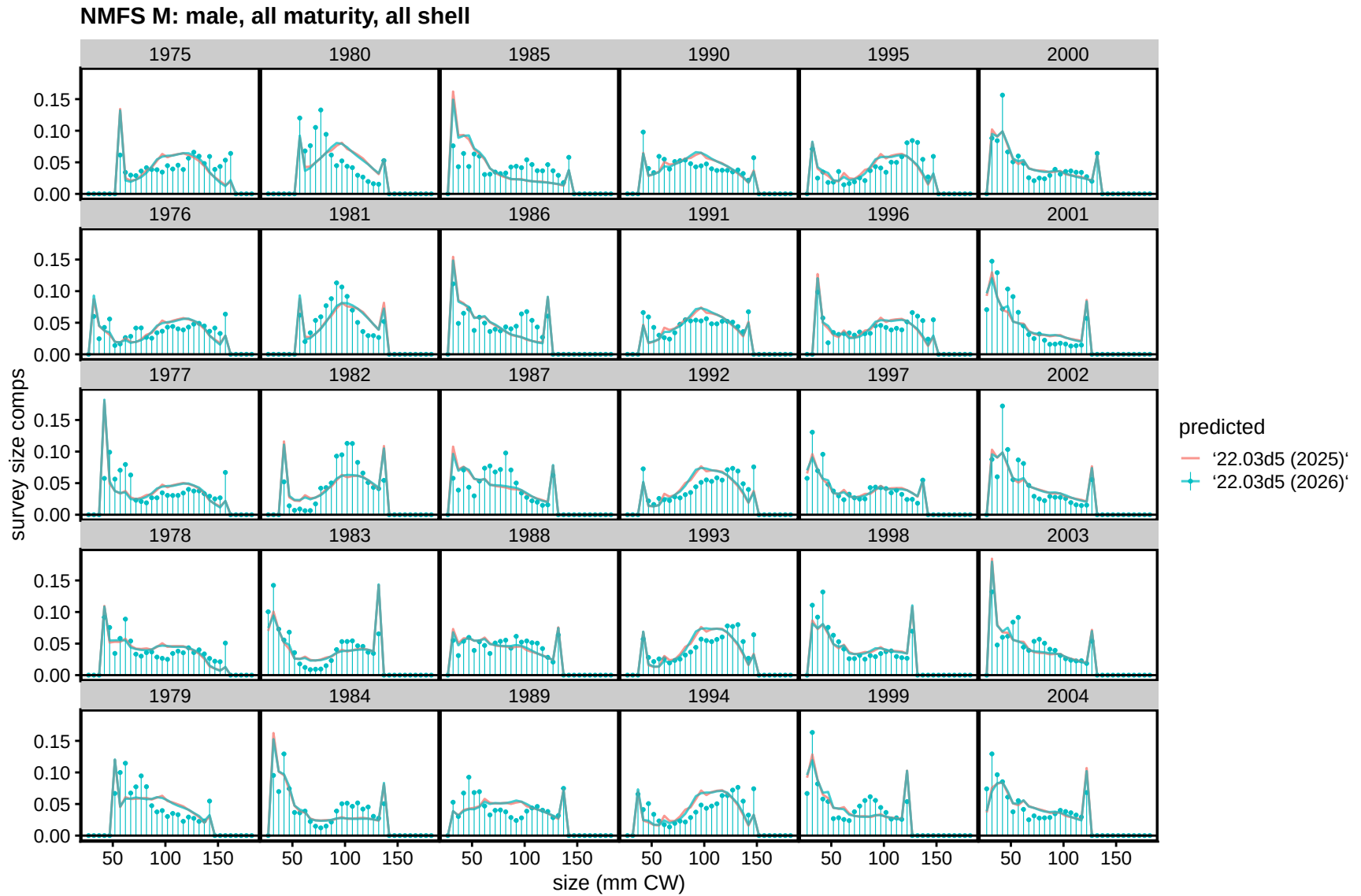


Figure 124. TCSAM02 models fits to survey size compositions in the NMFS M survey. Preferred model is 22.03d5 (2026).

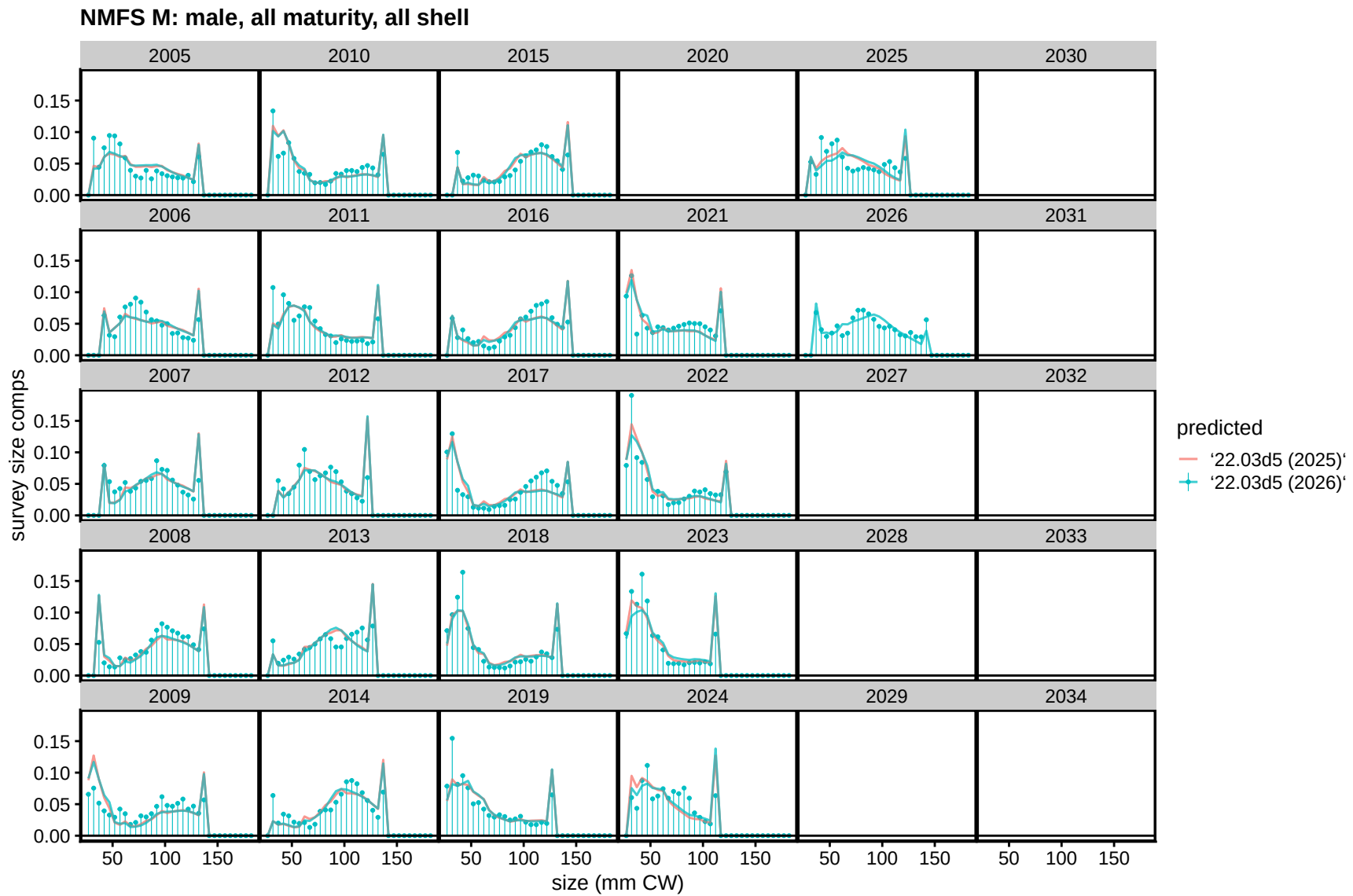


Figure 125. TCSAM02 models fits to survey size compositions in the NMFS M survey. Preferred model is 22.03d5 (2026).

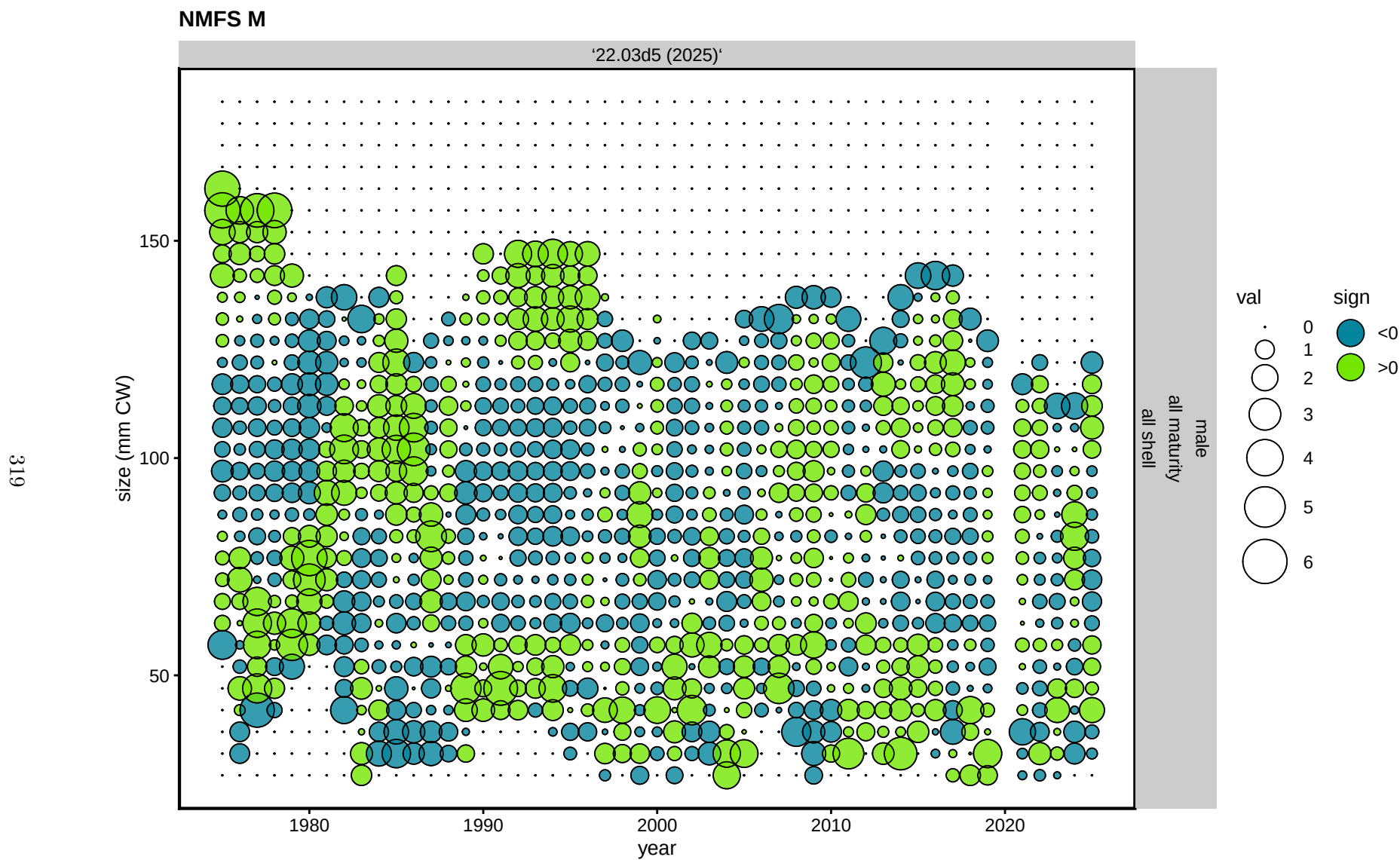


Figure 126. Pearson's residuals for fits to survey size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X' to facilitate identification.

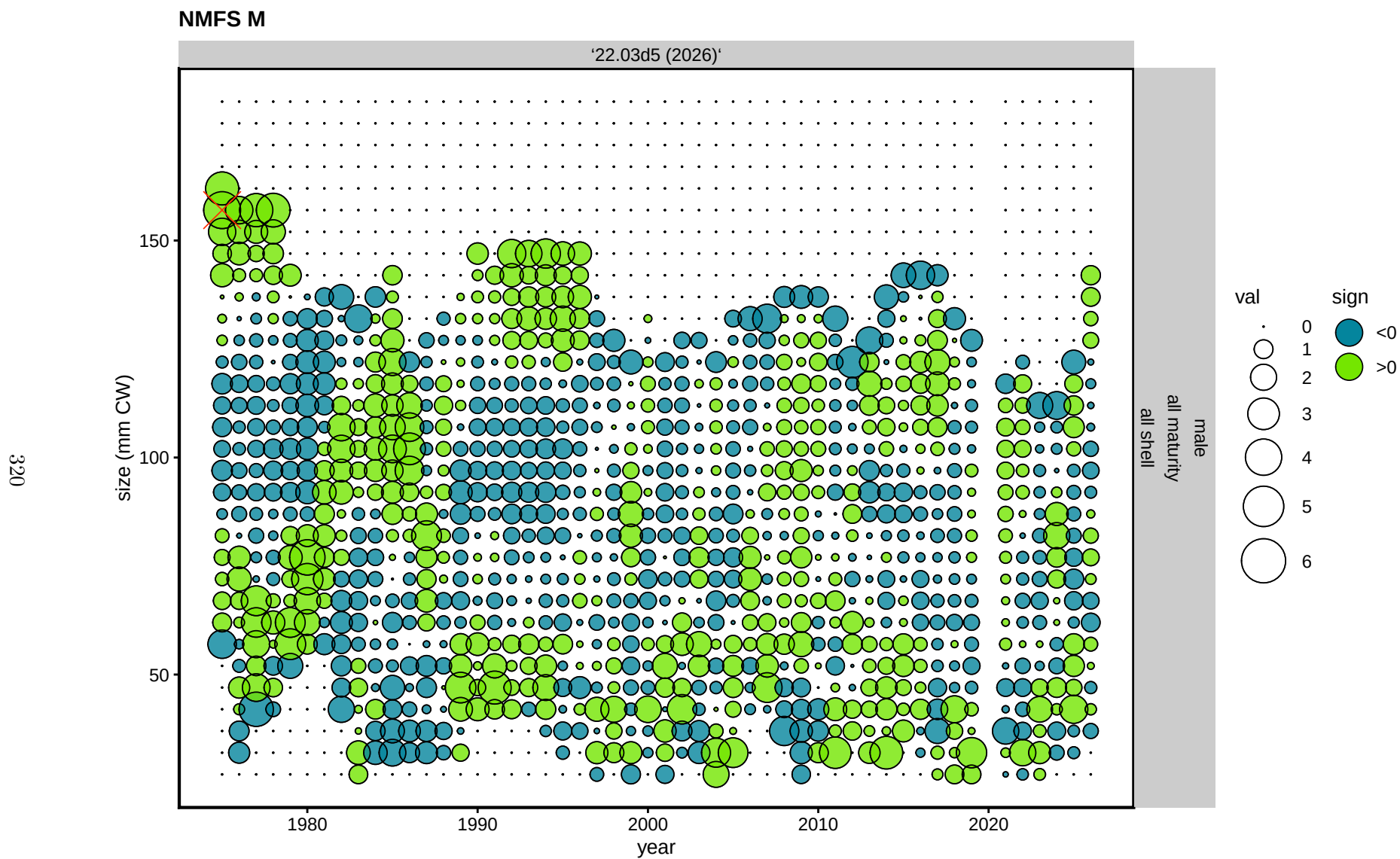


Figure 127. Pearson's residuals for fits to survey size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X' to facilitate identification.

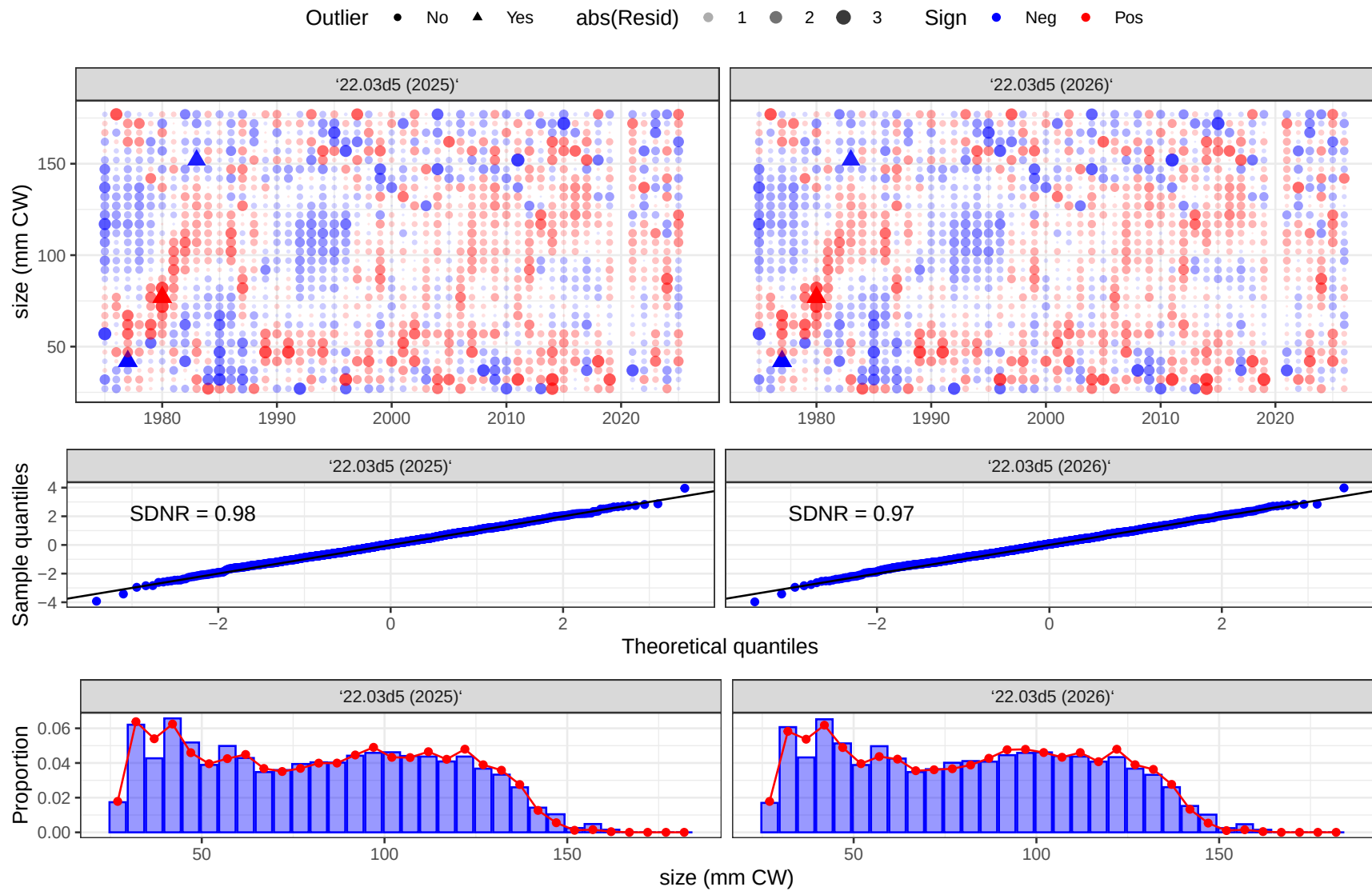


Figure 128. OSA residuals for fits to size compositions from the NMFS_M survey. The base/preferred model is 22.03d5.

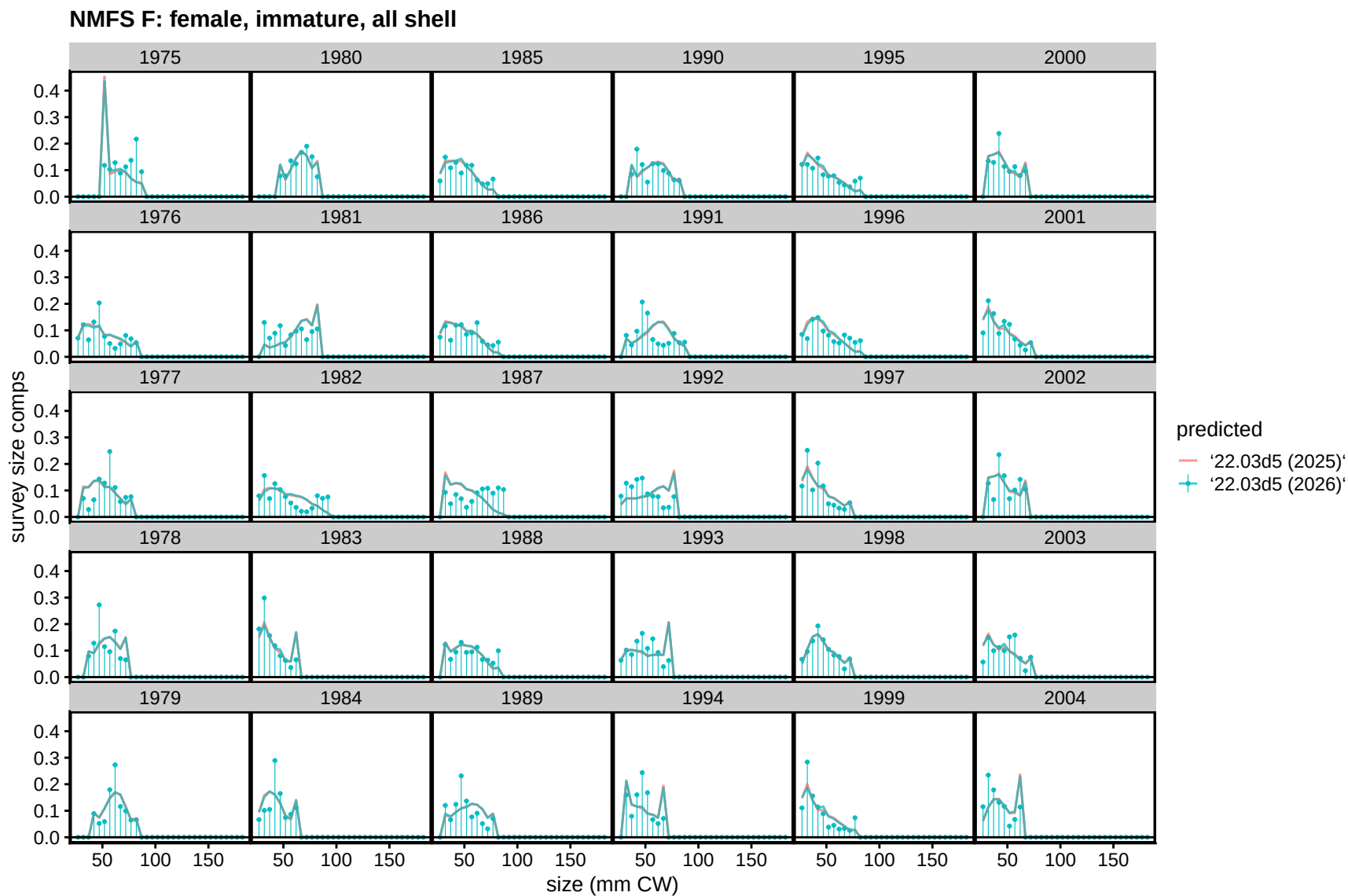


Figure 129. TCSAM02 models fits to survey size compositions in the NMFS F survey. Preferred model is 22.03d5 (2026).

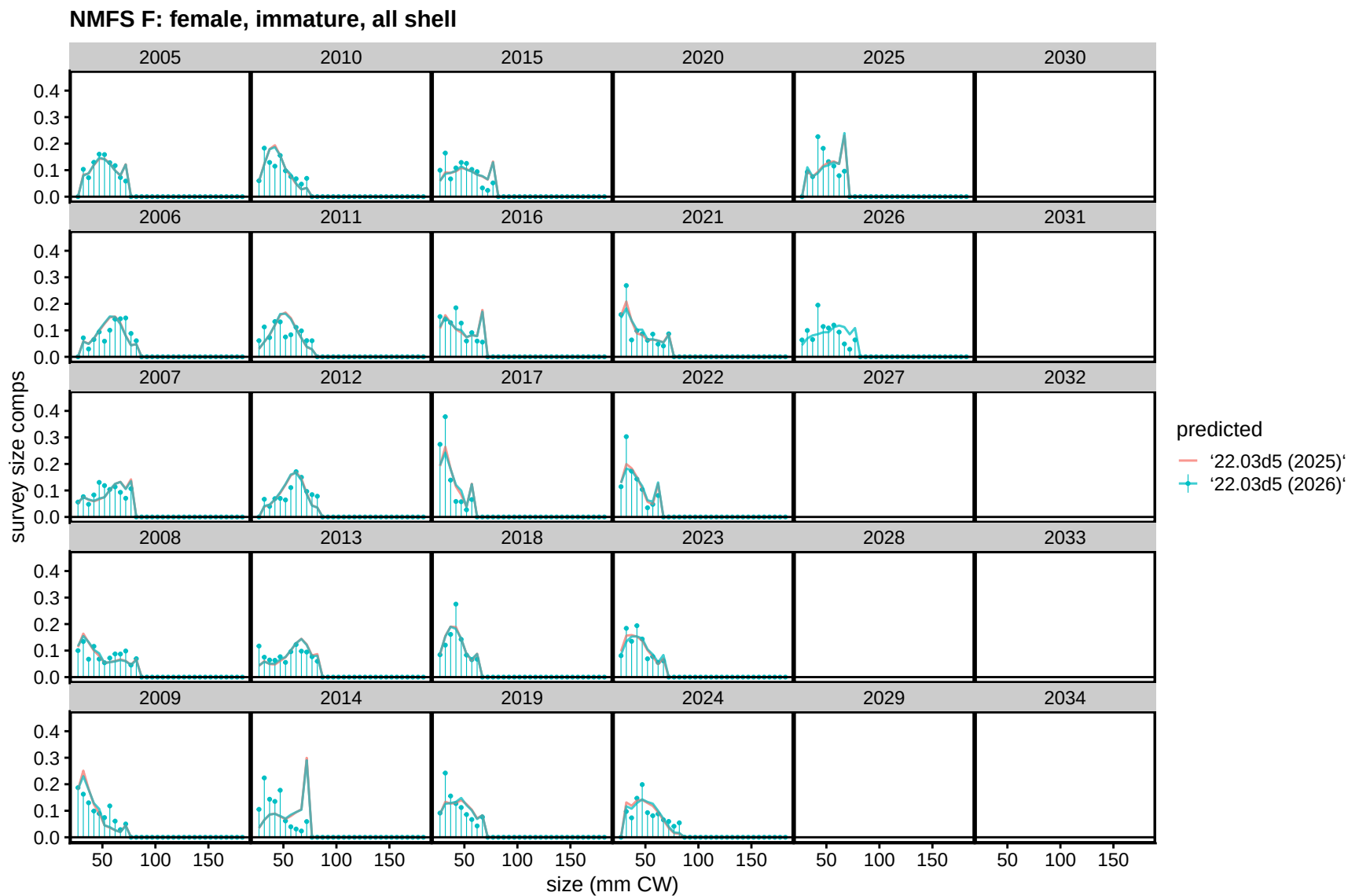


Figure 130. TCSAM02 models fits to survey size compositions in the NMFS F survey. Preferred model is 22.03d5 (2026).

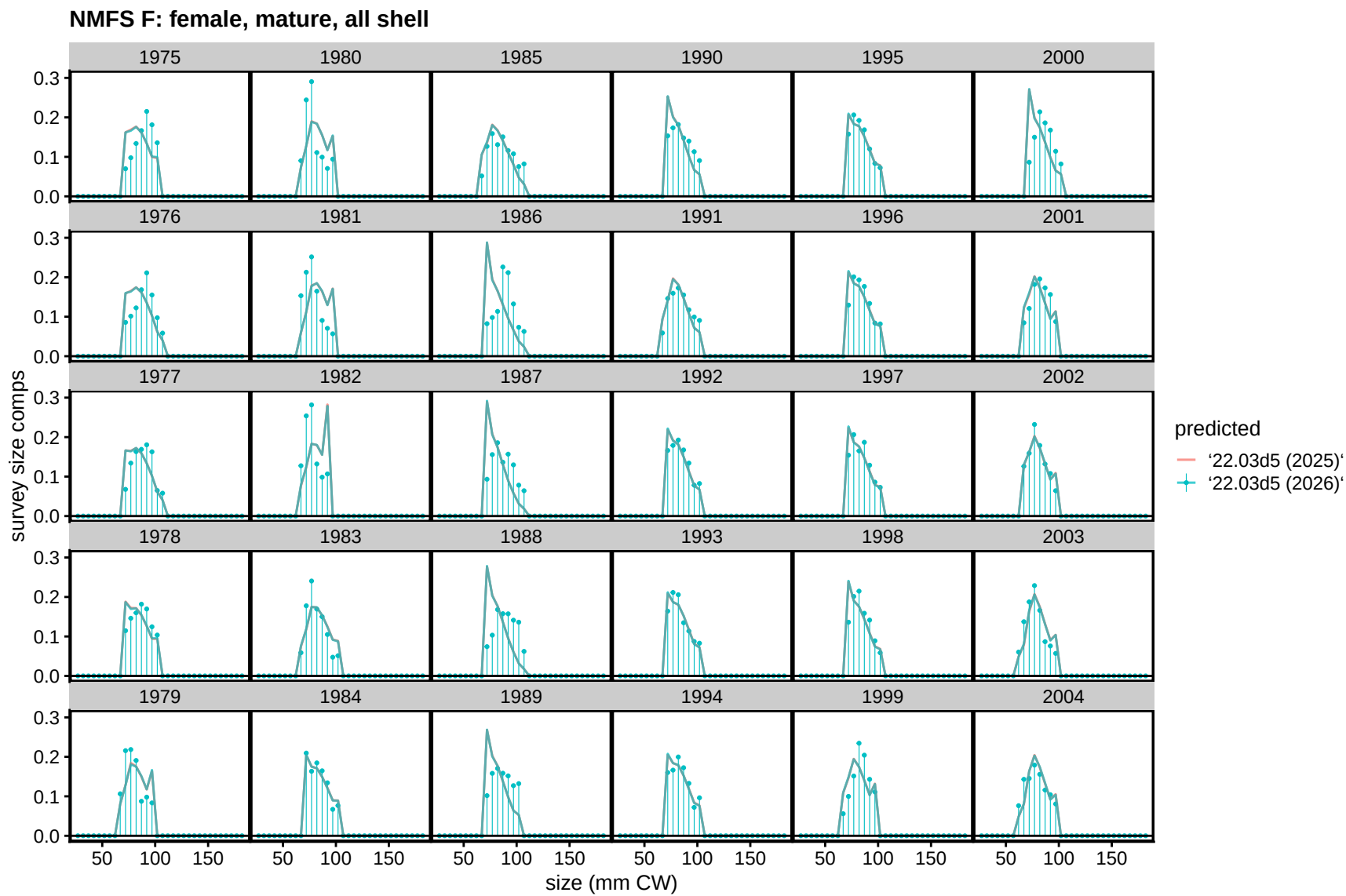


Figure 131. TCSAM02 models fits to survey size compositions in the NMFS F survey. Preferred model is 22.03d5 (2026).

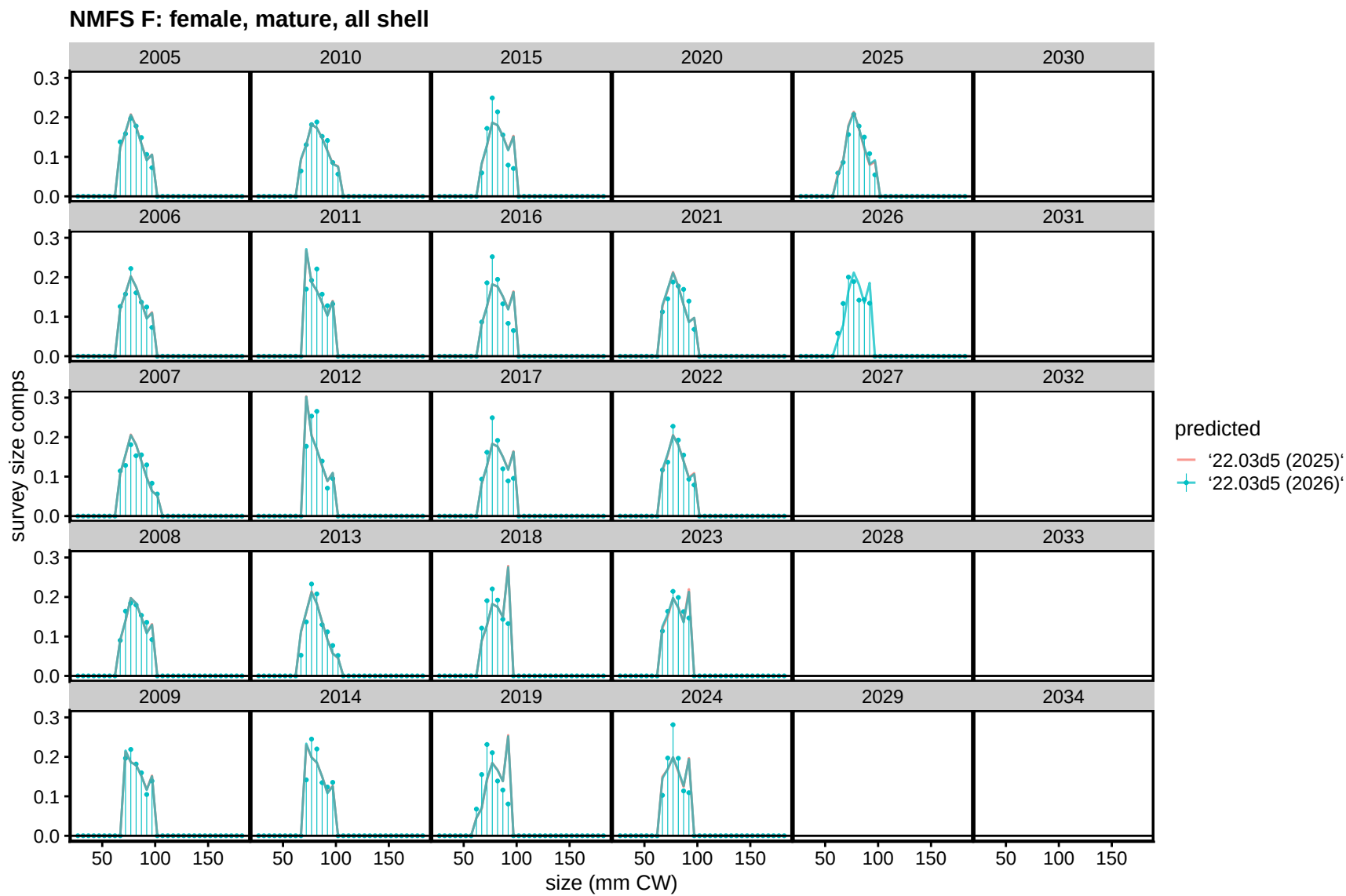


Figure 132. TCSAM02 models fits to survey size compositions in the NMFS F survey. Preferred model is 22.03d5 (2026).

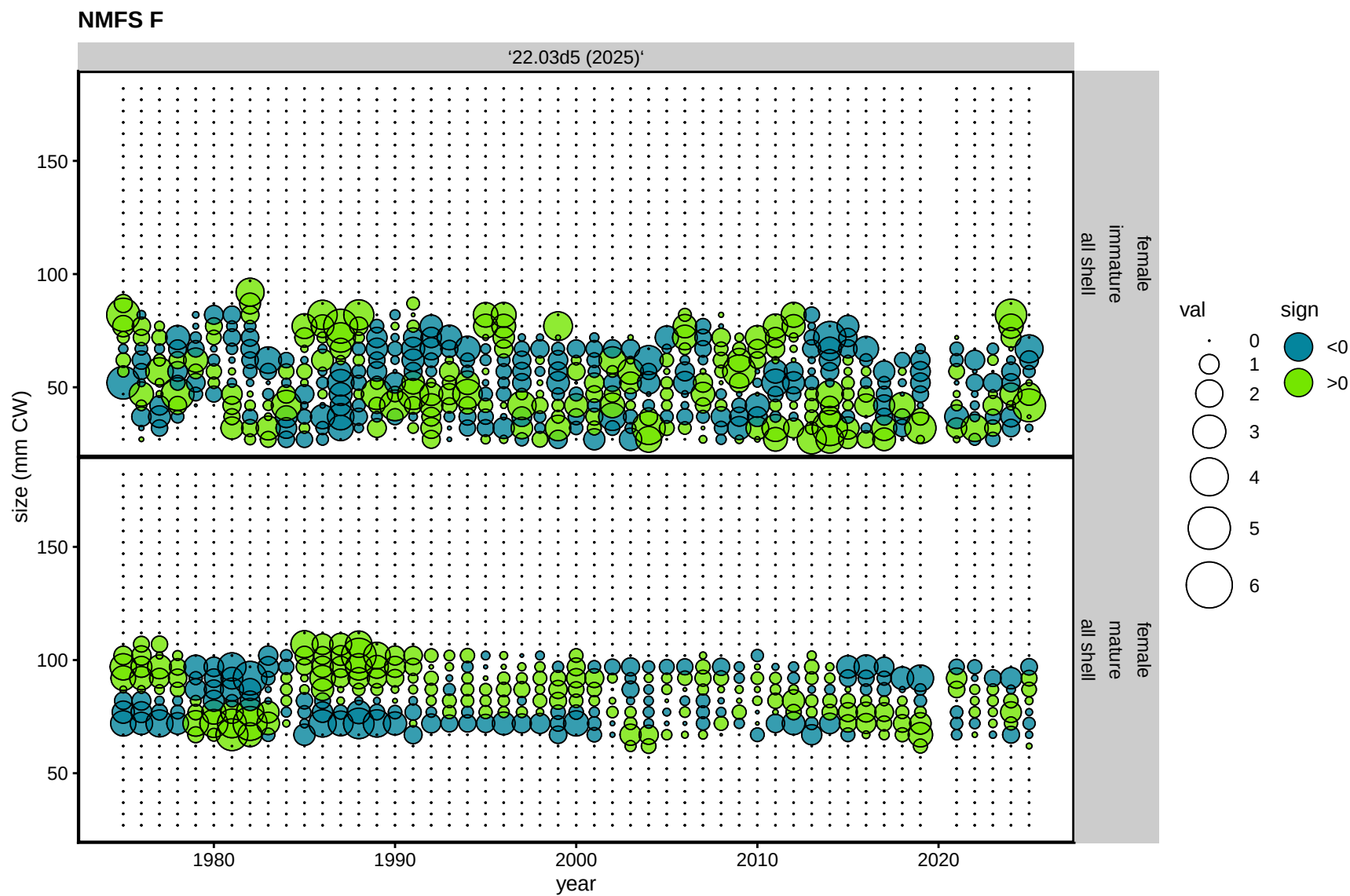


Figure 133. Pearson's residuals for fits to survey size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X' to facilitate identification.

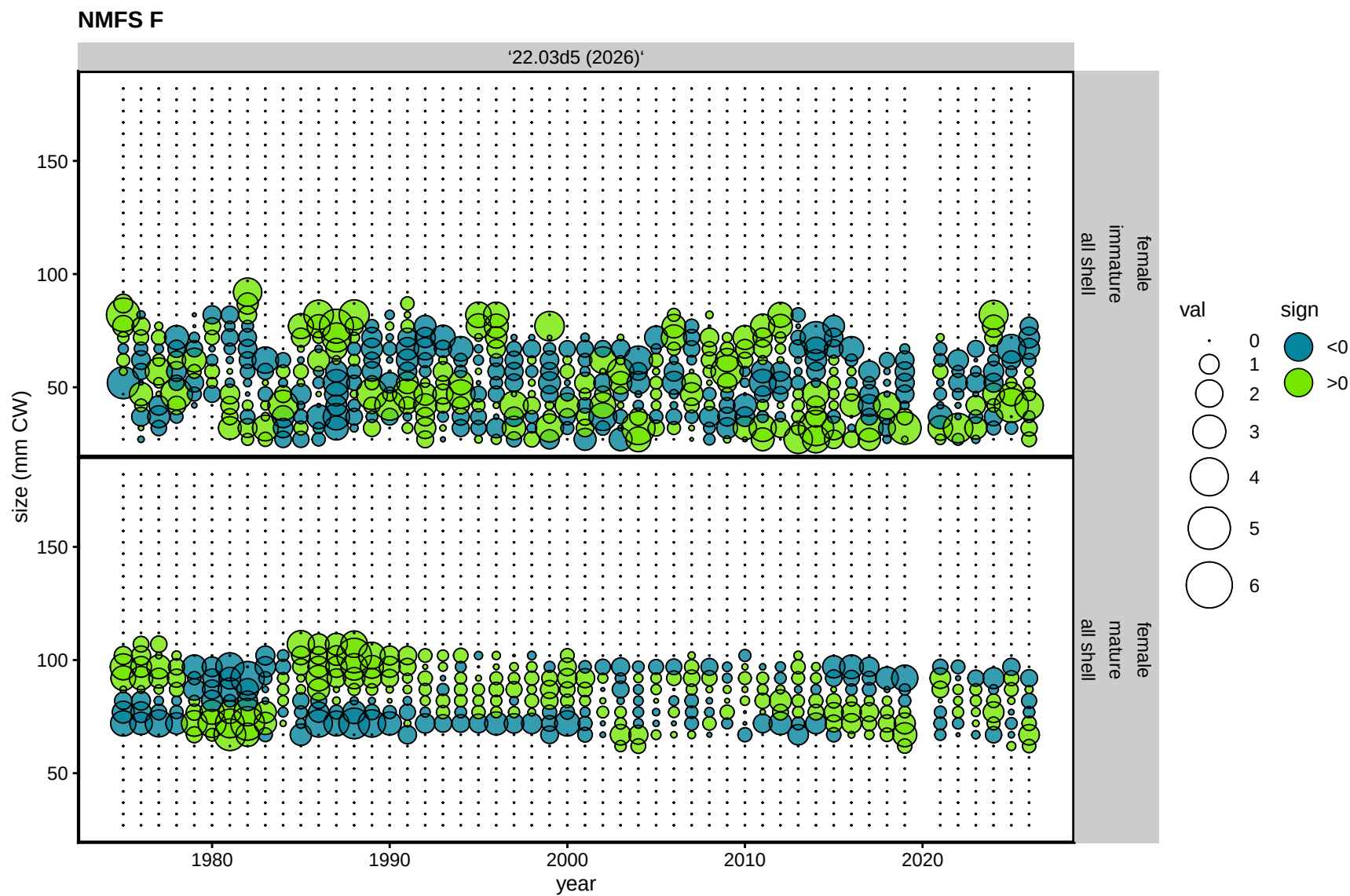


Figure 134. Pearson's residuals for fits to survey size composition data in the TCSAM02 models. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X' to facilitate identification.

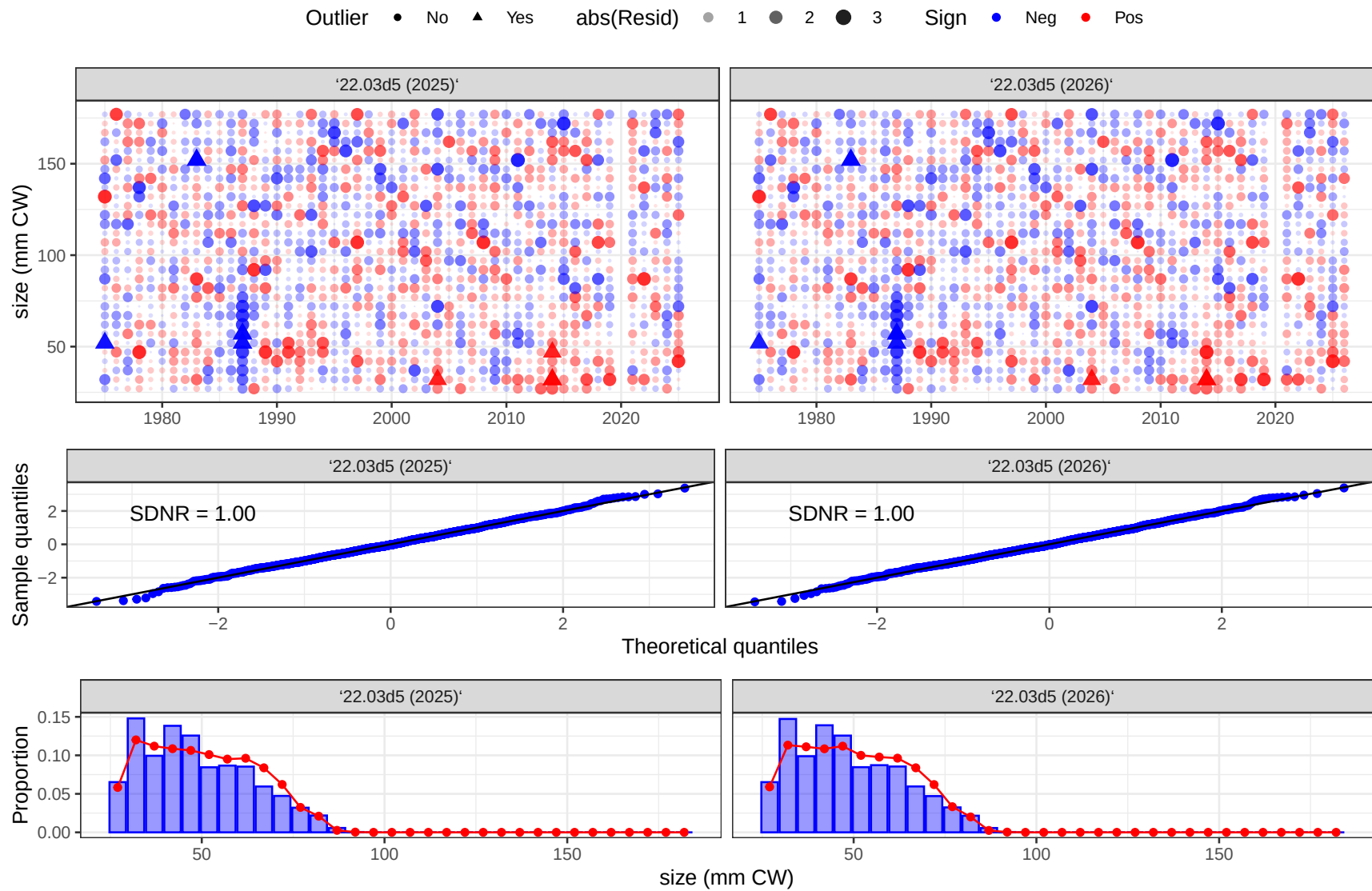


Figure 135. OSA residuals for fits to size compositions from the NMFS_F survey. The base/preferred model is 22.03d5.

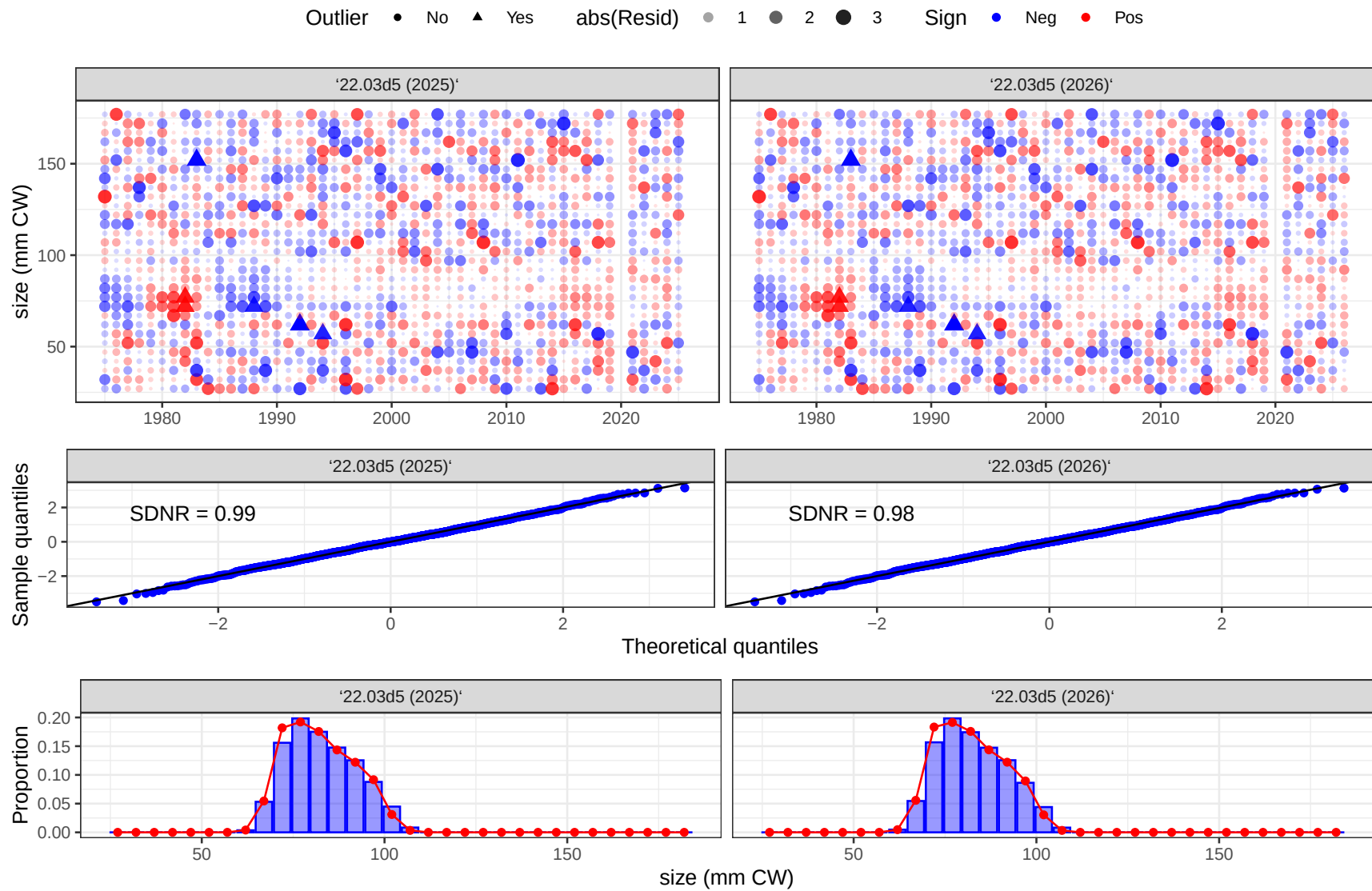


Figure 136. OSA residuals for fits to size compositions from the NMFS_F survey. The base/preferred model is 22.03d5.

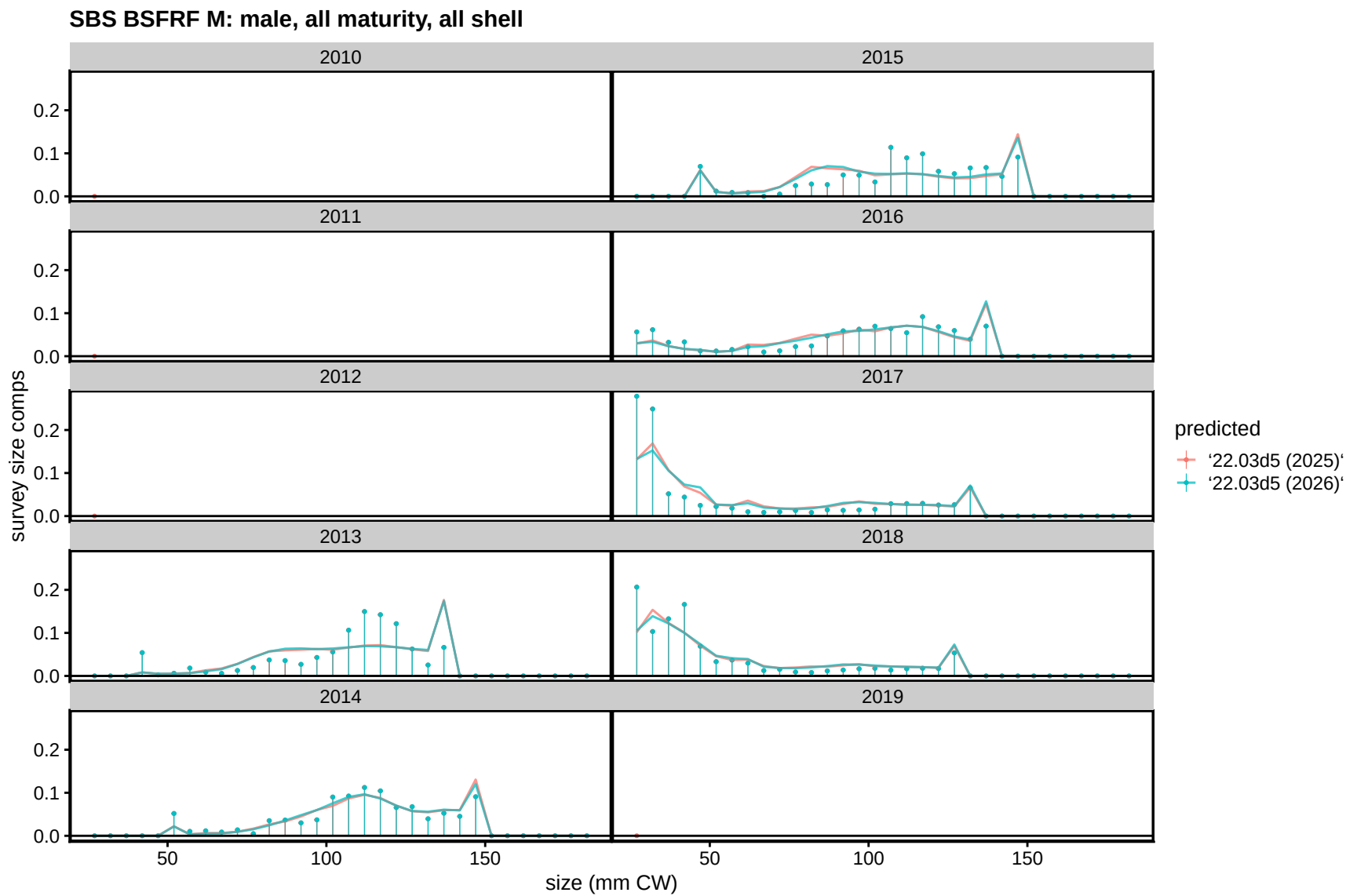


Figure 137. Fits to survey size compositions in the SBS BSFRF M survey. The base/preferred model is 22.03d5.

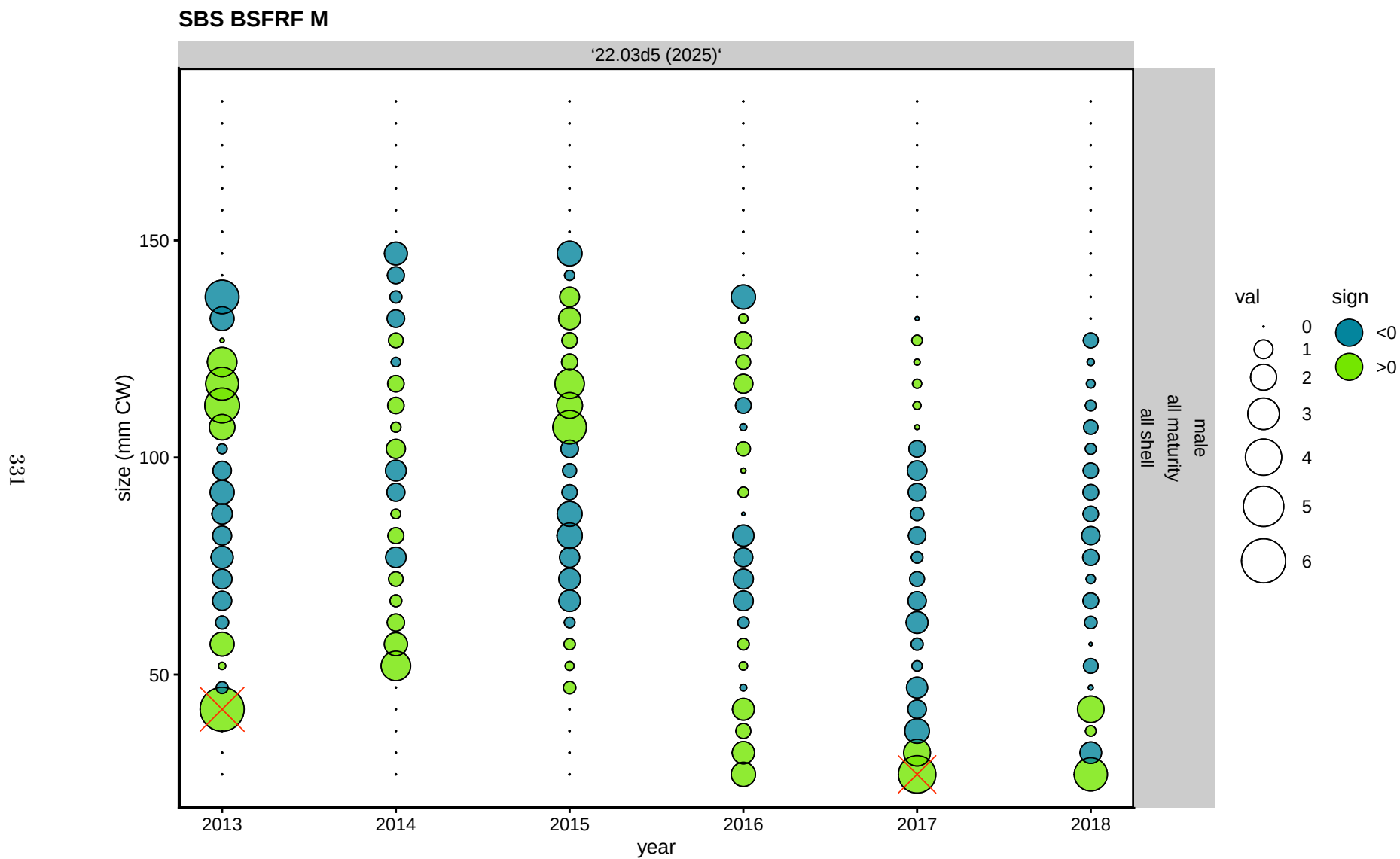


Figure 138. Pearson's residuals for fits to survey size composition in the BSFRF_M survey. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X' to facilitate identification.

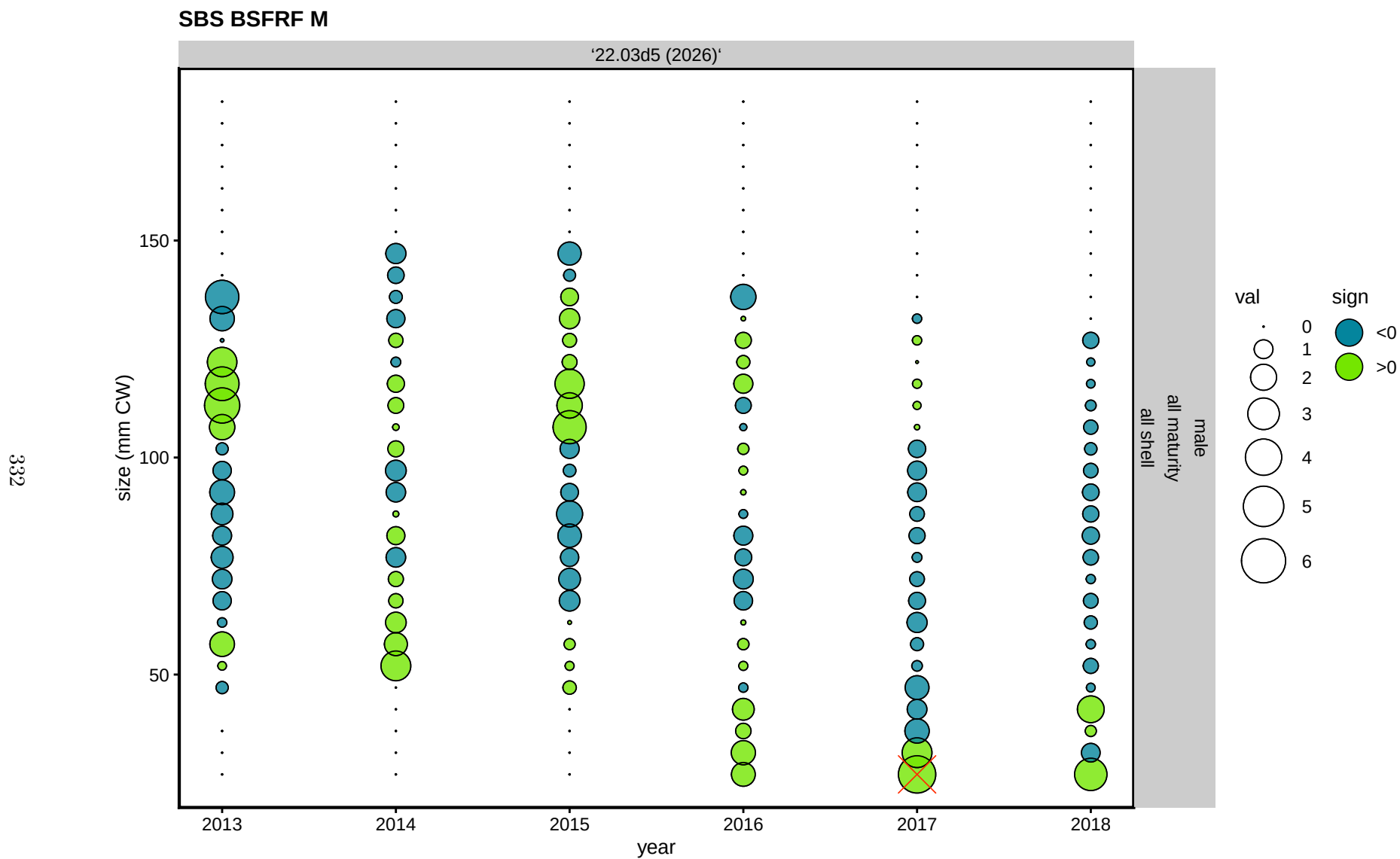


Figure 139. Pearson's residuals for fits to survey size composition in the BSFRF_M survey. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X' to facilitate identification.

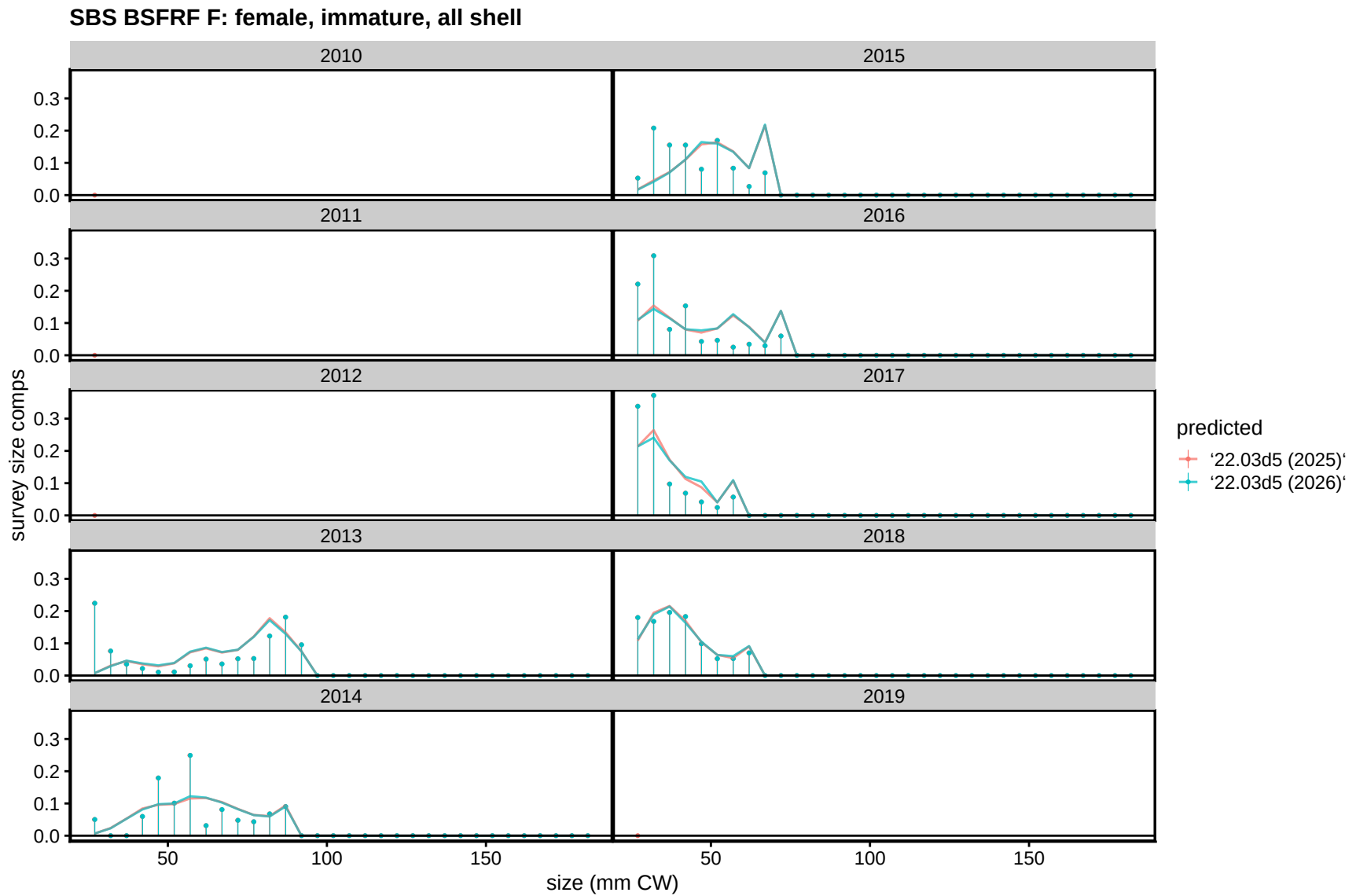


Figure 140. Fits to survey size compositions in the SBS BSFRF F survey. The base/preferred model is 22.03d5.

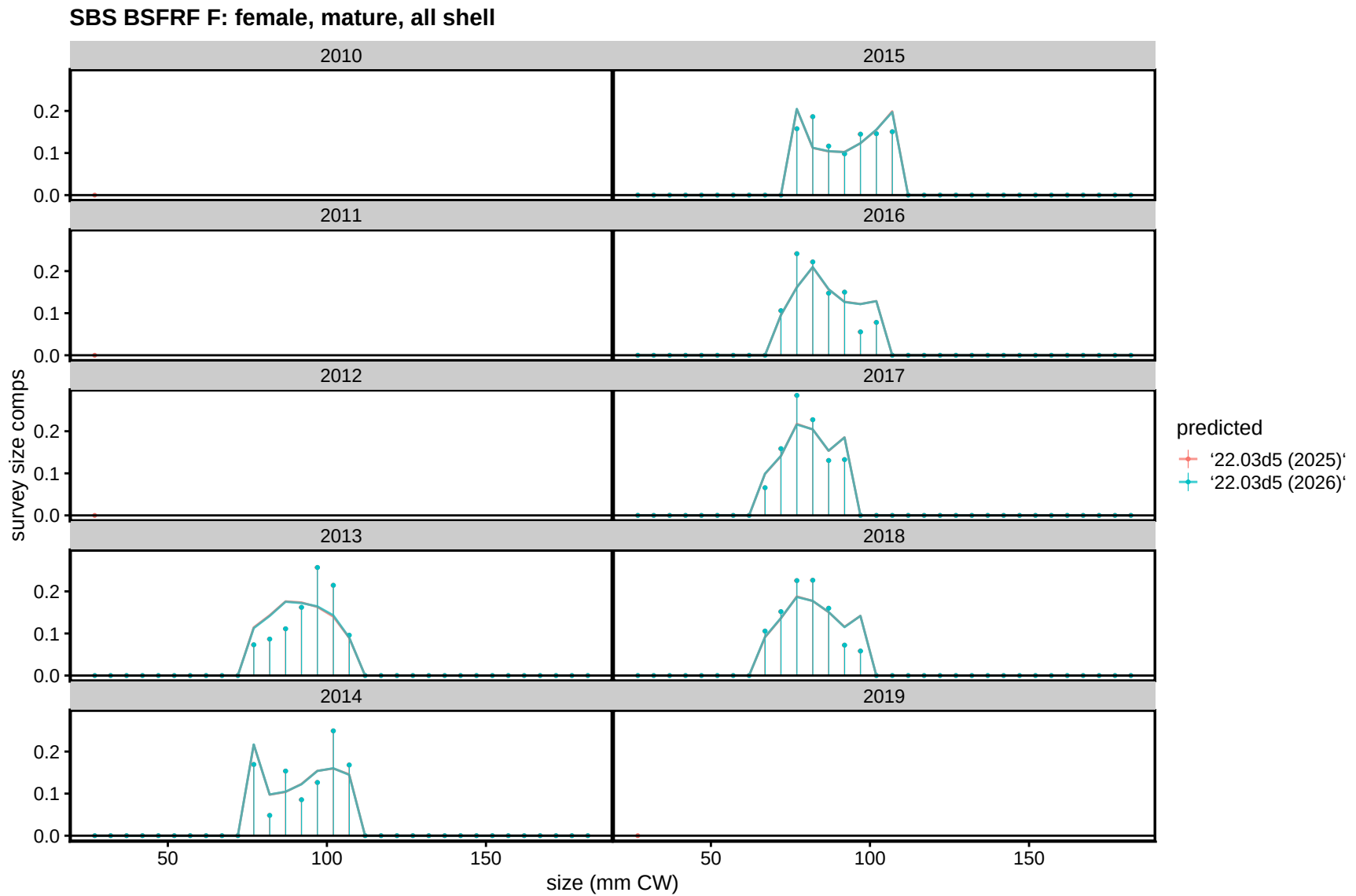


Figure 141. Fits to survey size compositions in the SBS BSFRF F survey. The base/preferred model is 22.03d5.

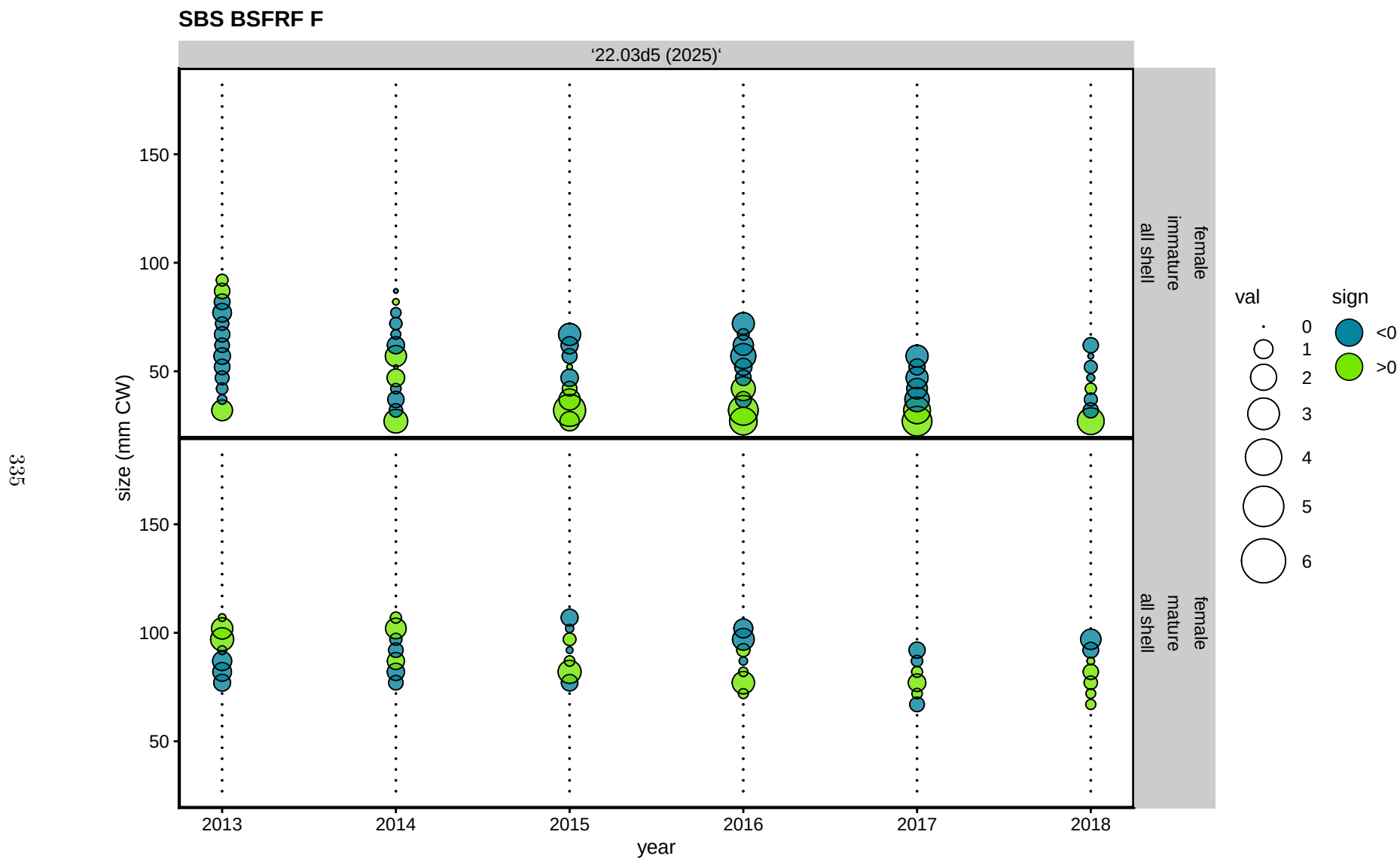


Figure 142. Pearson's residuals for fits to survey size composition in the BSFRF_F survey. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X' to facilitate identification.

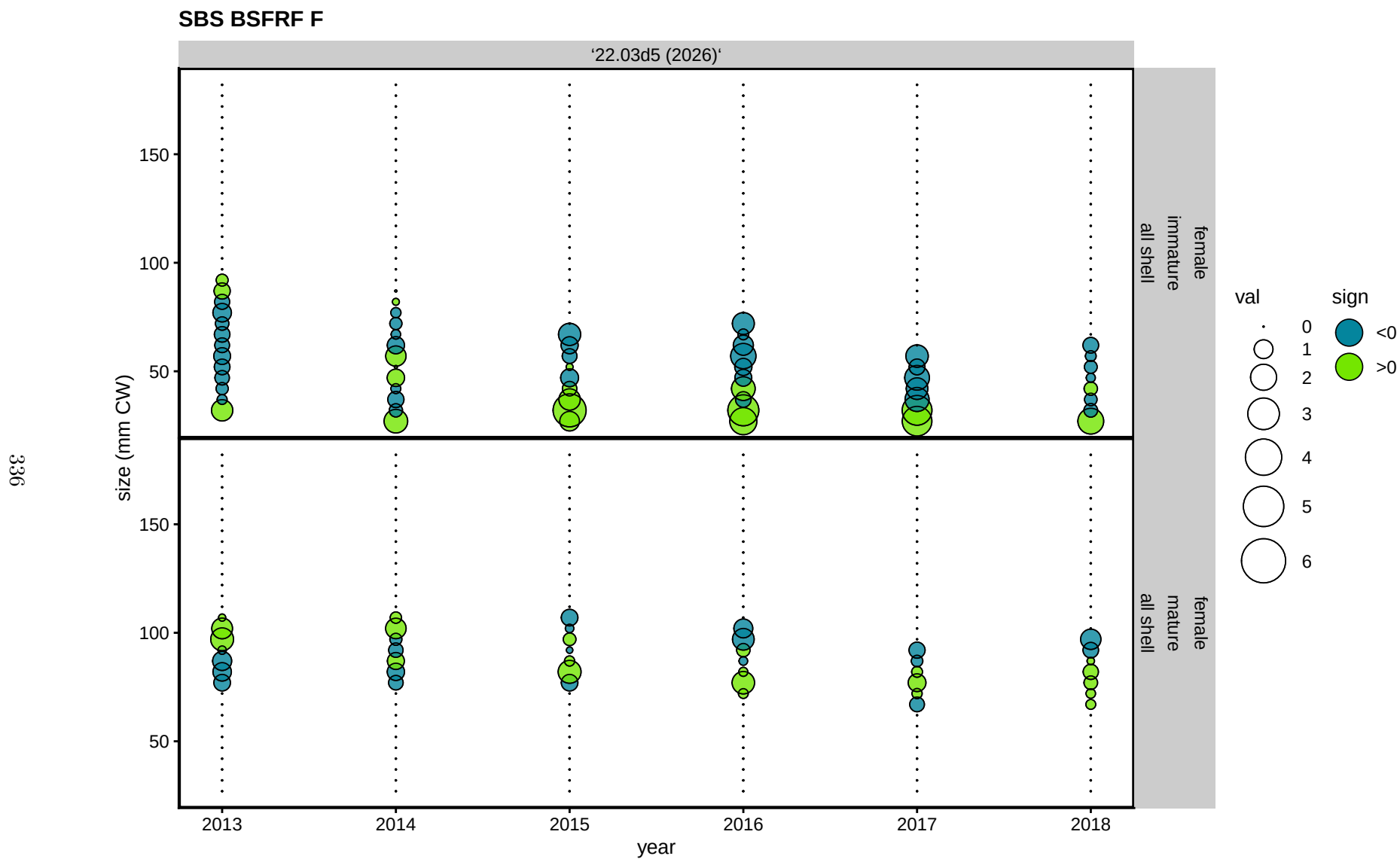


Figure 143. Pearson's residuals for fits to survey size composition in the BSFRF_F survey. Symbol areas reflect the size of each residual, extreme values (residuals larger than 4 in scale) are indicated with a red 'X' to facilitate identification.

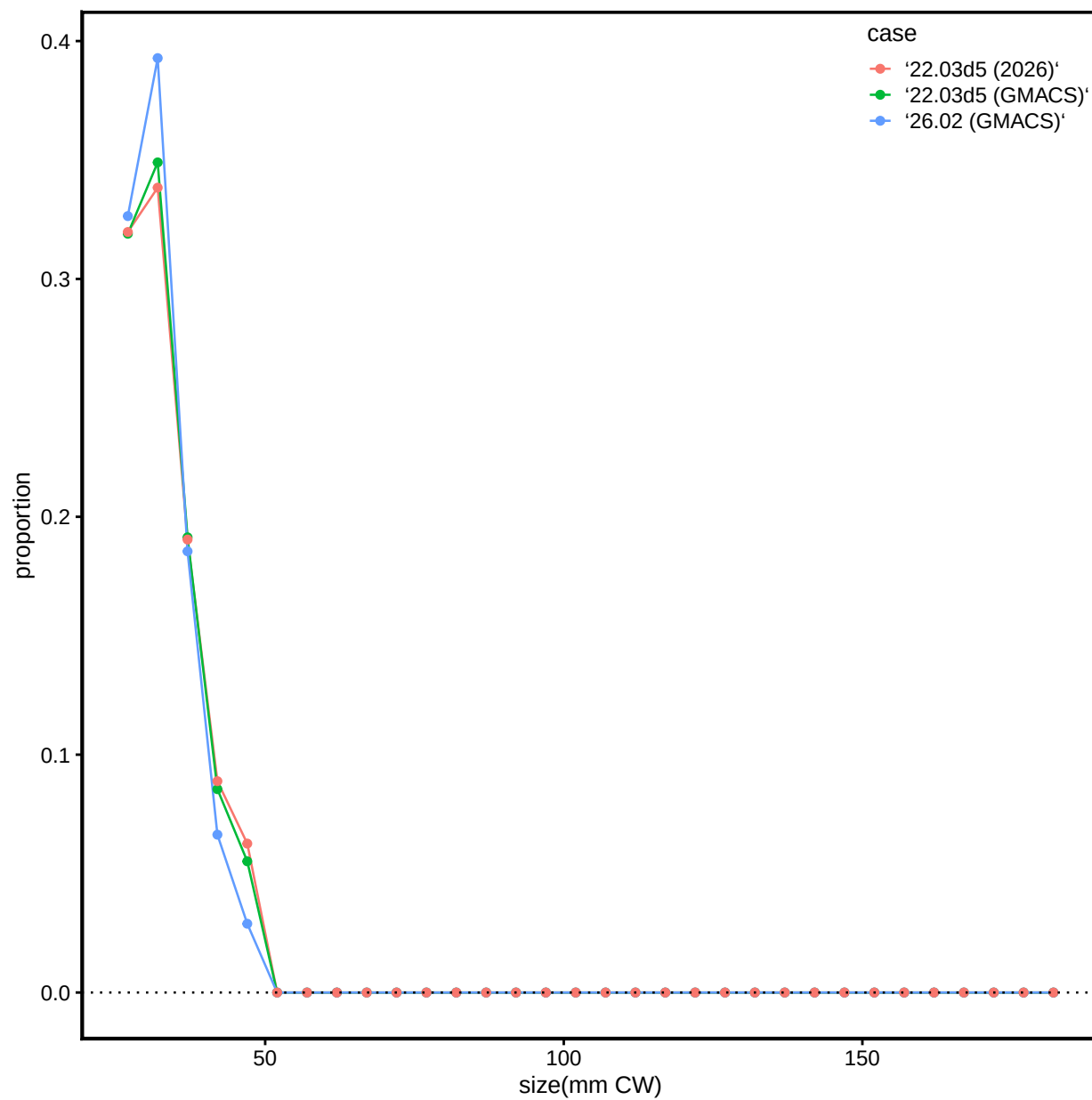


Figure 144. Comparison of estimated size-at-recruitment from the 22.03d5 (2026), 22.03d5 (GMACS), and 26.02 (GMACS) models. The size distribution at recruitment is not sex-specific.

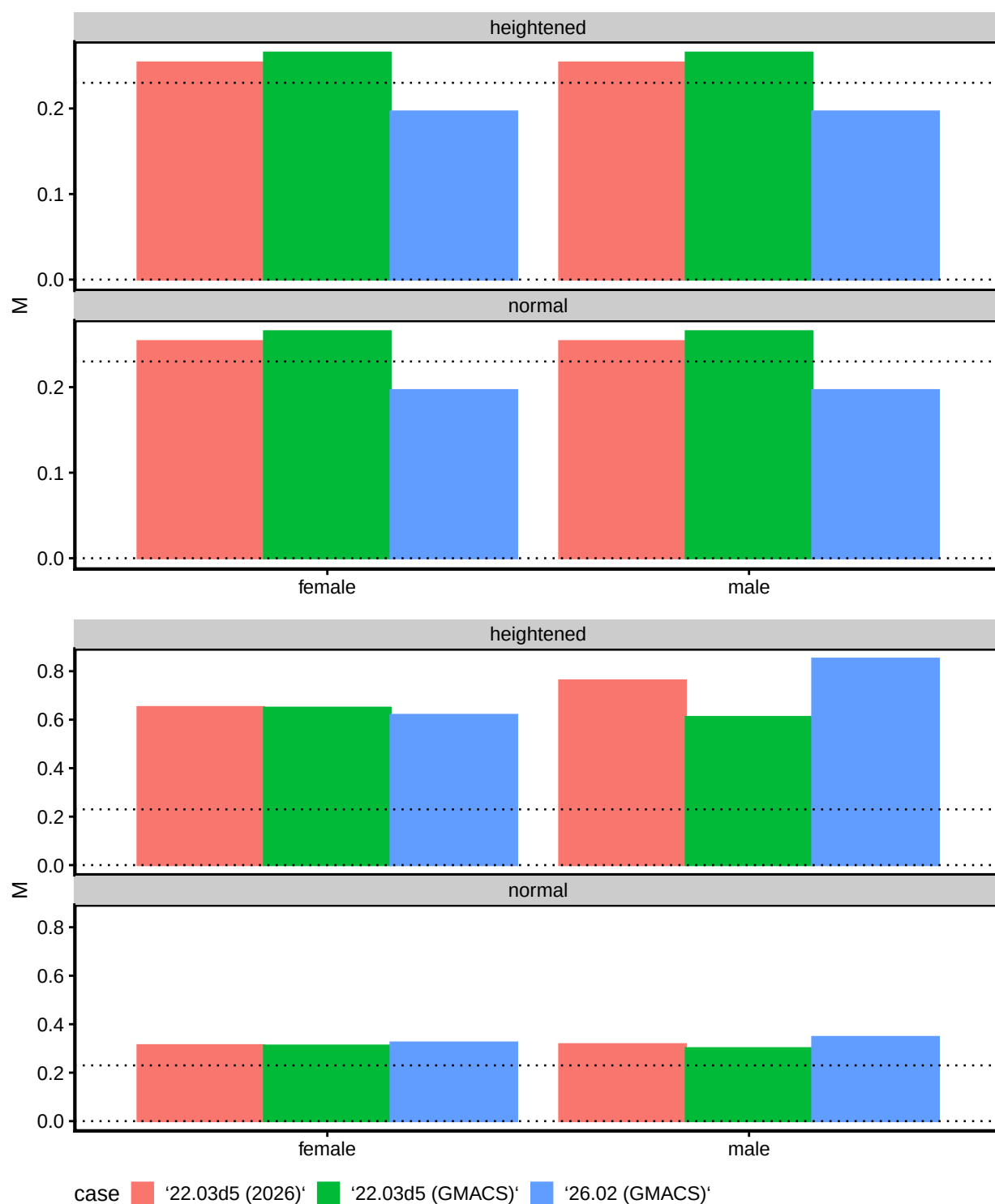


Figure 145. Estimated natural mortality rates (M) from the 22.03d5 (2026), 22.03d5 (GMACS), and 26.02 (GMACS), by biological category. Upper: immature crab; lower: mature crab. “heightened”: 1980-1984 time period; “normal”: remaining time period. M did not change for immature crab in the “heightened” time period.

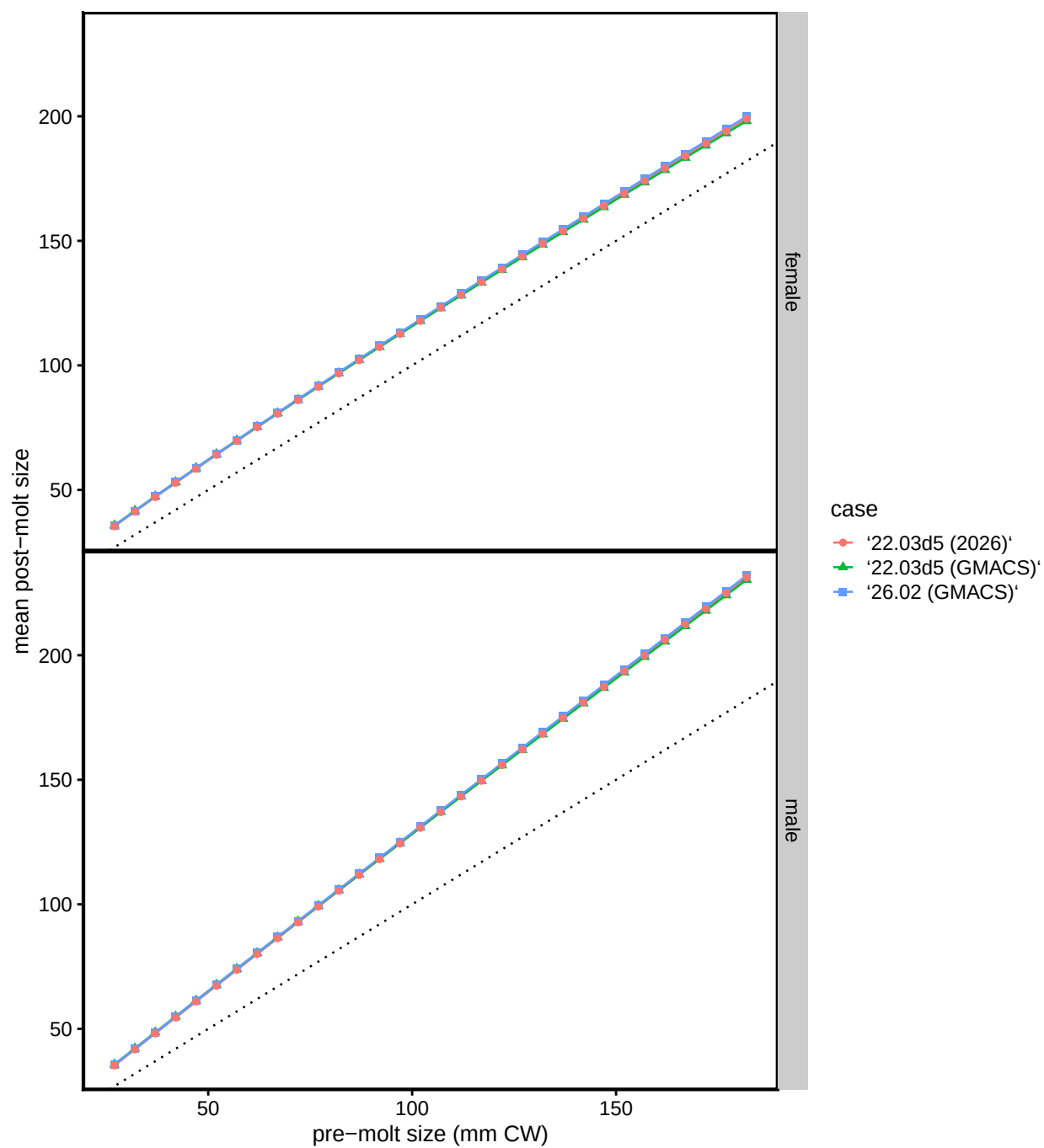


Figure 146. Estimated mean postmolt size, as a function of premolt size, from the 22.03d5 (2026), 22.03d5 (GMACS), and 26.02 (GMACS) models, by sex.

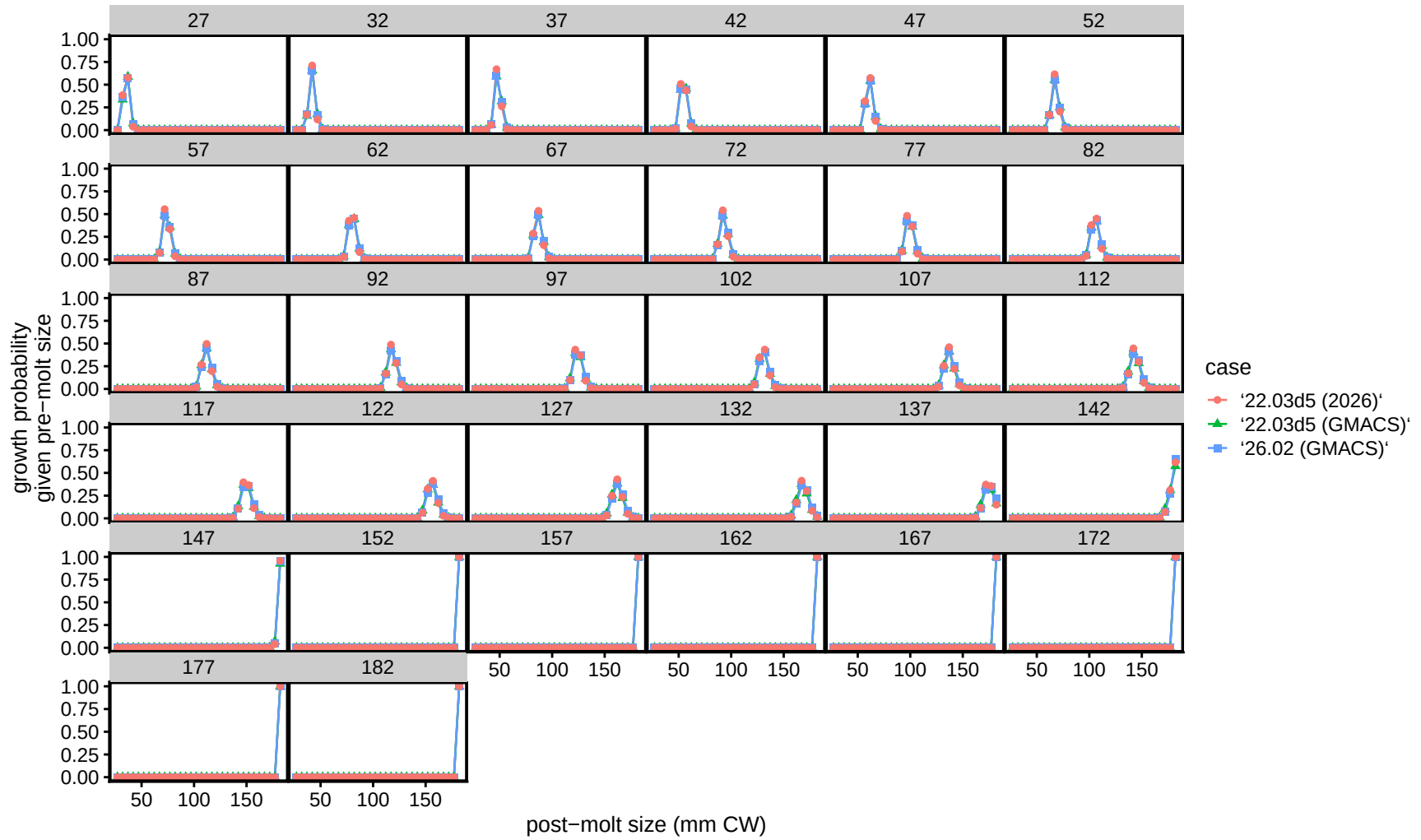


Figure 147. Estimated distribution of postmolt sizes, as a function of premolt size, from the 22.03d5 (2026), 22.03d5 (GMACS), and 26.02 (GMACS) models for males.

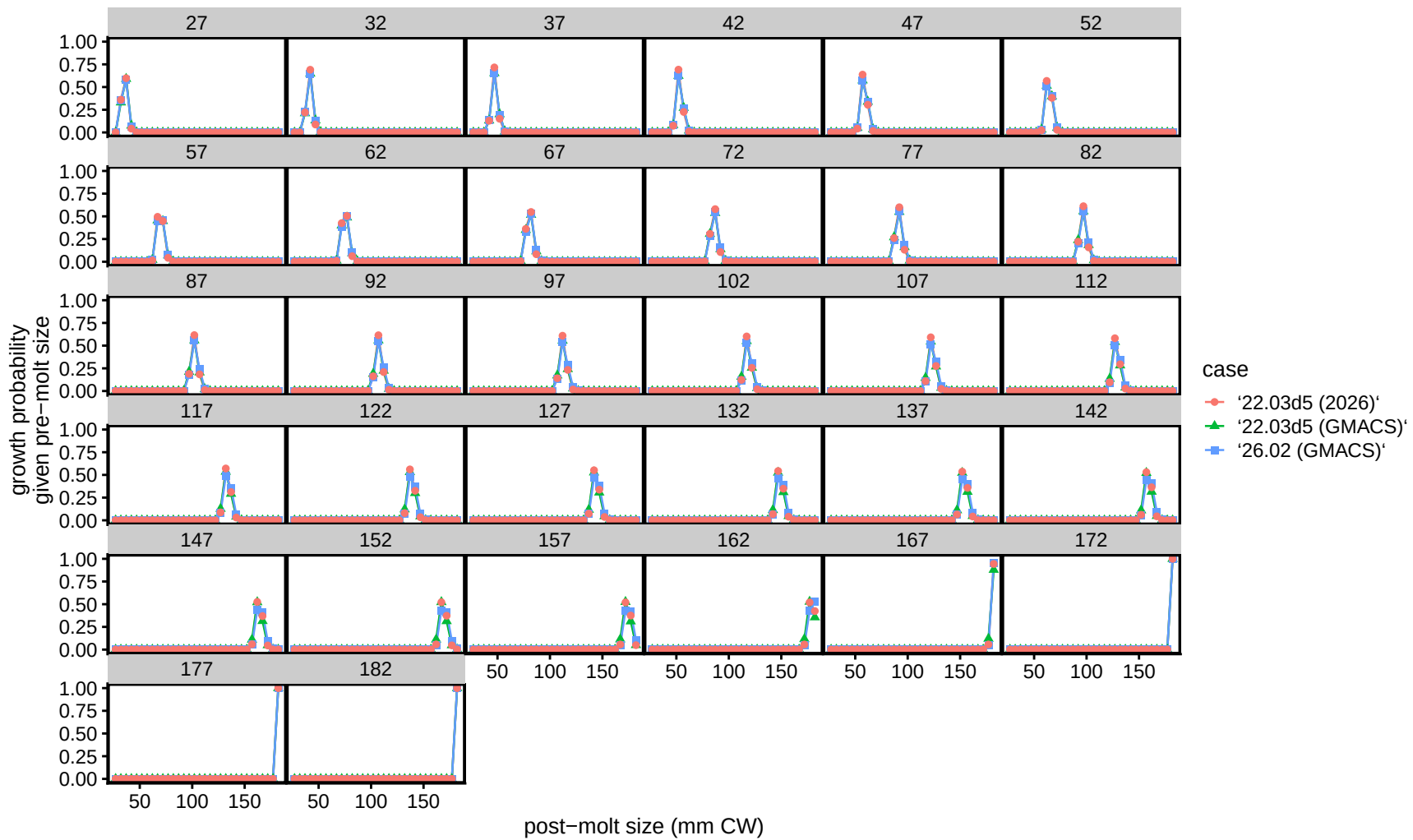


Figure 148. Estimated distribution of postmolt sizes, as a function of premolt size, from the 22.03d5 (2026), 22.03d5 (GMACS), and 26.02 (GMACS) models for females.

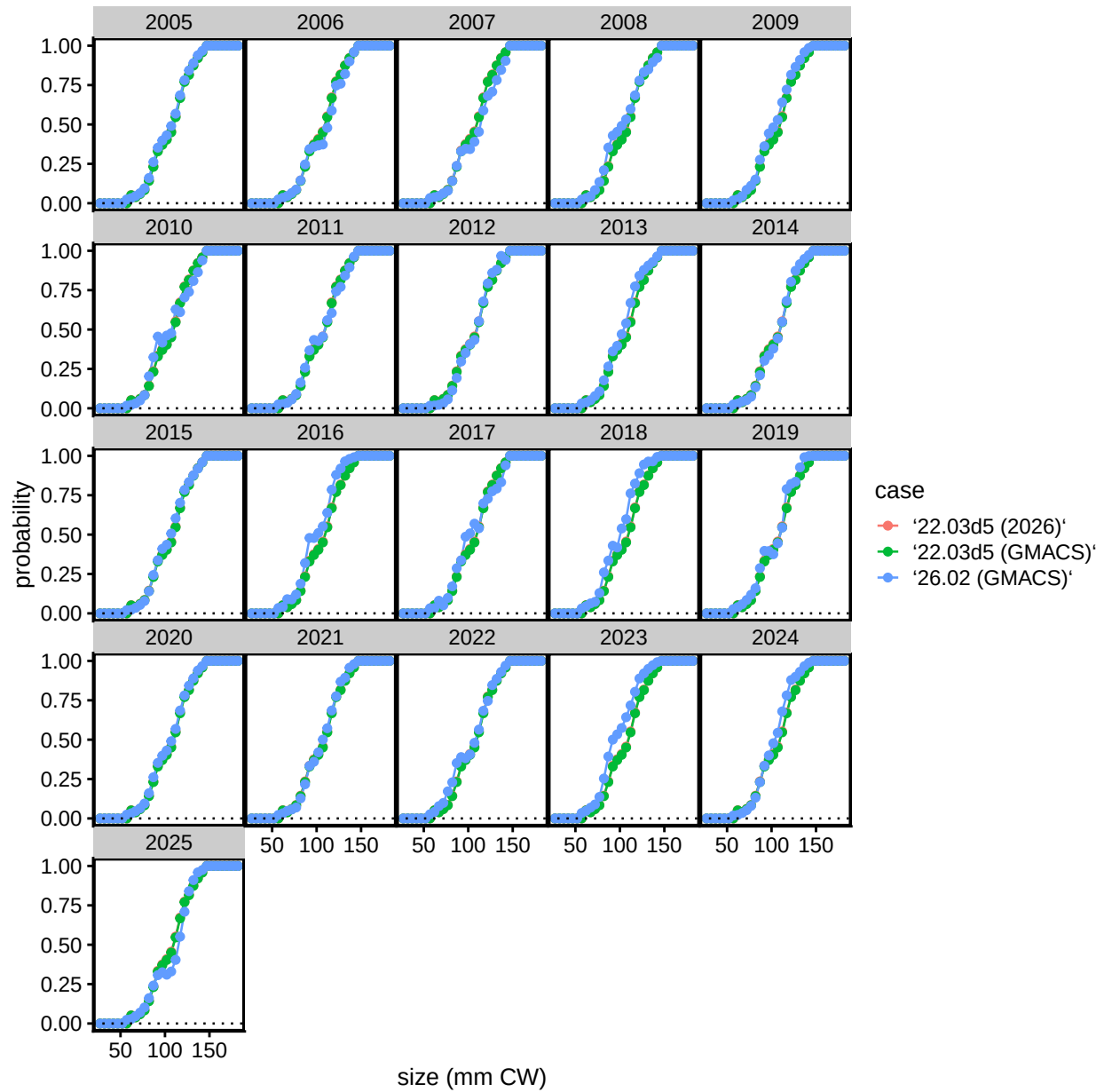


Figure 149. Comparison of the estimated probability of terminal molt for males from the 22.03d5 (2026), 22.03d5 (GMACS), and 26.02 (GMACS), by sex. Ogives prior to 2005 are the same as in that year.

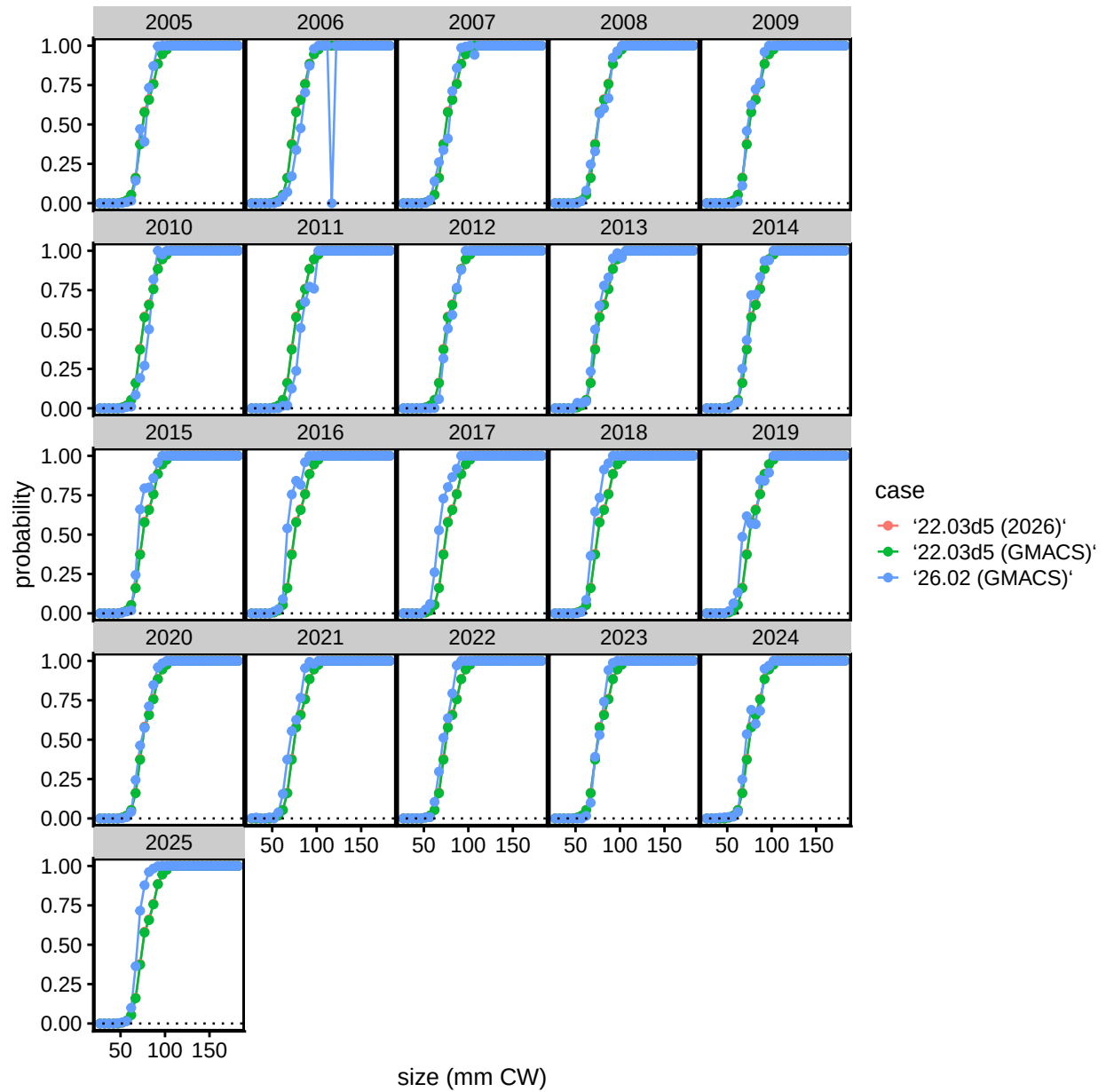


Figure 150. Comparison of the estimated probability of terminal molt for females from the 22.03d5 (2026), 22.03d5 (GMACS), and 26.02 (GMACS), by sex. Ogives prior to 2005 are the same as in that year.

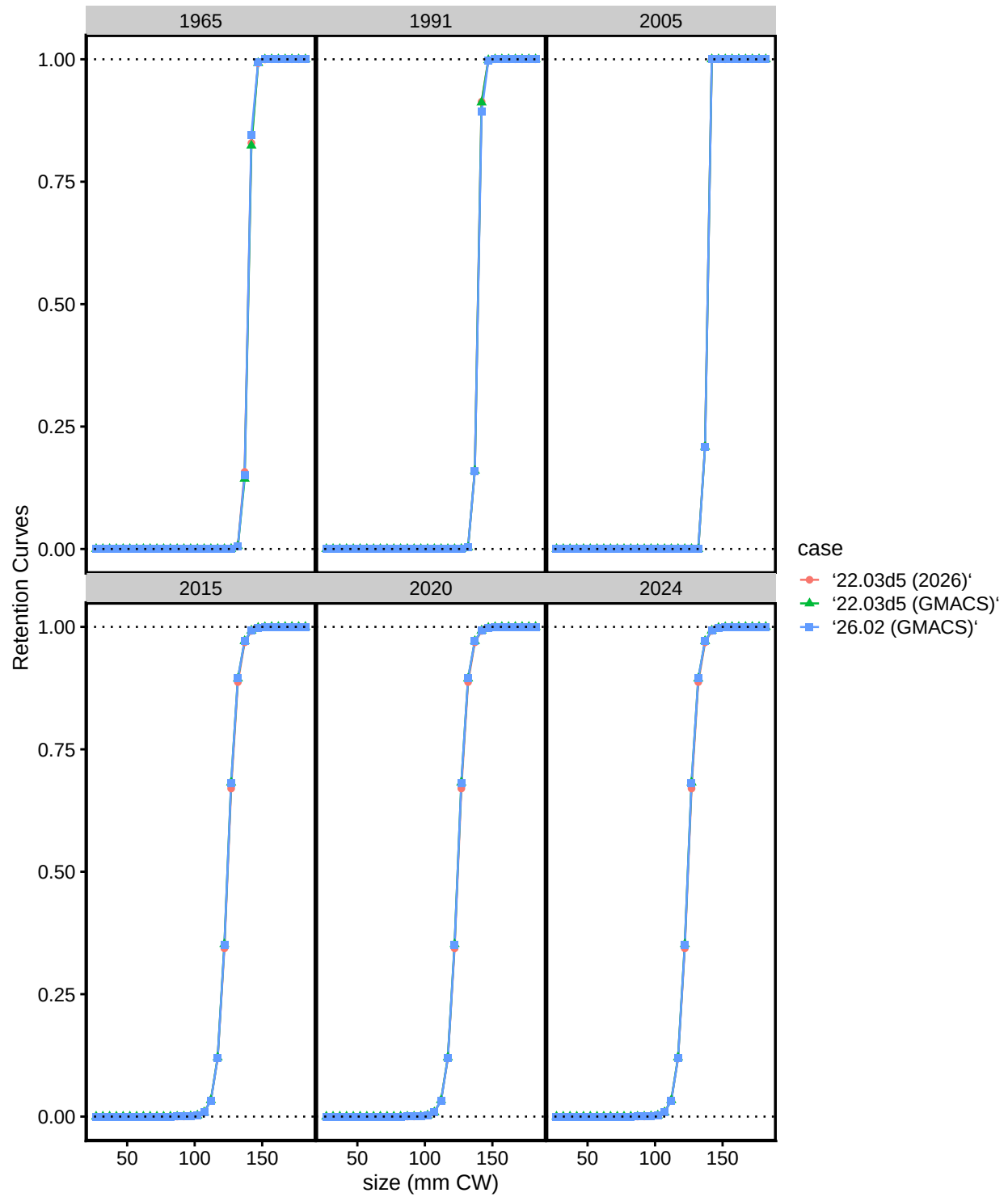


Figure 151. Comparison of the estimated fishery retention curves from the GMACS and TCSAM02 models.

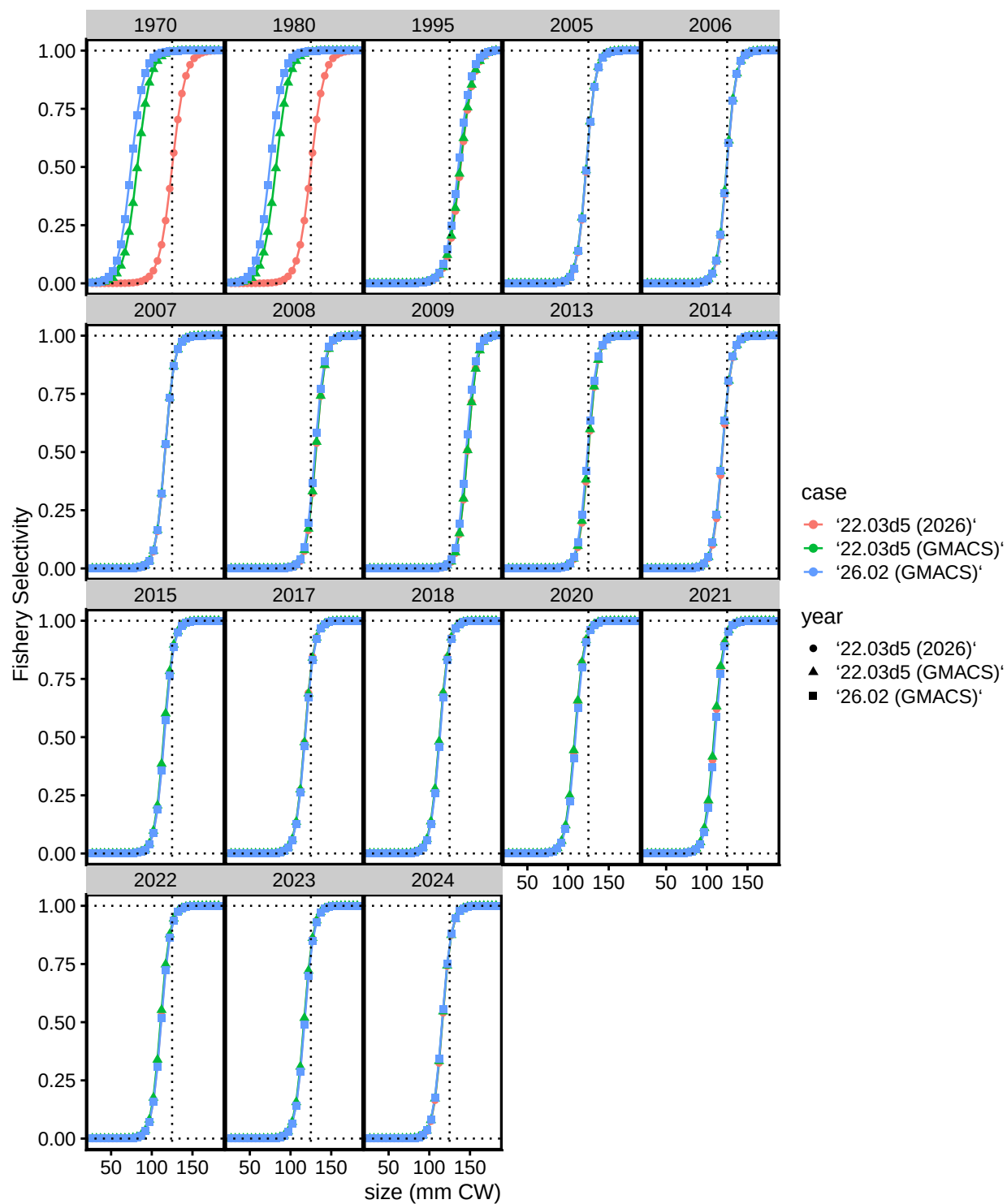


Figure 152. Comparison of the estimated fishery selectivity curves for males in the directed fishery as used in the GMACS and TCSAM02 models. The dotted line at 125 mm CW provides a reference point to the current industry-preferred size.

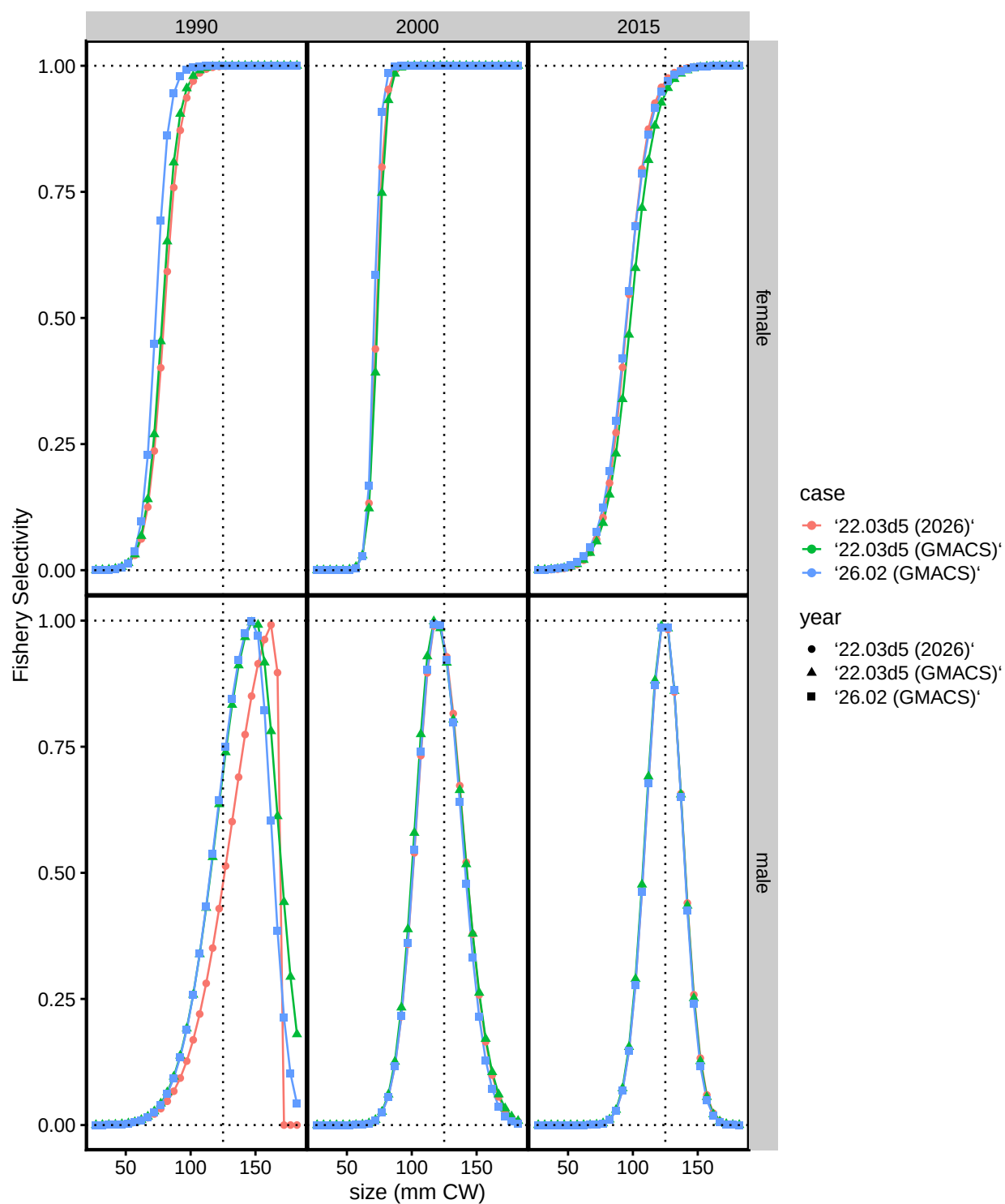


Figure 153. Comparison of the estimated fishery bycatch selectivity curves by sex in the snow crab fishery as used in the GMACS and TCSAM02 models. The dotted line at 125 mm CW provides a reference point to the current industry-preferred size.

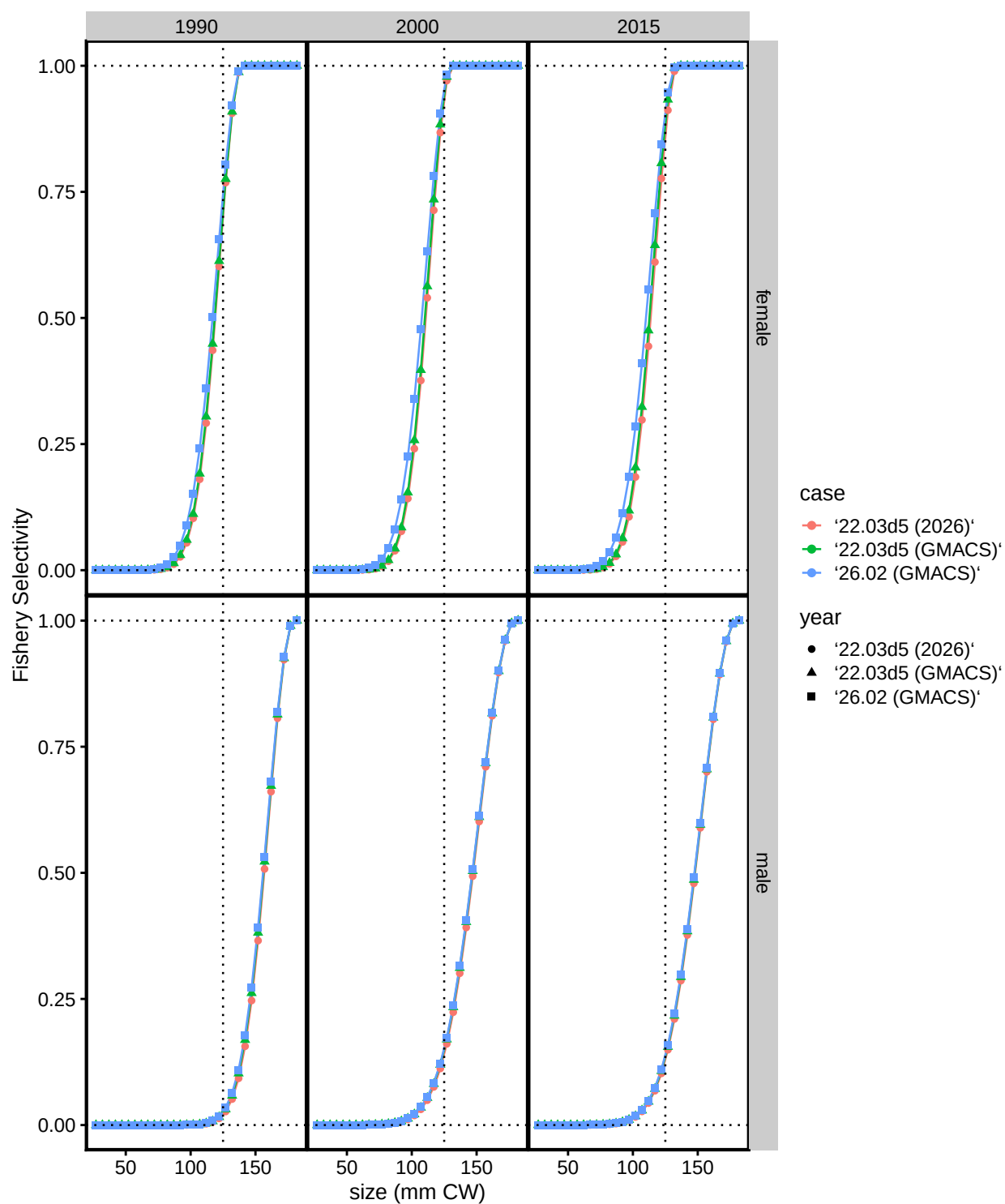


Figure 154. Comparison of the estimated fishery bycatch selectivity curves by sex in the BBRKC fishery as used in the GMACS and TCSAM02 models. The dotted line at 125 mm CW provides a reference point to the current industry-preferred size.

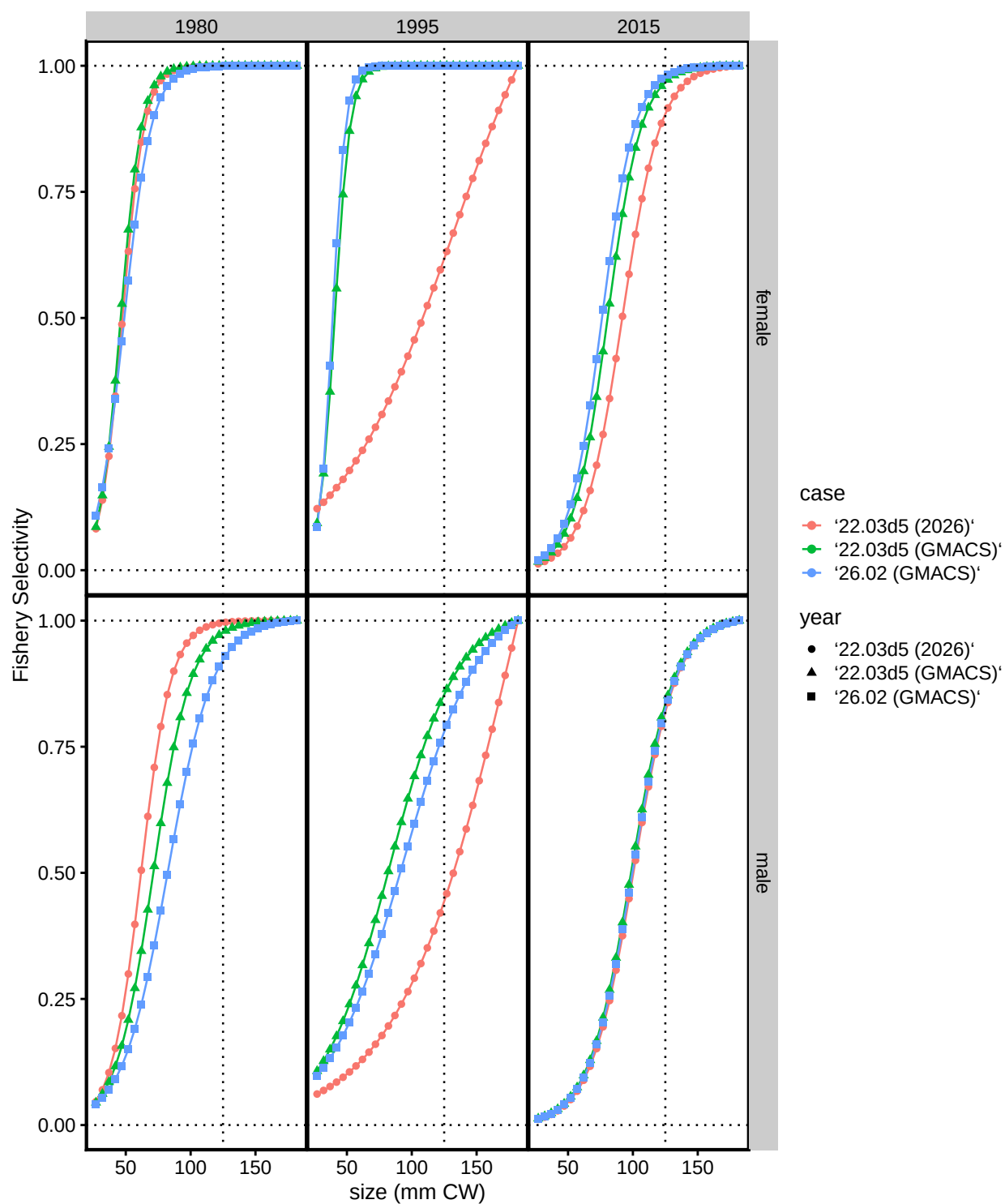


Figure 155. Comparison of the estimated fishery bycatch selectivity curves by sex in the groundfish fisheries as used in the GMACS and TCSAM02 models. The dotted line at 125 mm CW provides a reference point to the current industry-preferred size.

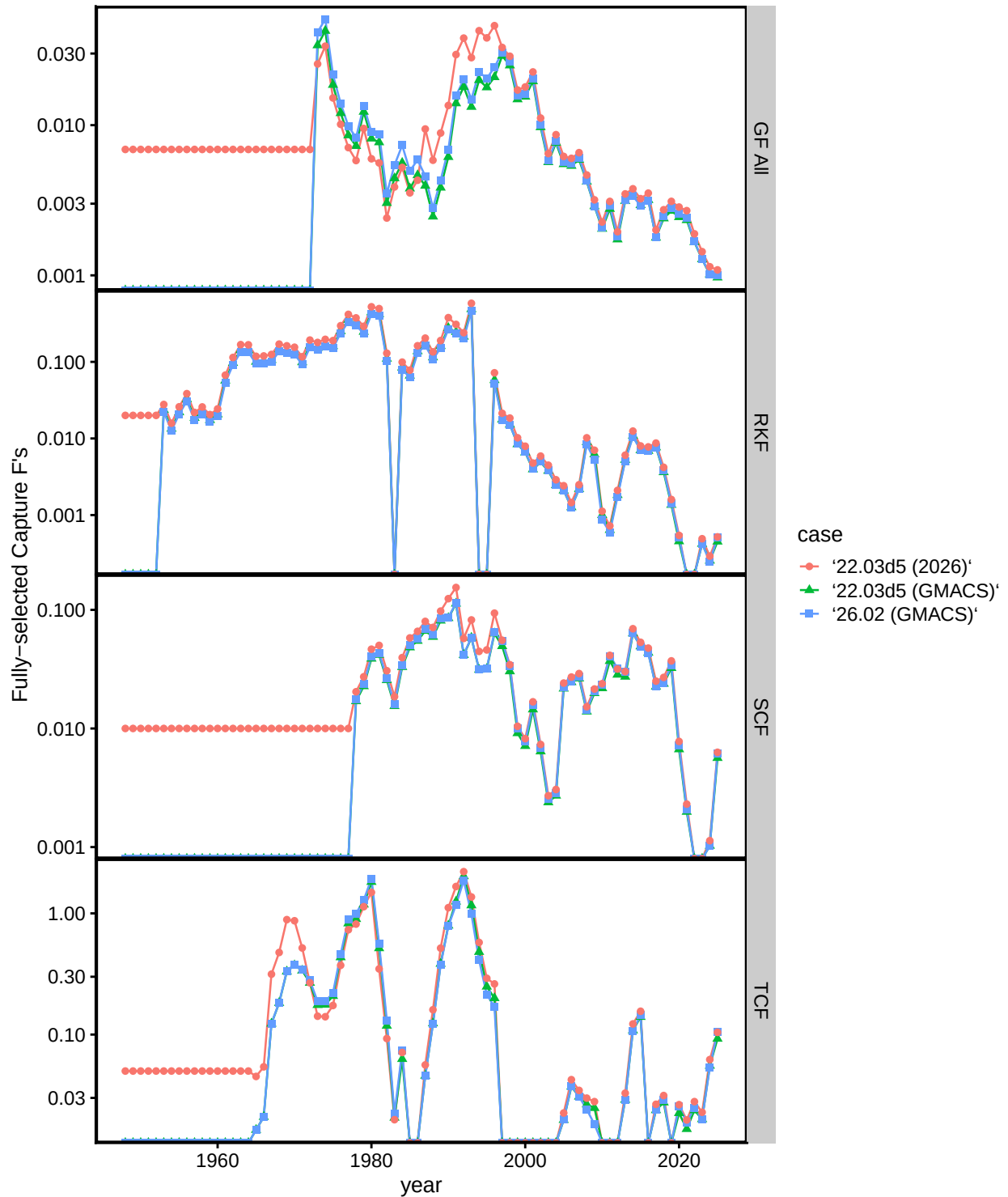


Figure 156. Comparison of the estimated fully-selected fishery capture rates for males in the directed and bycatch fisheries from the GMACS and TCSAM02 models. TCF: directed Tanner crab fishery; SCF: snow crab fishery, RKF: BBRKC fishery; GF All: groundfish fisheries. Capture rates before 1990 in the snow crab and BBRKC fisheries are based on effort extrapolation. Capture rates for females (plots not shown) are proportional to those for males.

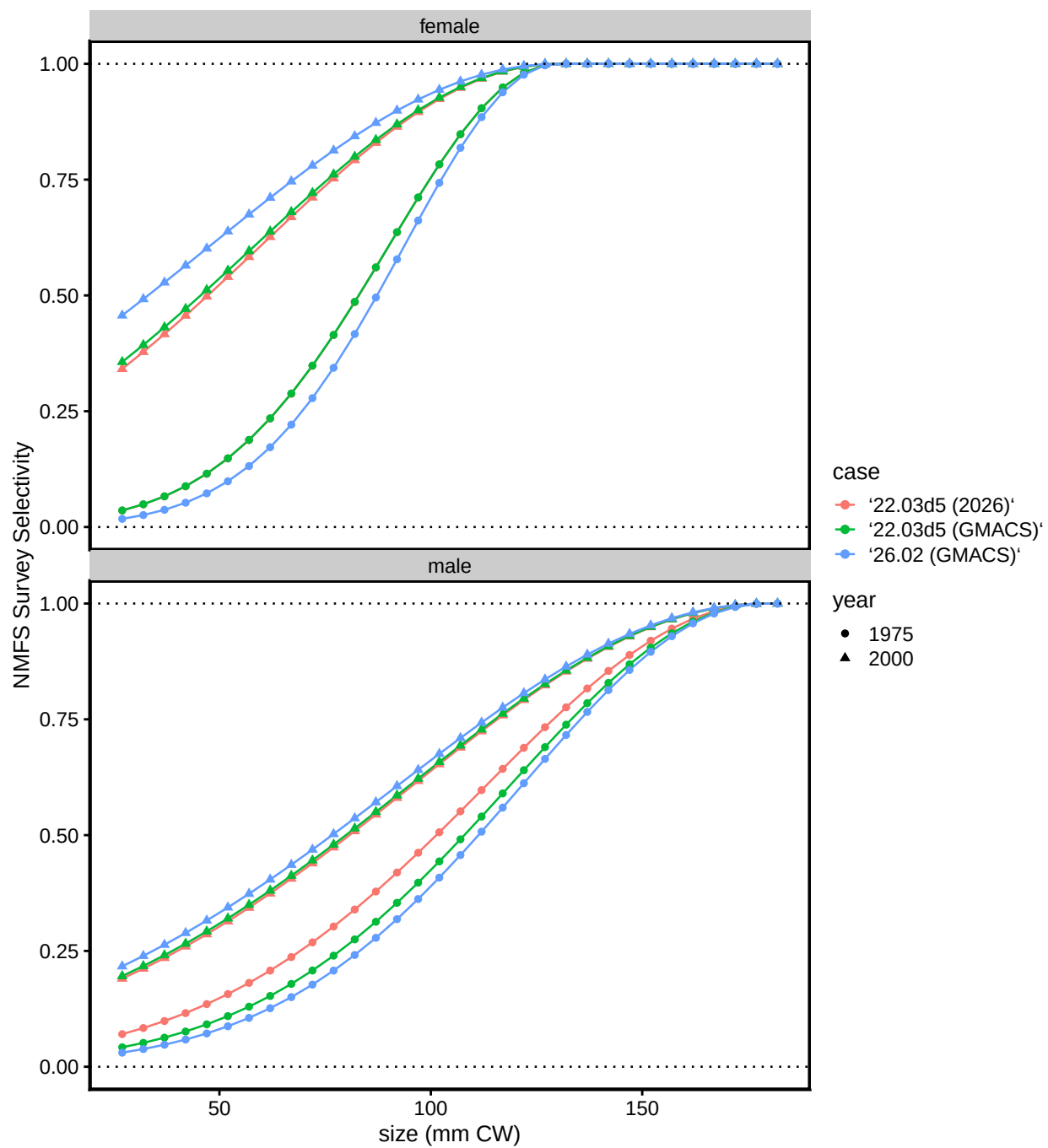


Figure 157. Comparison of the estimated NMFS survey selectivity curves by sex as used in the GMACS and TCSAM02 models.

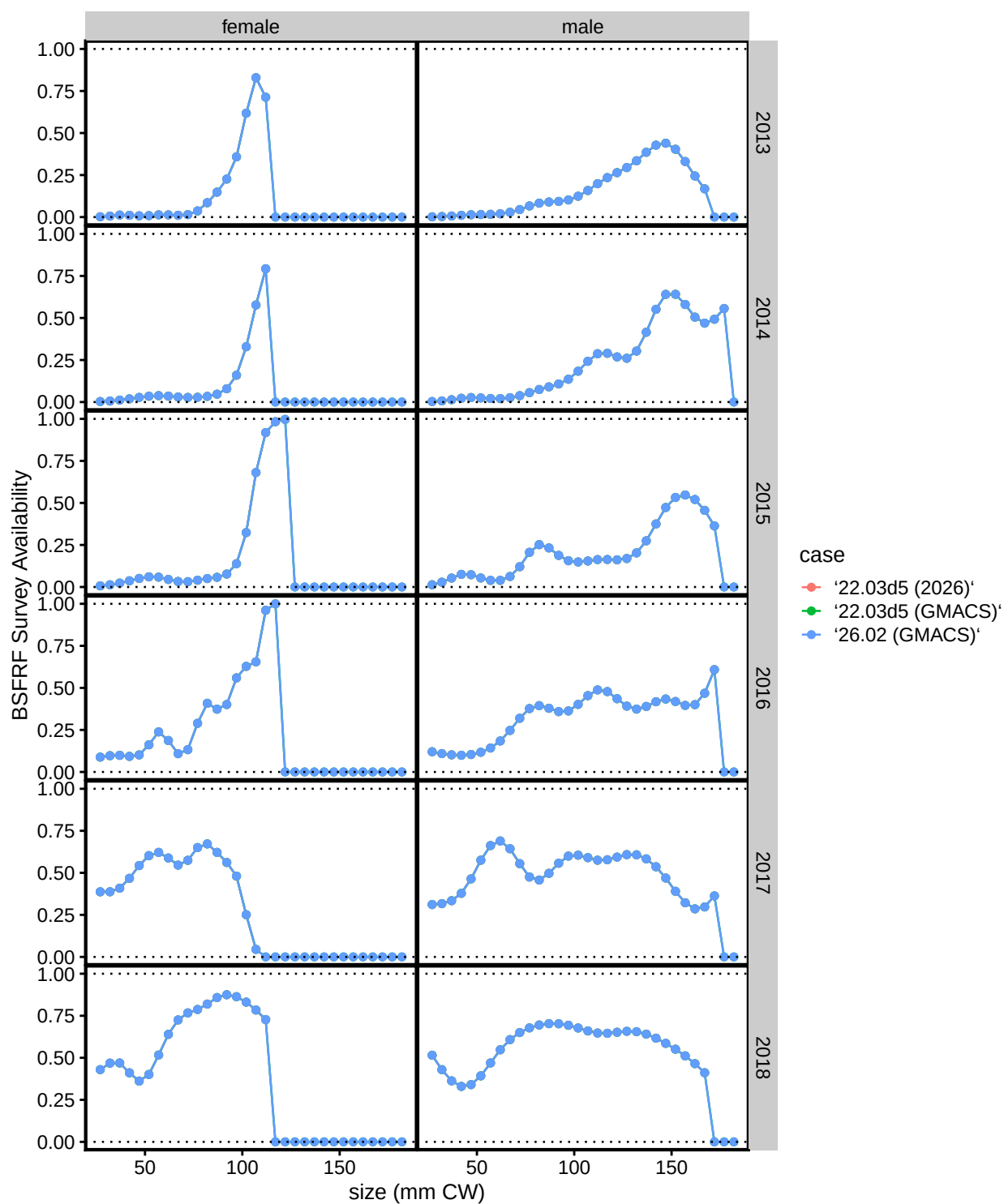


Figure 158. Comparison of the BSFRF survey availability curves by sex as used in the GMACS and TCSAM02 models. Values were estimated outside the models and are identical across models.

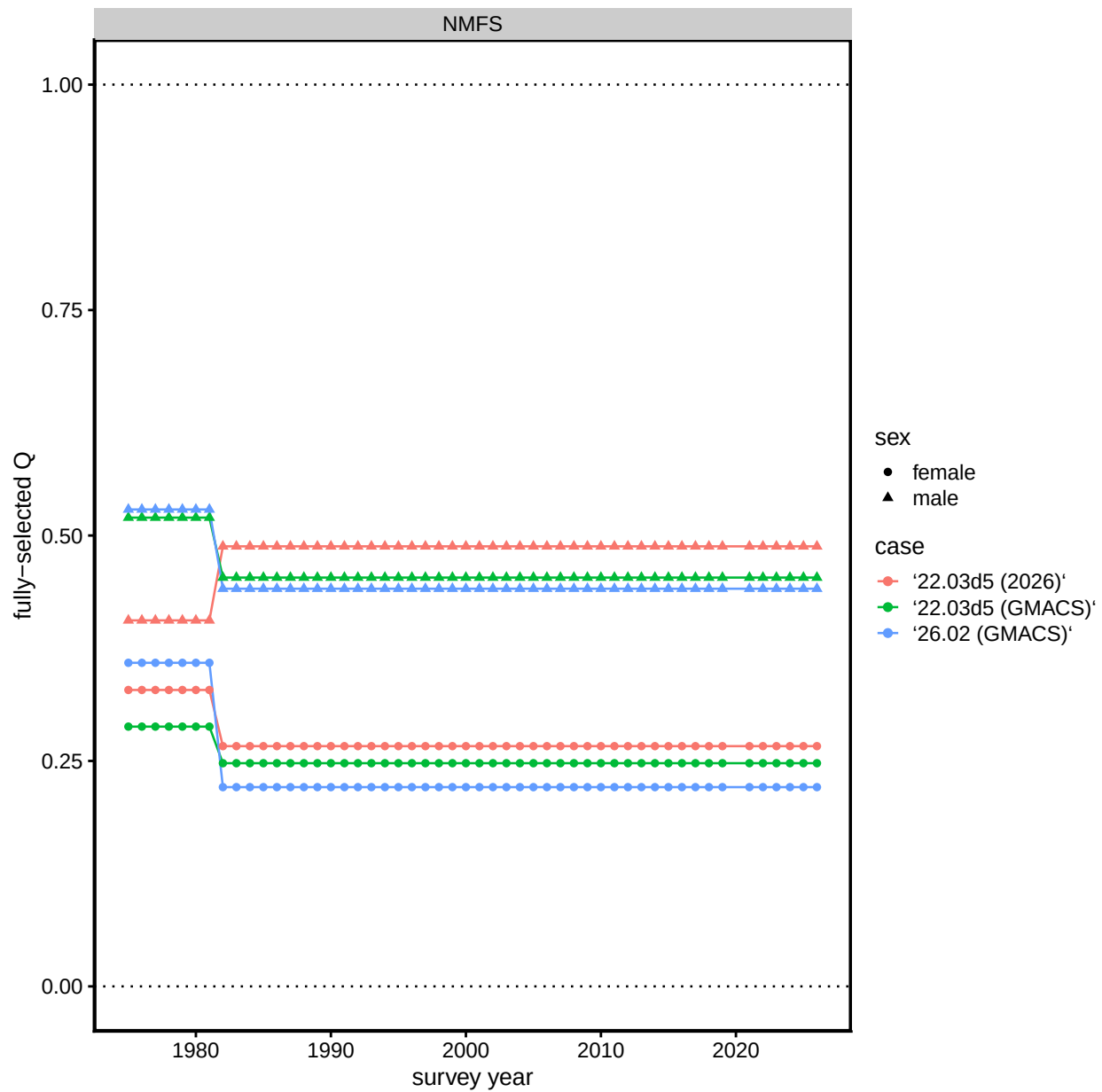


Figure 159. Comparison of estimated fully-selected survey catchability (q) for the NMFS survey by sex and year from the GMACS and TCSAM02 models. Fully-selected q 's for the BSFRF surveys are 1 in both models and are not shown.

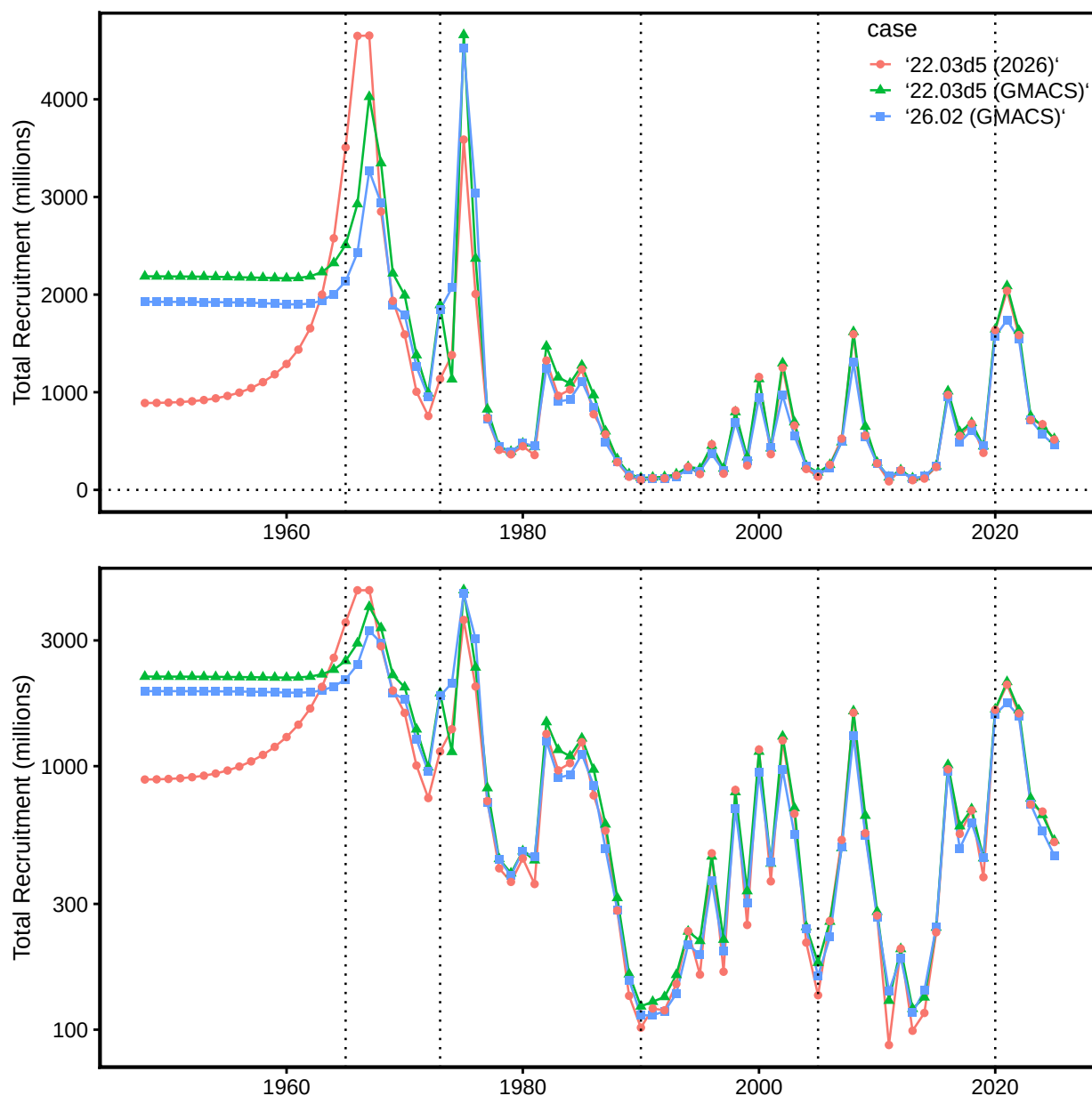


Figure 160. Comparison of estimated recruitment by year from the GMACS and TCSAM02 models. Upper plot: arithmetic scale; Lower plot: log-scale. The dotted vertical lines various temporal reference points: 1965-start of foreign fleet catch data; 1973-start of groundfish bycatch data; 1990-start of at sea observer estimates of total catch and size compositions in the crab fisheries; 2005-crab rationalization; 2020-no NMFS survey.

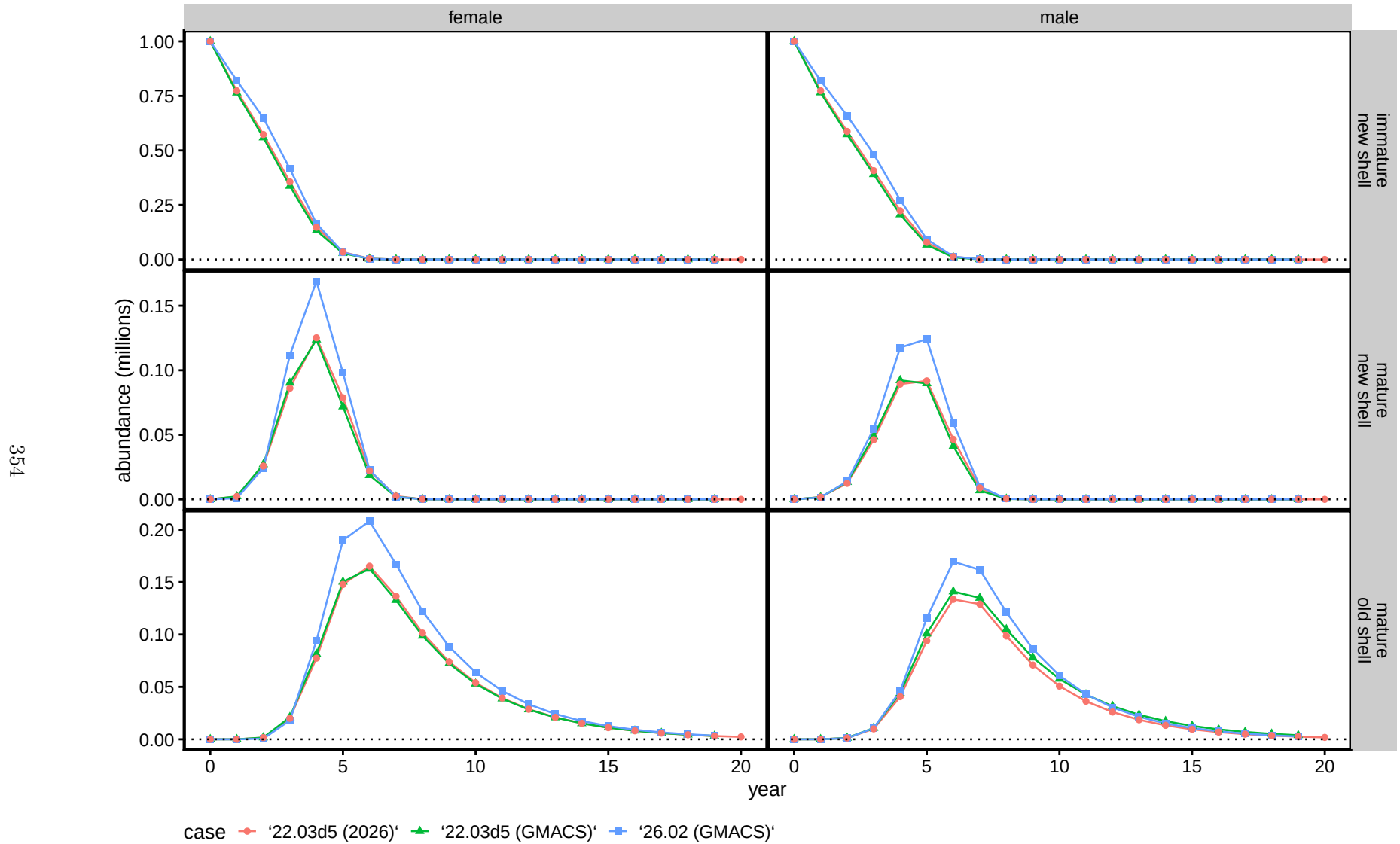


Figure 161. Comparison of the predicted abundance of a single recruitment cohort through time by sex and maturity/shell state using conditions from the final model year for the GMACS and TCSAM02 models.

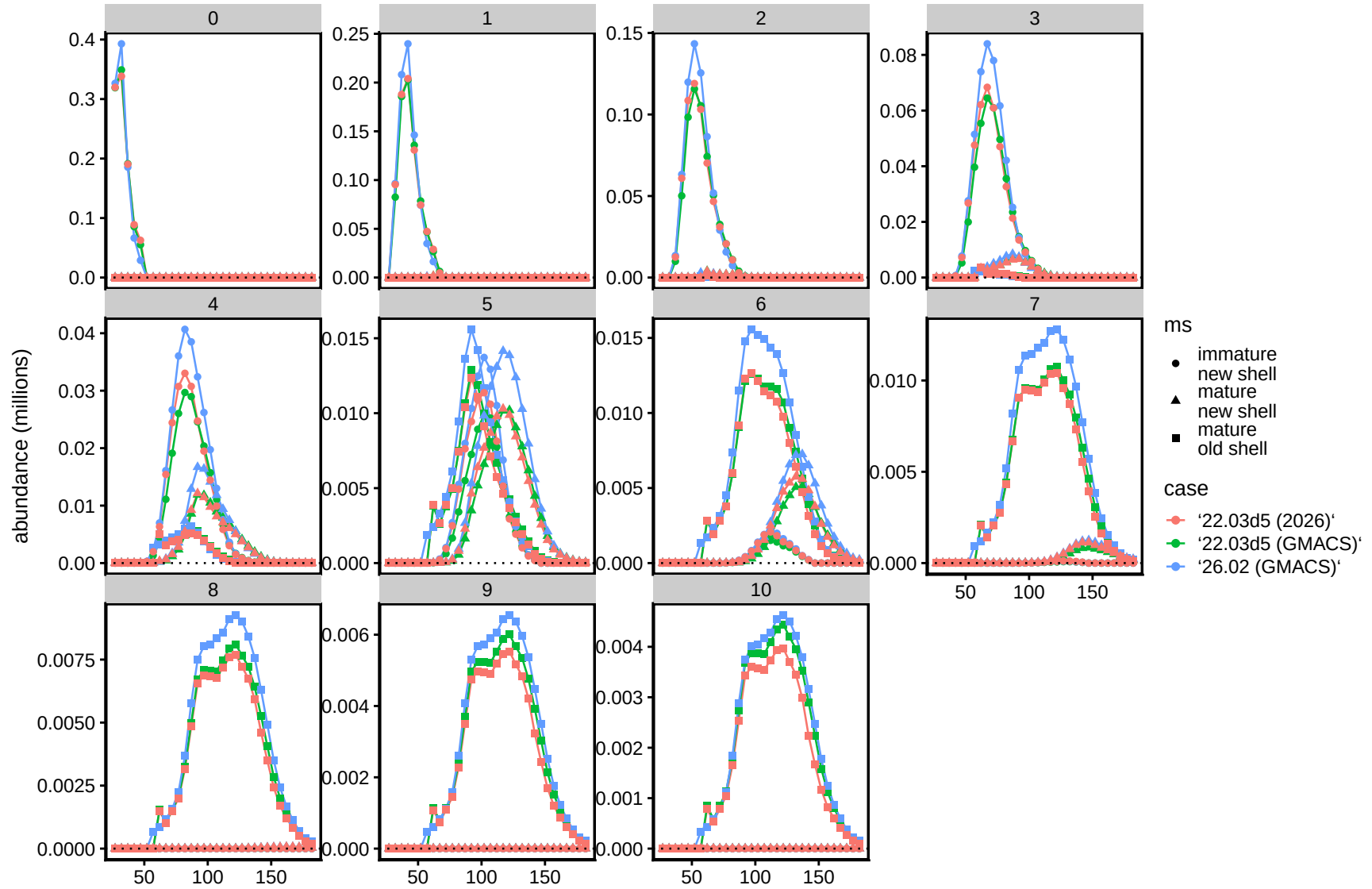


Figure 162. Comparison of the predicted abundance-at-size of a single recruitment cohort through time by sex and maturity/shell condition using conditions from the final model year for the GMACS and TCSAM02 models.

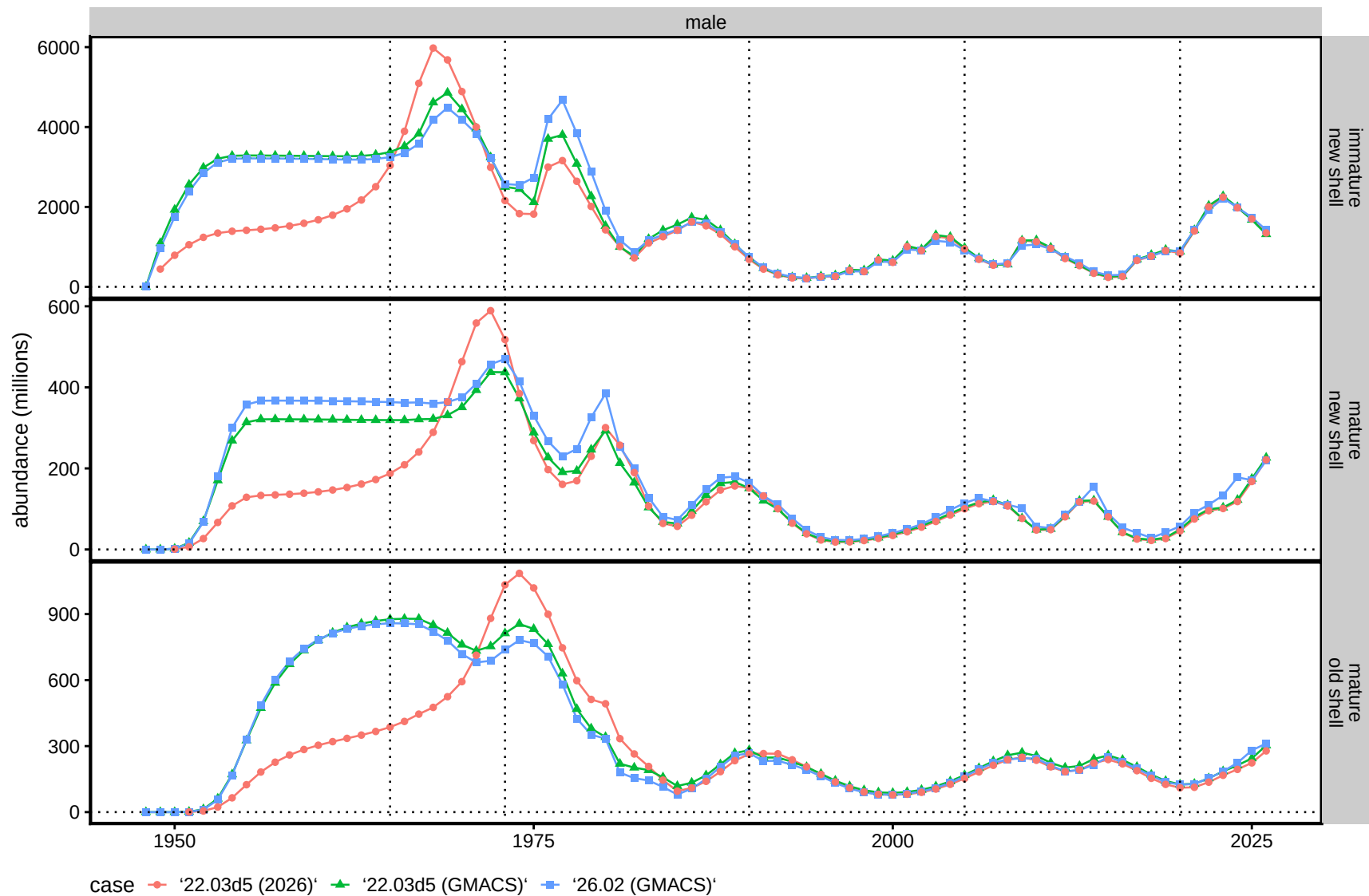


Figure 163. Comparison of the predicted population abundance through time by maturity/shell condition for males from the GMACS and TCSAM02 models. The dotted vertical lines indicate various temporal reference points: 1965-start of foreign fleet catch data; 1973-start of groundfish bycatch data; 1990-start of at sea observer estimates of total catch and size compositions in the crab fisheries; 2005-crab rationalization; 2020-no NMFS survey.

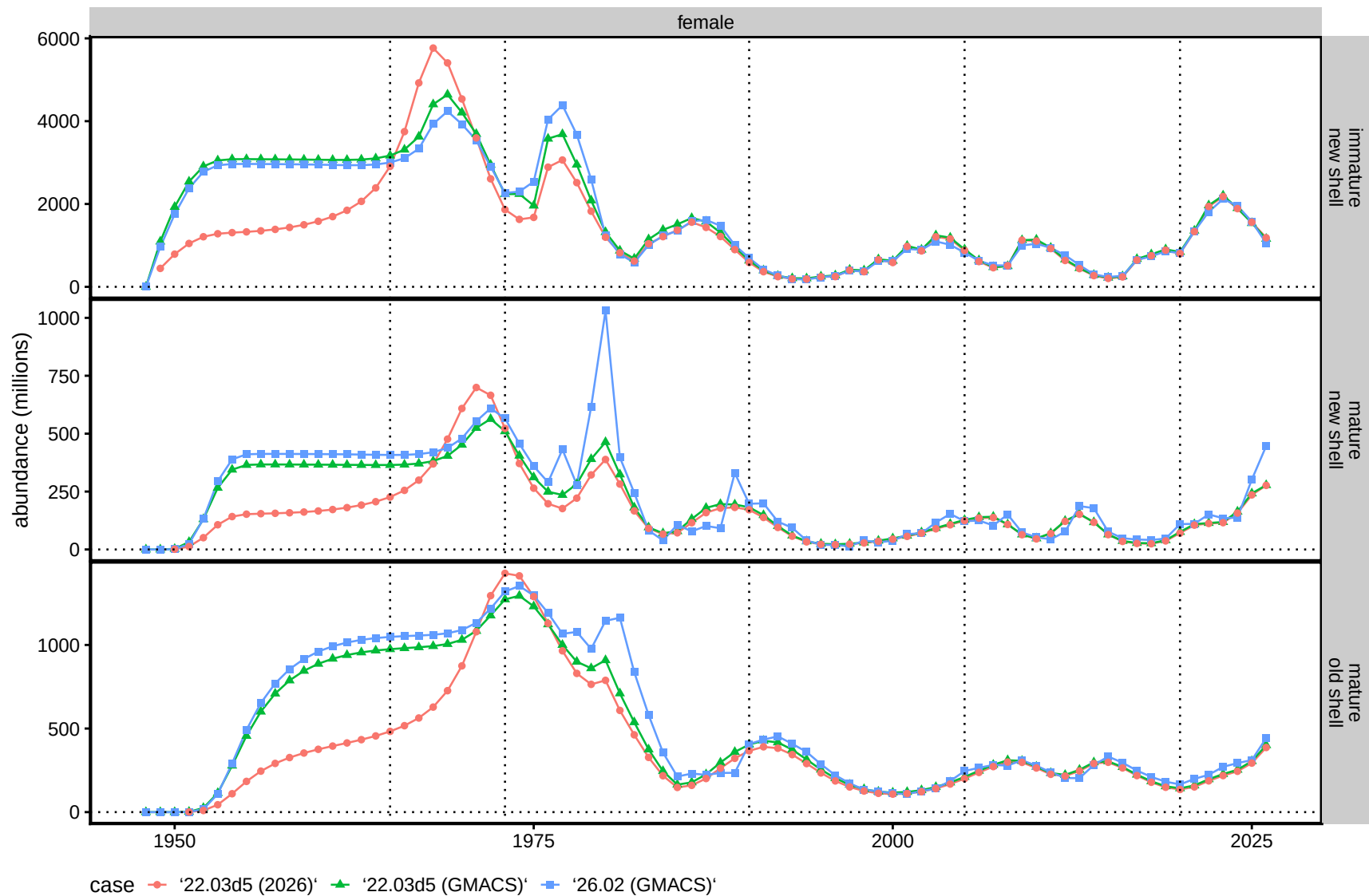


Figure 164. Comparison of the predicted population abundance through time by maturity/shell condition for females from the GMACS and TCSAM02 models. The dotted vertical lines indicate various temporal reference points: 1965-start of foreign fleet catch data; 1973-start of groundfish bycatch data; 1990-start of at sea observer estimates of total catch and size compositions in the crab fisheries; 2005-crab rationalization; 2020-no NMFS survey.

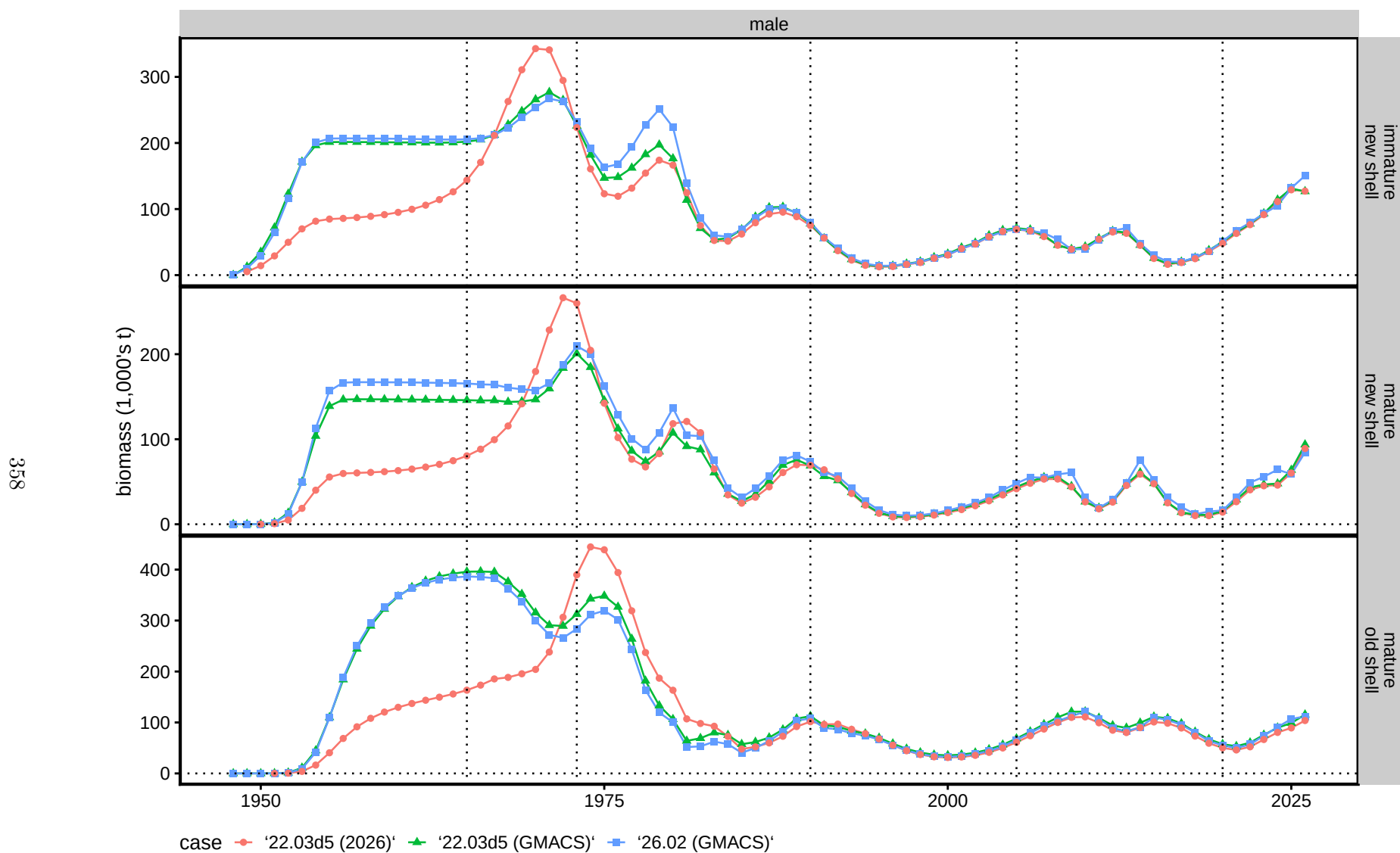


Figure 165. Comparison of the predicted population biomass through time by maturity/shell condition for males from the GMACS and TCSAM02 models. The dotted vertical lines indicate various temporal reference points: 1965-start of foreign fleet catch data; 1973-start of groundfish bycatch data; 1990-start of at sea observer estimates of total catch and size compositions in the crab fisheries; 2005-crab rationalization; 2020-no NMFS survey.

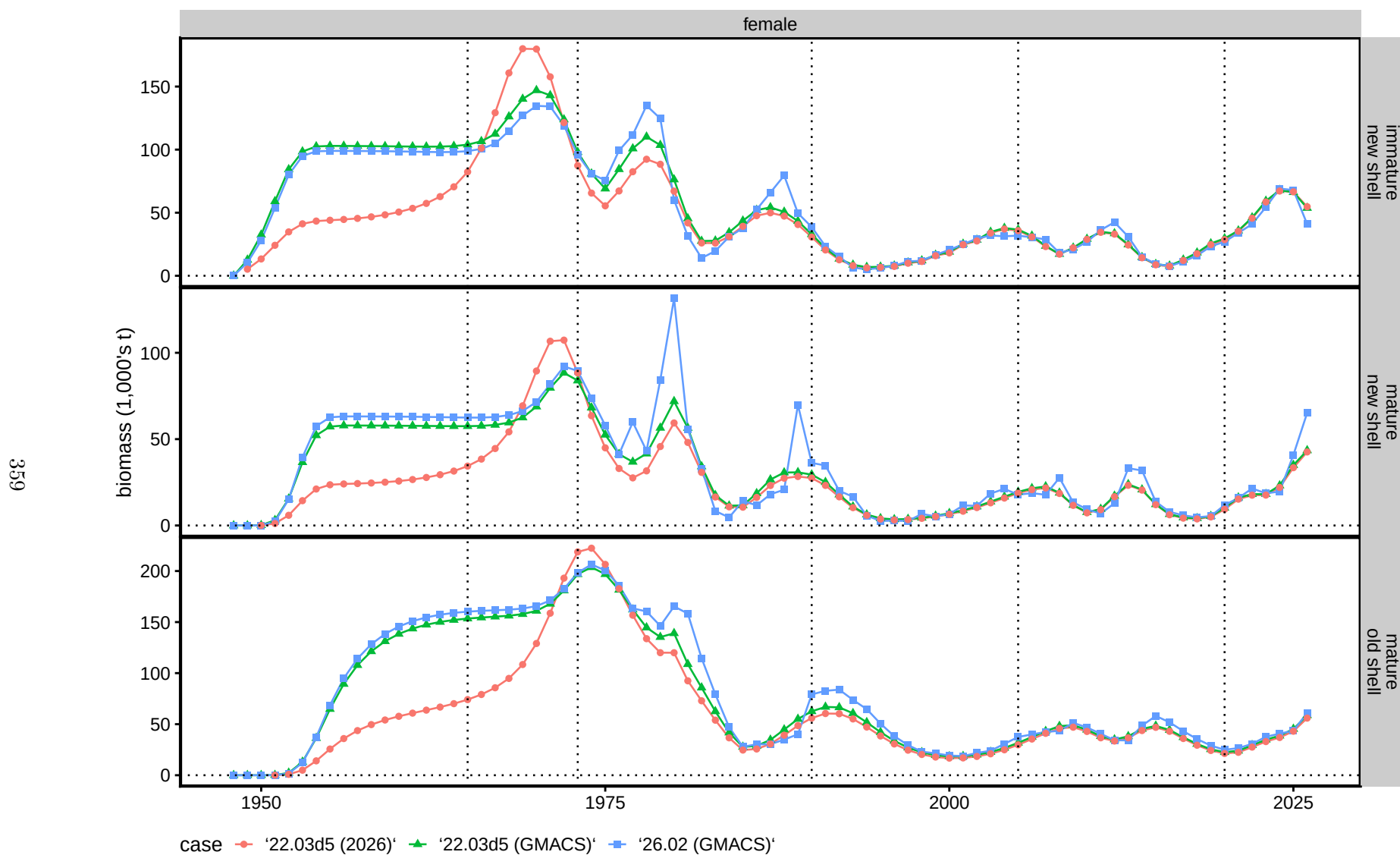


Figure 166. Comparison of the predicted population biomass through time by maturity/shell condition for females from the GMACS and TCSAM02 models. The dotted vertical lines indicate various temporal reference points: 1965-start of foreign fleet catch data; 1973-start of groundfish bycatch data; 1990-start of at sea observer estimates of total catch and size compositions in the crab fisheries; 2005-crab rationalization; 2020-no NMFS survey.

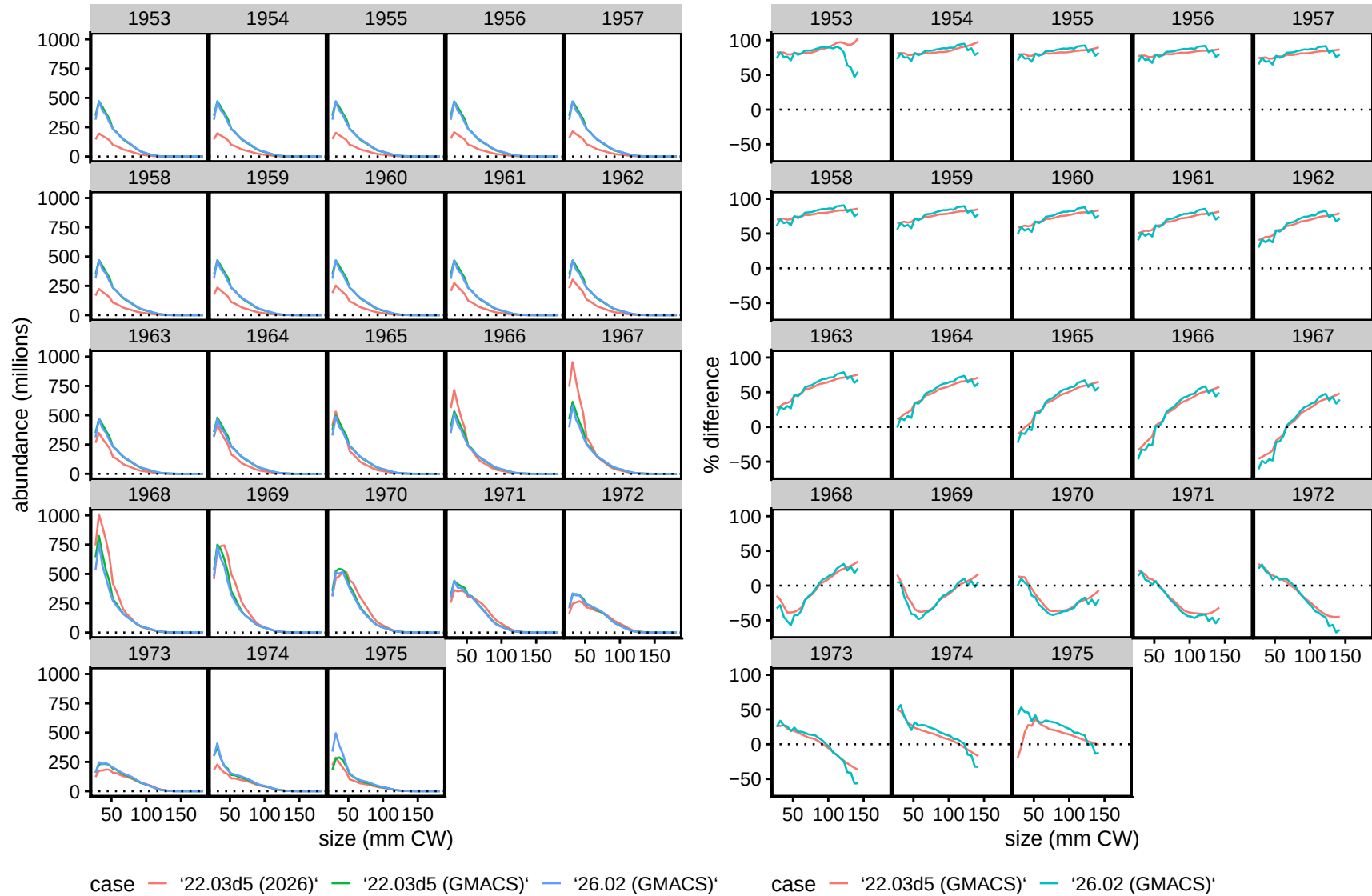


Figure 167. Comparison of the predicted population abundance-at-size through time (1953-1975) for immature, new shell males from the GMACS and TCSAM02 models. Left: values; right: percent differences.

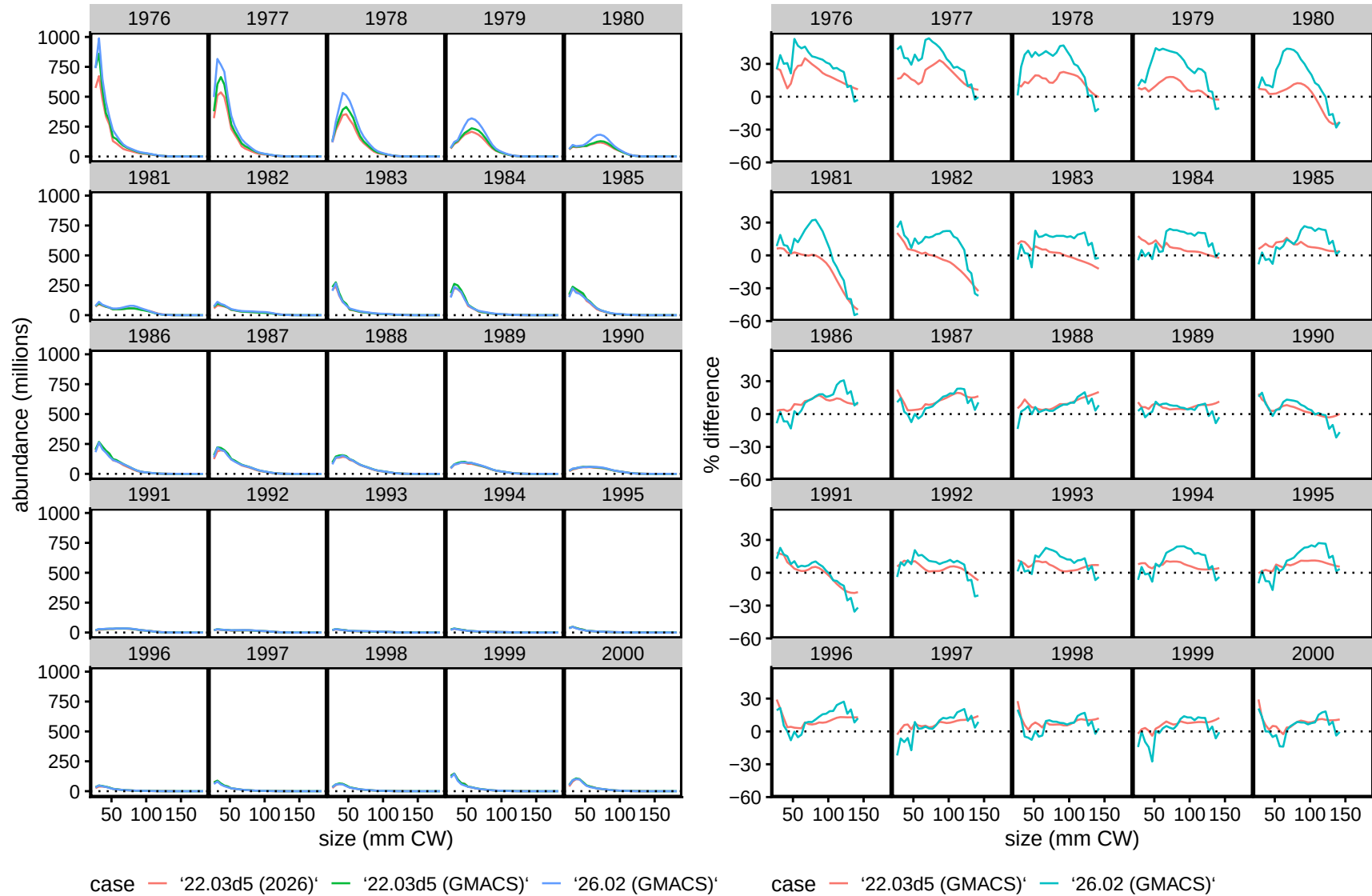


Figure 168. Comparison of the predicted population abundance-at-size through time (1976-2000) for immature, new shell males from the GMACS and TCSAM02 models. Left: values; right: percent differences.

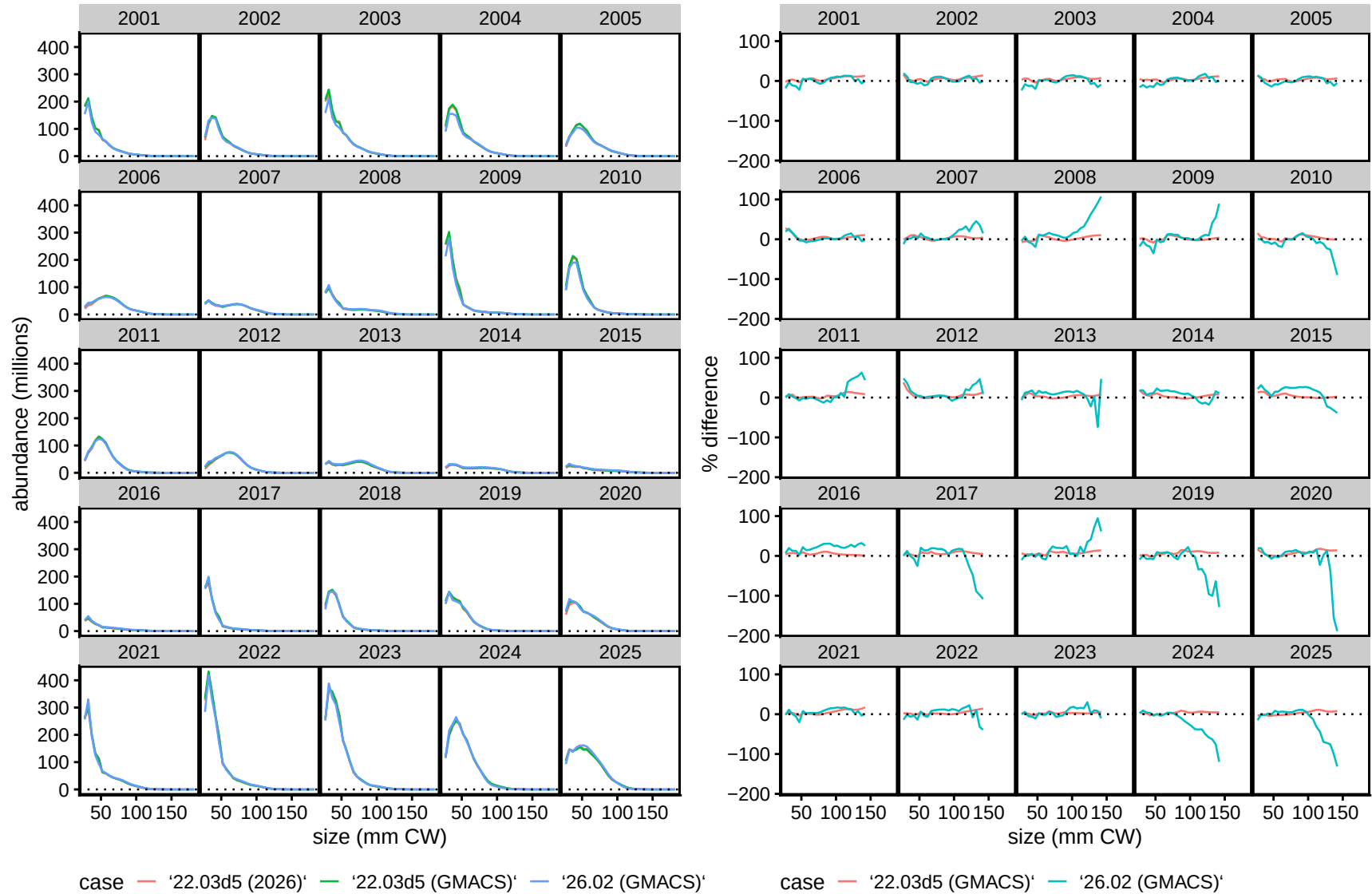


Figure 169. Comparison of the predicted population abundance-at-size through time (2001-2025) for immature, new shell males from the GMACS and TCSAM02 models. Left: values; right: percent differences.

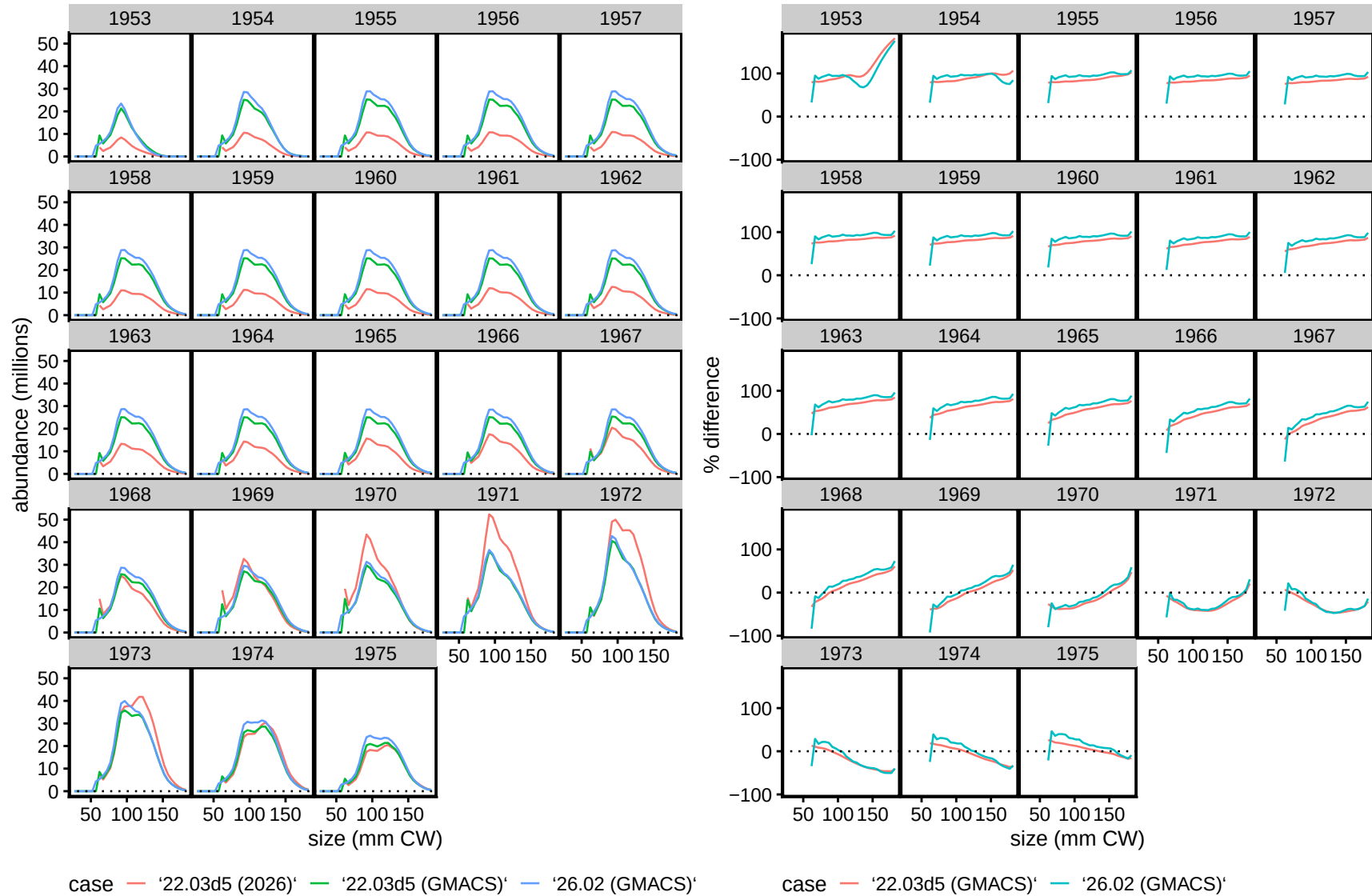


Figure 170. Comparison of the predicted population abundance-at-size through time (1953-1975) for mature, new shell males from the GMACS and TCSAM02 models. Left: values; right: percent differences.

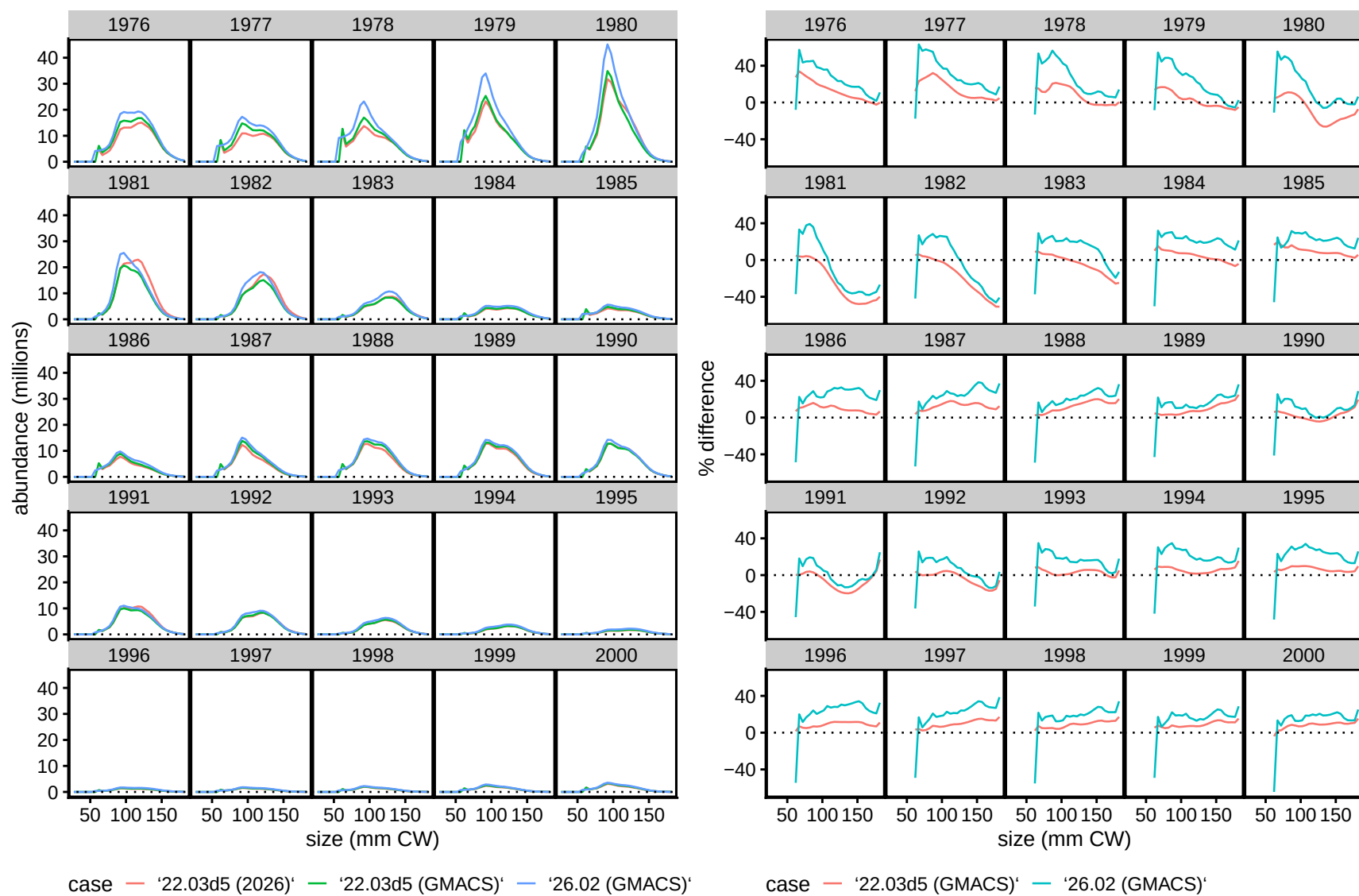


Figure 171. Comparison of the predicted population abundance-at-size through time (1976-2000) for mature, new shell males from the GMACS and TCSAM02 models. Left: values; right: percent differences.

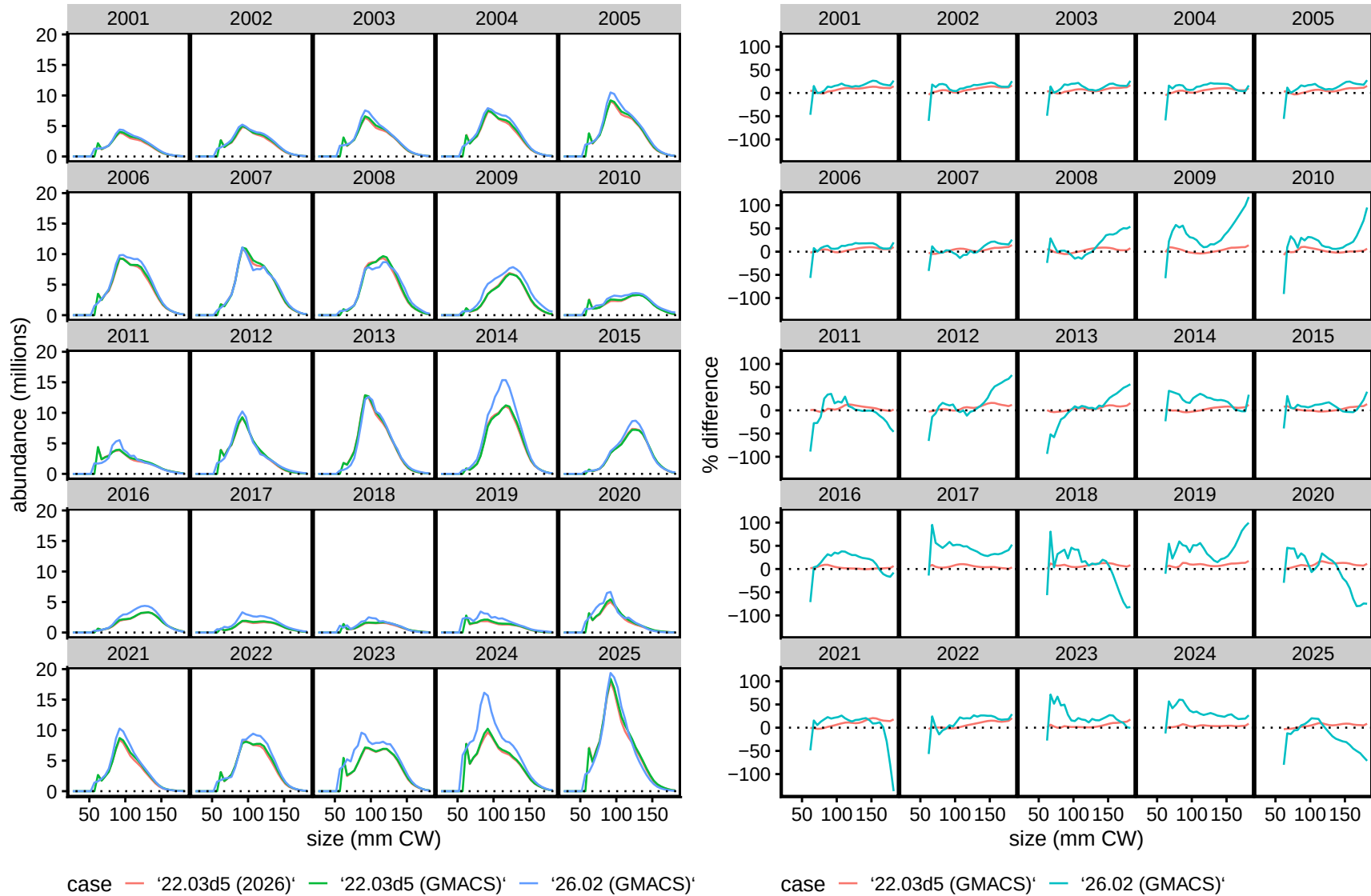


Figure 172. Comparison of the predicted population abundance-at-size through time (2001-2025) for mature, new shell males from the GMACS and TCSAM02 models. Left: values; right: percent differences.

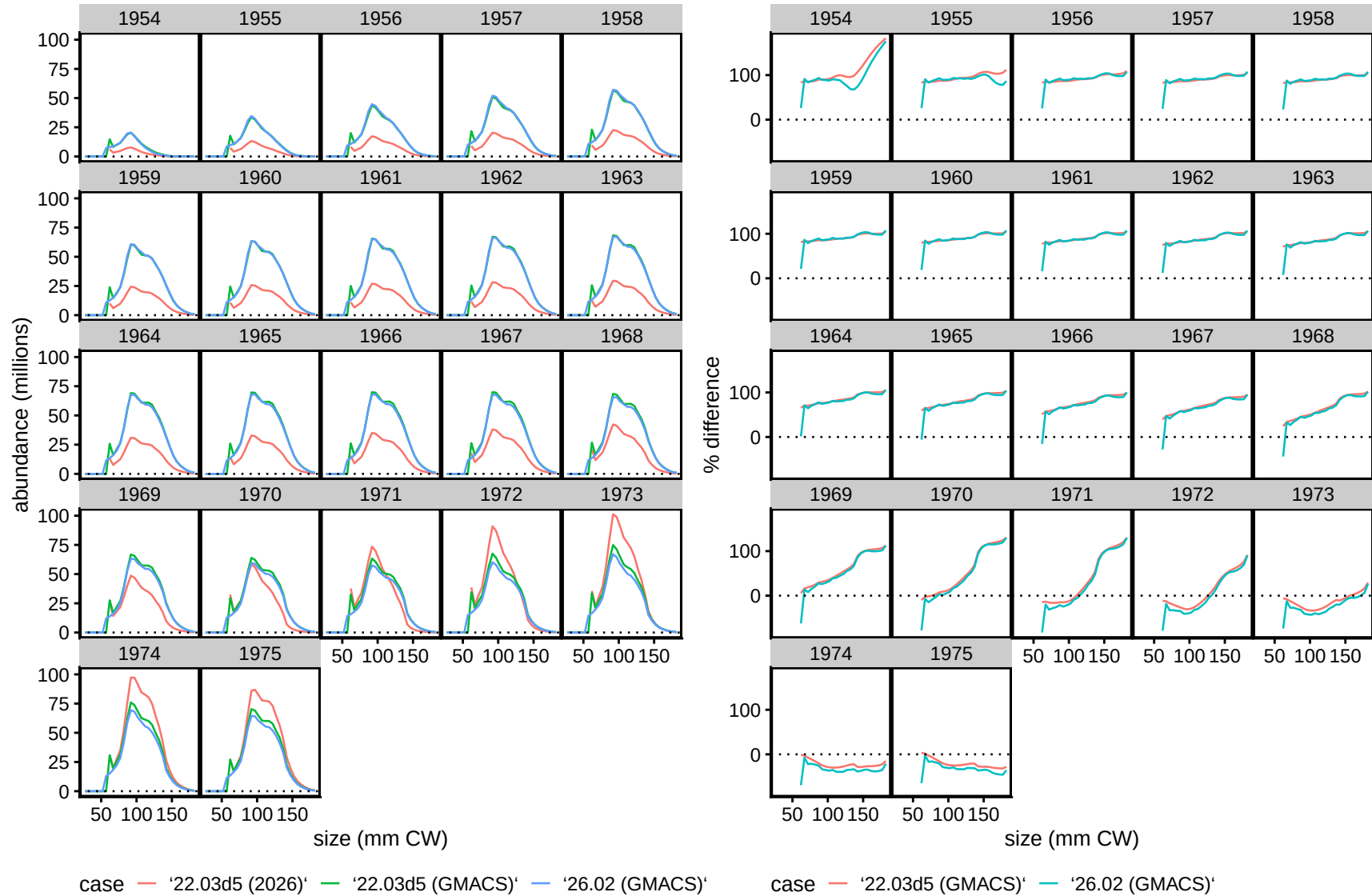


Figure 173. Comparison of the predicted population abundance-at-size through time (1953-1975) for mature, old shell males from the GMACS and TCSAM02 models. Left: values; right: percent differences.

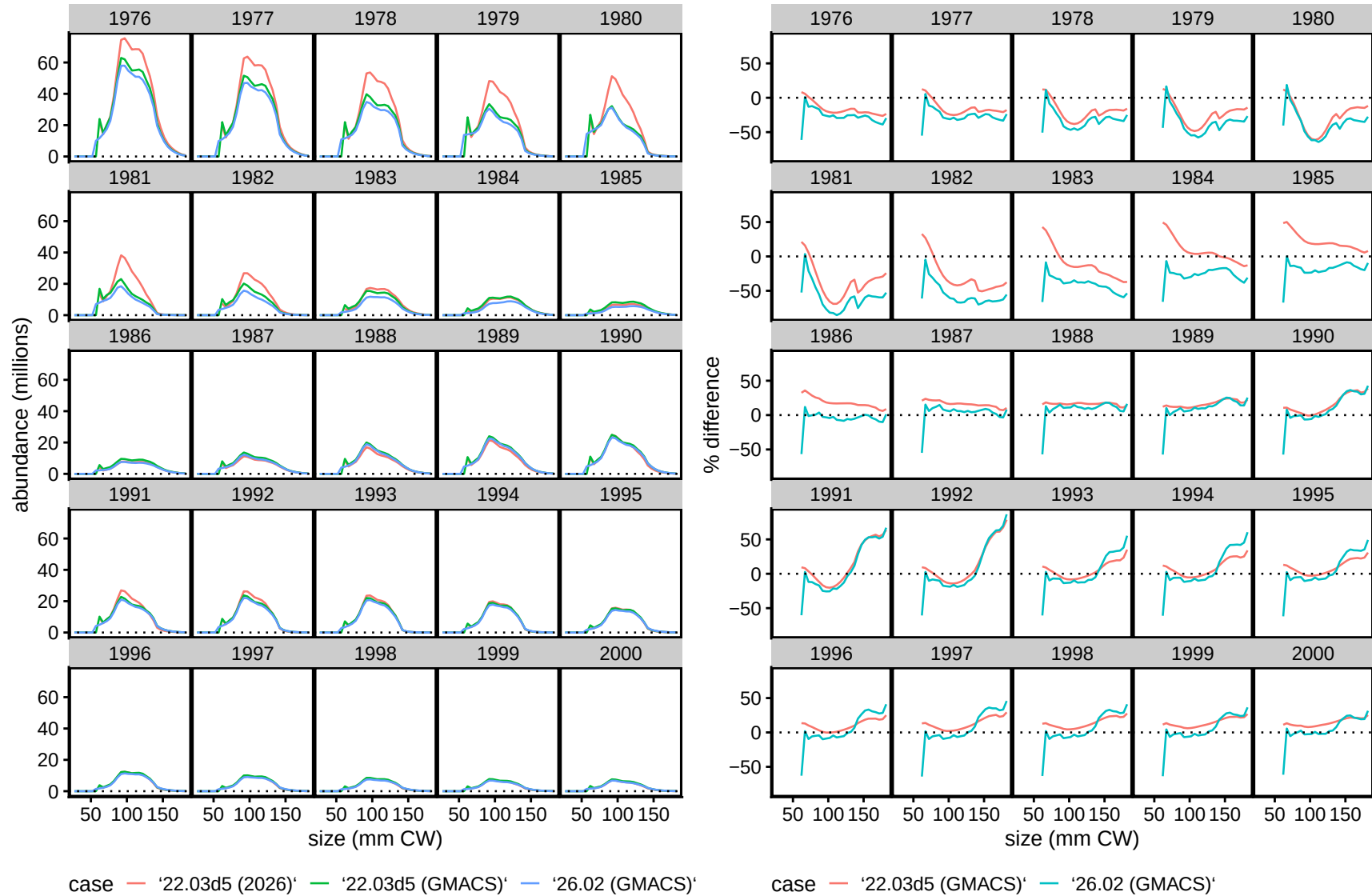


Figure 174. Comparison of the predicted population abundance-at-size through time (1976-2000) for mature, old shell males from the GMACS and TCSAM02 models. Left: values; right: percent differences.

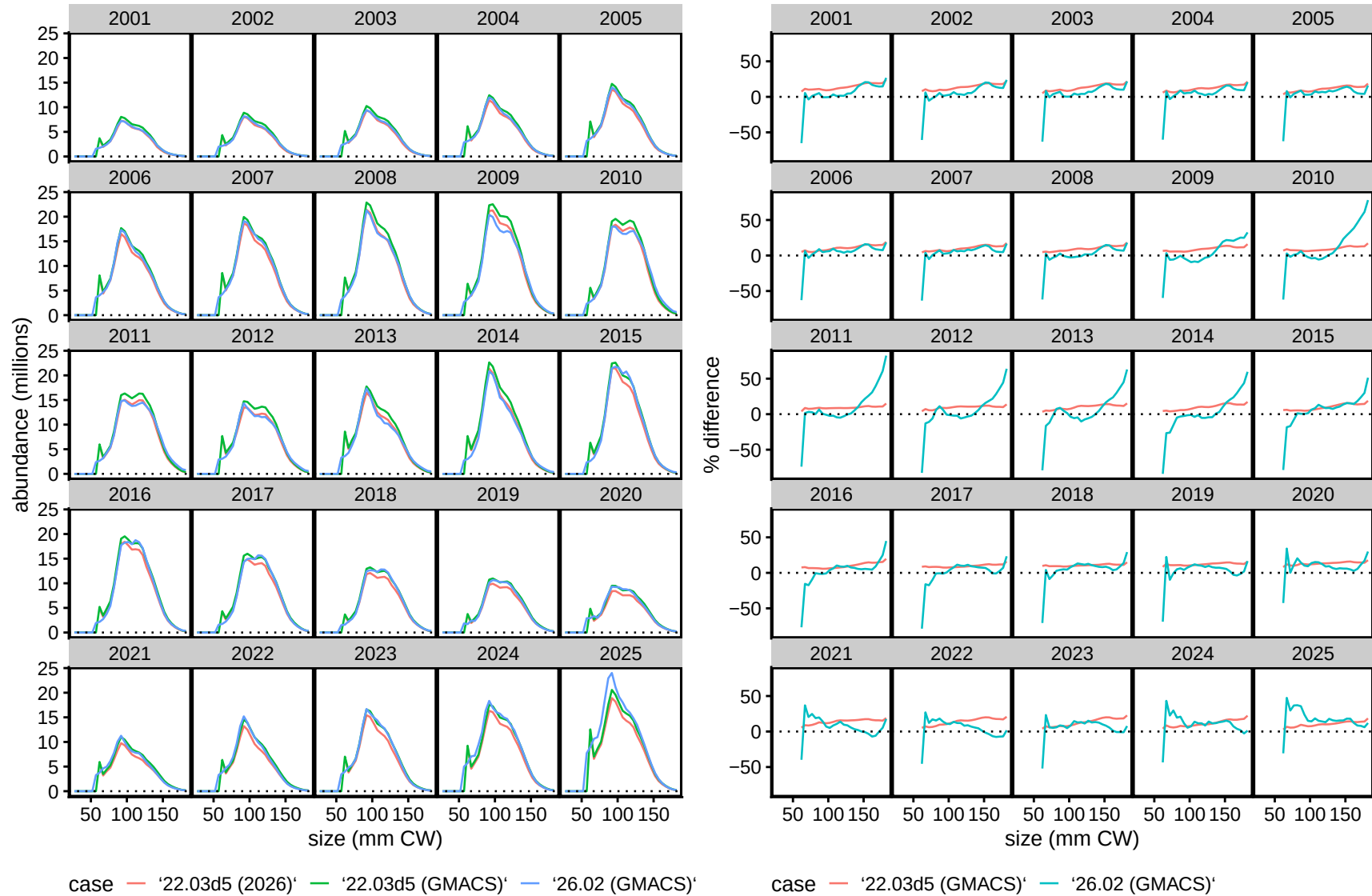


Figure 175. Comparison of the predicted population abundance-at-size through time (2001-2025) for mature, old shell males from the GMACS and TCSAM02 models. Left: values; right: percent differences.

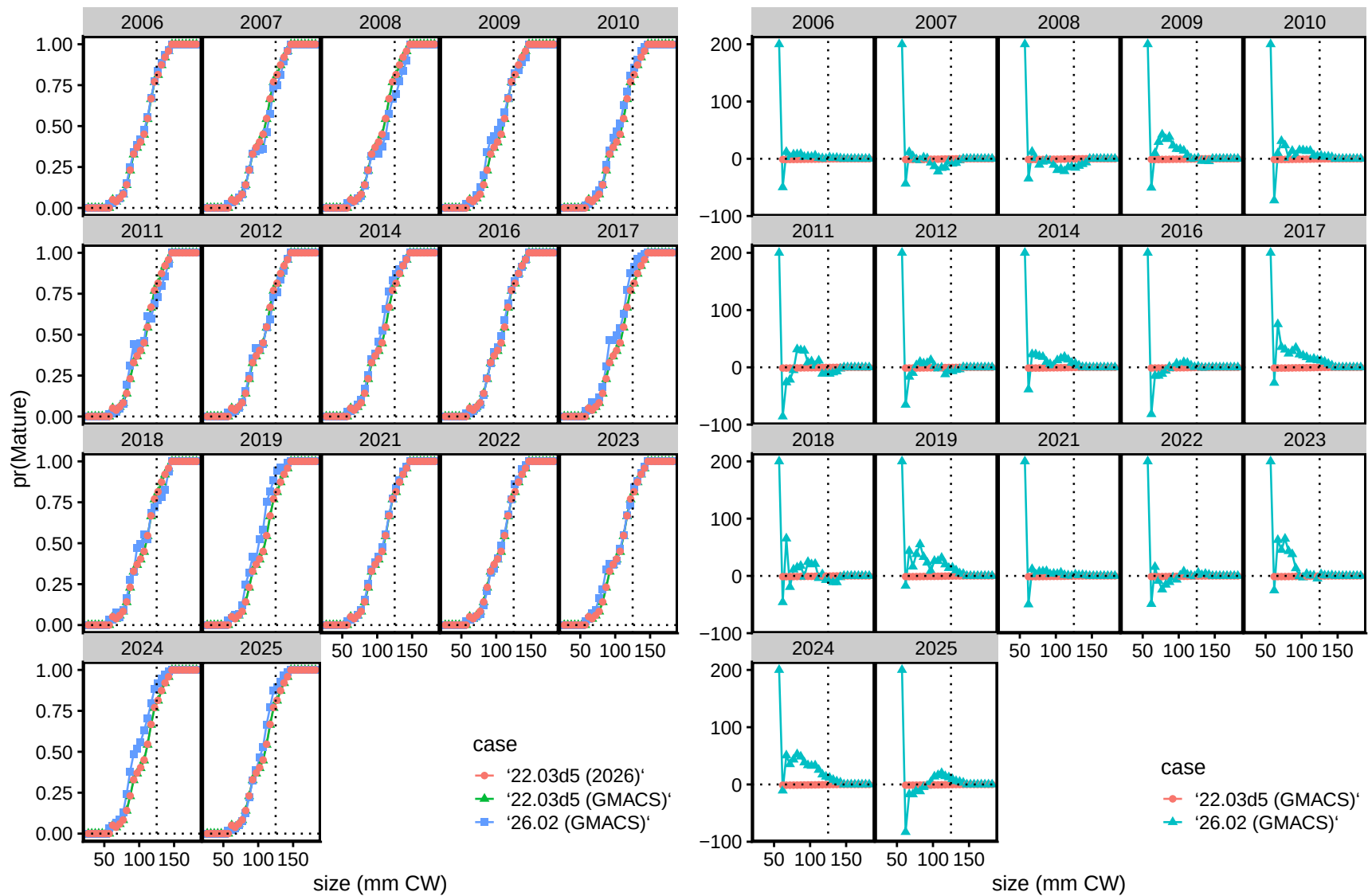


Figure 176. Comparison of the predicted male maturity ogives through time based on predicted NMFS survey abundance-at-size for immature and mature new shell crab from the GMACS and TCSAM02 models using model size bins. Left: values; right: percent differences.

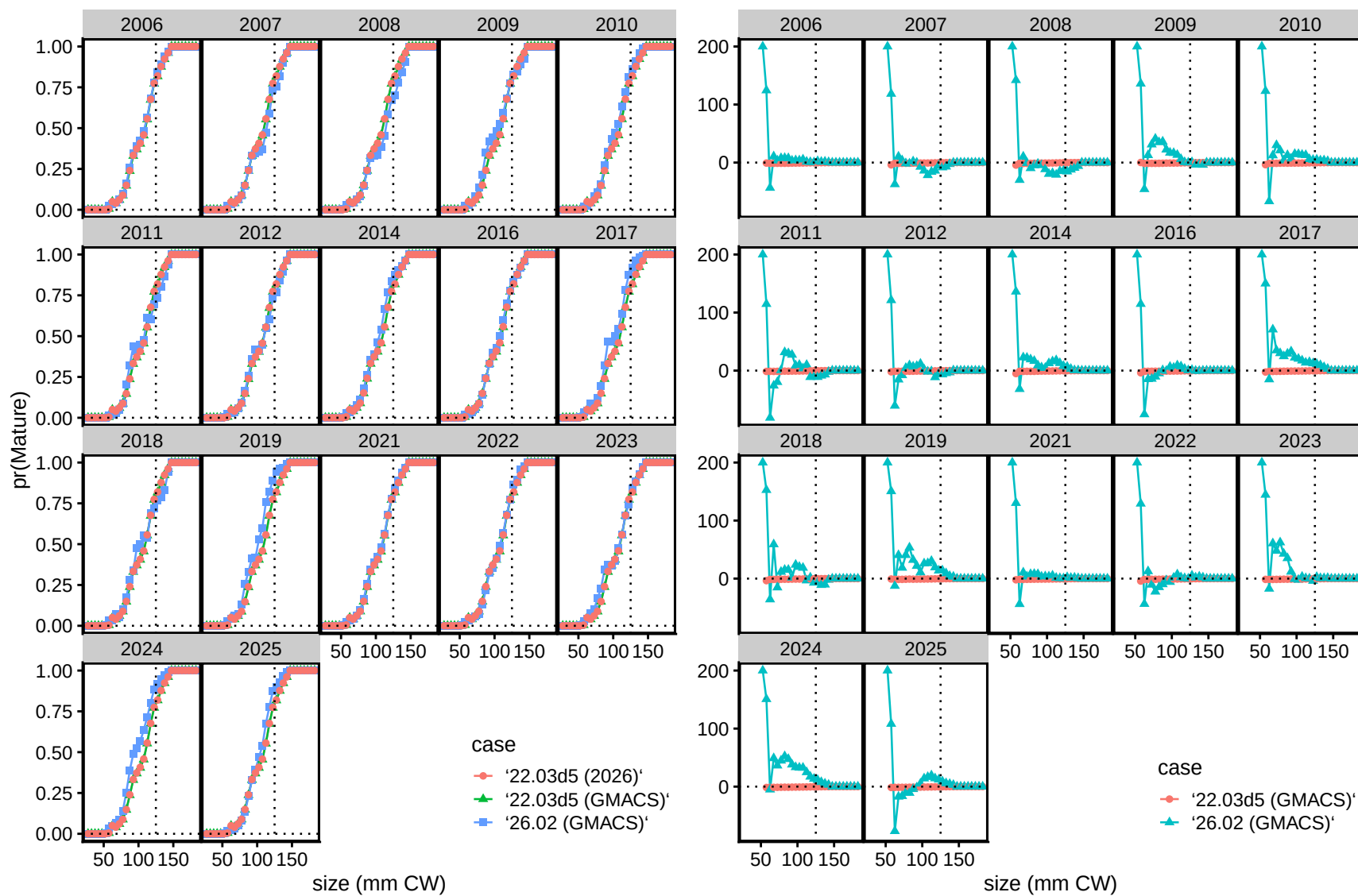


Figure 177. Comparison of the predicted male maturity ogives through time based on predicted NMFS survey abundance-at-size for immature and mature new shell crab from the GMACS and TCSAM02 models, using observed size bins. Left: values; right: percent differences.

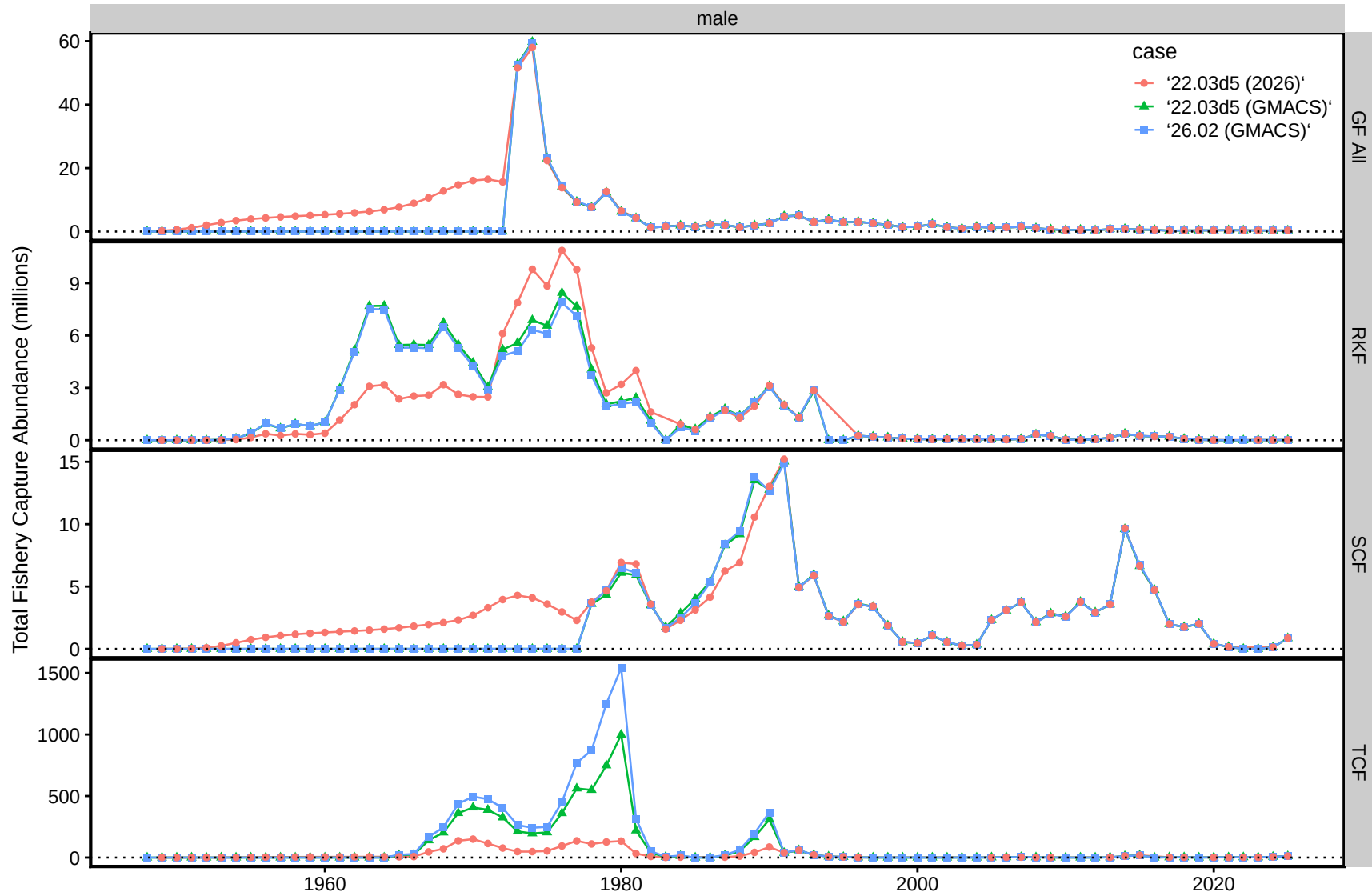


Figure 178. Comparison of the predicted capture abundance by fishery through time for males from the GMACS and TCSAM02 models. Left: values; right: percent differences.

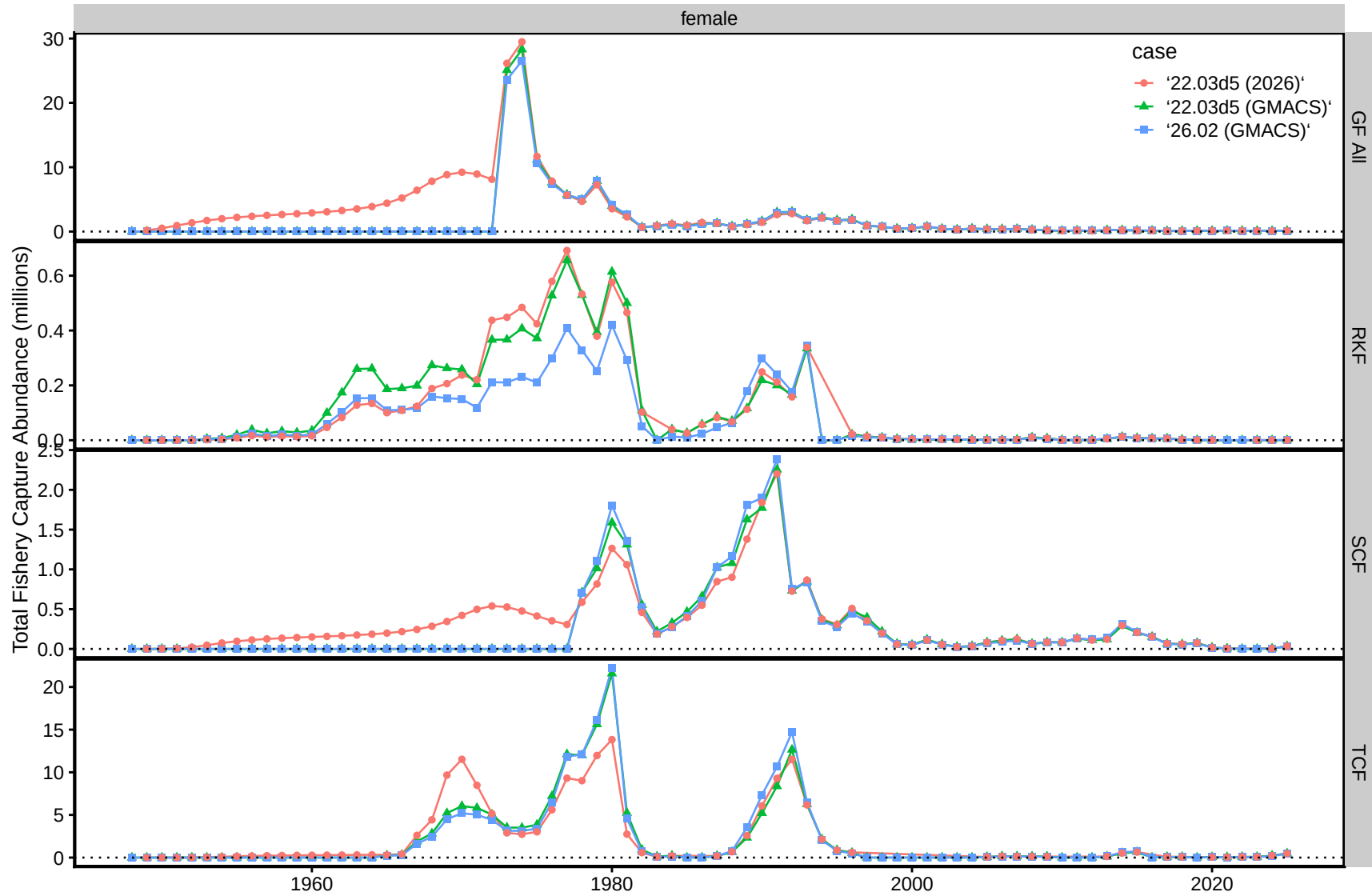


Figure 179. Comparison of the predicted capture abundance by fishery through time for females from the GMACS and TCSAM02 models. Left: values; right: percent differences.

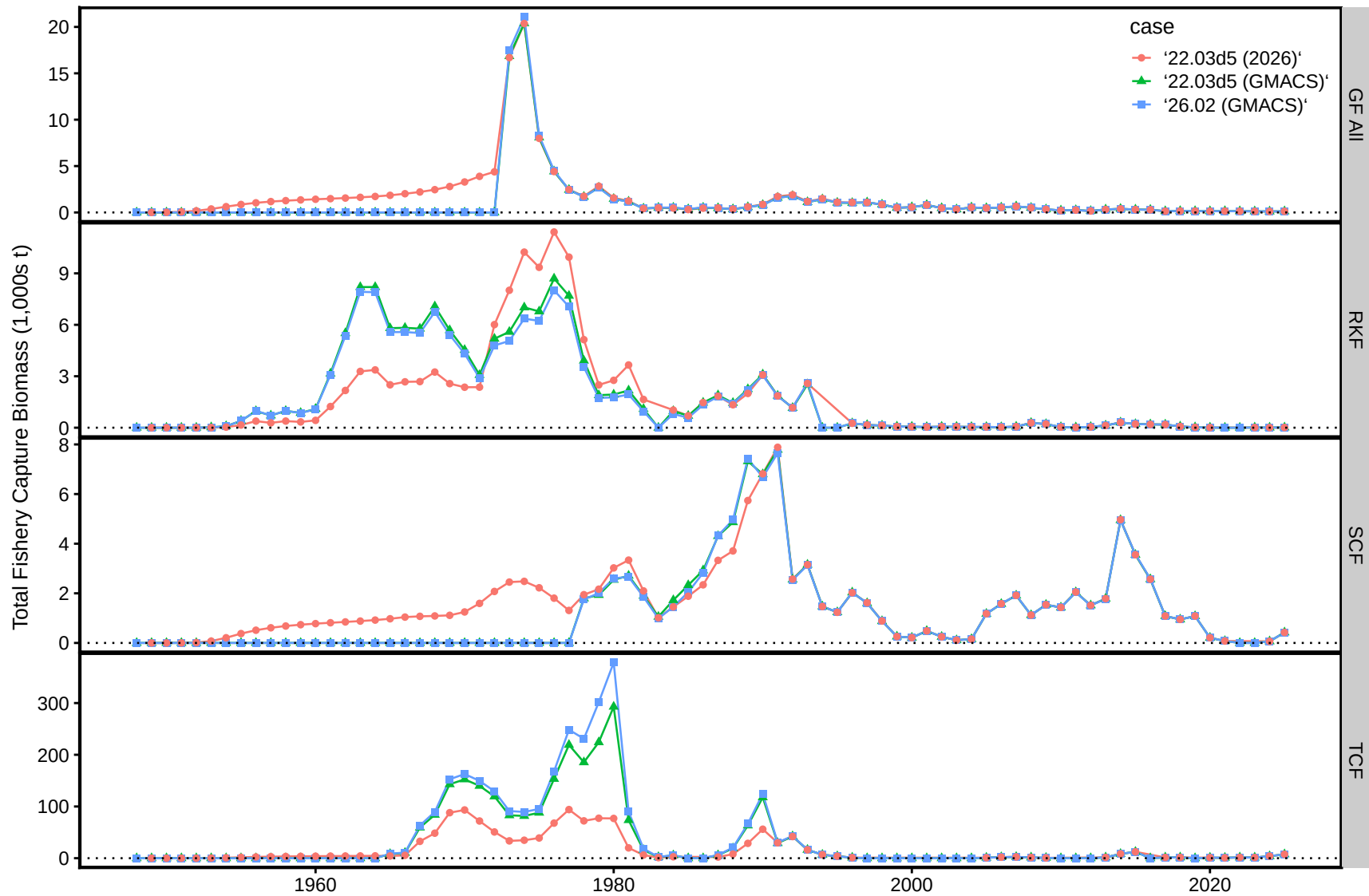


Figure 180. Comparison of the predicted capture biomass by fishery through time for males from the GMACS and TCSAM02 models.

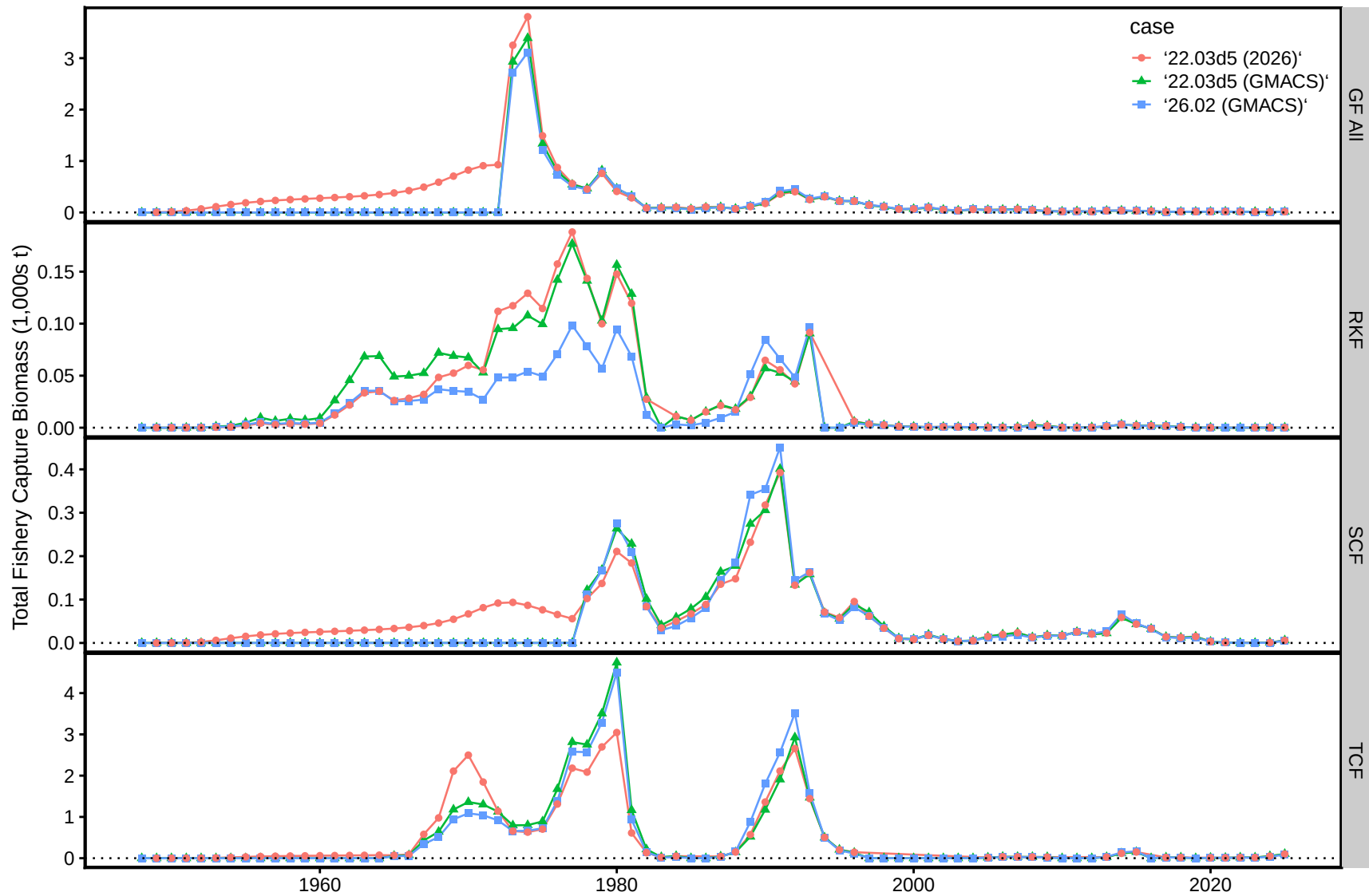


Figure 181. Comparison of the predicted capture biomass by fishery through time for females from the GMACS and TCSAM02 models.

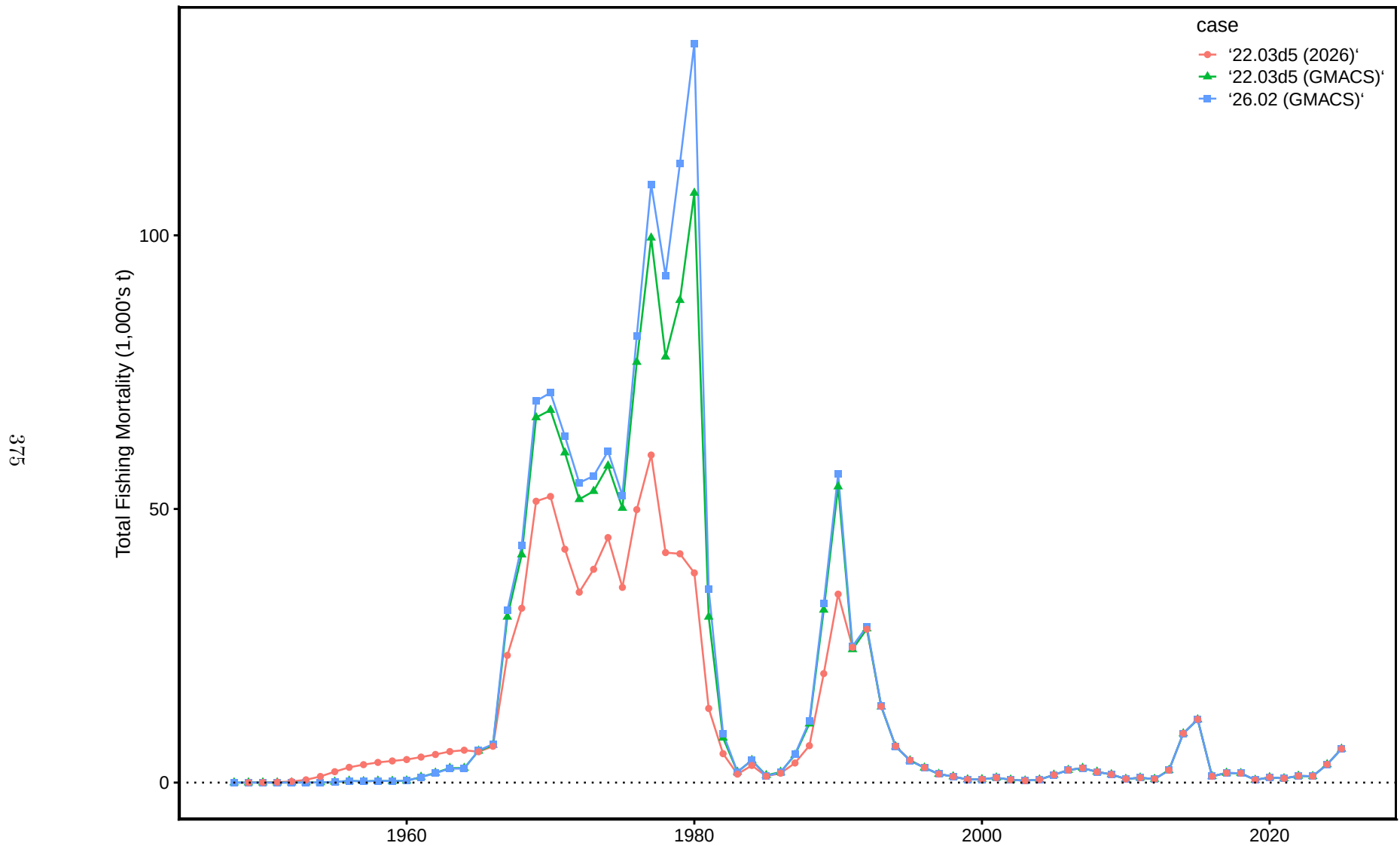


Figure 182. Comparison of the predicted total fishing mortality (biomass) through time from the GMACS and TCSAM02 models.

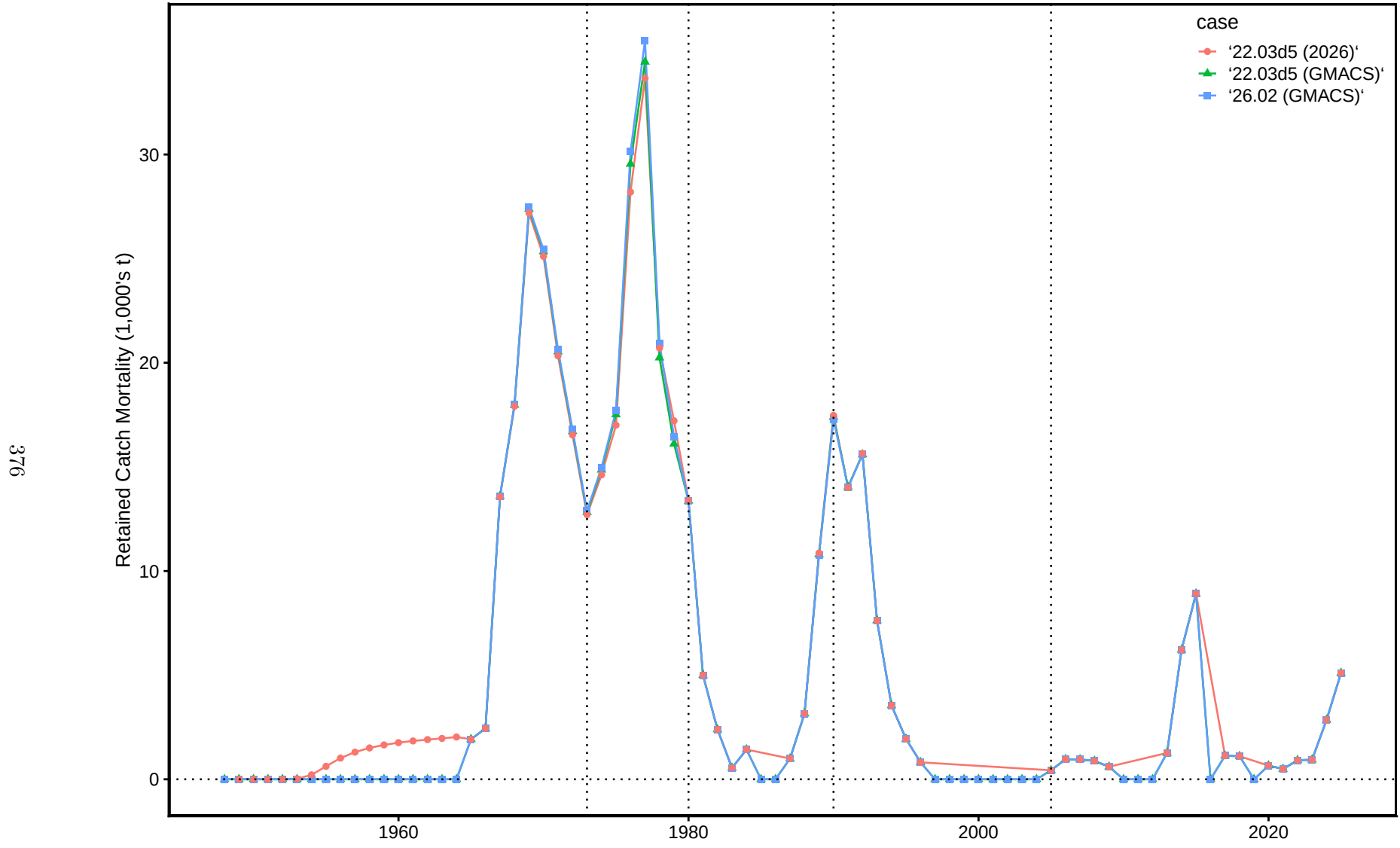


Figure 183. Comparison of the predicted retained catch mortality (biomass) through time from the GMACS and TCSAM02 models. Dotted vertical lines indicate 1973, 1980, 1990, and 2005

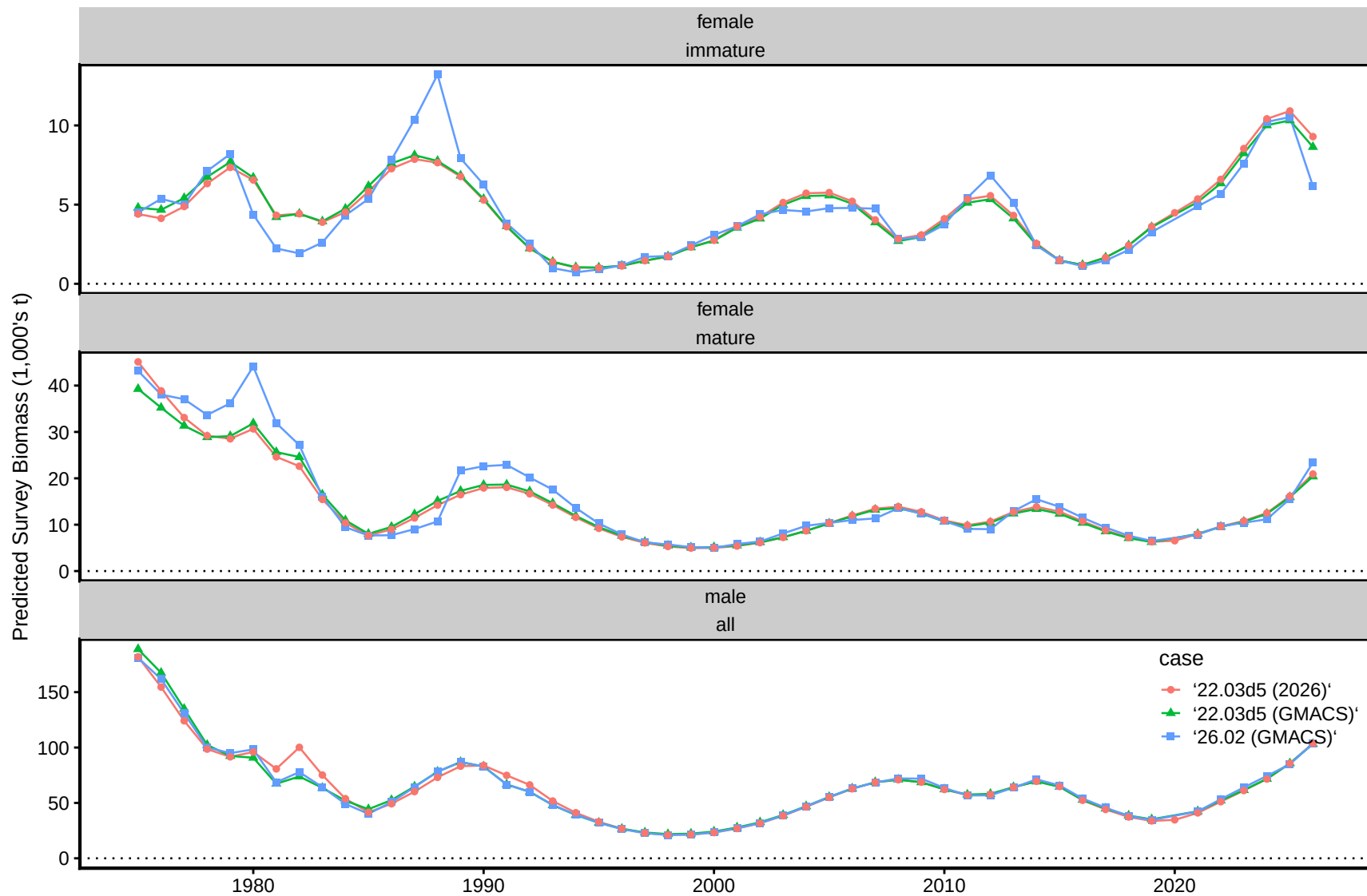


Figure 184. Comparison of the predicted NMFS survey biomass through time from the GMACS and TCSAM02 models.

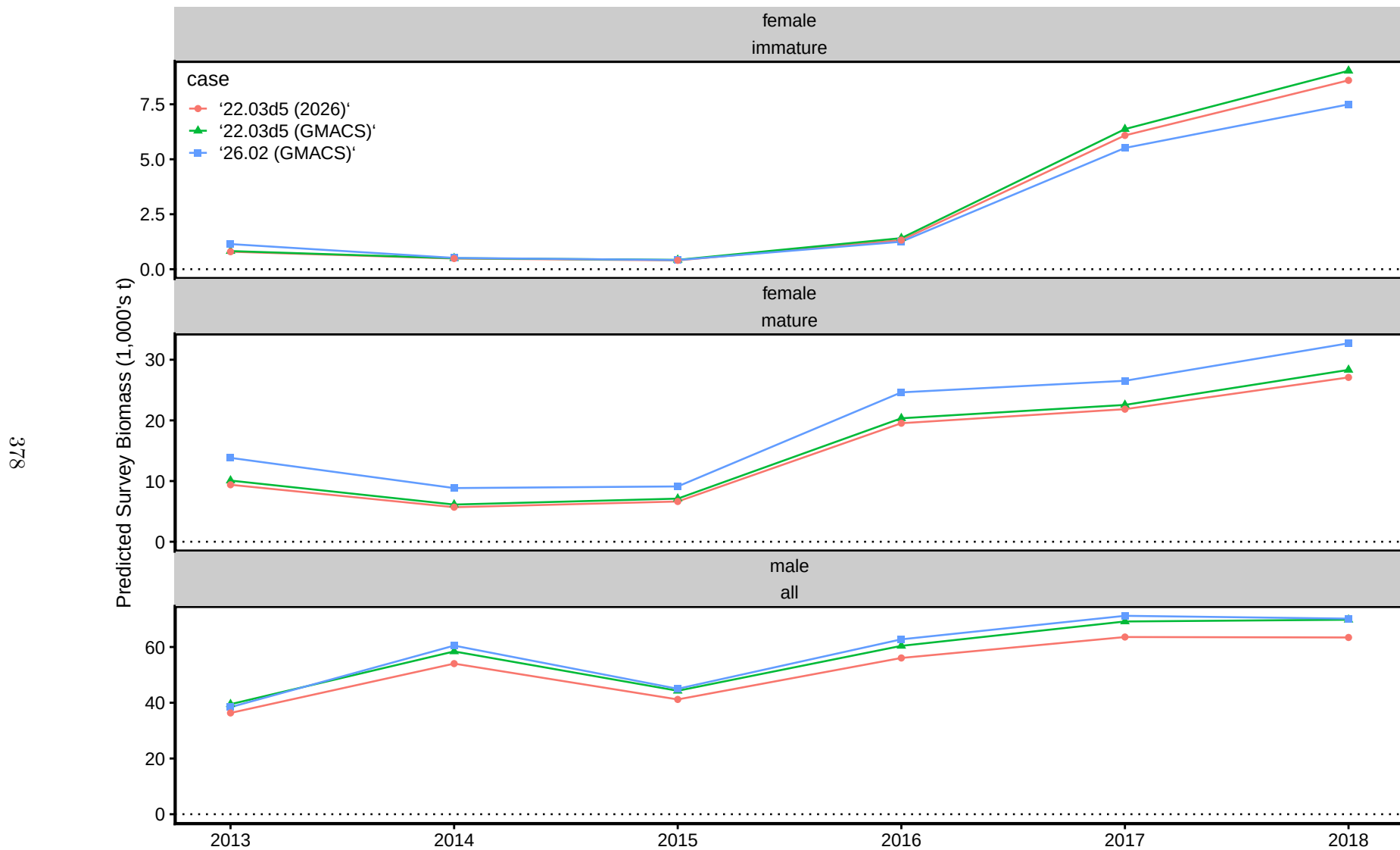


Figure 185. Comparison of the predicted BSFRF survey biomass through time from the GMACS and TCSAM02 models.

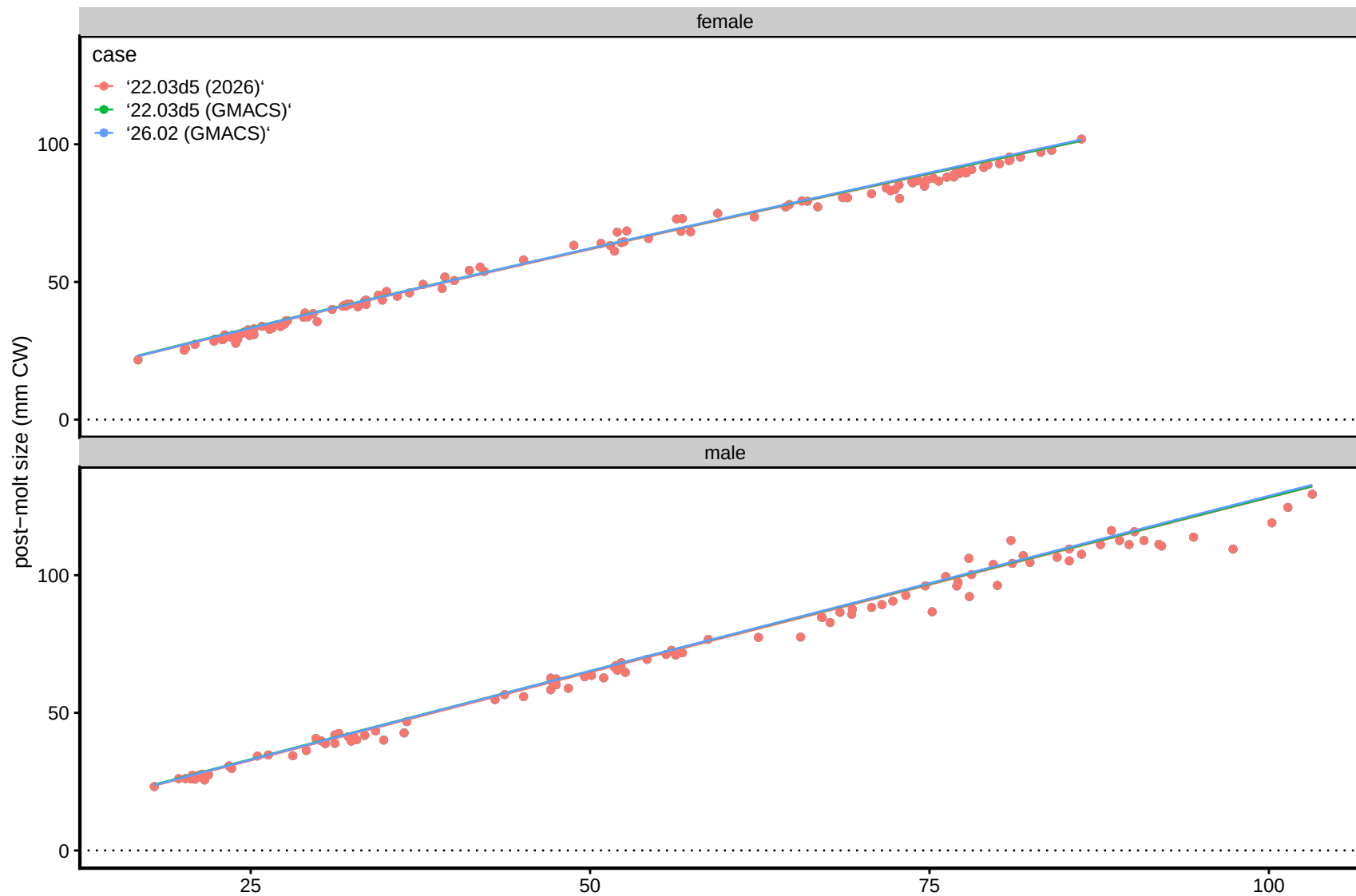


Figure 186. Comparison of fits to molt increment data by sex. Observed values: points, predicted values: lines.

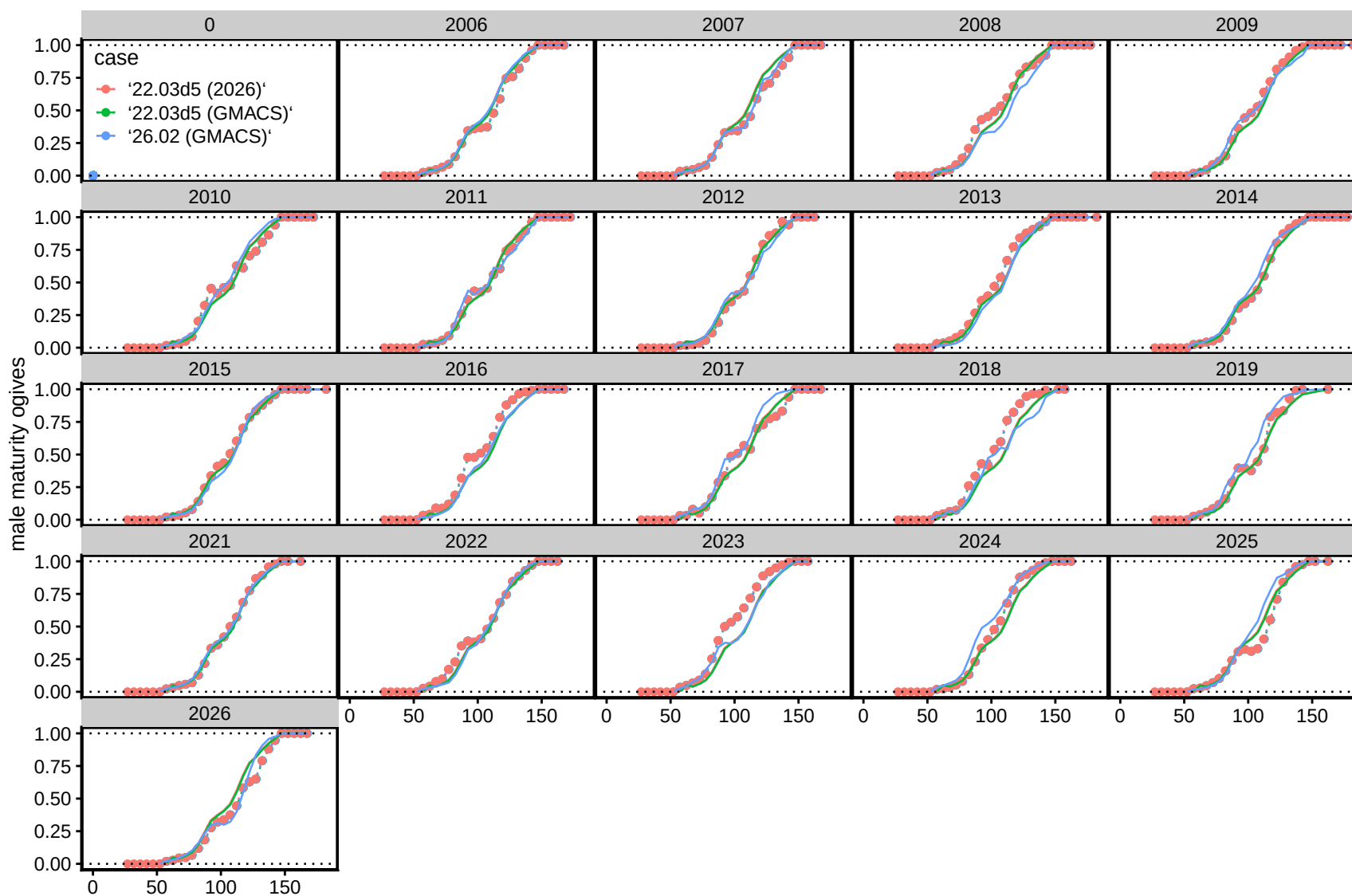


Figure 187. Comparison of fits to male maturity ogives based on chela height/carapace width measurements on males during the NMFS EBS bottom trawl surveys. Observed: points and dotted line, predicted: lines.

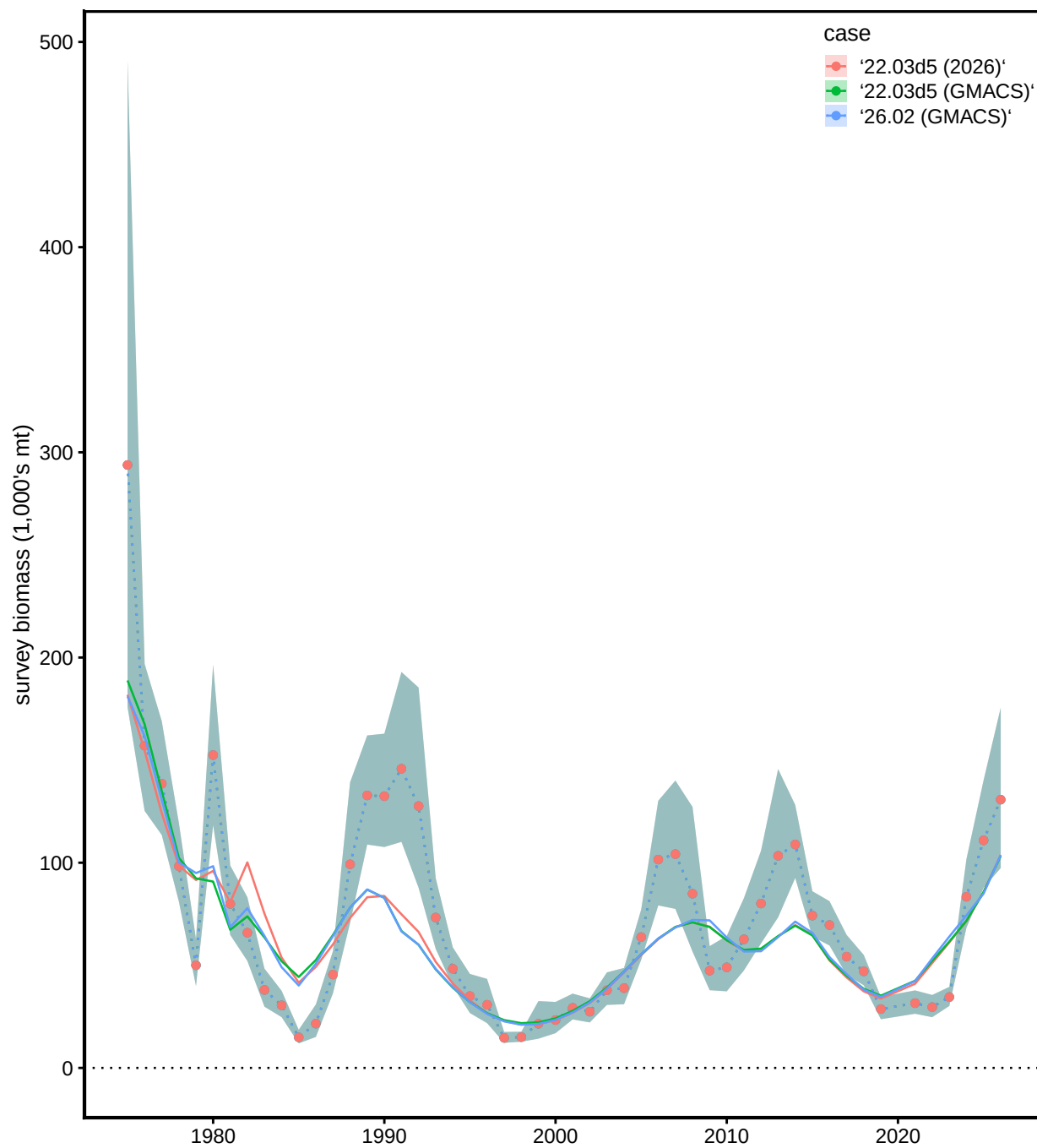


Figure 188. Comparison of fits to male survey biomass in the NMFS surveys. Observed values: points, dotted line, and shading (90% lognormal CIs); predicted: lines.

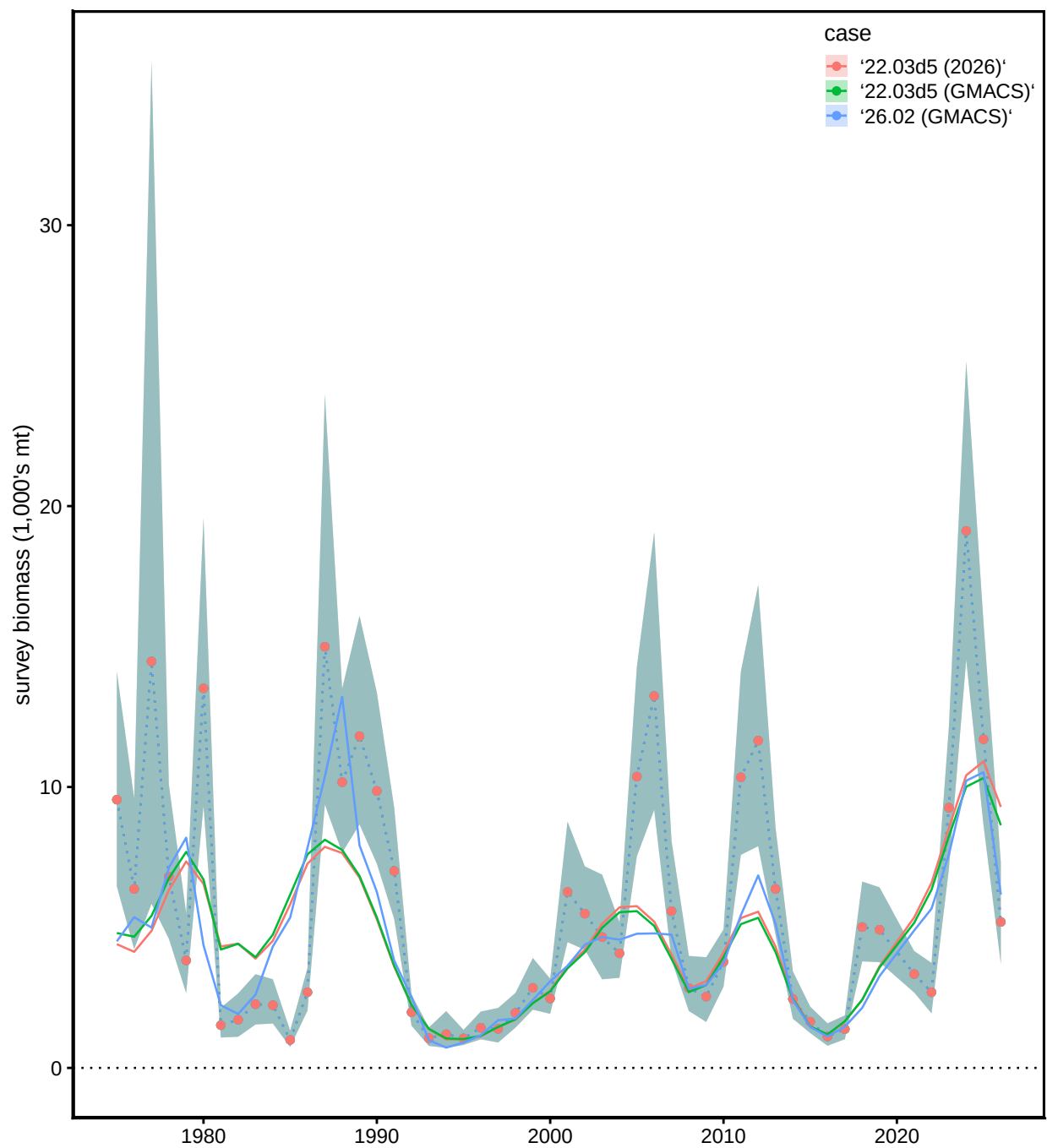


Figure 189. Comparison of fits to immature female survey biomass in the NMFS surveys. Observed values: points, dotted line, and shading (90% lognormal CIs); predicted: lines.

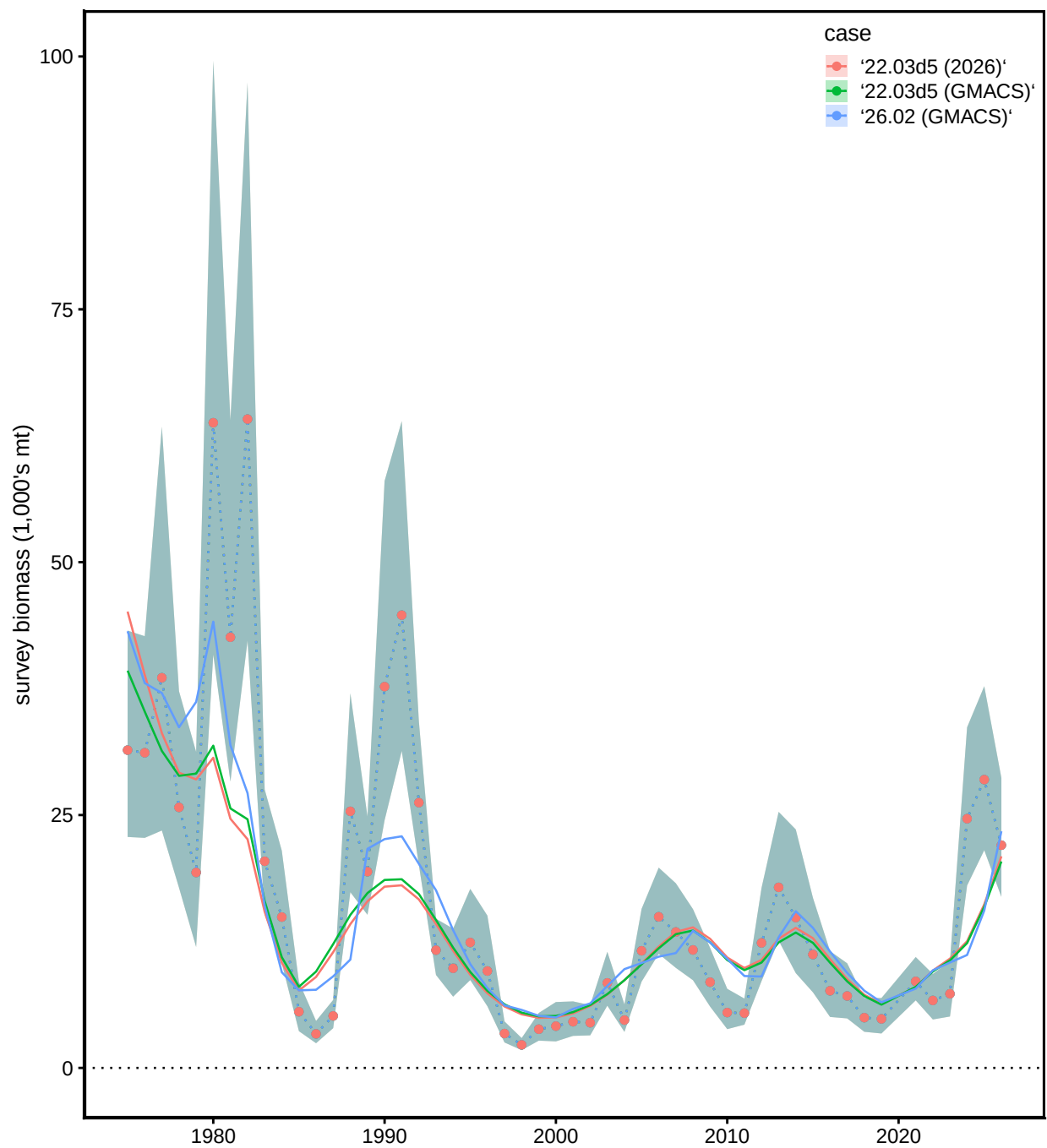


Figure 190. Comparison of fits to mature female survey biomass in the NMFS surveys. Observed values: points, dotted line, and shading (90% lognormal CIs); predicted: lines.

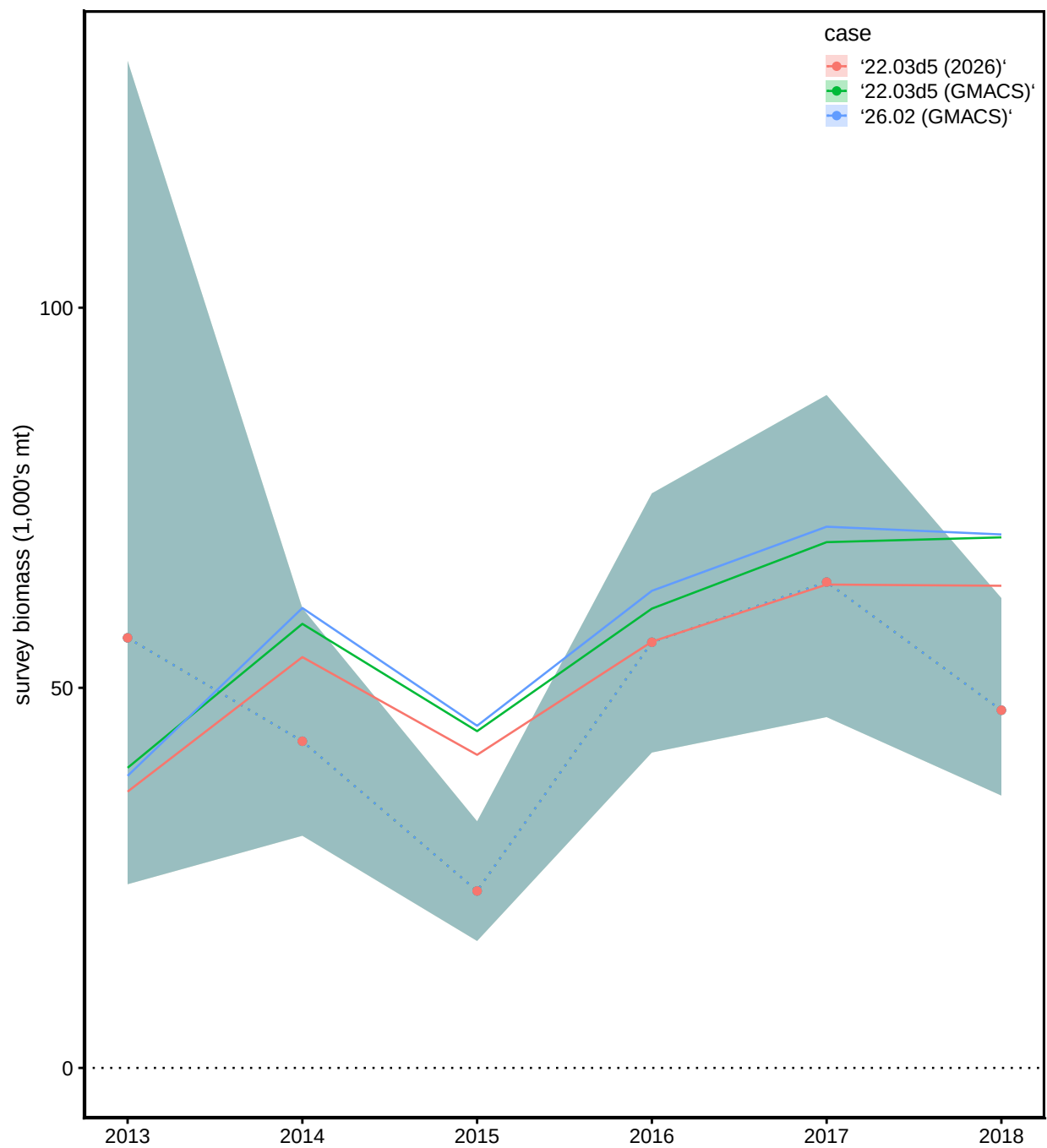


Figure 191. Comparison of fits to male survey biomass in the BSFRF surveys. Observed values: points, dotted line, and shading (90% lognormal CIs); predicted: lines.

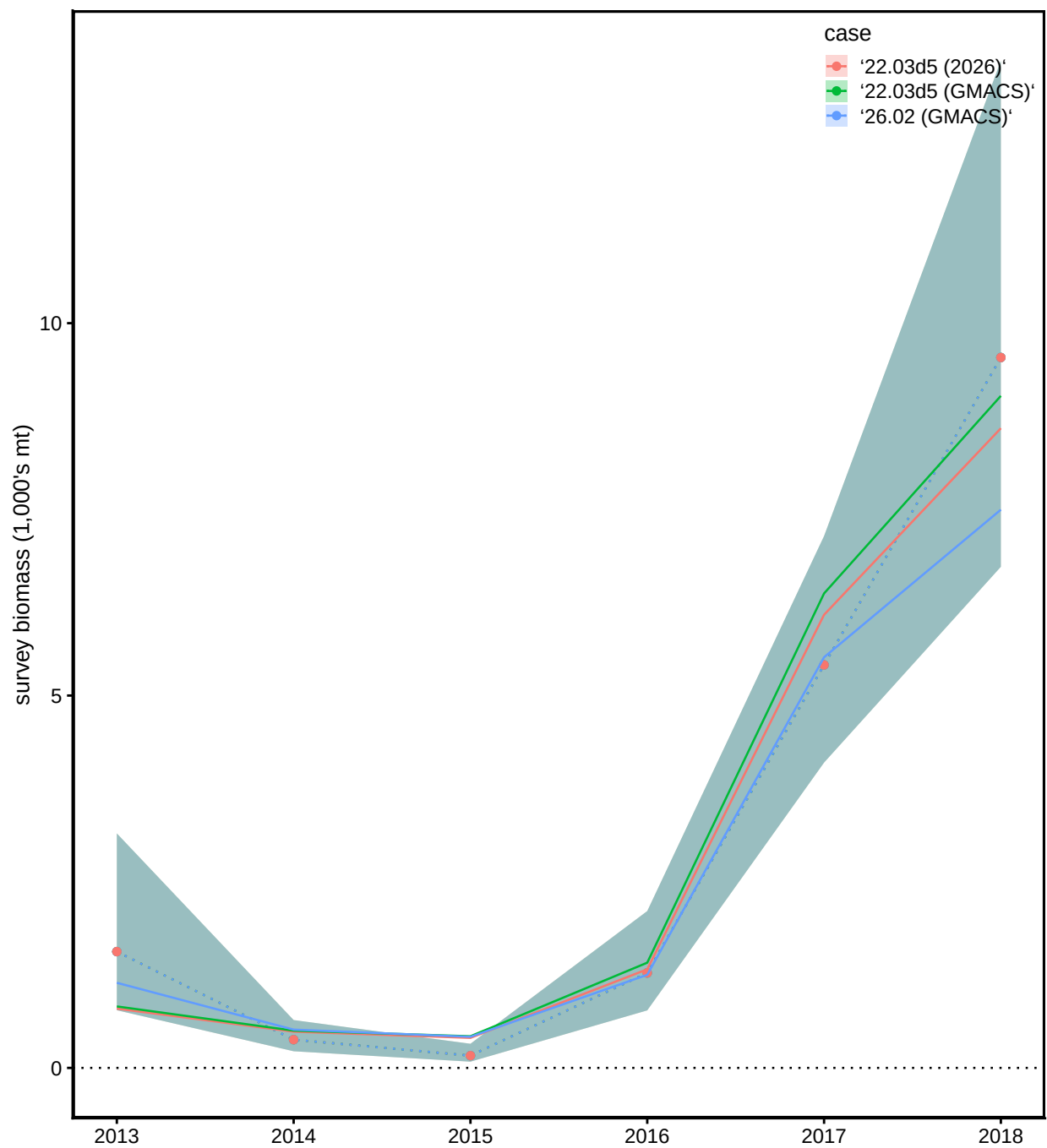


Figure 192. Comparison of fits to immature female survey biomass in the BSFRF surveys. Observed values: points, dotted line, and shading (90% lognormal CIs); predicted: lines.

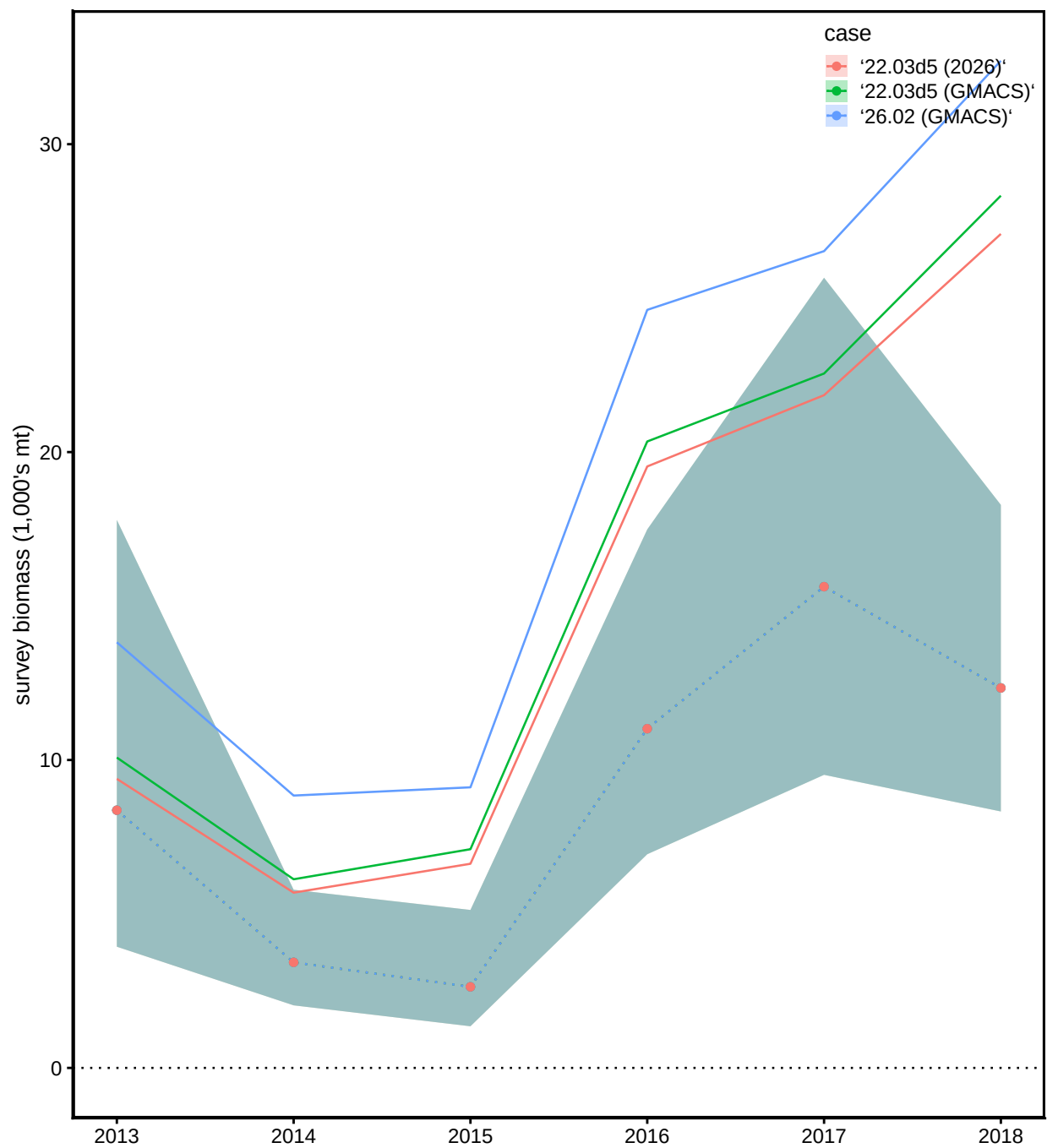


Figure 193. Comparison of fits to mature female survey biomass in the BSFRF surveys. Observed values: points, dotted line, and shading (90% lognormal CIs); predicted: lines.

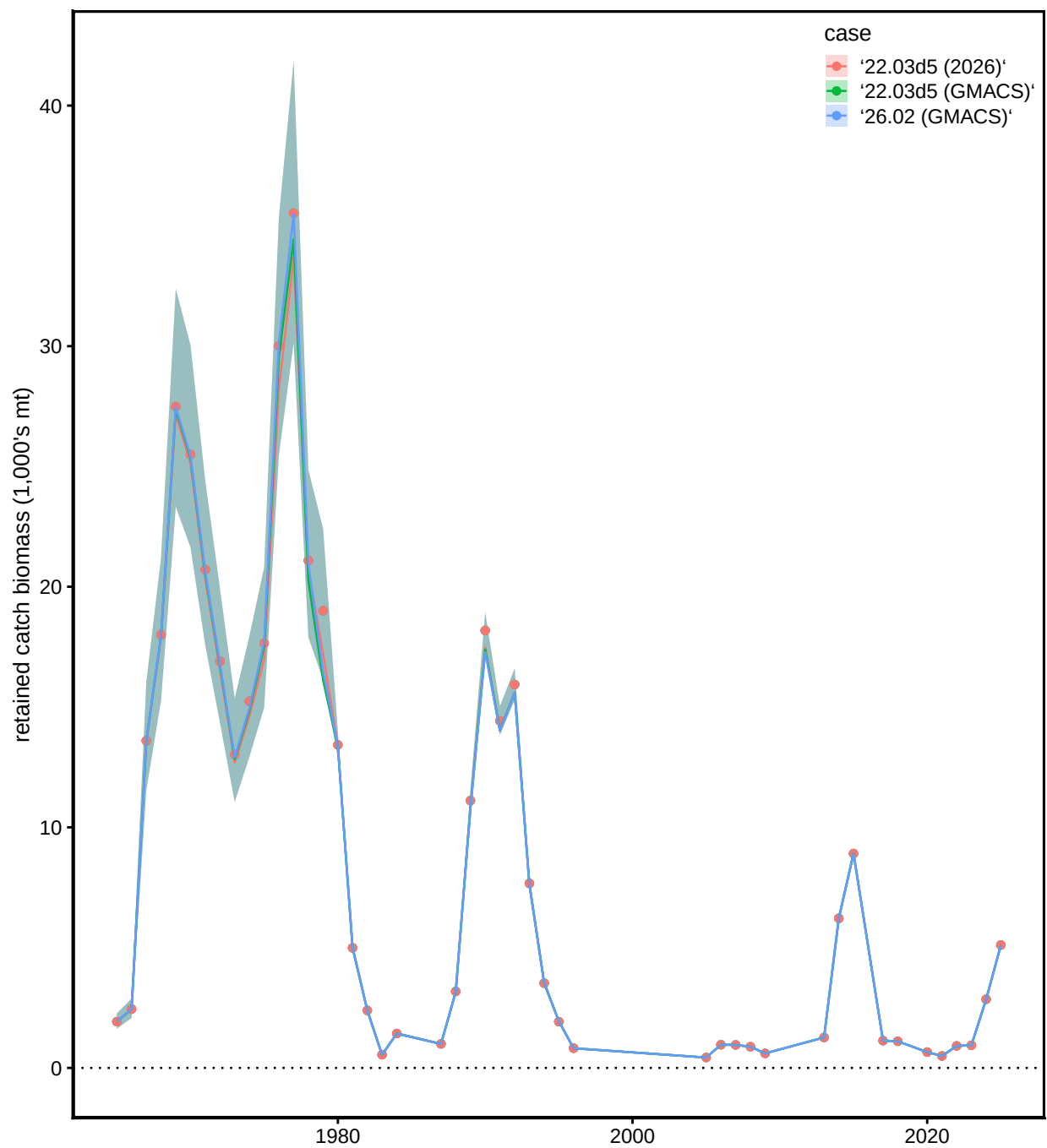


Figure 194. Comparison of fits to retained catch biomass in the directed fishery. Observed—points, dotted line, and shading (90% lognormal CIs), predicted—lines.

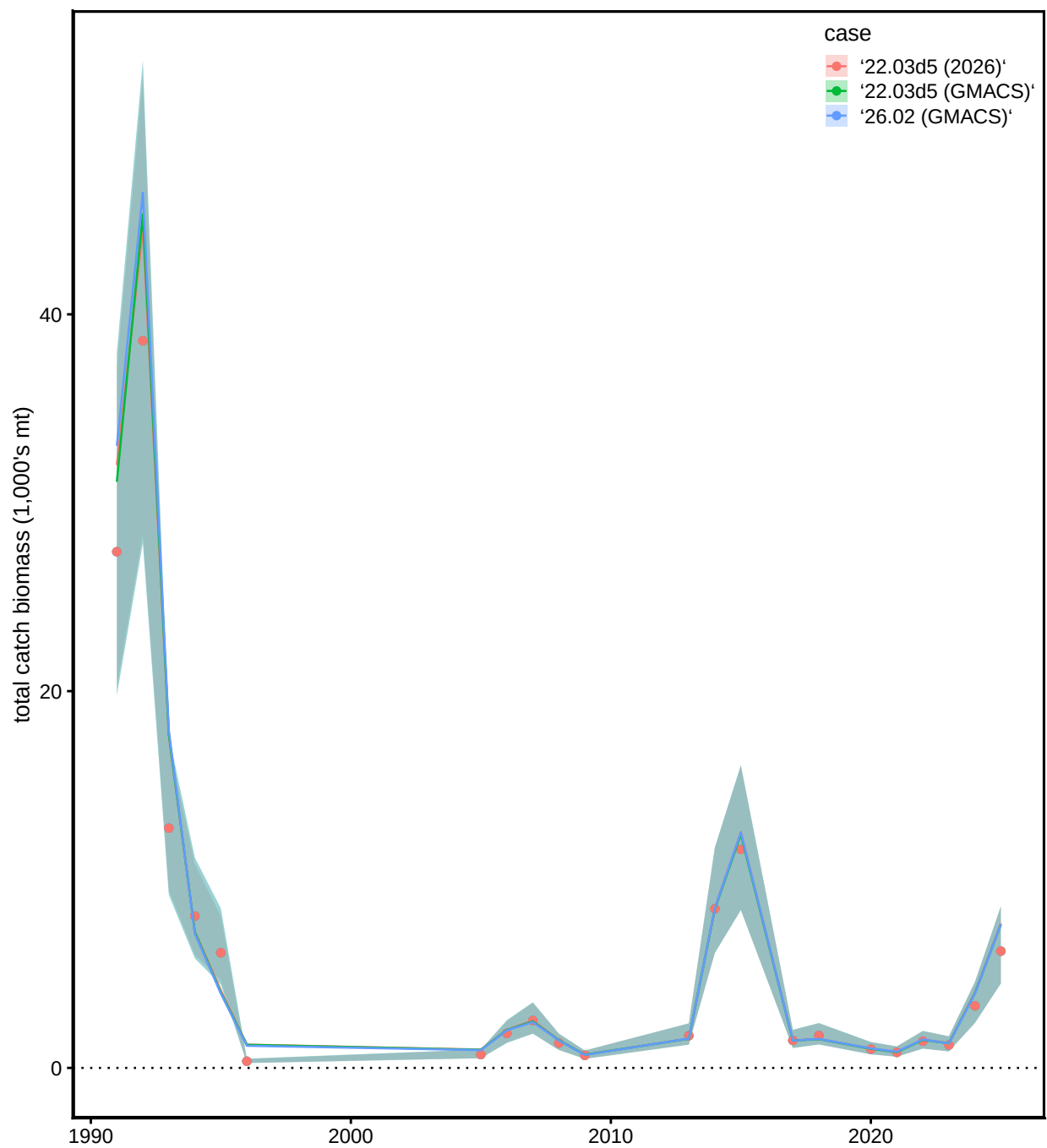


Figure 195. Comparison of fits to total catch biomass in the directed fishery. Observed—points, dotted line, and shading (90% lognormal CIs), predicted—lines.

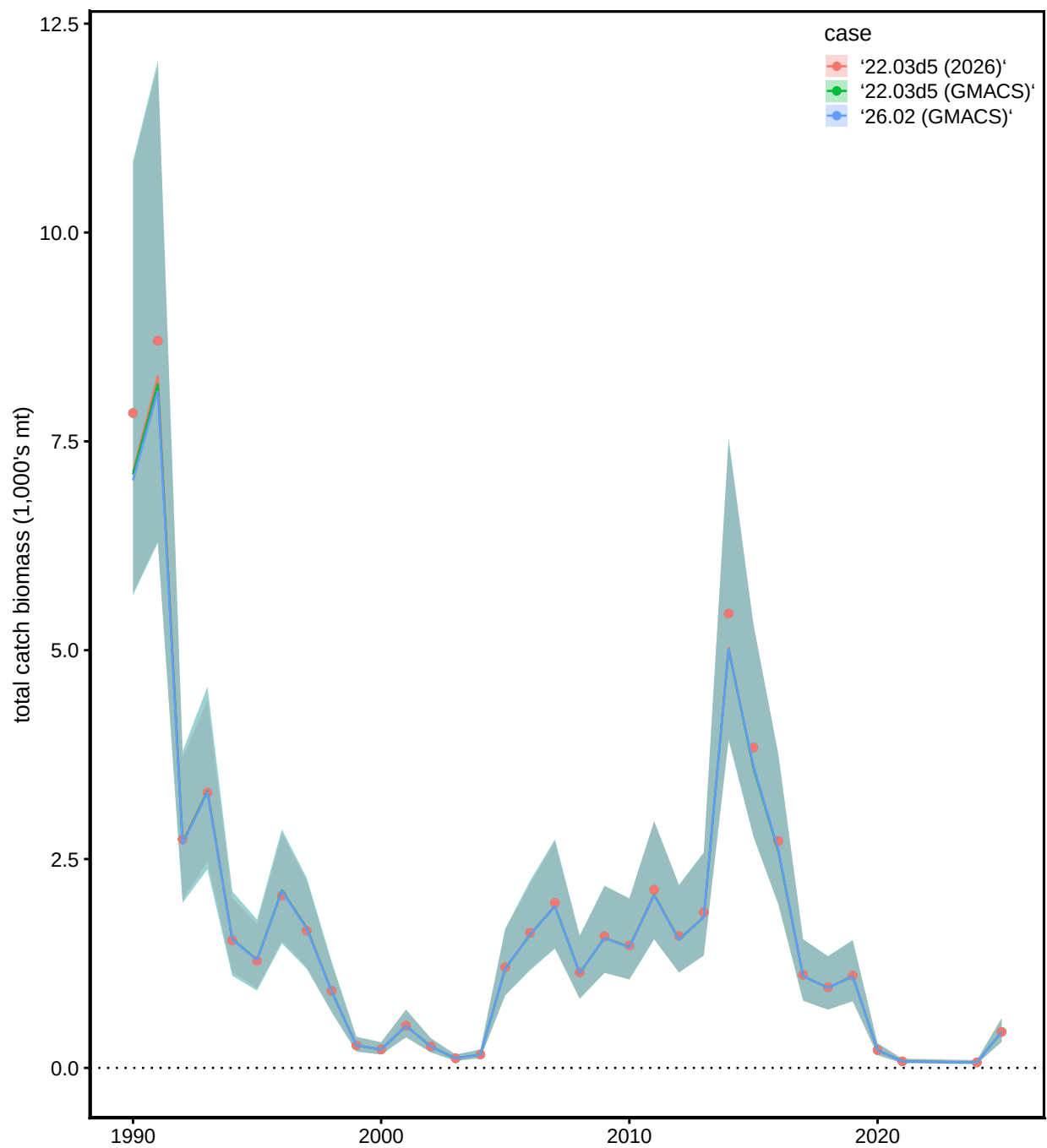


Figure 196. Comparison of fits to total catch biomass in the snow crab fishery. Observed—points, dotted line, and shading (90% lognormal CIs), predicted—lines.

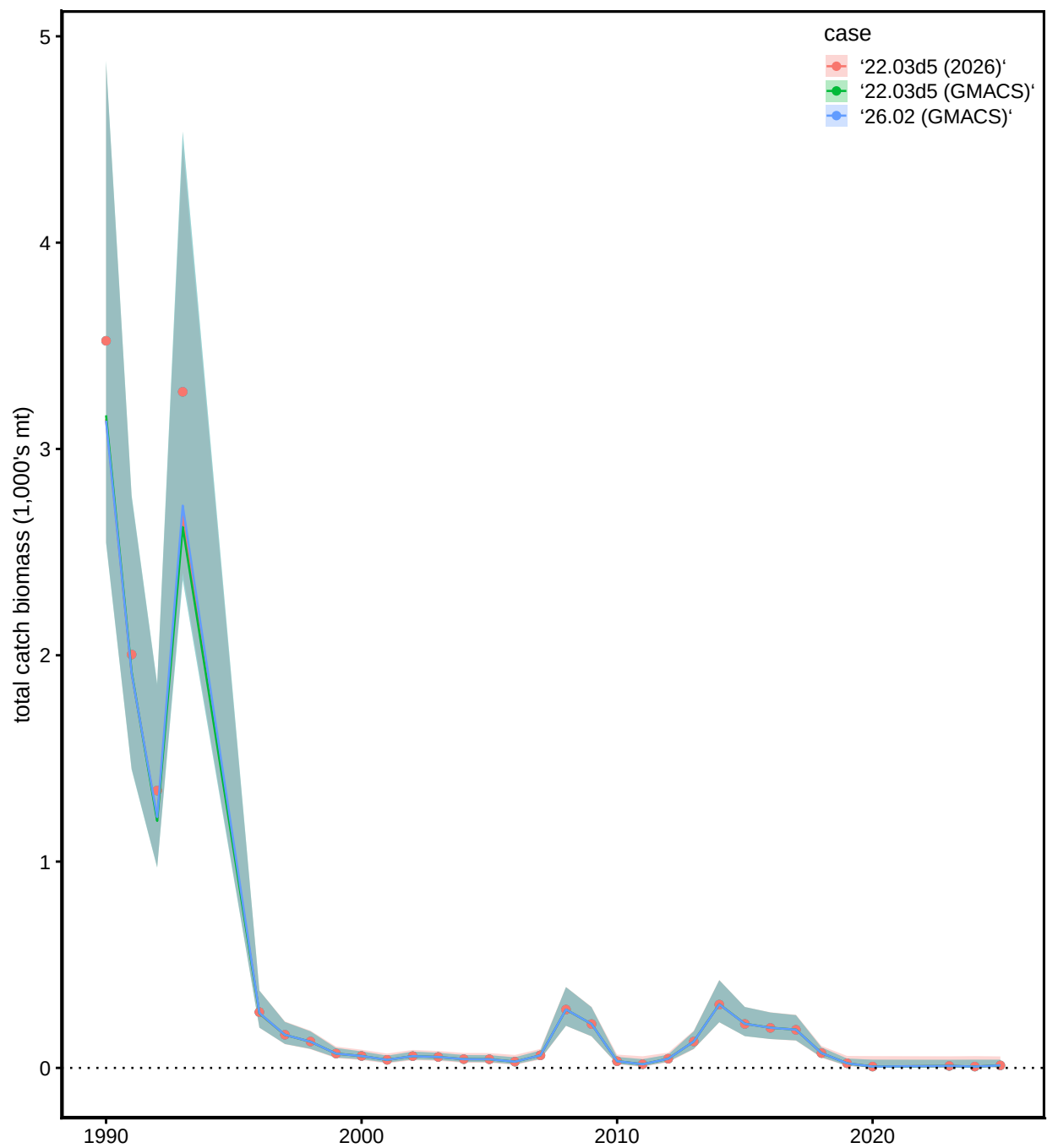


Figure 197. Comparison of fits to total catch biomass in the BBRKC fishery. Observed-points, dotted line, and shading (90% lognormal CIs), predicted-lines.

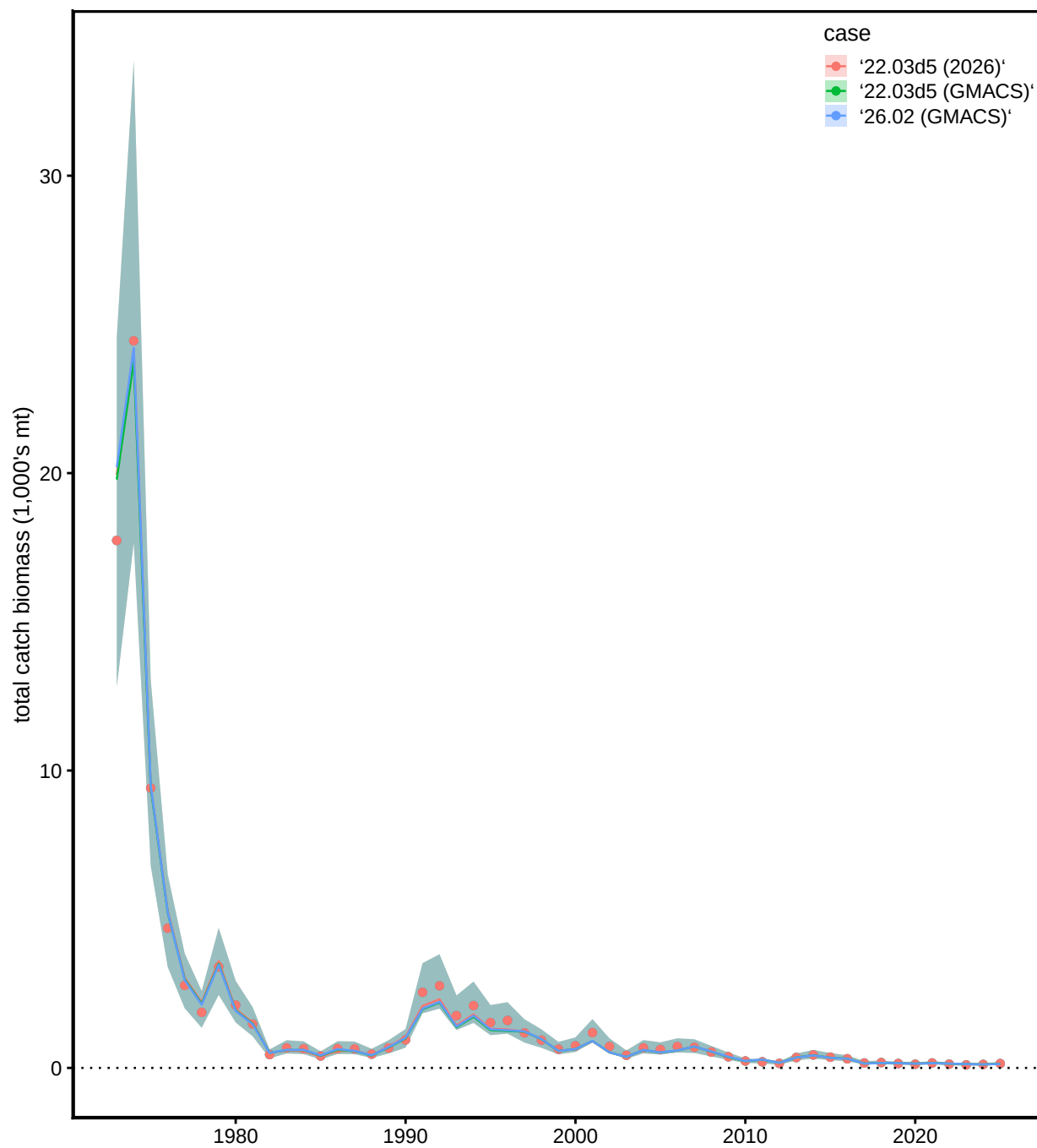


Figure 198. Comparison of fits to total catch biomass in the groundfish fisheries. Observed—points, dotted line, and shading (90% lognormal CIs), predicted—lines.

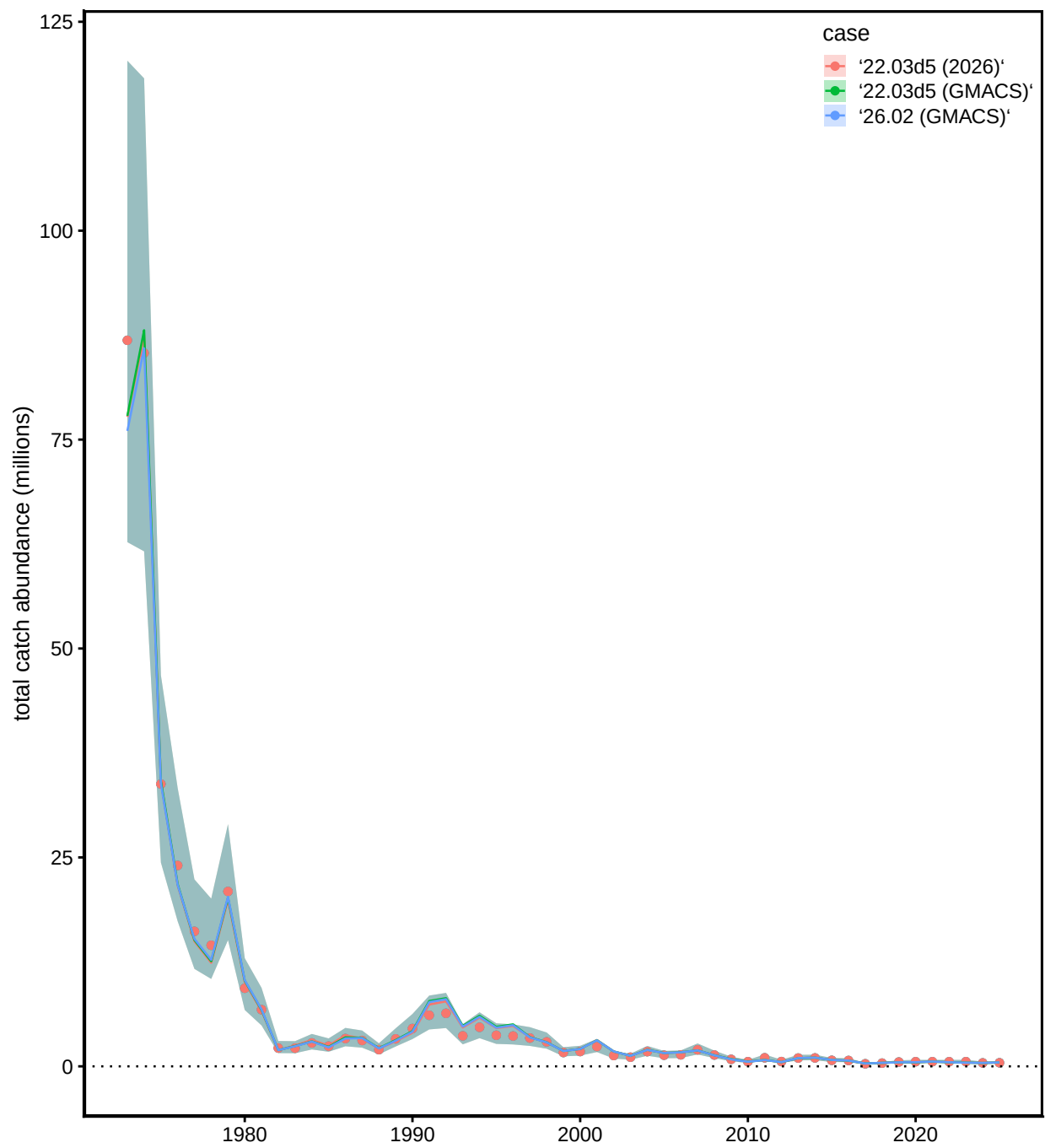


Figure 199. Comparison of fits to total catch abundance in the groundfish fisheries. Observed—points, dotted line, and shading (90% lognormal CIs), predicted—lines.

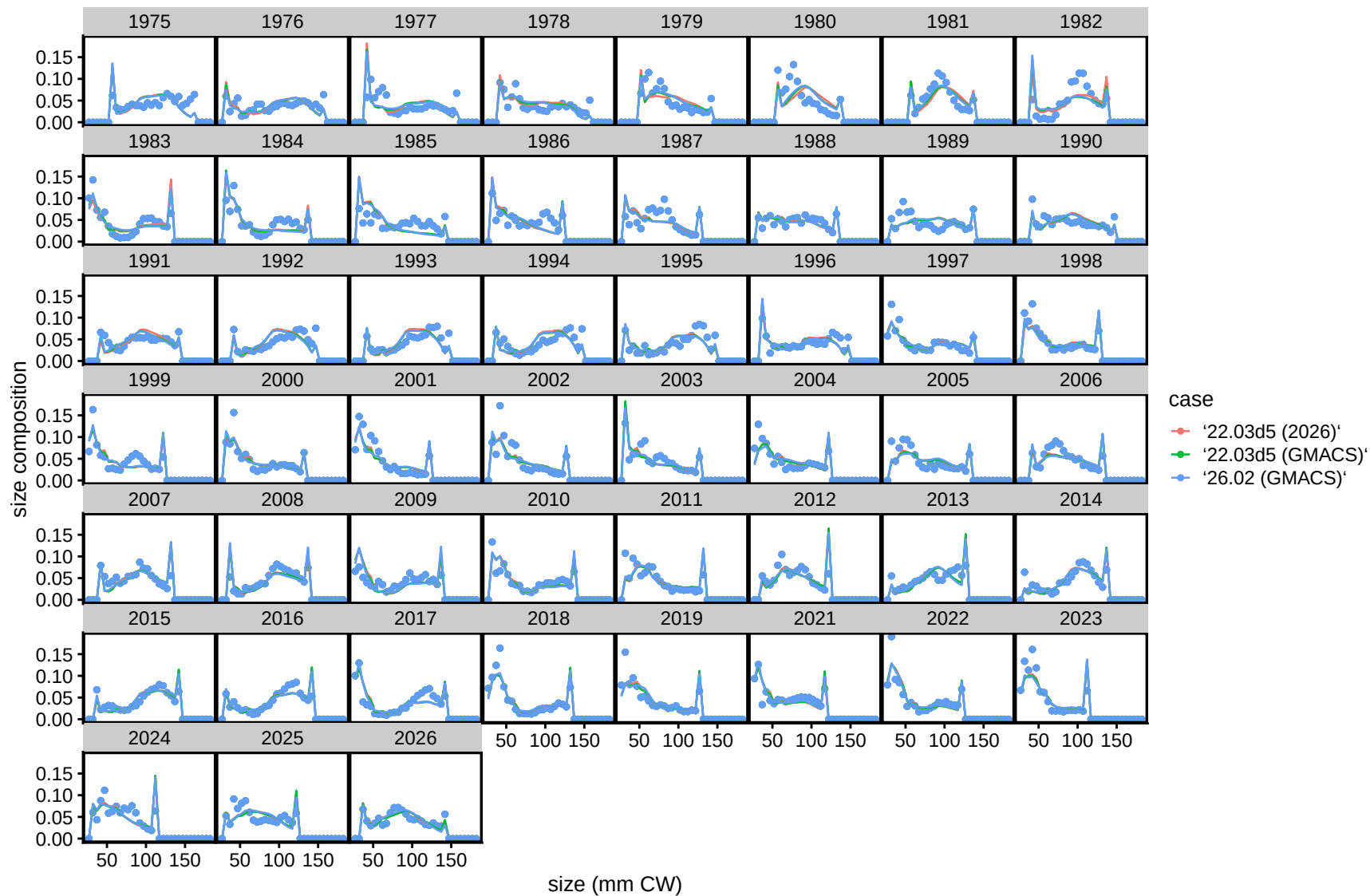


Figure 200. Fits to size composition data from the NMS surveys for males. Points: observed values; lines: predicted values.

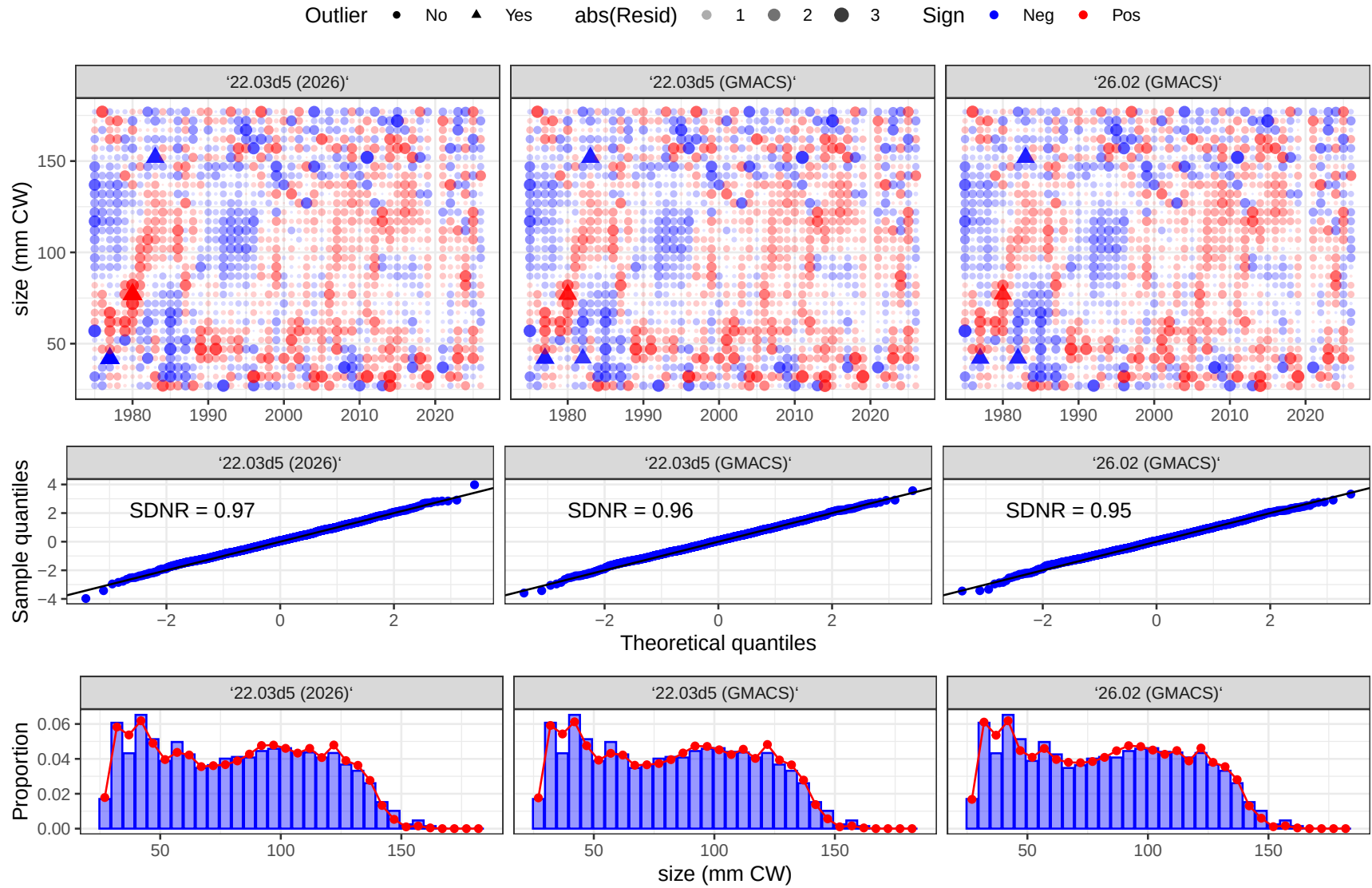


Figure 201. OSA residuals for models fit to NMFS survey size compositions for males.

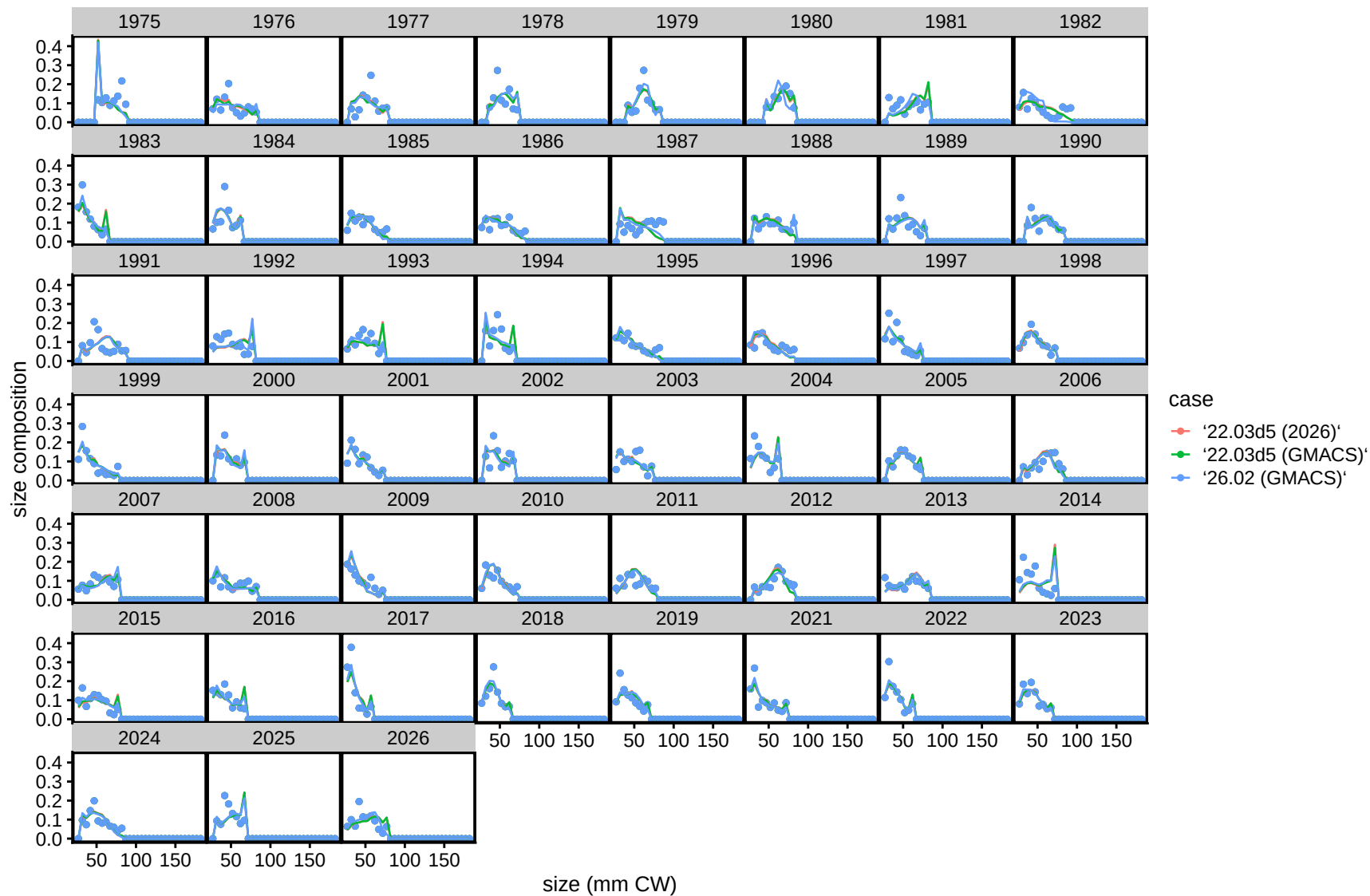


Figure 202. Fits to size composition data from the NMFS surveys for immature females. Points: observed values; lines: predicted values.

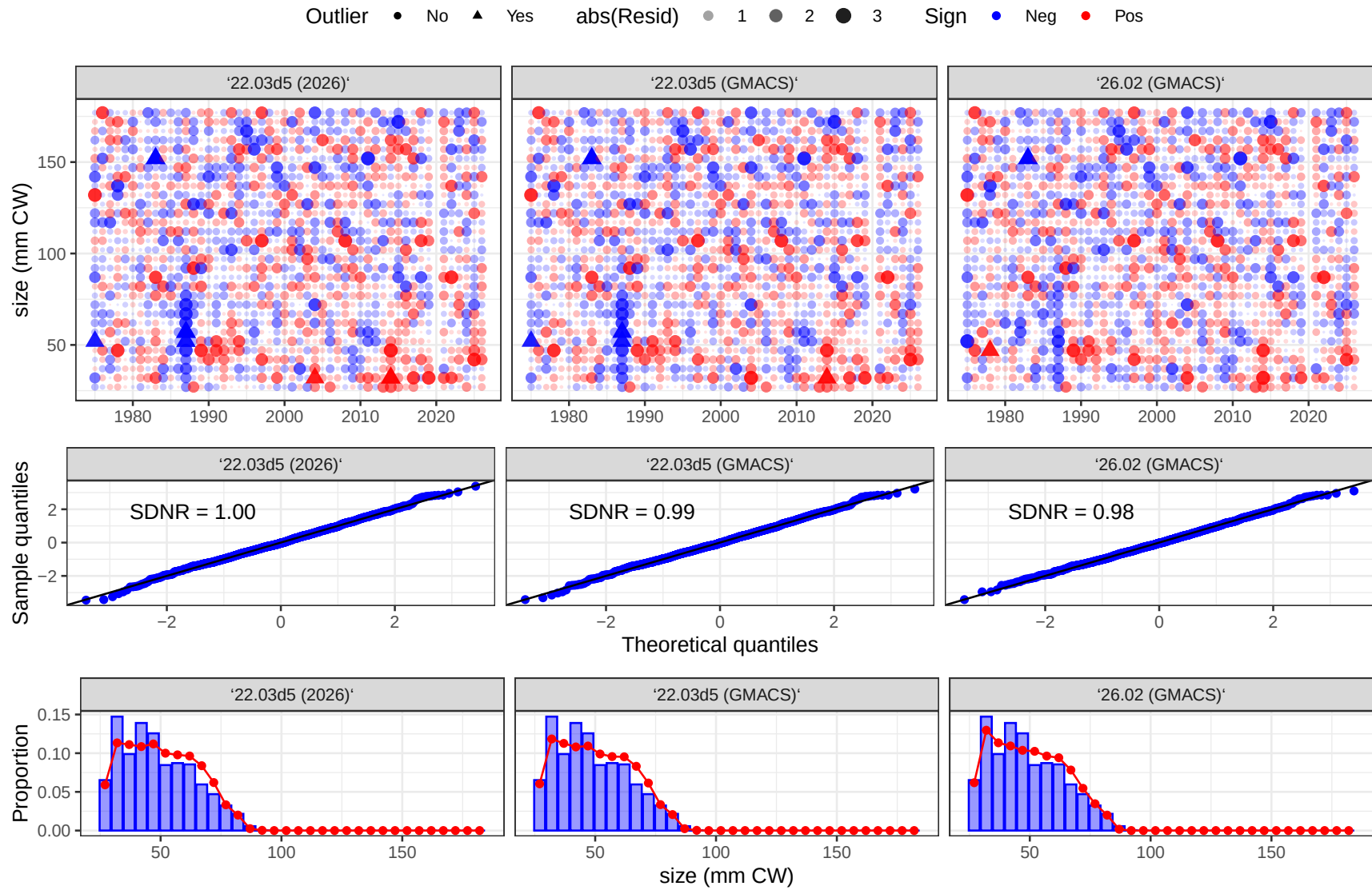


Figure 203. OSA residuals for models fit to NMFS survey size compositions for immature females.

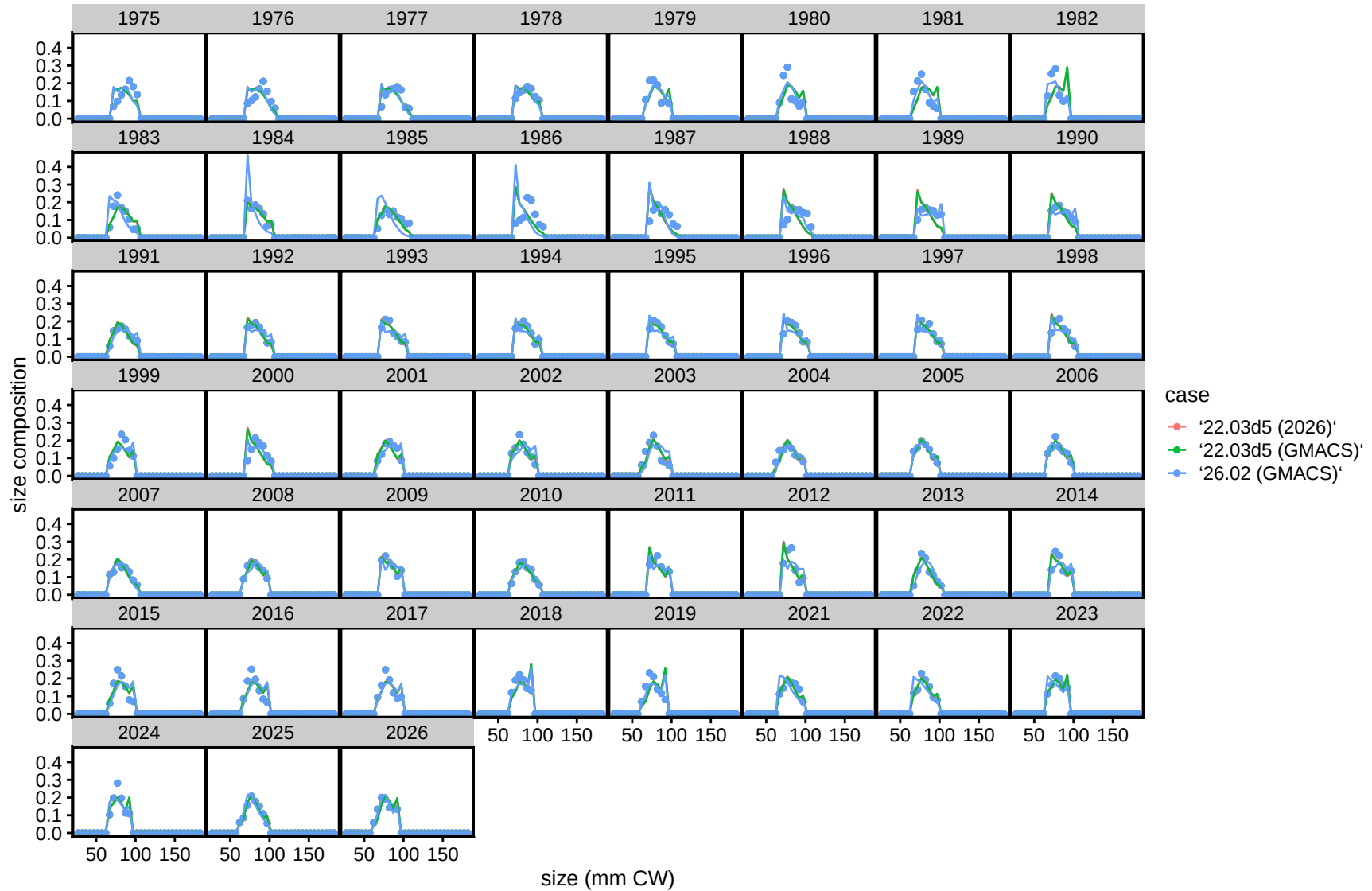


Figure 204. Fits to total catch size composition data from the NMFS surveys for mature females. Points: observed values; lines: predicted values.

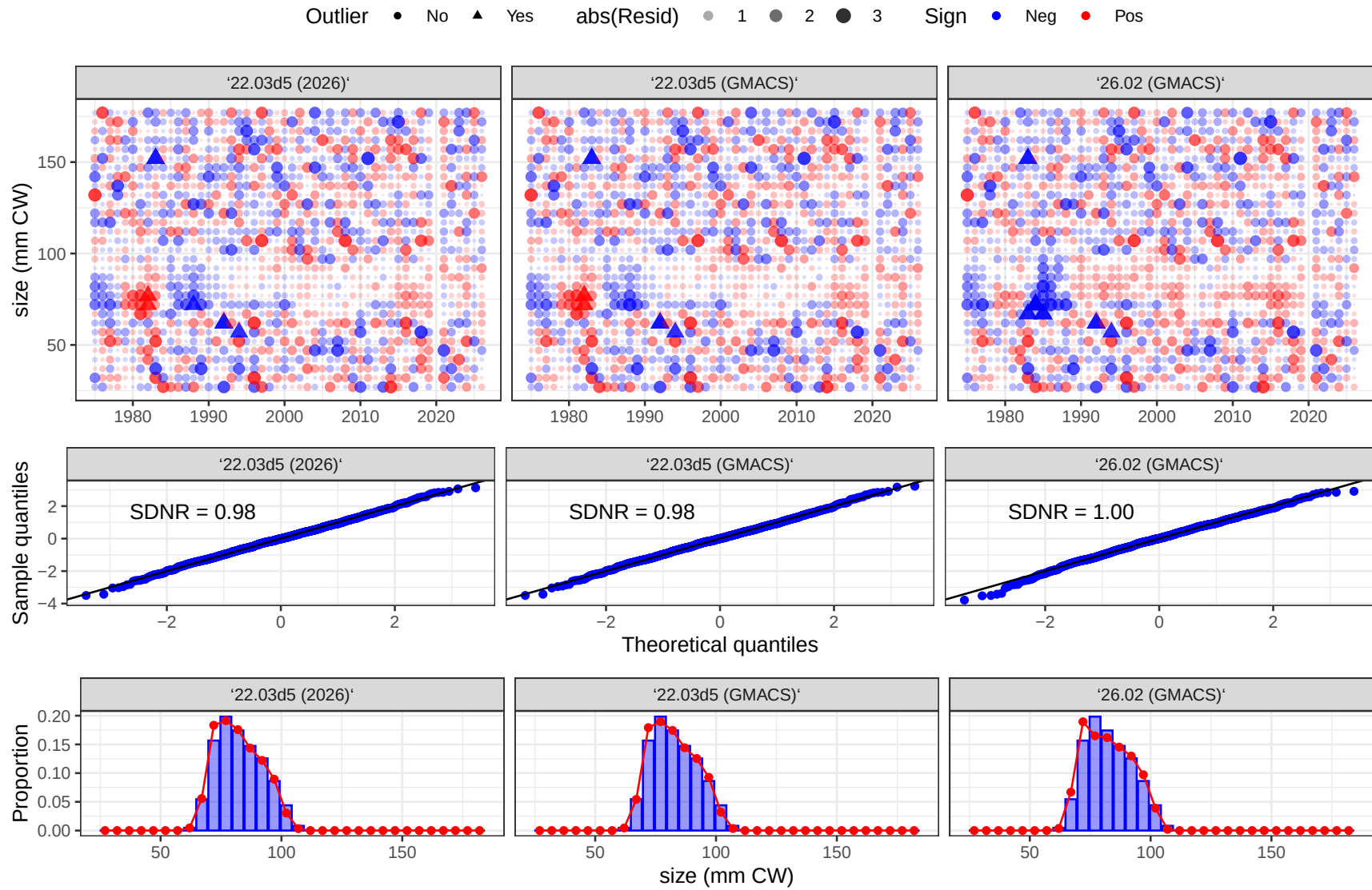


Figure 205. OSA residuals for models fit to NMFS survey size compositions for mature females.

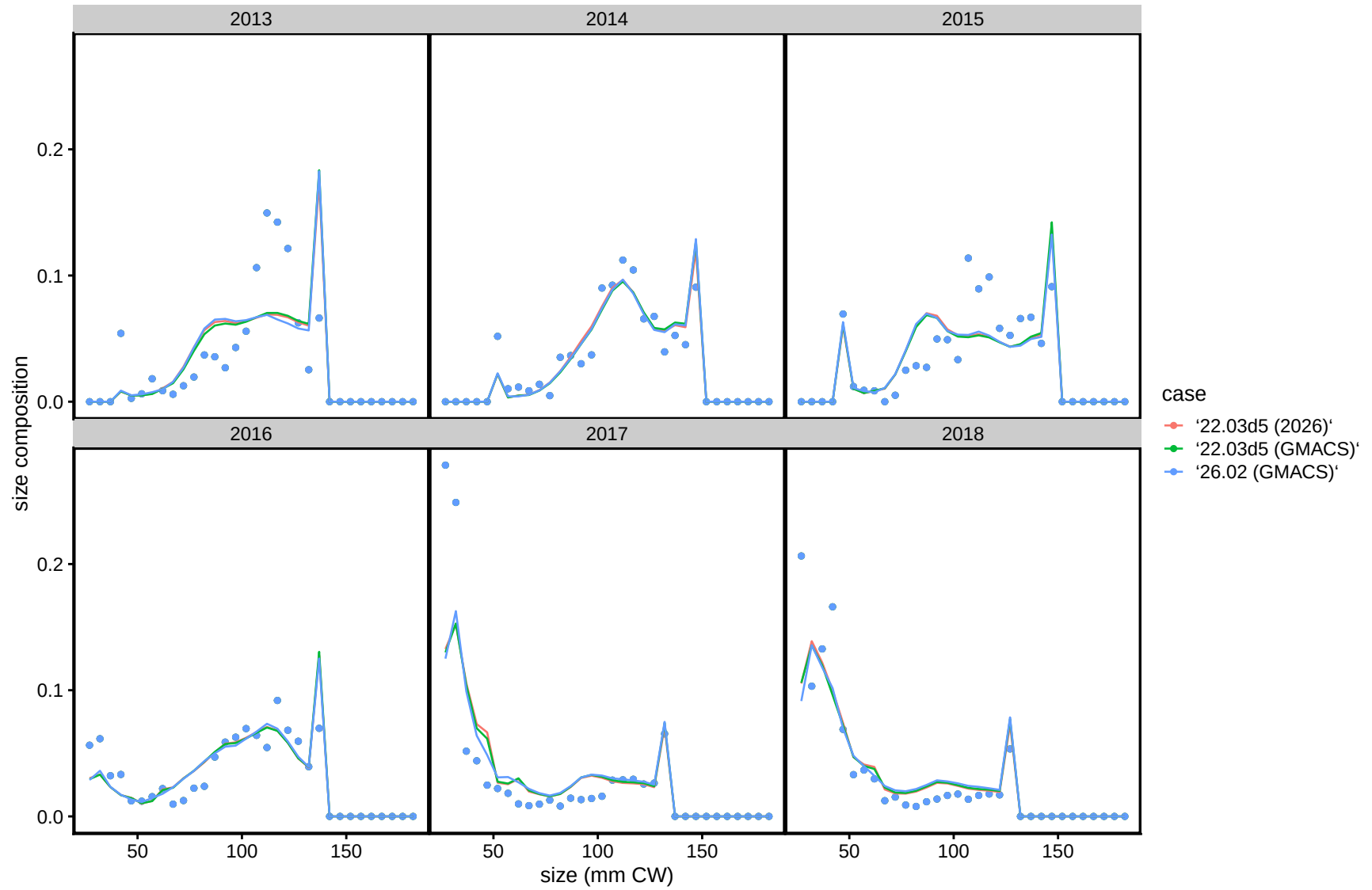


Figure 206. Fits to size composition data from the BSFRF surveys for males. Points: observed values; lines: predicted values.

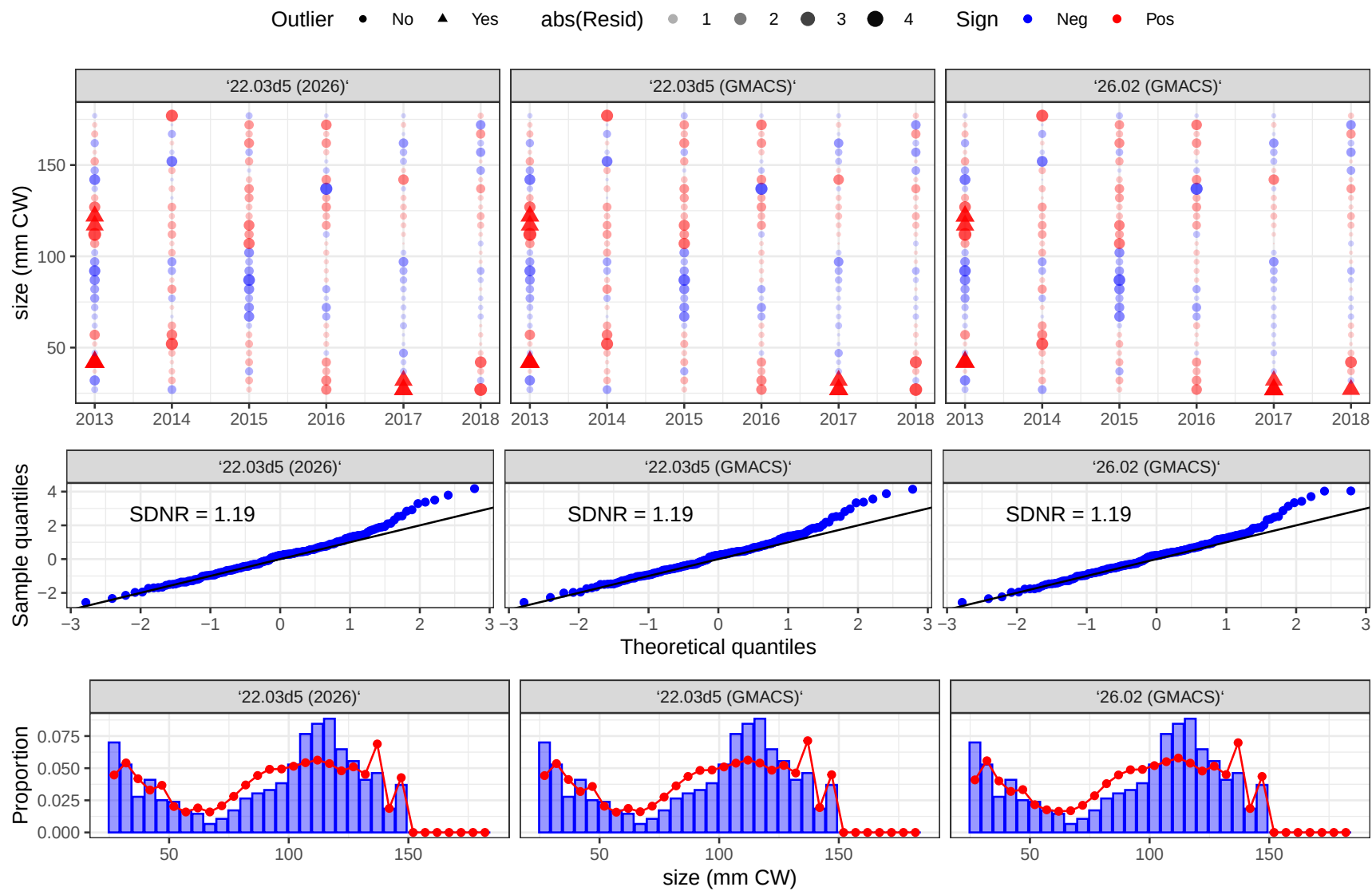


Figure 207. OSA residuals for models fit to BSFRF survey size compositions for males.

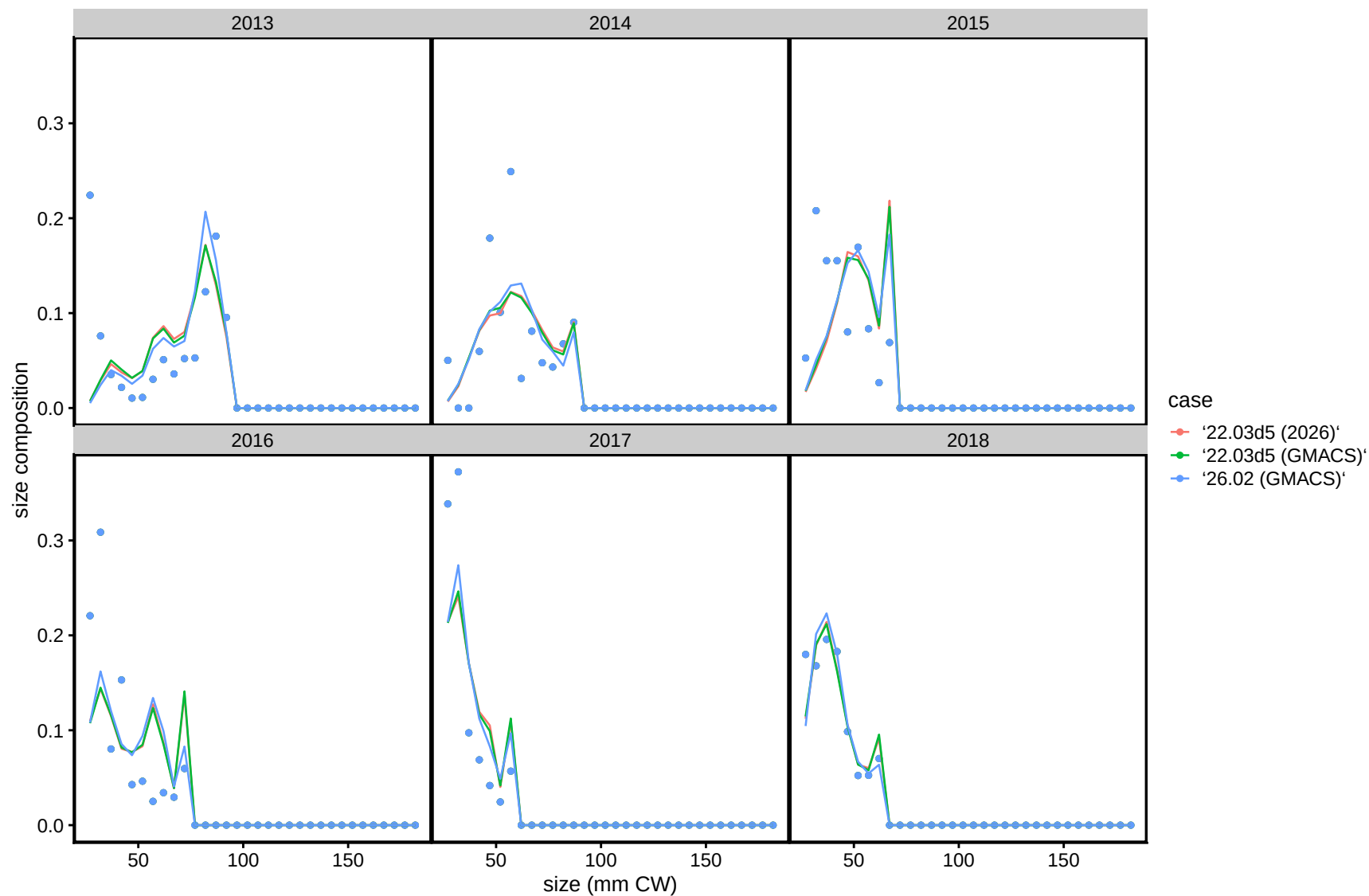


Figure 208. Fits to size composition data from the BSFRF survey for immature females. Points: observed values; lines: predicted values.

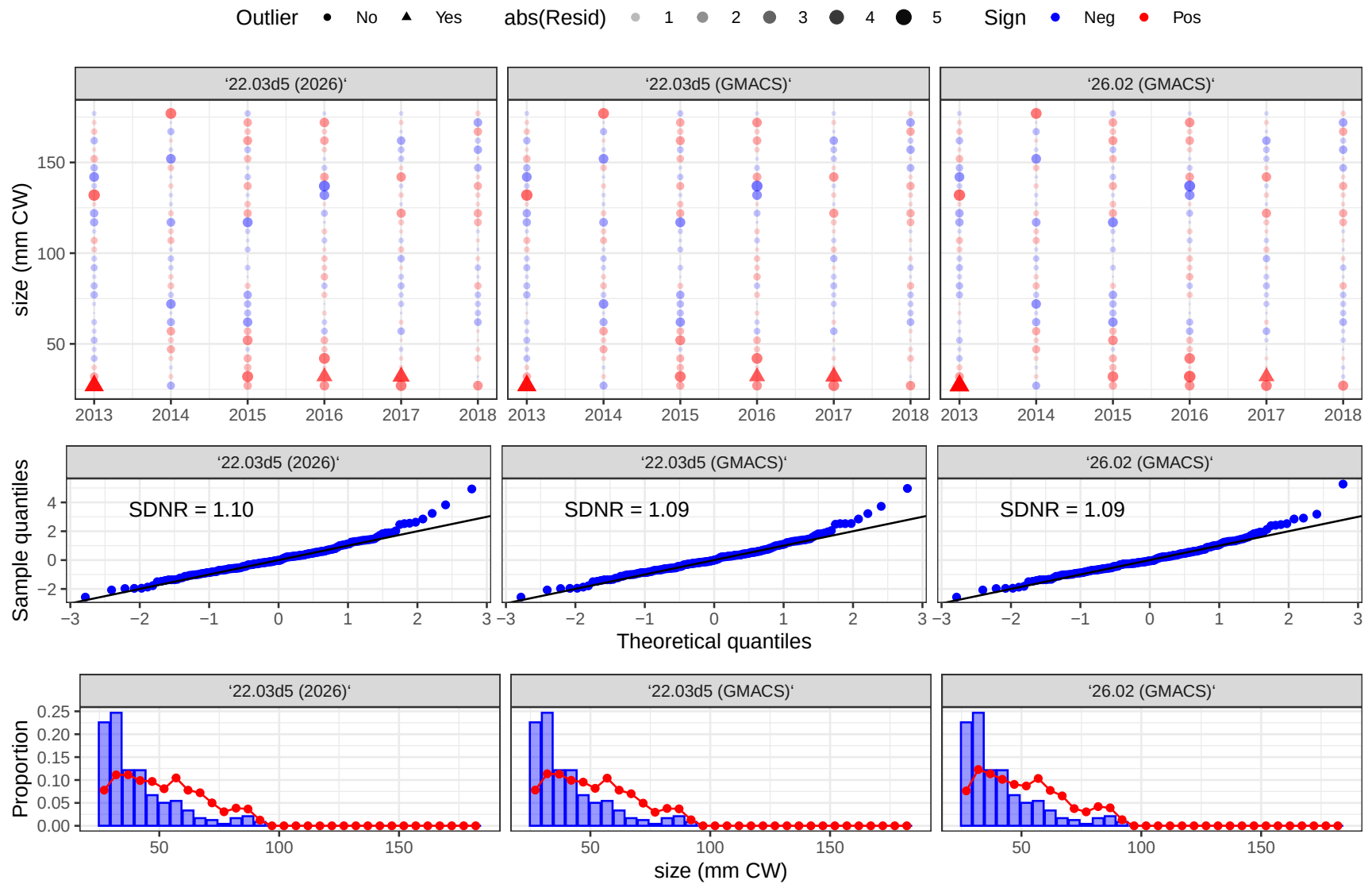


Figure 209. OSA residuals for models fit to BSFRF survey size compositions for immature females.

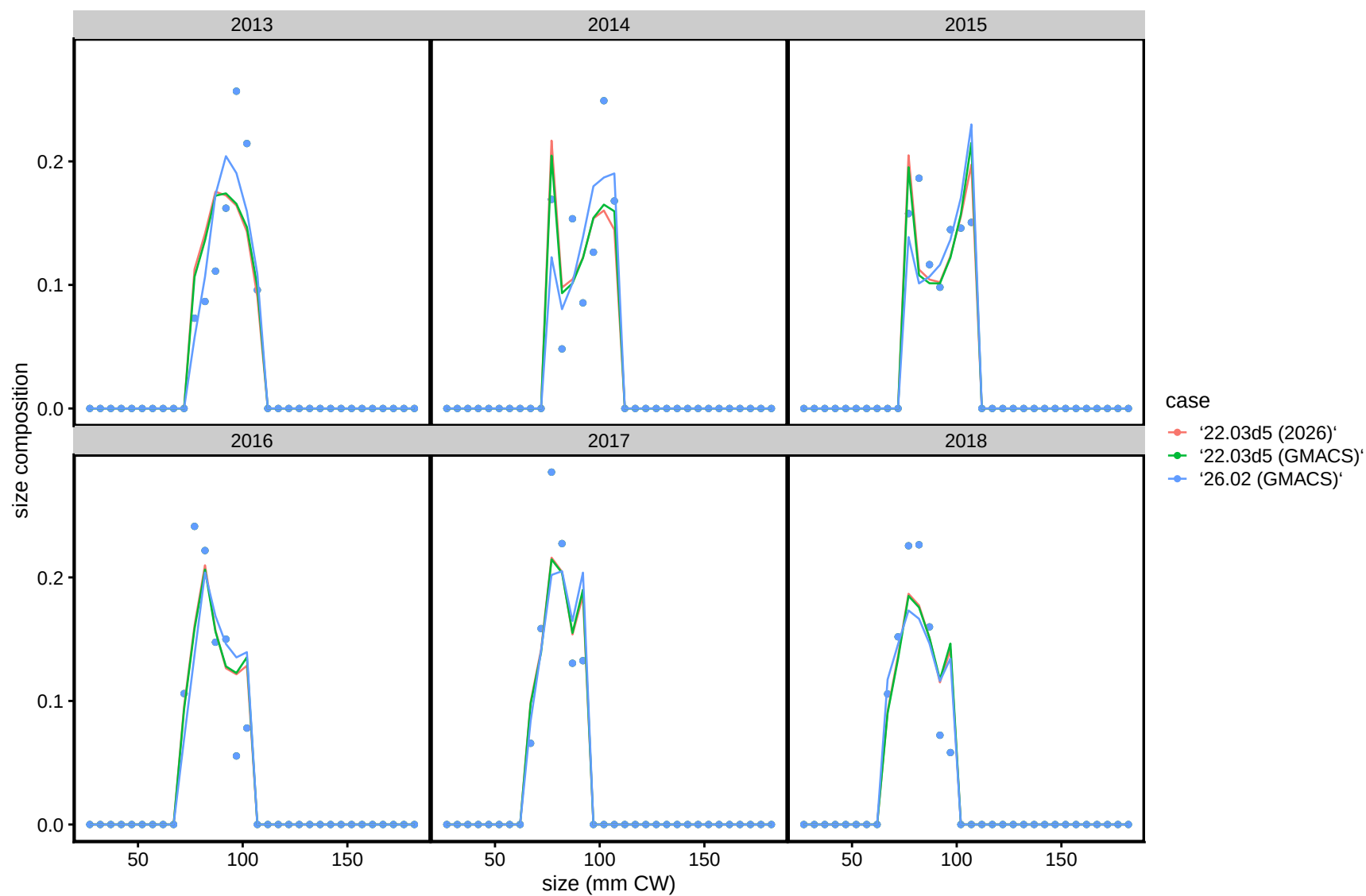


Figure 210. Fits to total catch size composition data from the BSFRF surveys for mature females. Points: observed values; lines: predicted values.

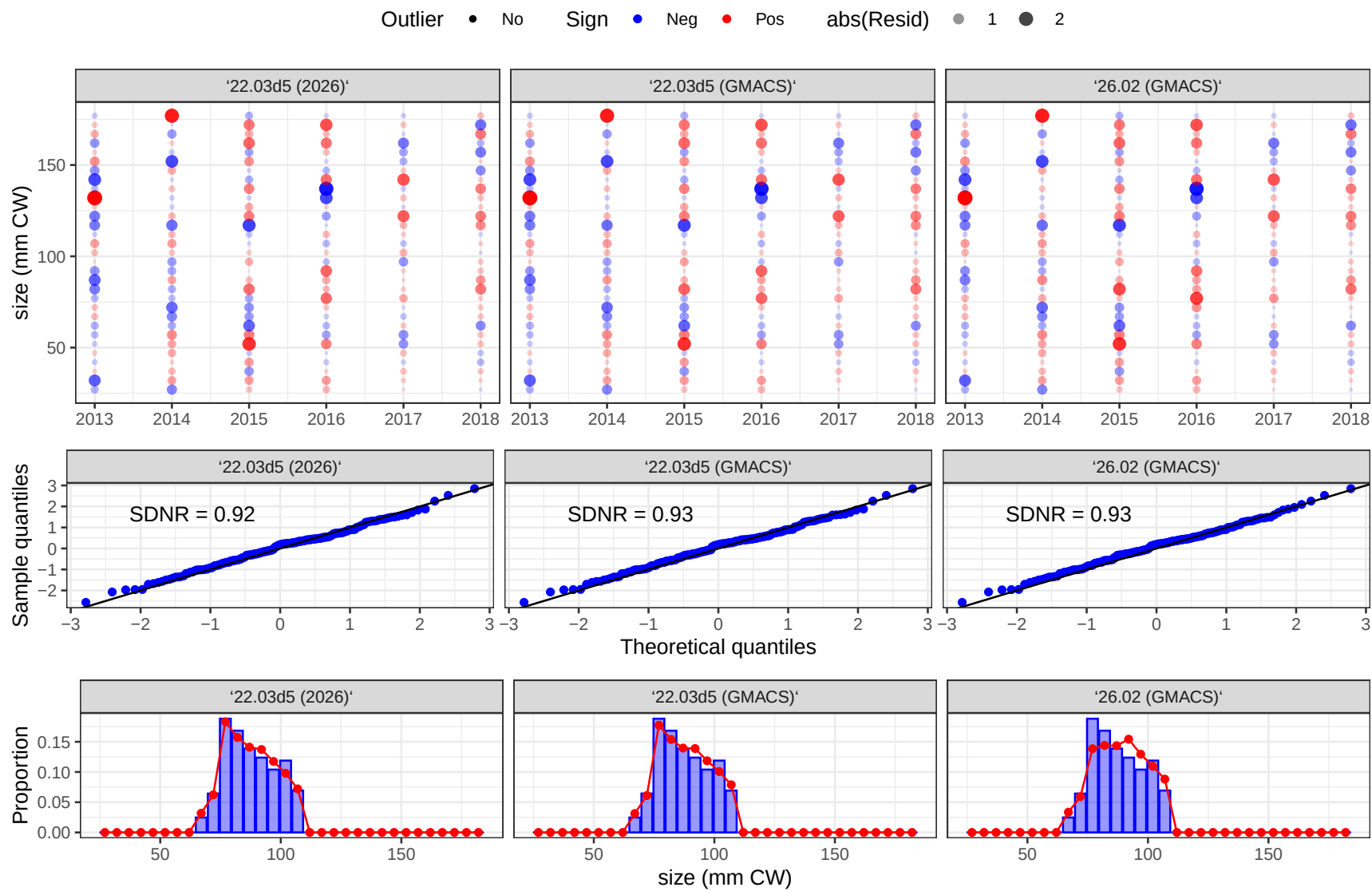


Figure 211. OSA residuals for models fit to BSFRF survey size compositions for mature females.

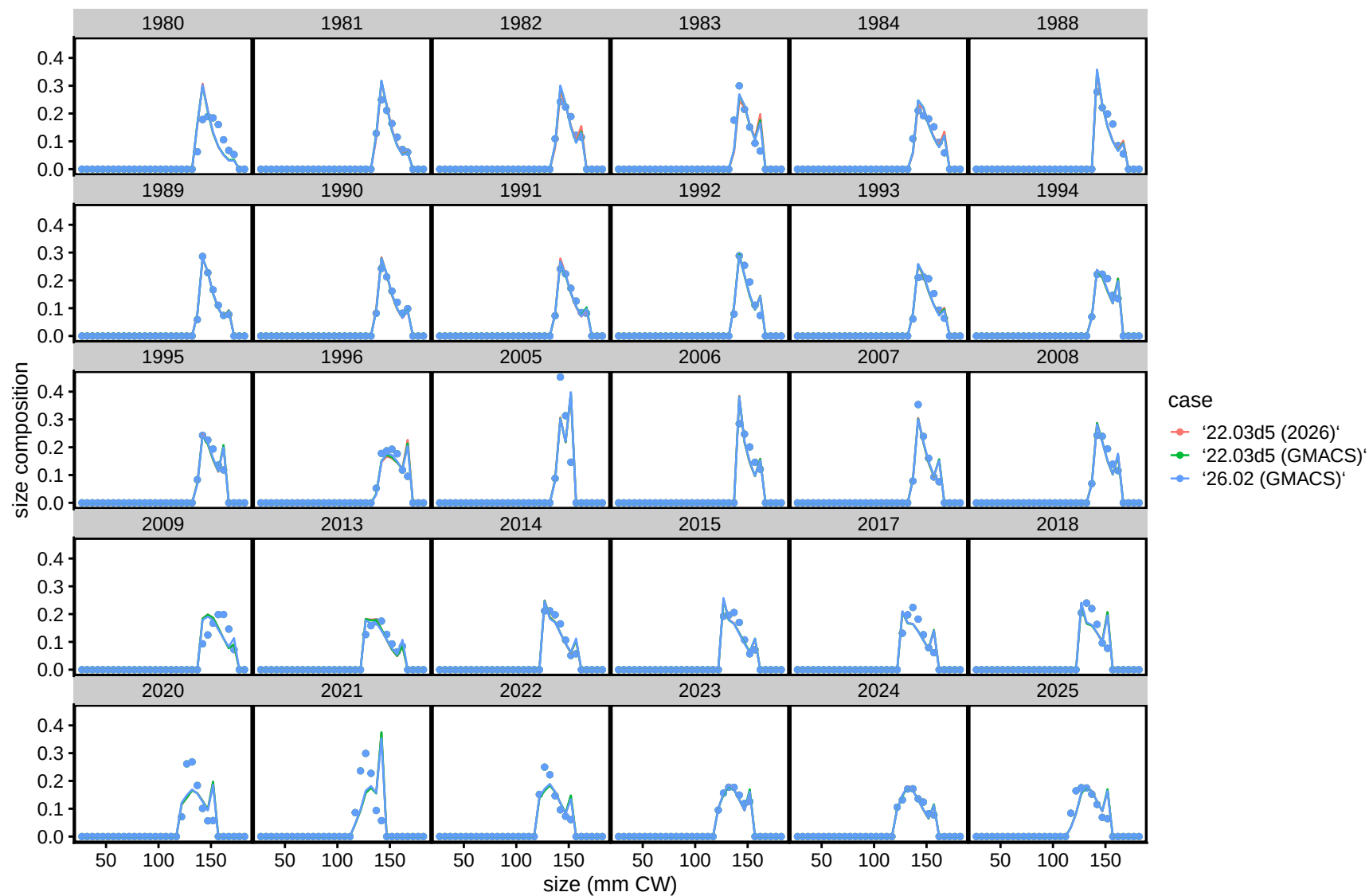


Figure 212. Fits to retained catch size composition data from the directed fishery. Points: observed values; lines: predicted values.

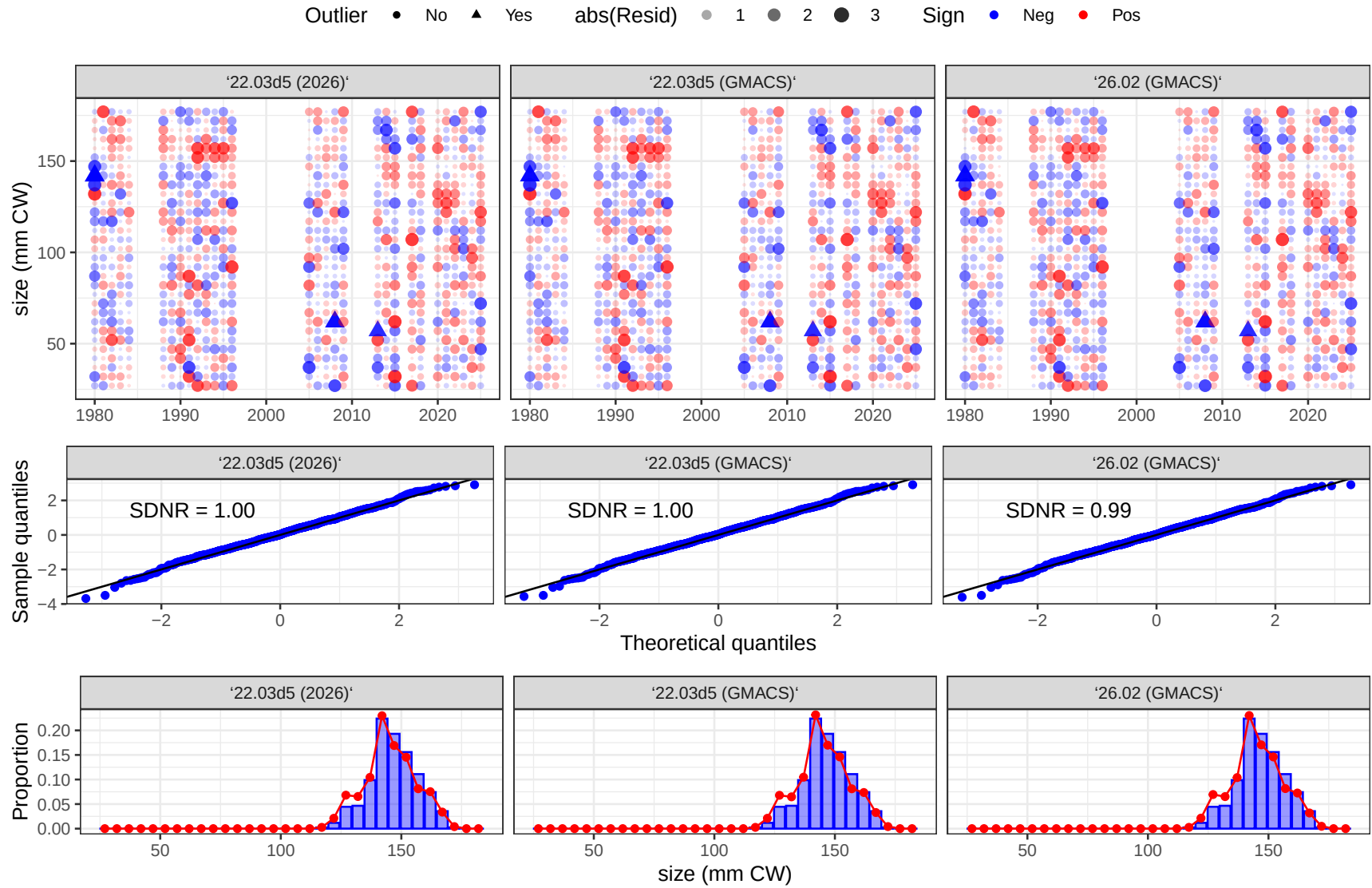


Figure 213. OSA residuals for models fit to retained catch size compositions from the directed fishery.

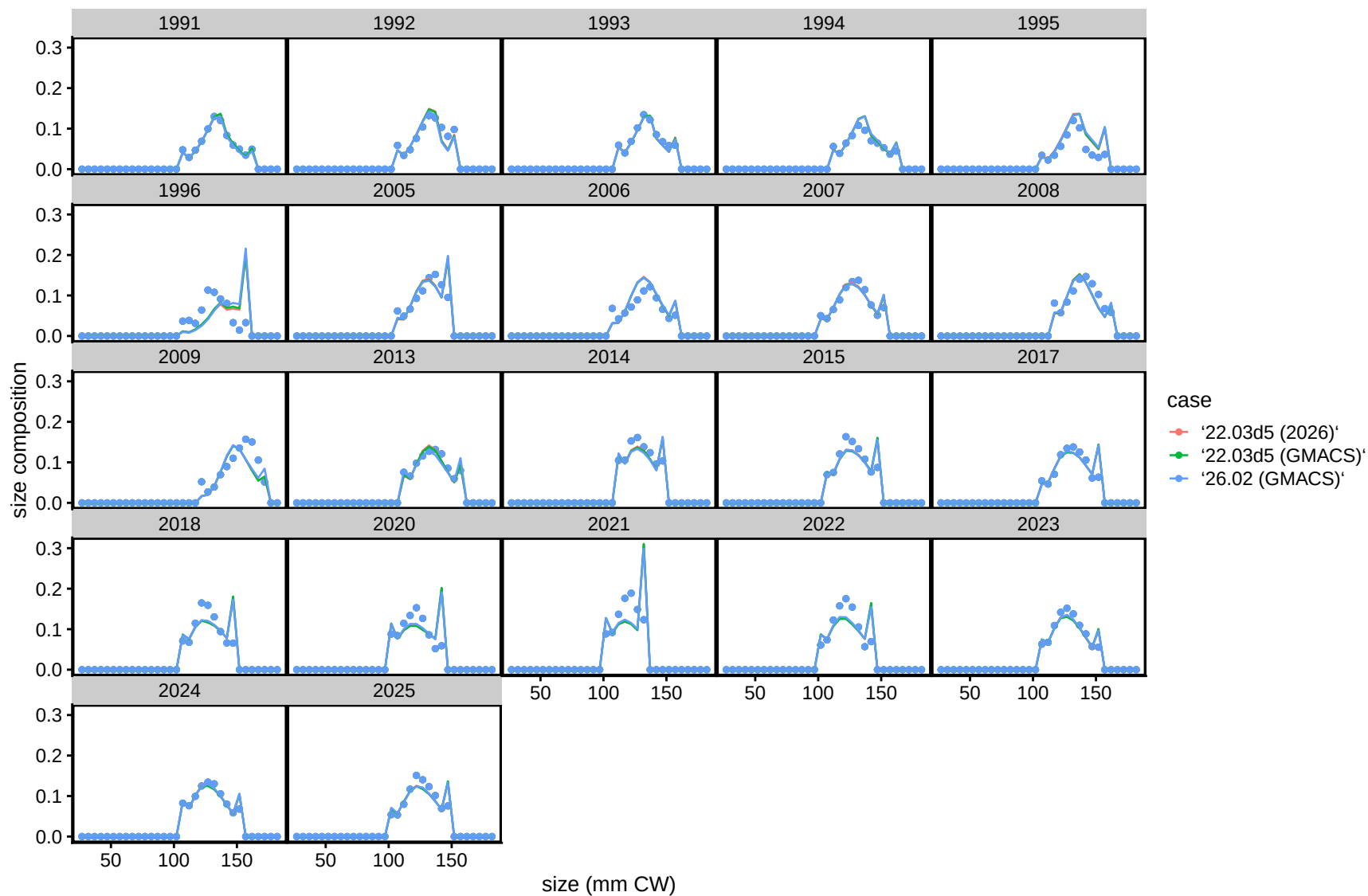


Figure 214. Fits to total catch size composition data from the directed fishery for males. Points: observed values; lines: predicted values.

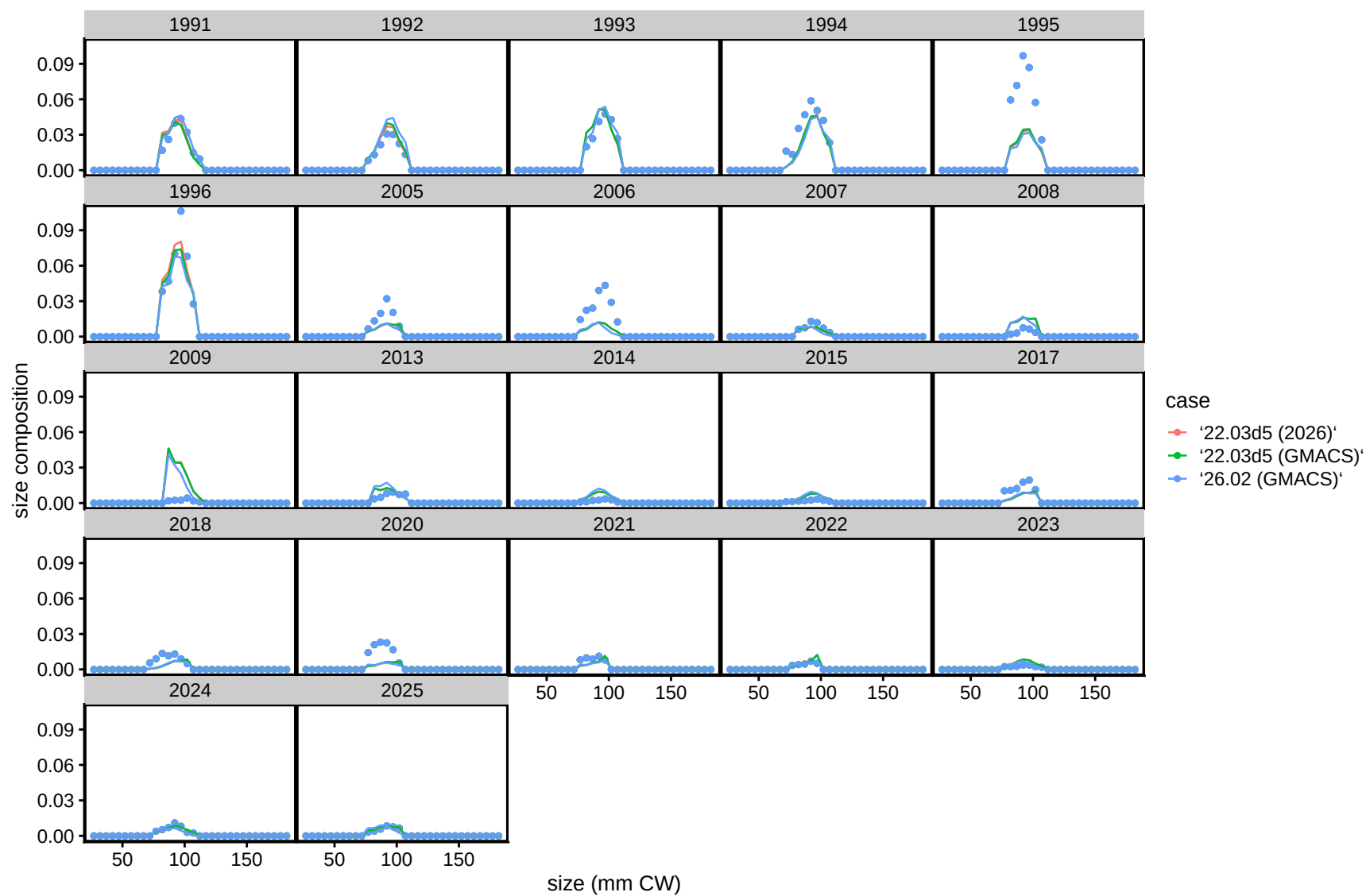


Figure 215. Fits to total catch size composition data from the directed fishery for females. Points: observed values; lines: predicted values.

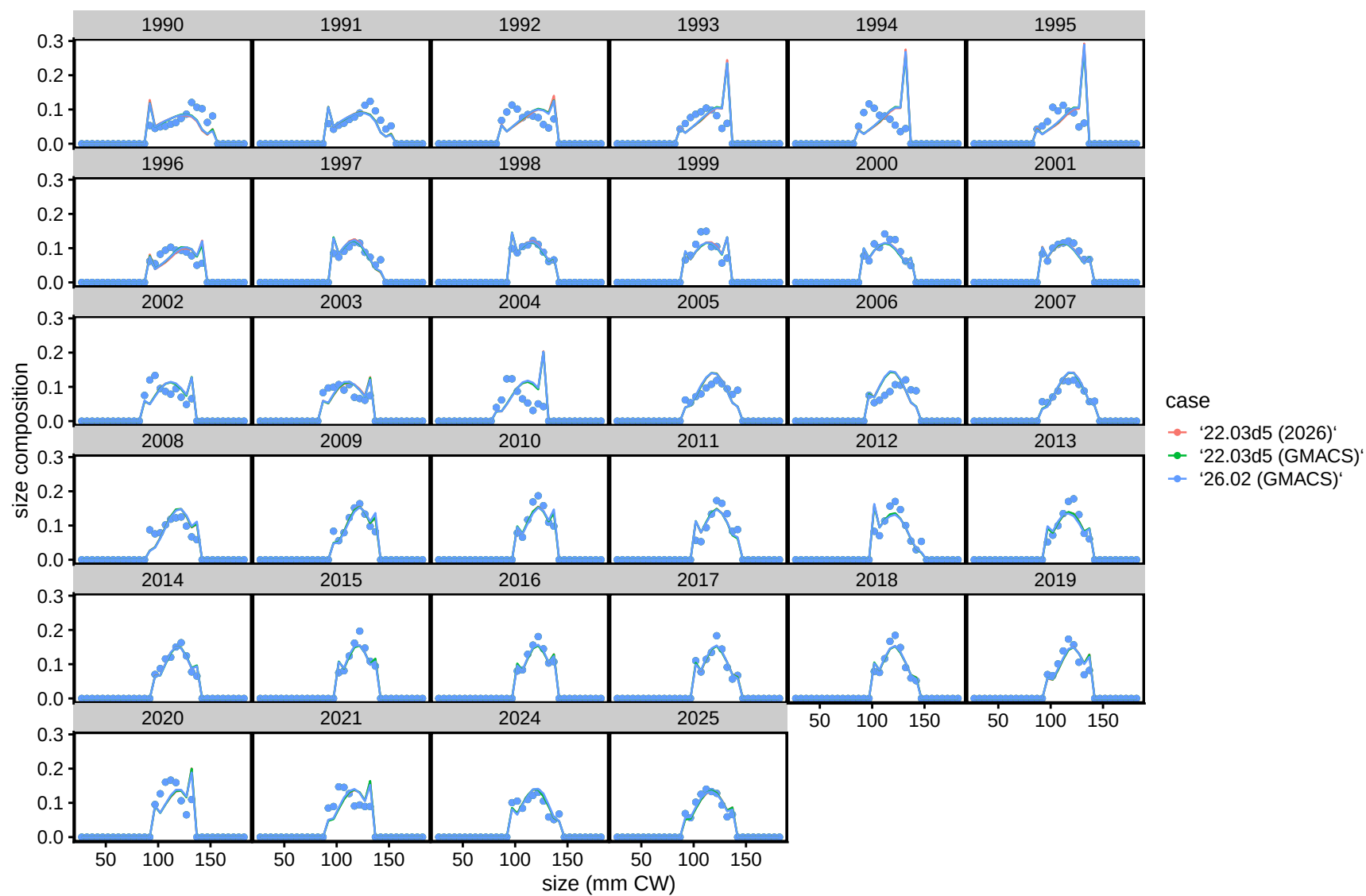


Figure 216. Fits to total catch size composition data from the snow crab fishery for males. Points: observed values; lines: predicted values.

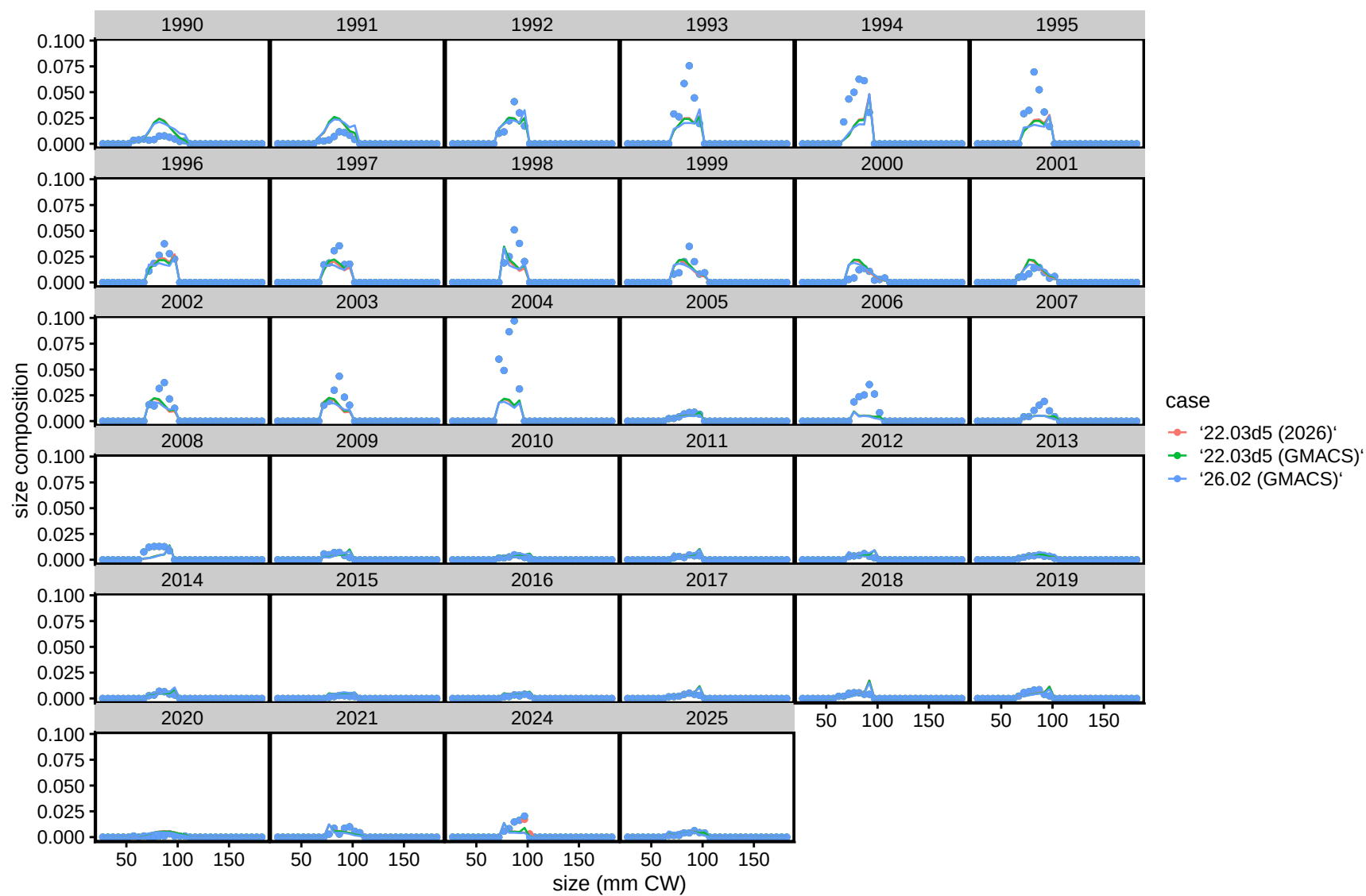


Figure 217. Fits to total catch size composition data from the snow crab fishery for females. Points: observed values; lines: predicted values.

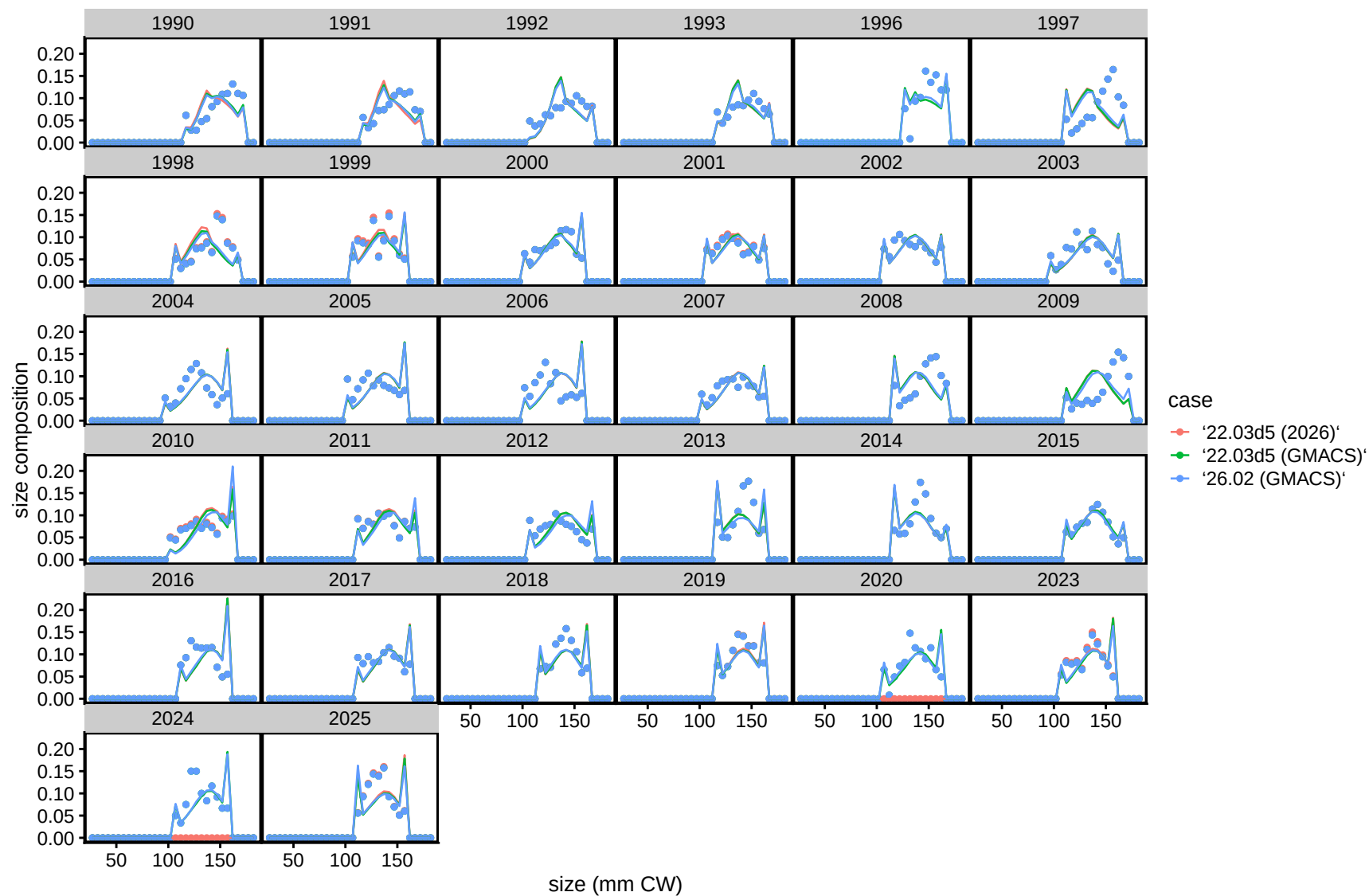


Figure 218. Fits to total catch size composition data from the BBRKC fishery for males. Points: observed values; lines: predicted values.

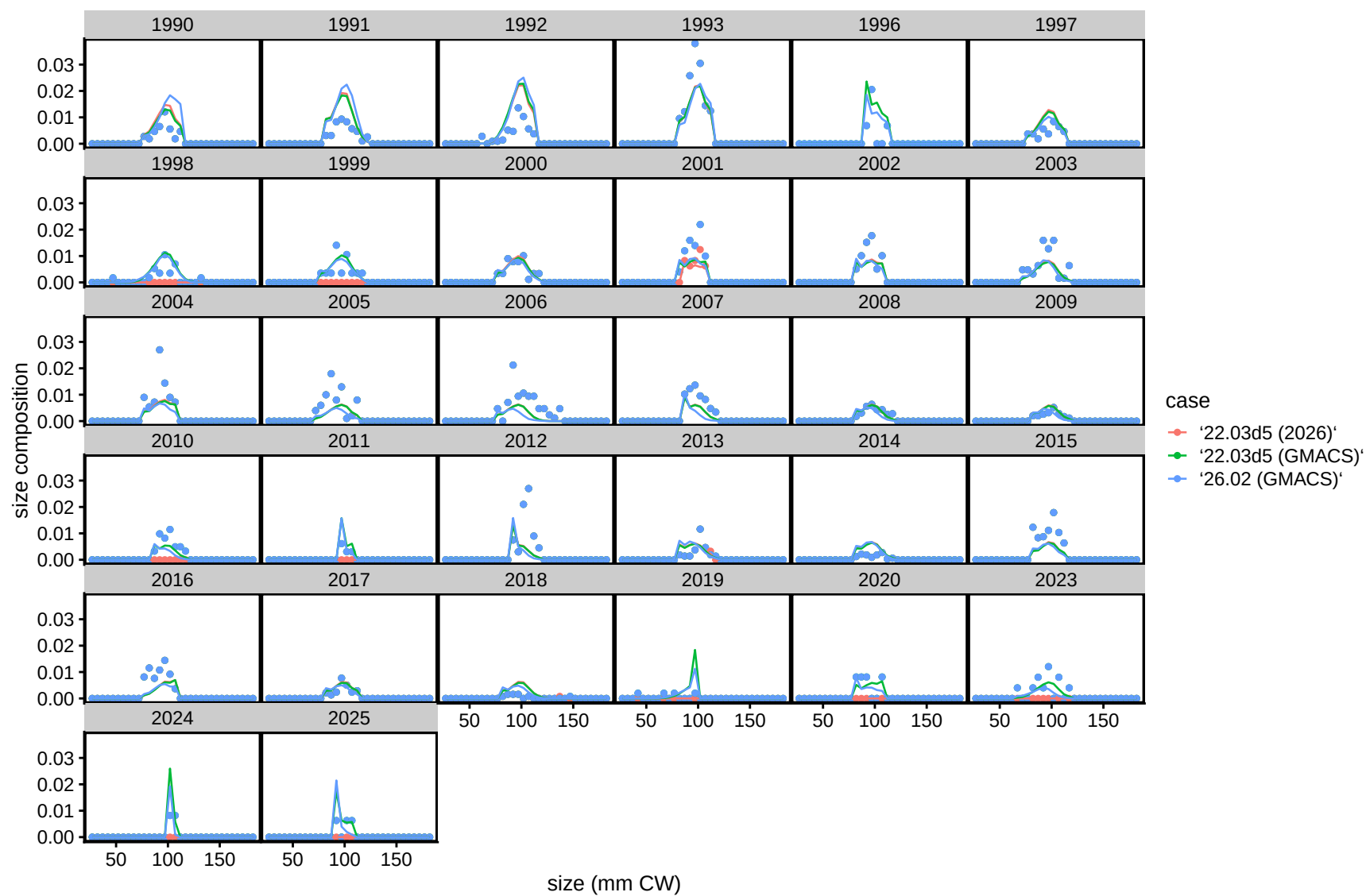


Figure 219. Fits to total catch size composition data from the BBRKC fishery for females. Points: observed values; lines: predicted values.

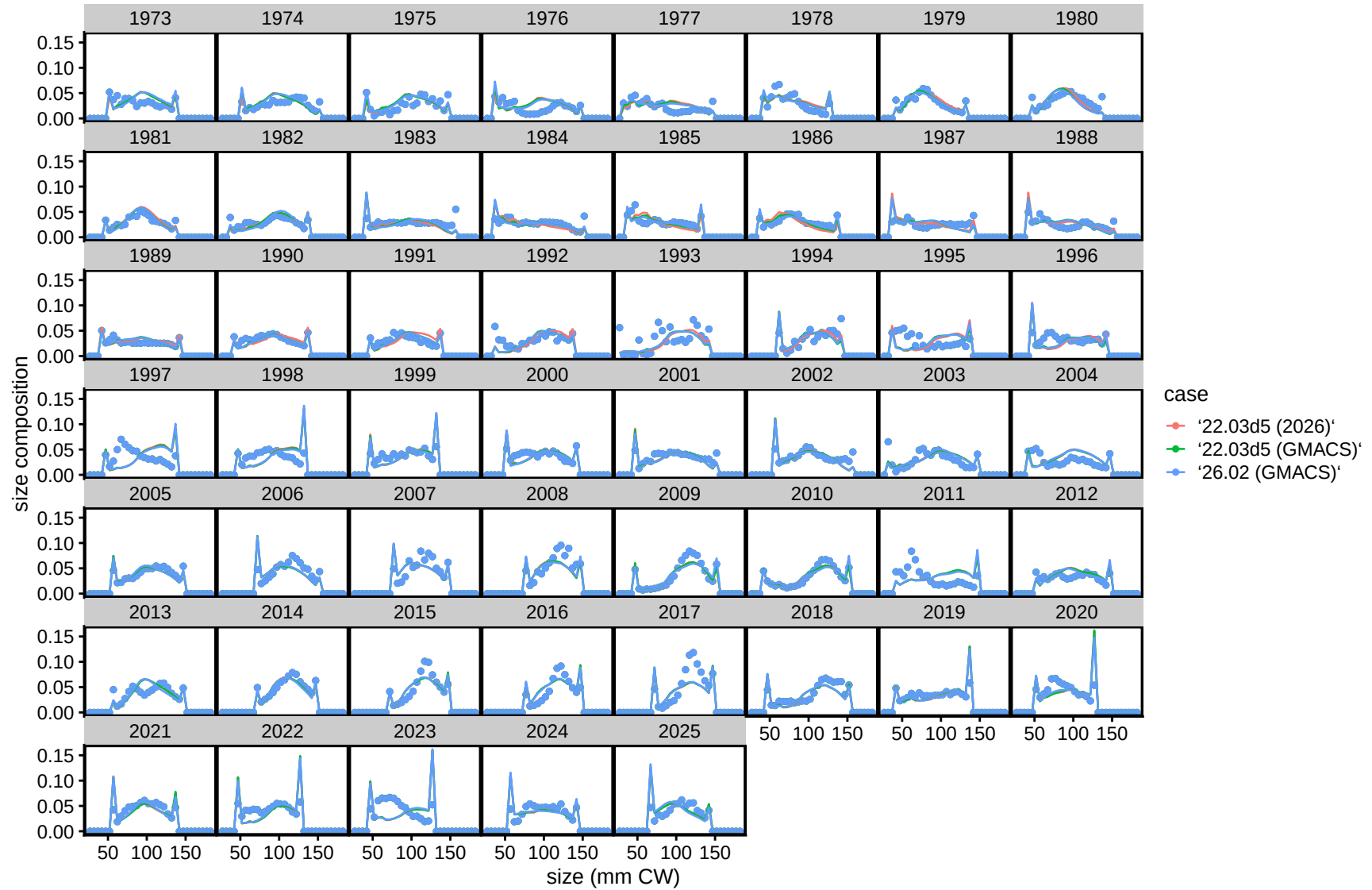


Figure 220. Fits to total catch size composition data from the groundfish fisheries for males. Points: observed values; lines: predicted values.

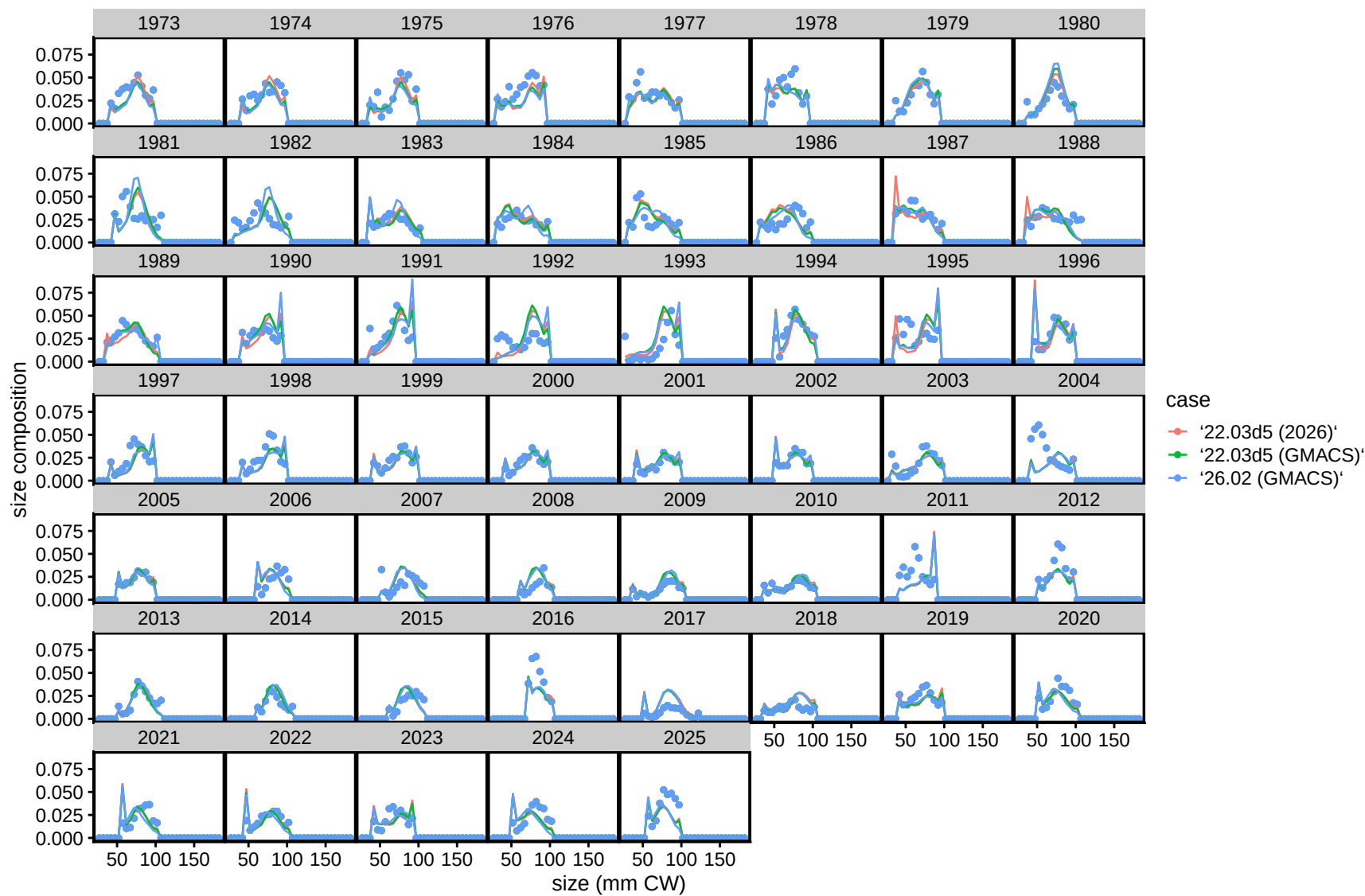


Figure 221. Fits to total catch size composition data from the groundfish fisheries for females. Points: observed values; lines: predicted values.

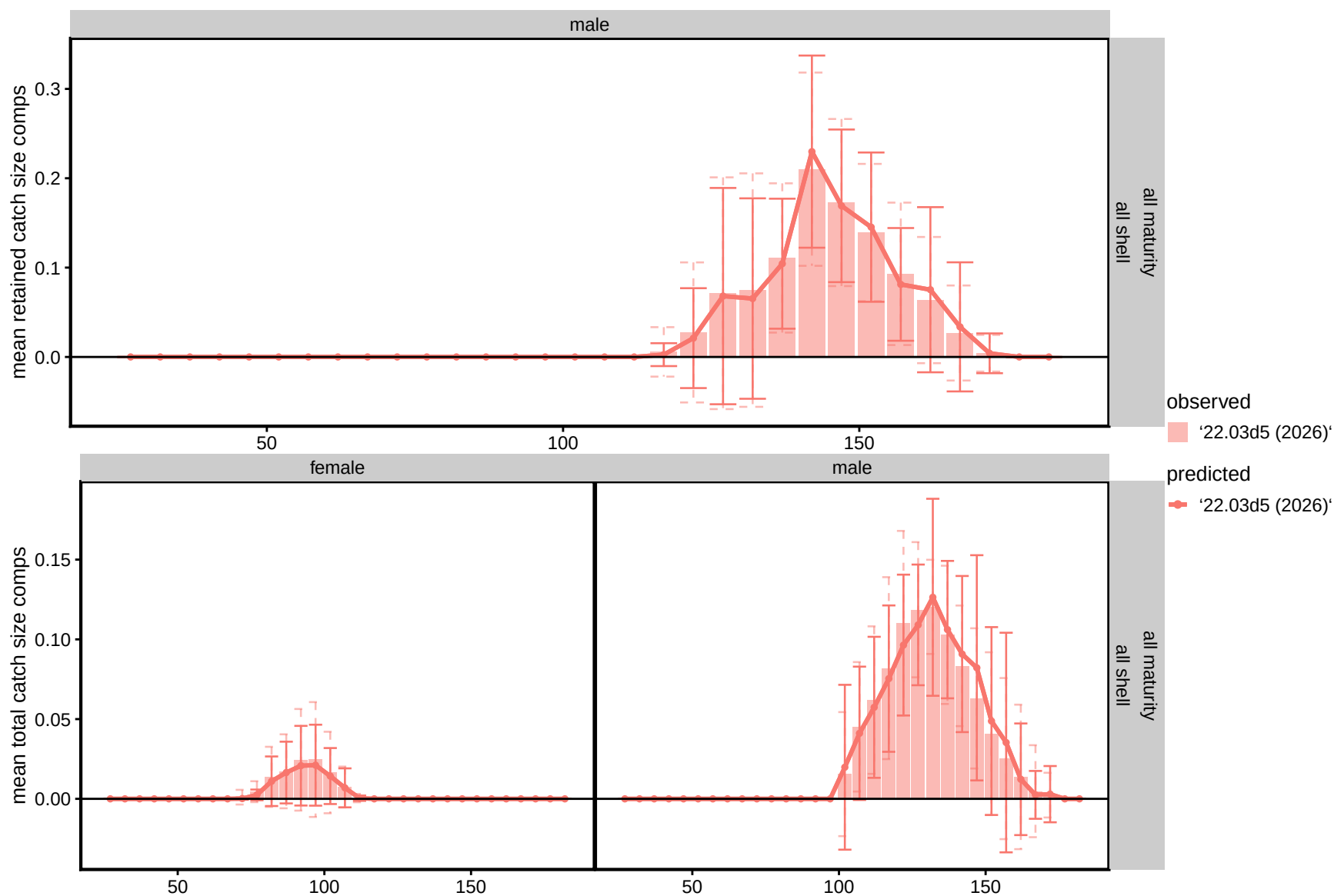


Figure 222. TCSAM02 models fits to directed fishery mean size compositions. Upper plot: retained catch; lower plot: total catch. Model 22.03d5 (2026) is the preferred model.

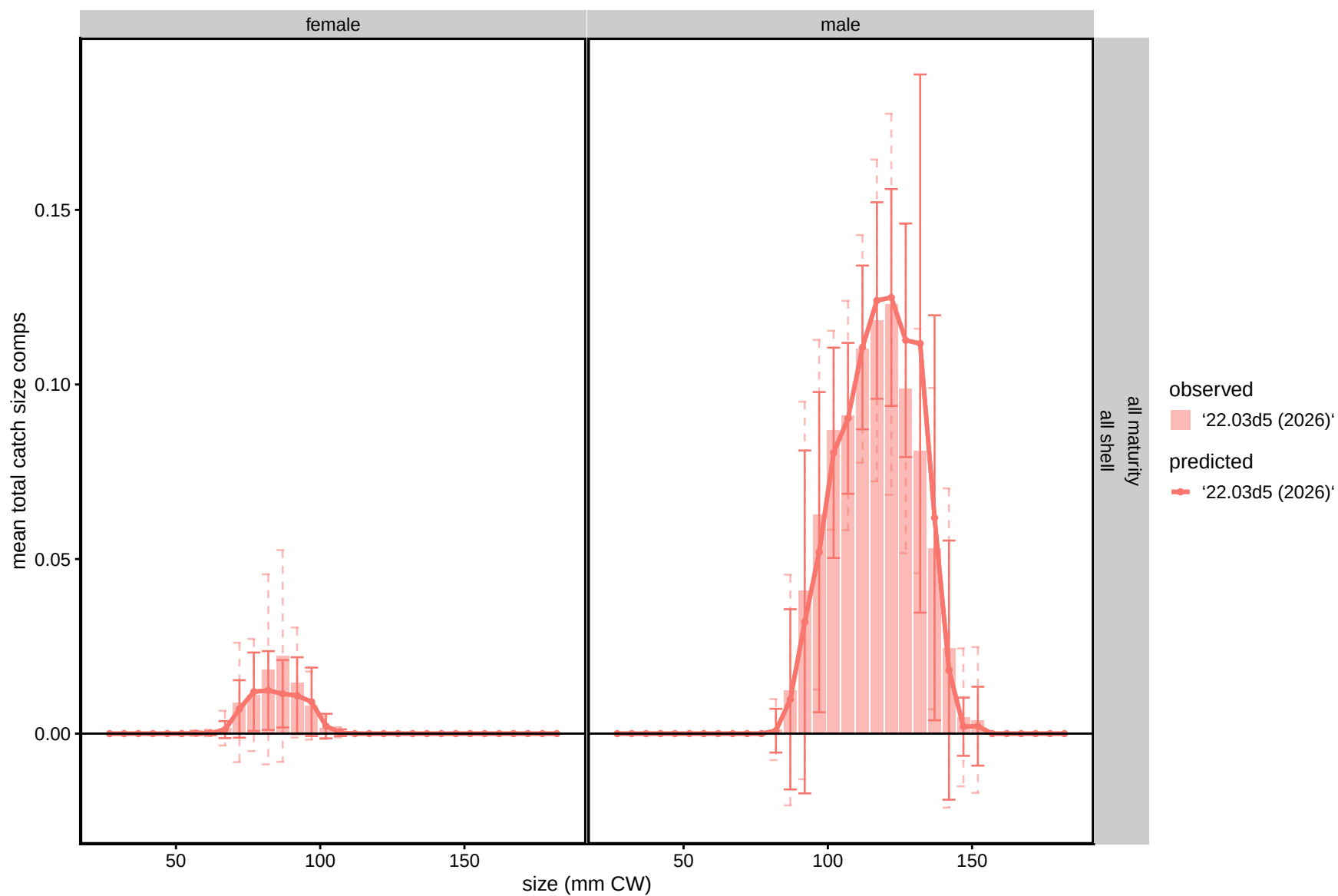


Figure 223. TCSAM02 models fits to mean bycatch size compositions from the snow crab fishery. Model 22.03d5 (2026) is the preferred model.

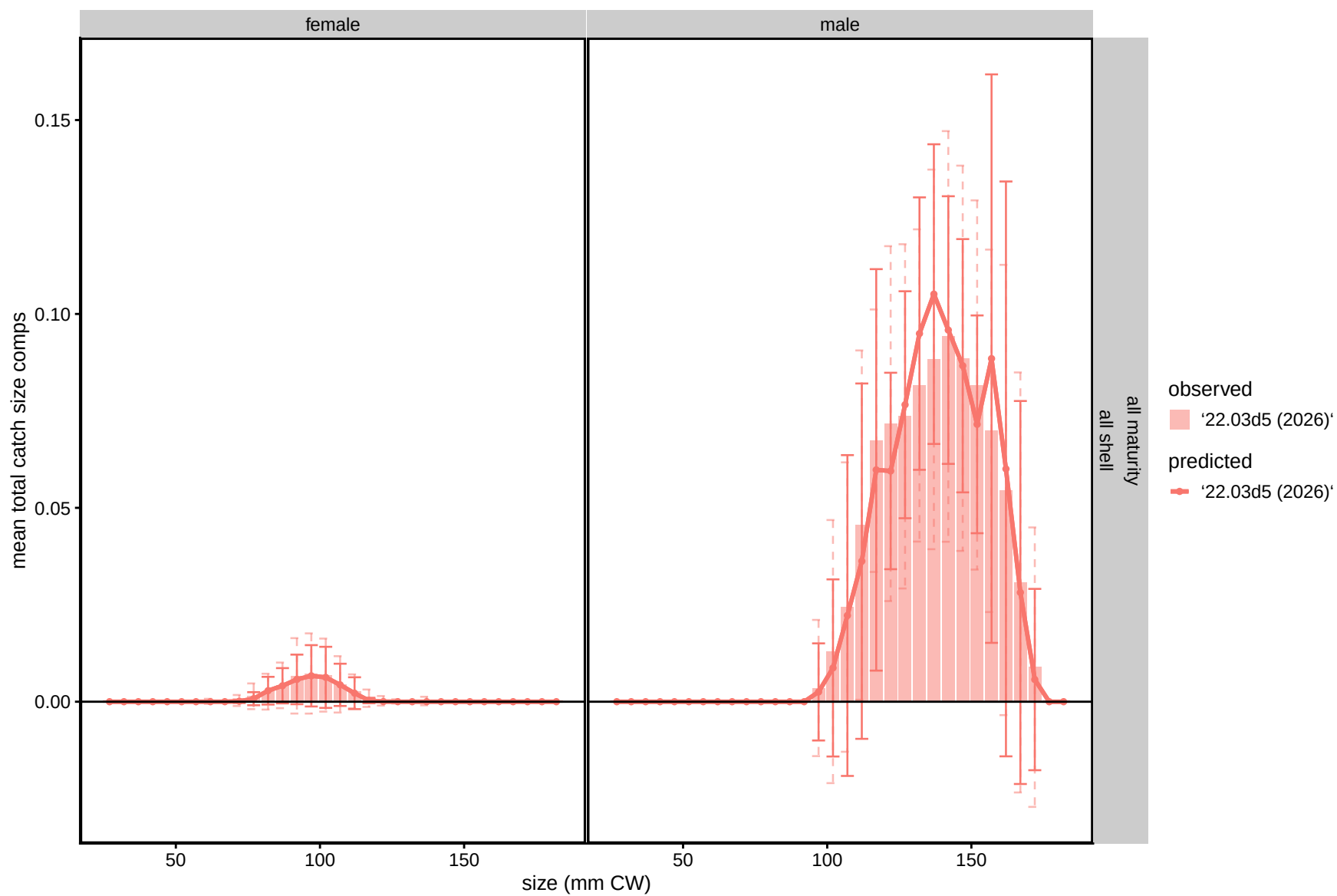


Figure 224. TCSAM02 models fits to mean bycatch size compositions from the BBRKC fishery. Model 22.03d5 (2026) is the preferred model.

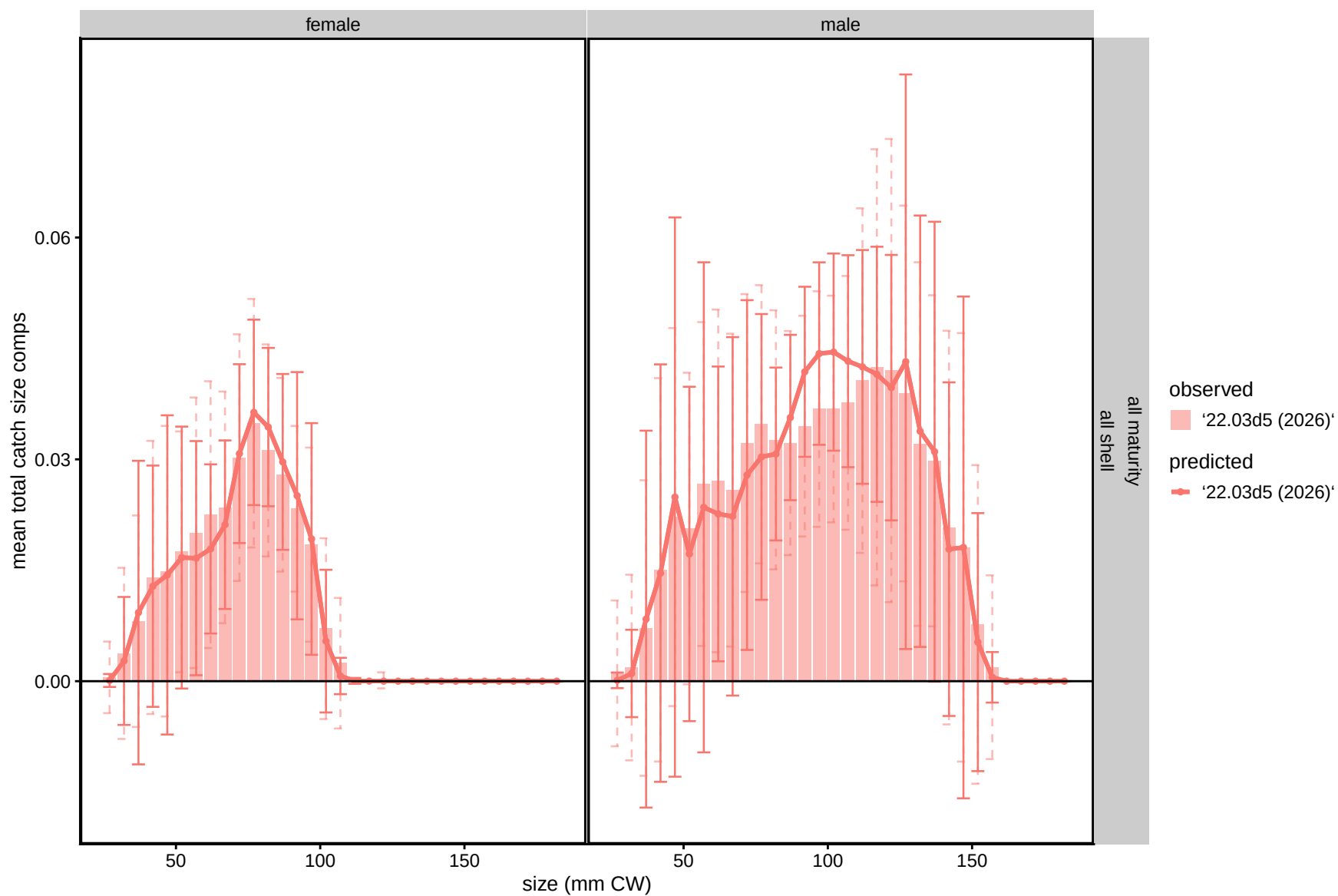


Figure 225. TCSAM02 models fits to mean bycatch size compositions from the groundfish fisheries. The total catch size compositions were normalized similarly for all model scenarios. Model 22.03d5 (2026) is the preferred model.

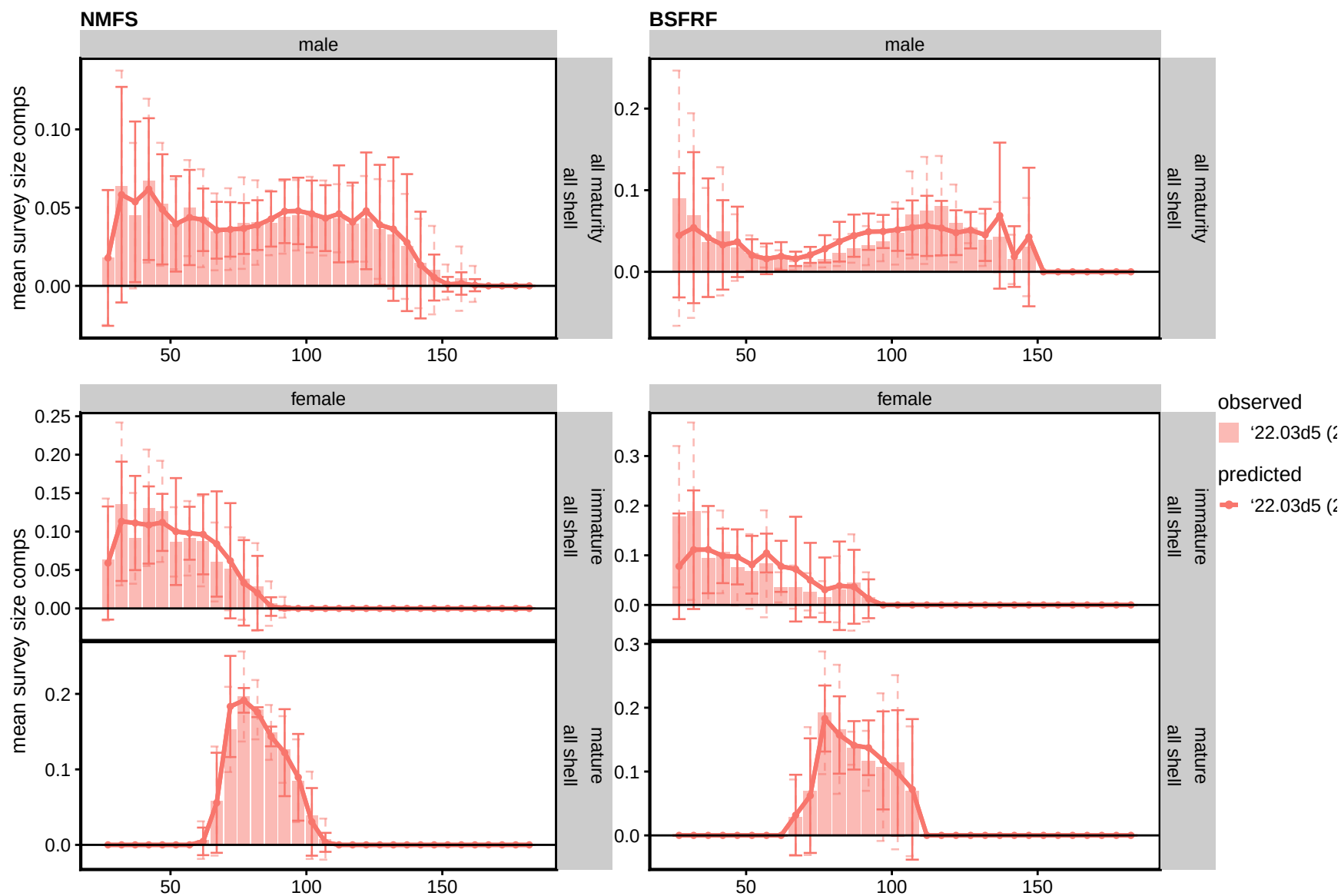


Figure 226. TCSAM02 models fits to mean survey size compositions from the NMFS EBS (left column) and BSFRF SBS (right column) surveys. The total catch size compositions were normalized similarly for all model scenarios.

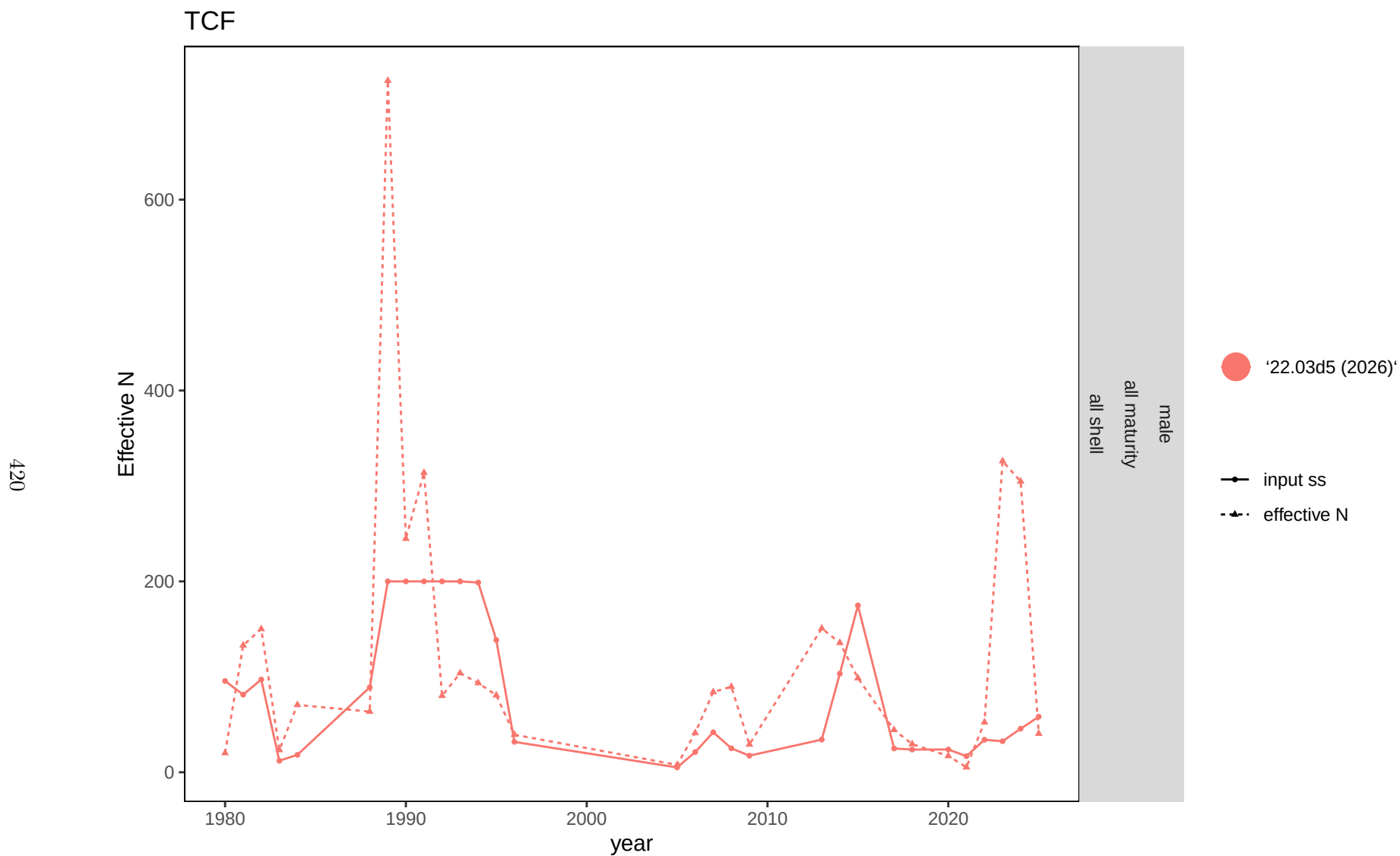


Figure 227. Effective sample sizes compared with input sample sizes for retained catch data. Dotted lines are effective N's, solid lines are input sample sizes. Input sample sizes are constrained to a maximum of 200. Model 22.03d5 (2026) is the preferred model.

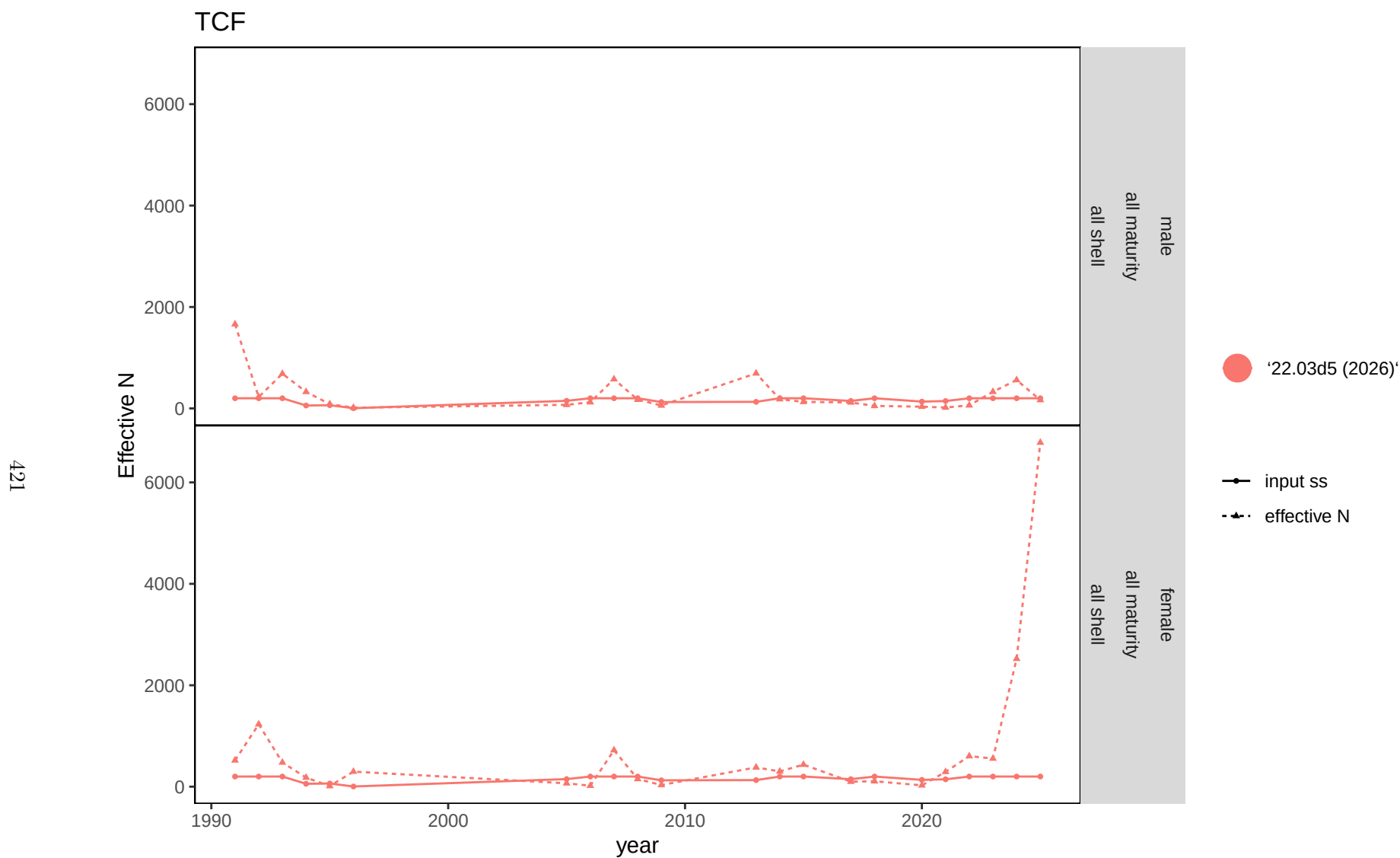


Figure 228. Effective sample sizes compared with input sample sizes for total catch data from the TCF fishery. Dotted lines are effective N's, solid lines are input sample sizes. Input sample sizes are scaled to sum to 200 in each year across categories. Model 22.03d5 (2026) is the preferred model.

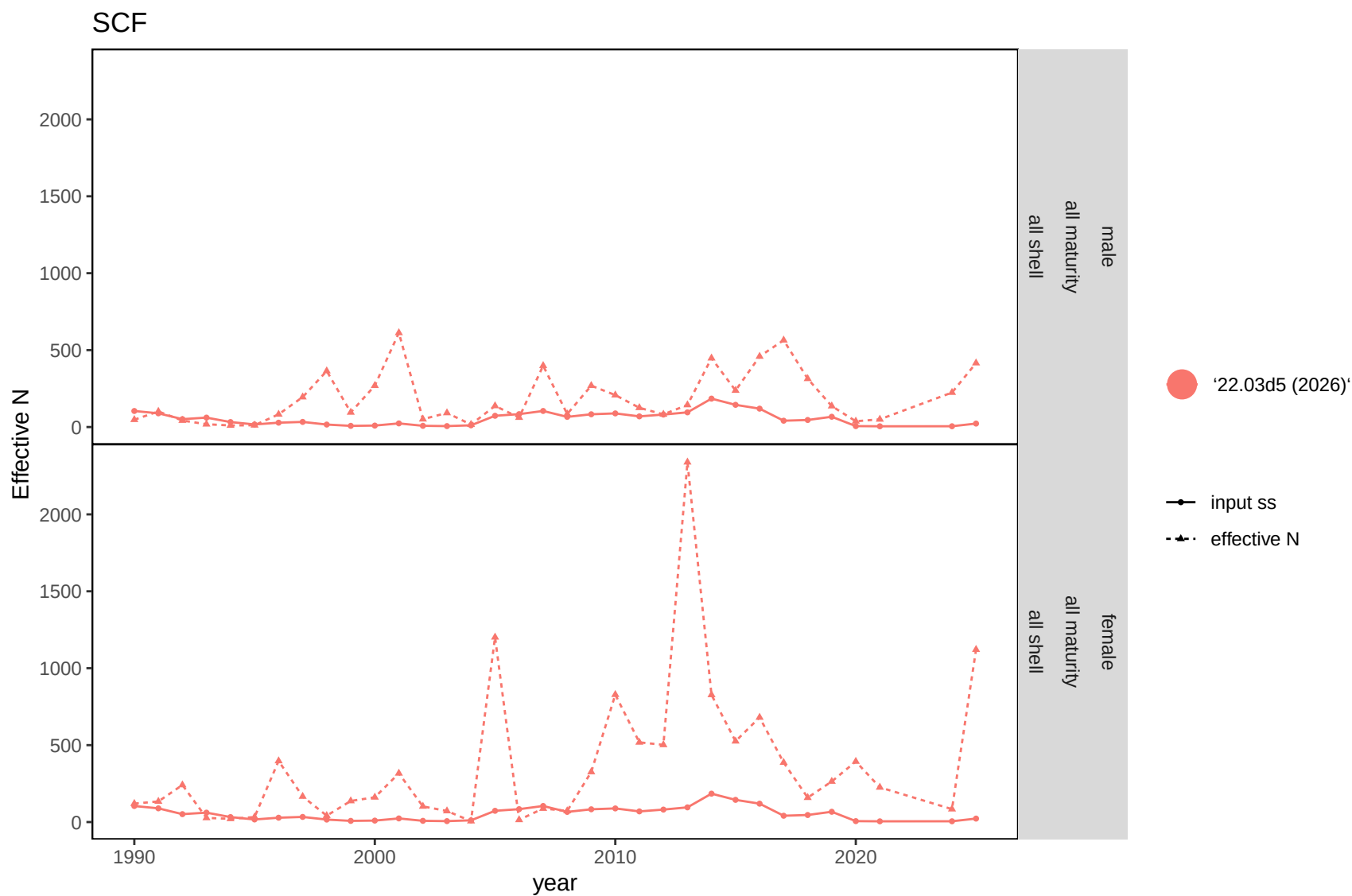


Figure 229. Effective sample sizes compared with input sample sizes for total catch data from the SCF fishery. Dotted lines are effective N's, solid lines are input sample sizes. Input sample sizes are scaled to sum to 200 in each year across categories. Model 22.03d5 (2026) is the preferred model.

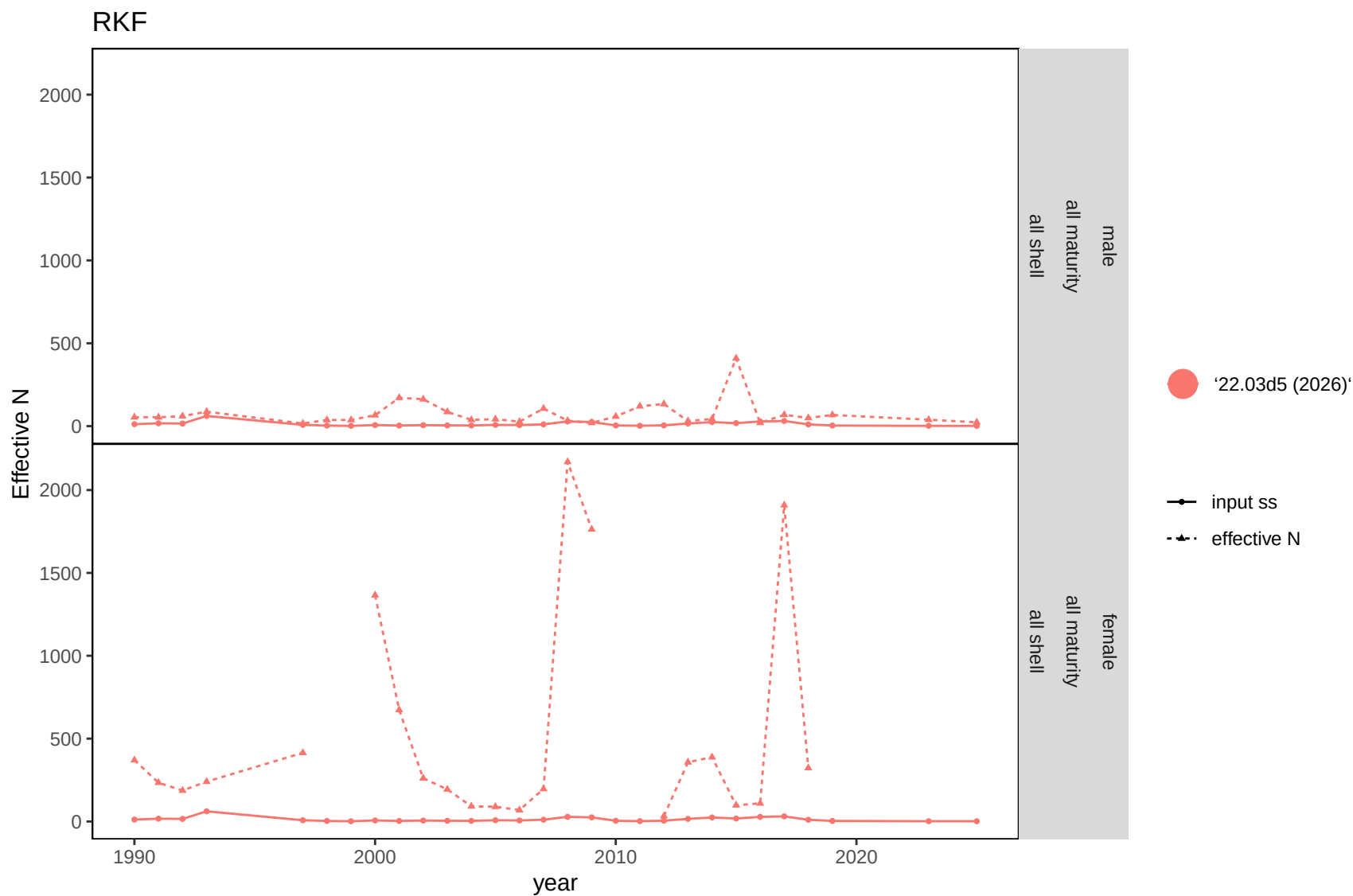


Figure 230. Effective sample sizes compared with input sample sizes for total catch data from the RKF fishery. Dotted lines are effective N's, solid lines are input sample sizes. Input sample sizes are scaled to sum to 200 in each year across categories. Model 22.03d5 (2026) is the preferred model.

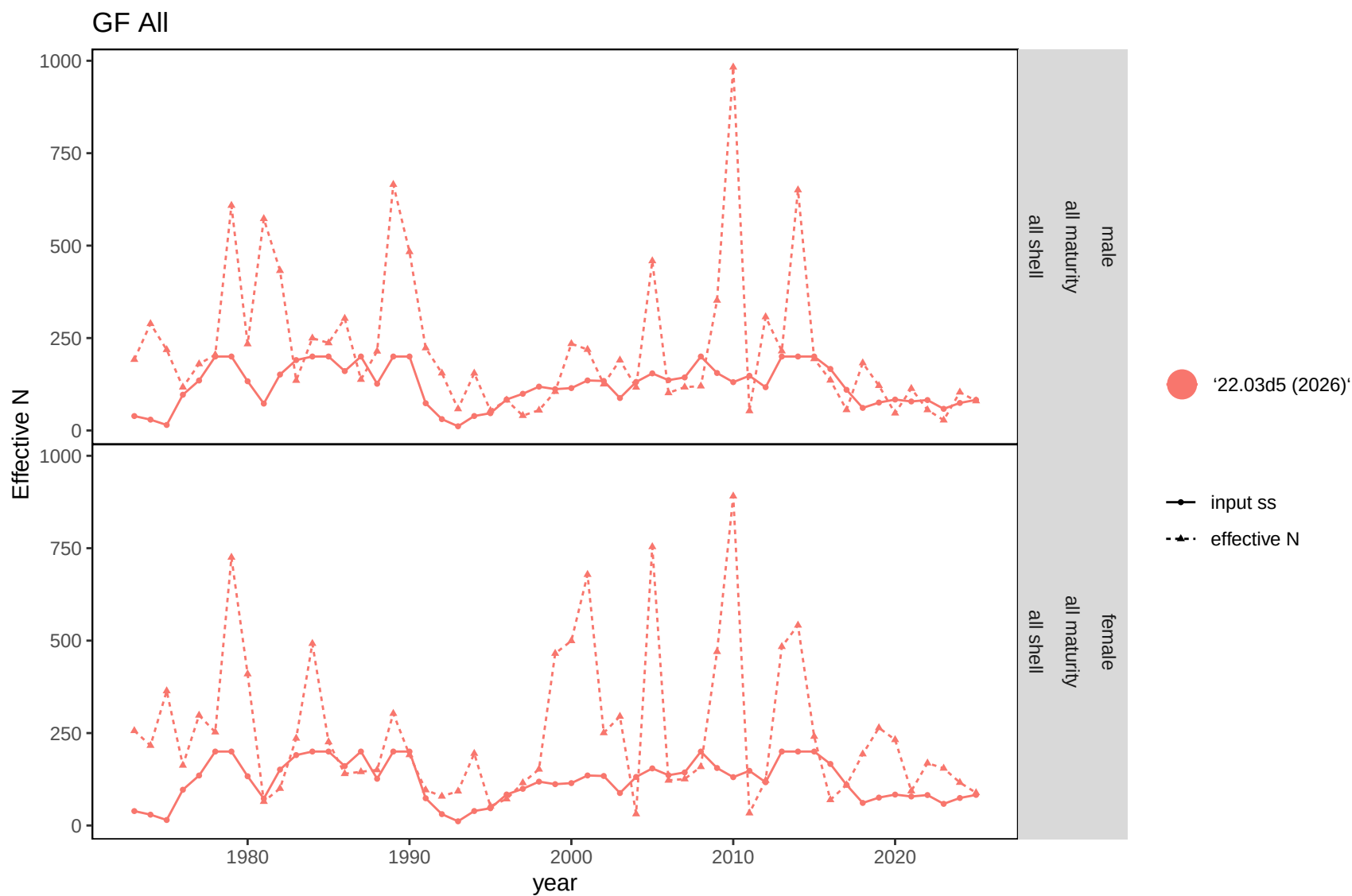


Figure 231. Effective sample sizes compared with input sample sizes for total catch data from the GF All fishery. Dotted lines are effective N's, solid lines are input sample sizes. Input sample sizes are scaled to sum to 200 in each year across categories. Model 22.03d5 (2026) is the preferred model.

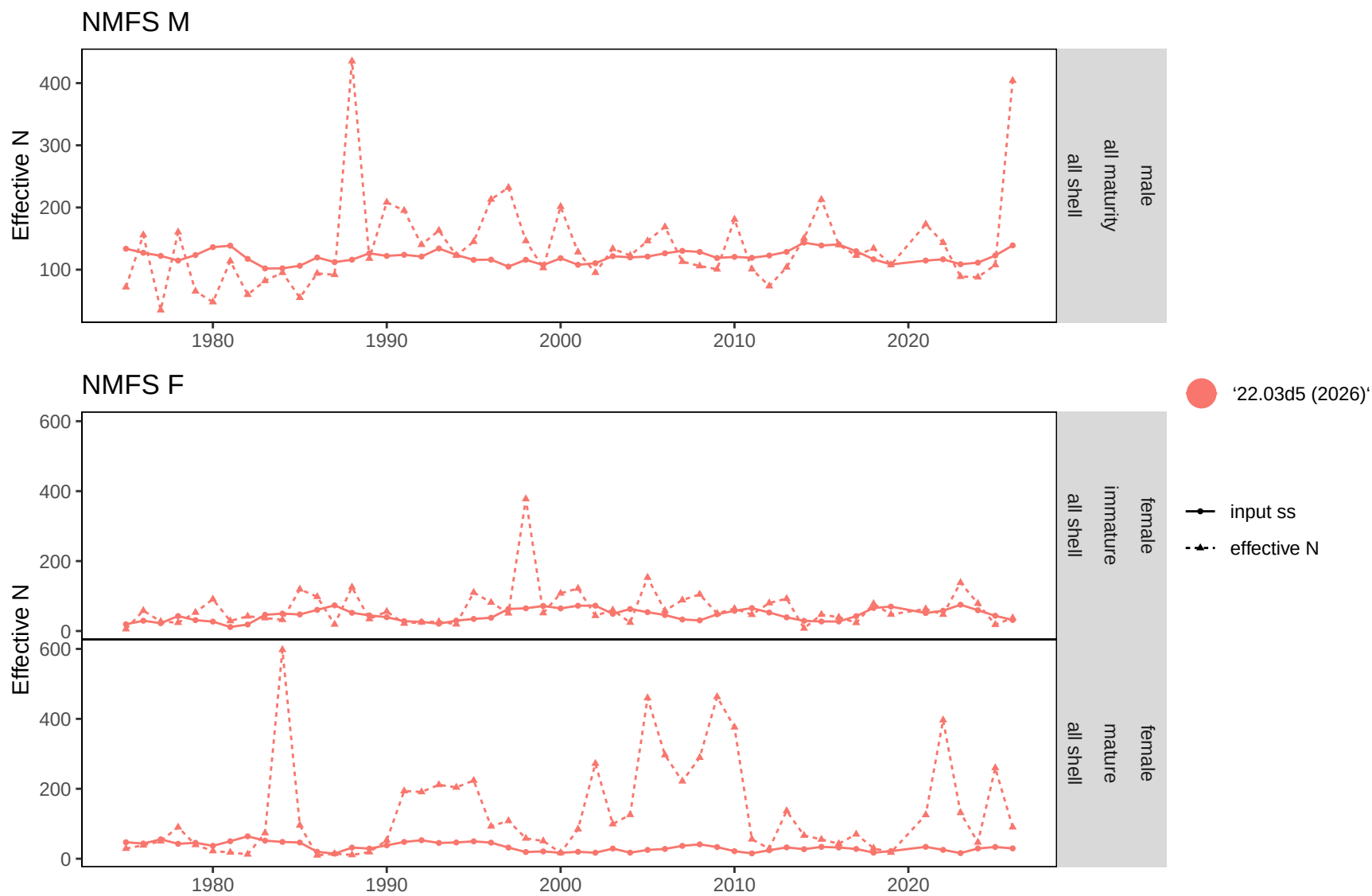


Figure 232. Effective sample sizes compared with input sample sizes for NMFS survey data. Dotted lines are effective N's, solid lines are input sample sizes. Input sample sizes are scaled to sum to 200 in each year across categories.

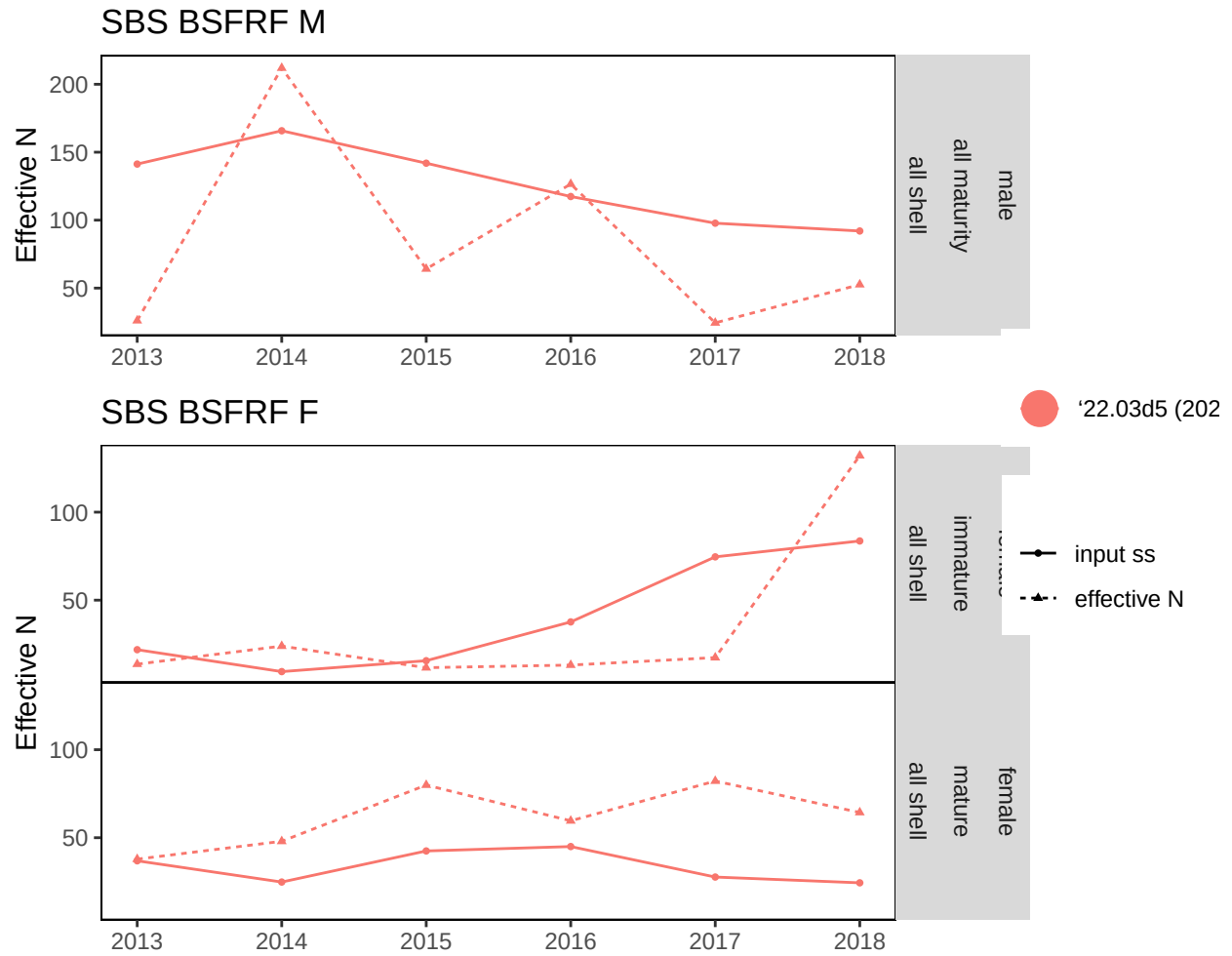


Figure 233. Effective sample sizes compared with input sample sizes for the BSFRF survey data. Dotted lines are effective N's, solid lines are input sample sizes. Input sample sizes are scaled to sum to 200 in each year across categories.

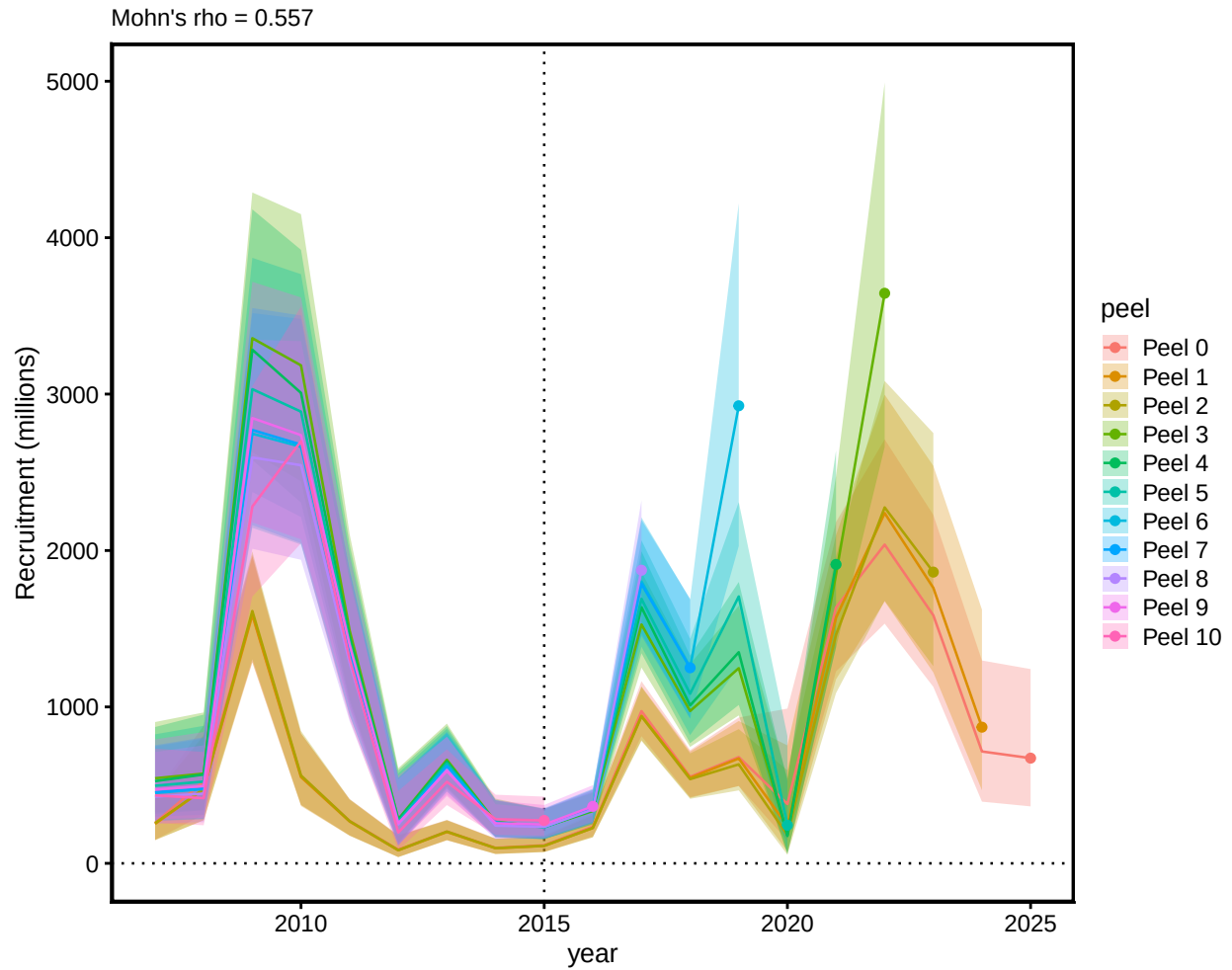


Figure 234. Retrospective analysis for recruitment time series, with Mohn's rho value (0.557). Each “peel” represents results from the model run with that number of years of data removed from the complete data series. Lines: estimates; fills: 80% confidence intervals; points: end point of estimated time series for each peel.

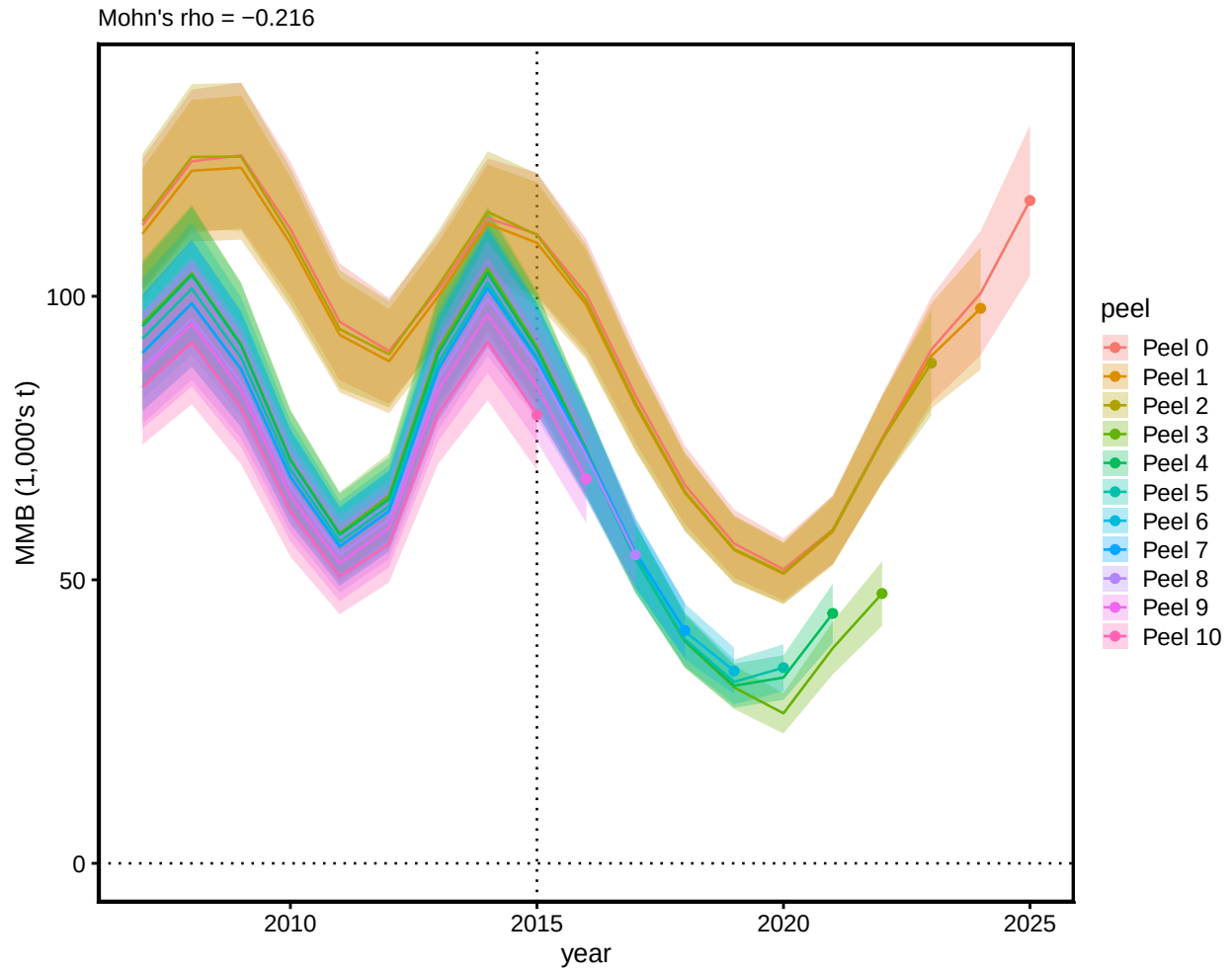


Figure 235. Retrospective analysis for mature male biomass time series, with Mohn's rho value (-0.216). Each “peel” represents results from the model run with that number of years of data removed from the complete data series. Lines: estimates; fills: 80% confidence intervals; points: end point of estimated time series for each peel.

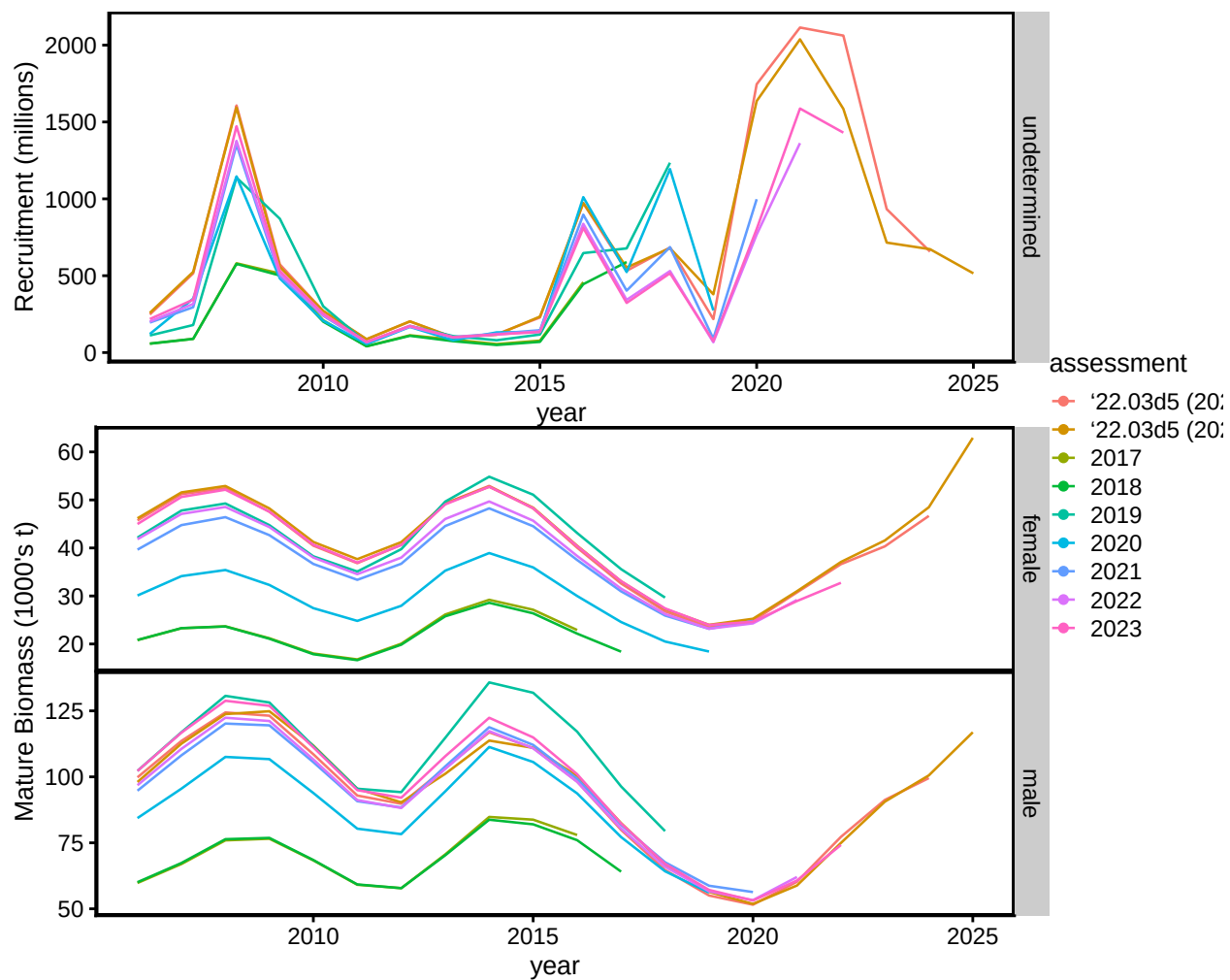


Figure 237. Comparison of estimated recruitment (upper plot) and mature biomass (lower plot) for the last 20 years from the preferred model and previous assessments.

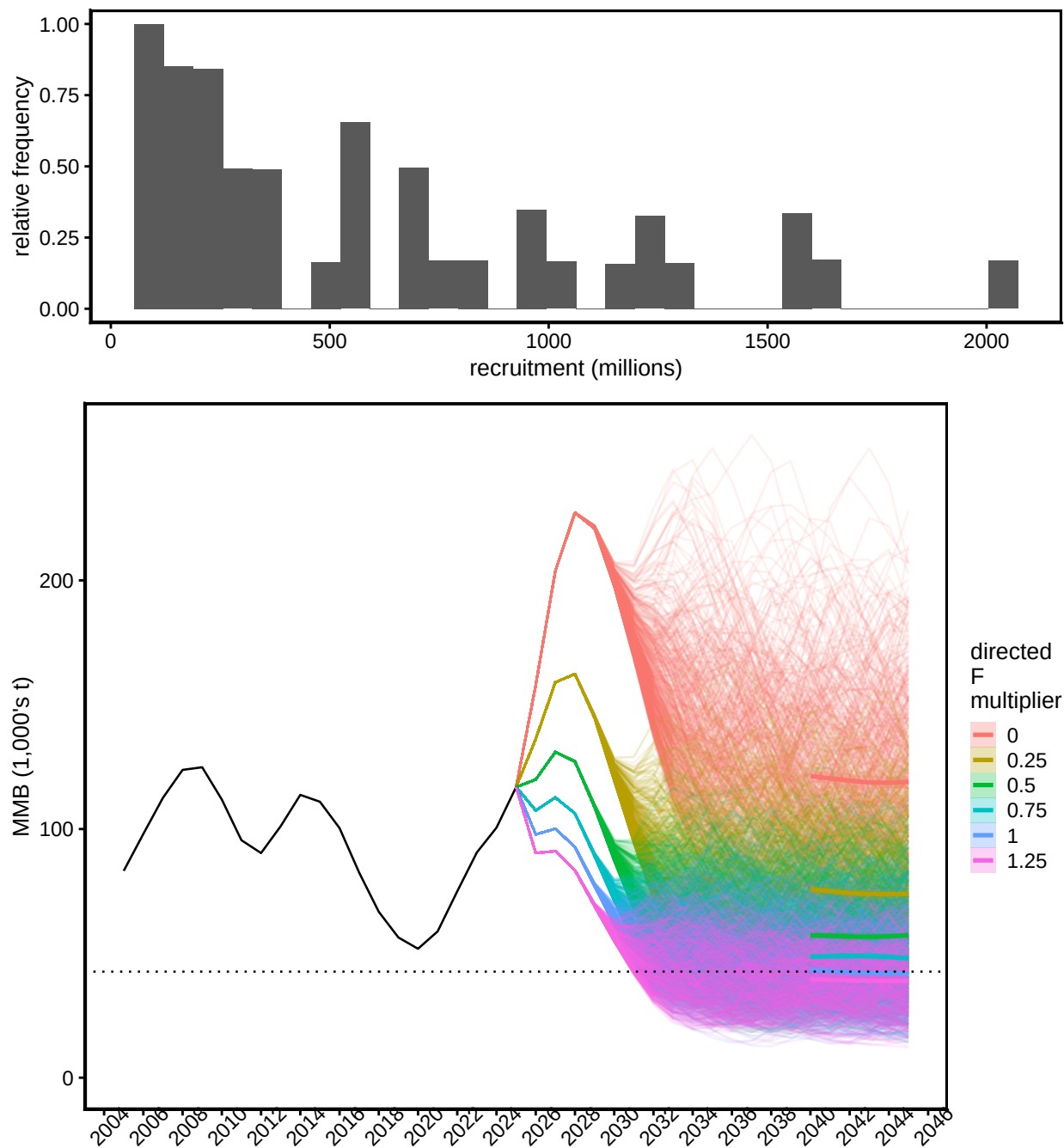


Figure 238. Tanner crab stock projections (lower plot) from 22.03d5 (2026) under constant F 's based on multipliers of the directed F_{OFL} and randomly-resampled annual recruitment using the same population dynamics used to determine the OFL.

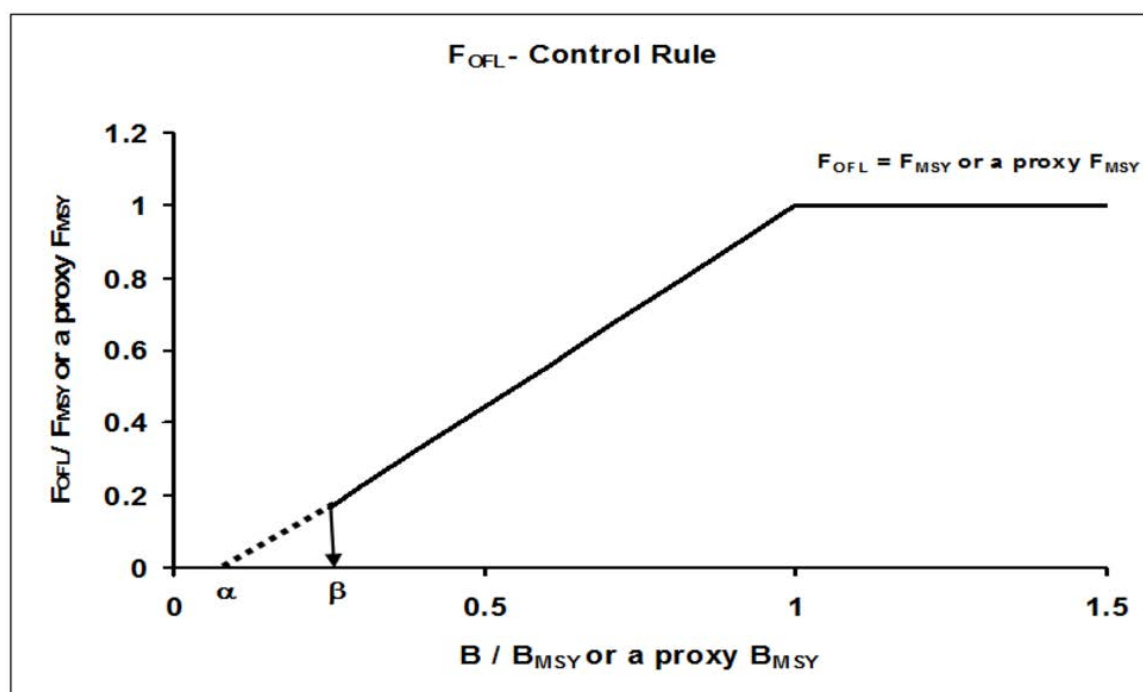


Figure 239. The F_{OFL} control rule.

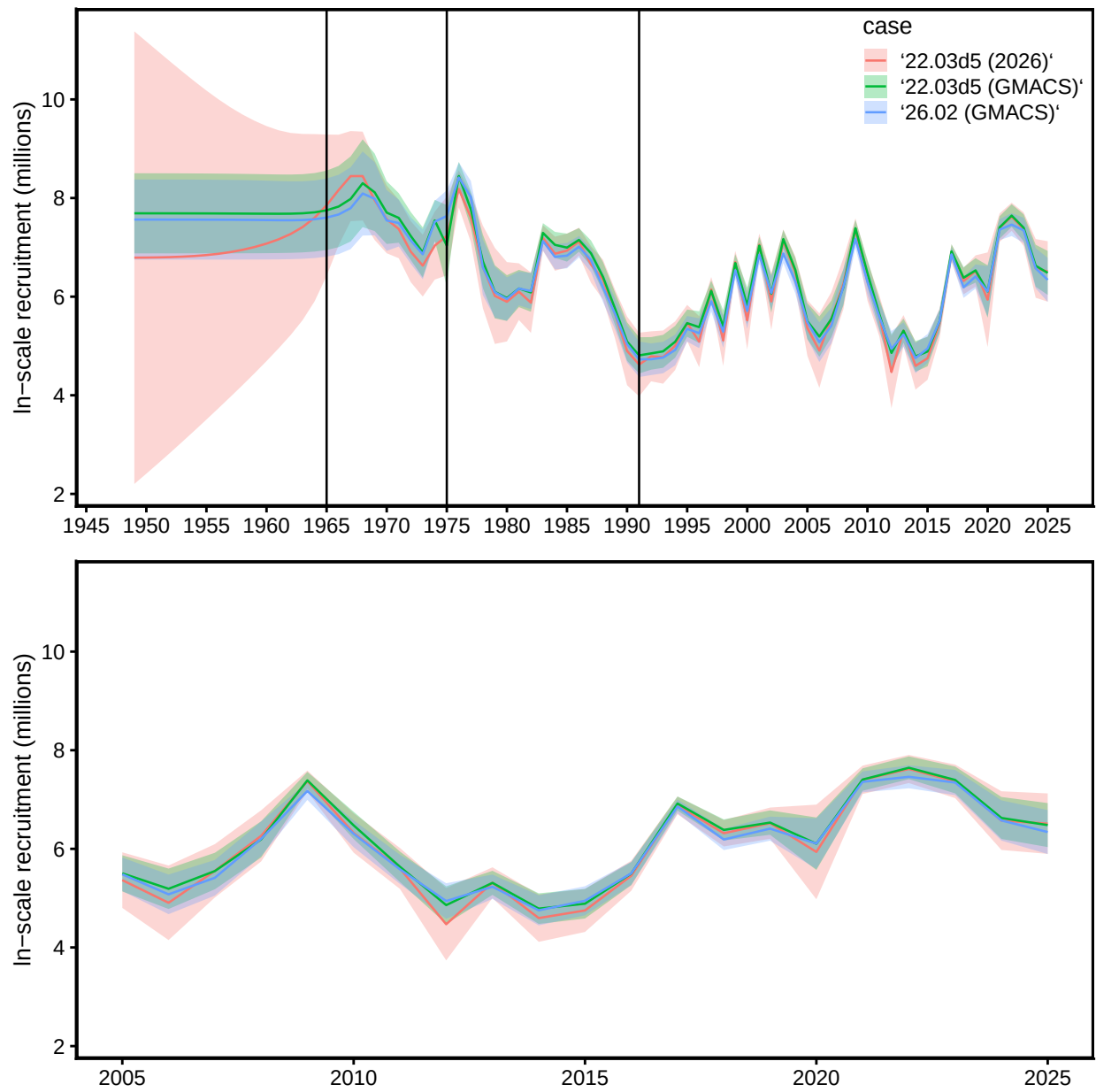


Figure 240. Time series of estimated ln-scale recruitment, with 90% confidence intervals from the GMACS and TCSAM02 models.

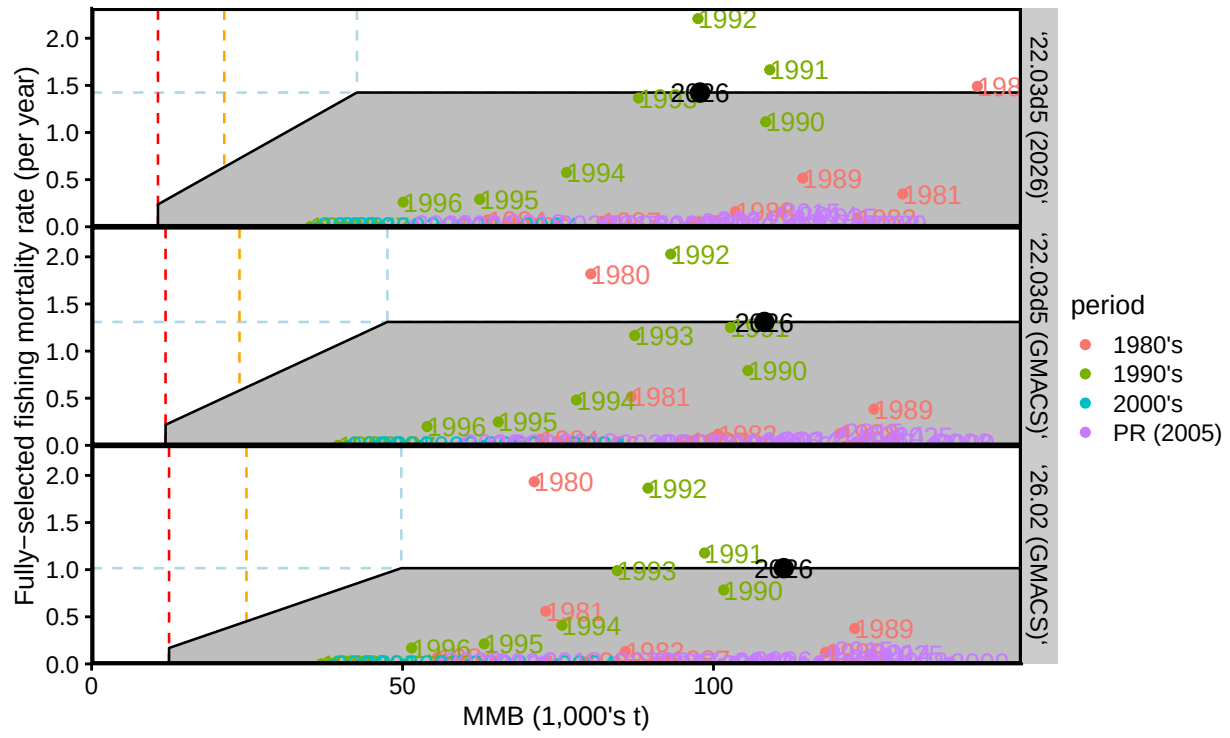


Figure 241. Quad plot for the author's preferred model, 22.03d5 (2026). Estimated values are shown starting in 1980. The value for 2026 assumes the OFL is taken in the upcoming fishing season. Colors refer to different time periods (PR: post-rationalization). Vertical dashed lines indicate: red- β ; orange-MSST; blue- B_{MSY} . Horizontal dashed line indicates F_{MSY} .

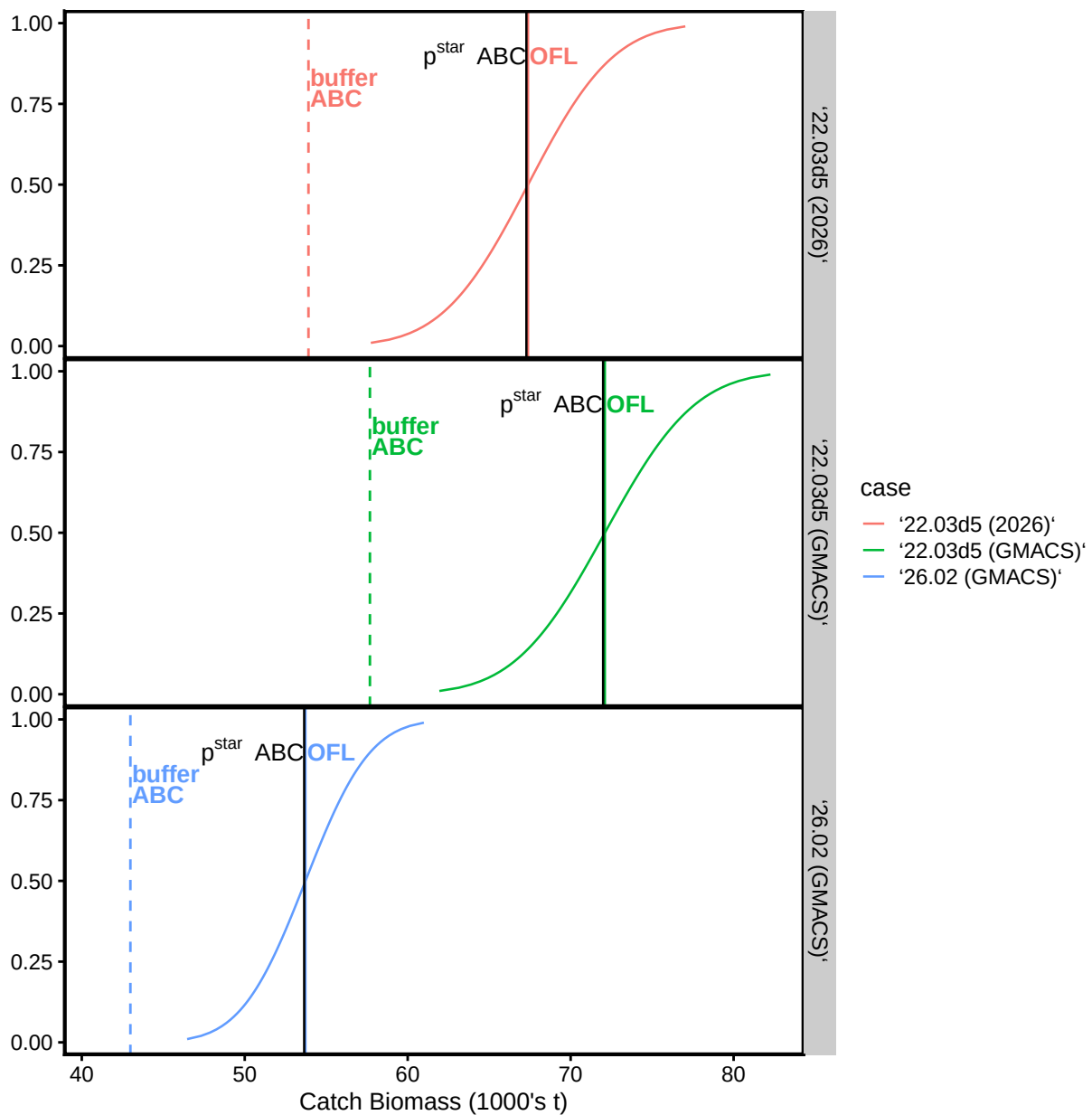


Figure 242. OFL and ABCs from the models considered for management, with the distribution used to determine the p-star ABCs. The p-star ABCs are the maximum permissible ABCs under each model and are base on model-derived estimates of uncertainty in the associated OFL. The buffer ABCs are based on applying an author-recommended 0.2% buffer to the OFL.

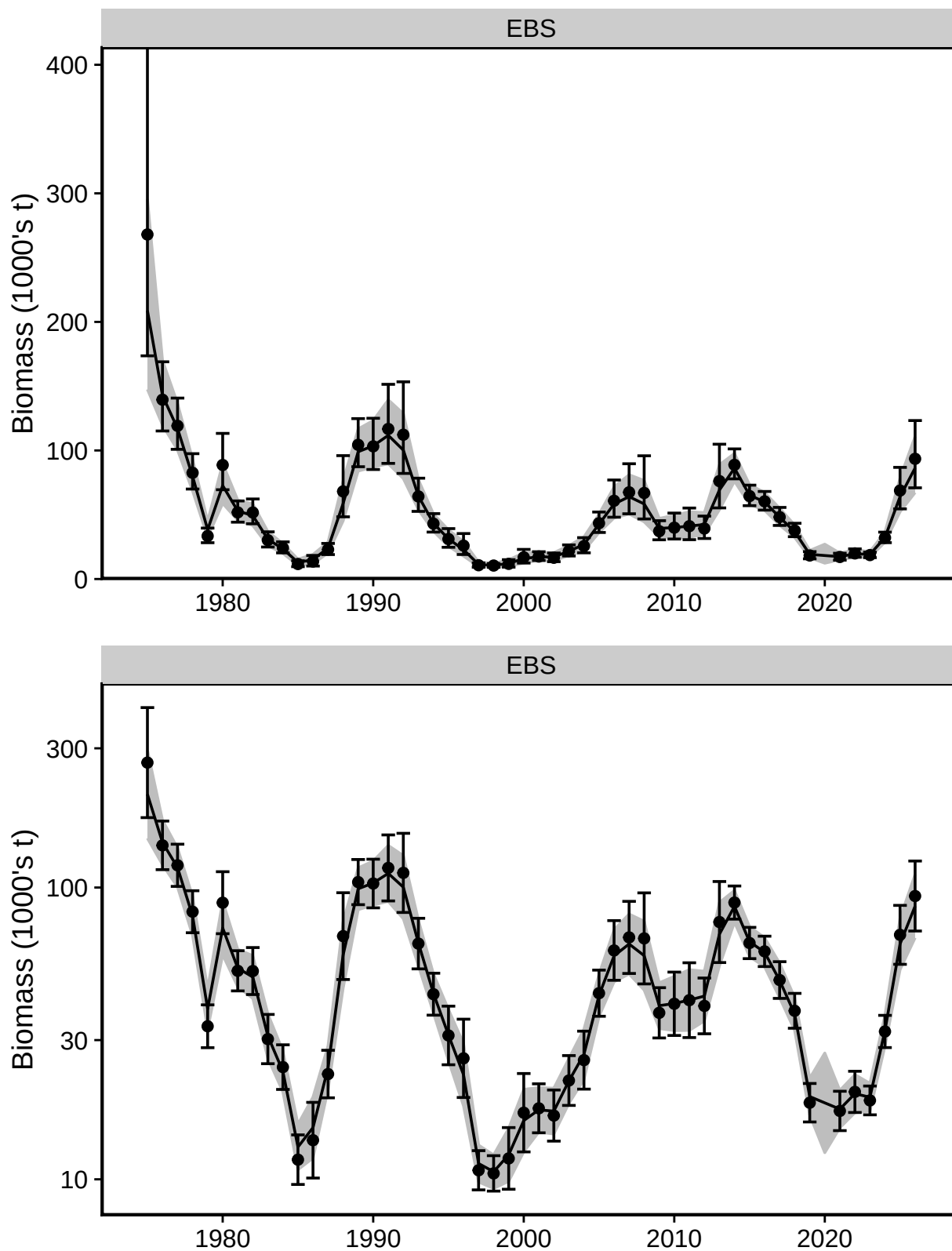


Figure 243. Estimated time series for vulnerable male biomass from the NMFS EBS shelf survey: 1) design based estimates (circles) and 80% lognormal confidence intervals (vertical bars); 2) random walk model-estimated time series (line) and 80% confidence intervals (shading). Upper plot: y-axis on arithmetic scale; lower plot: y-axis on log-scale.

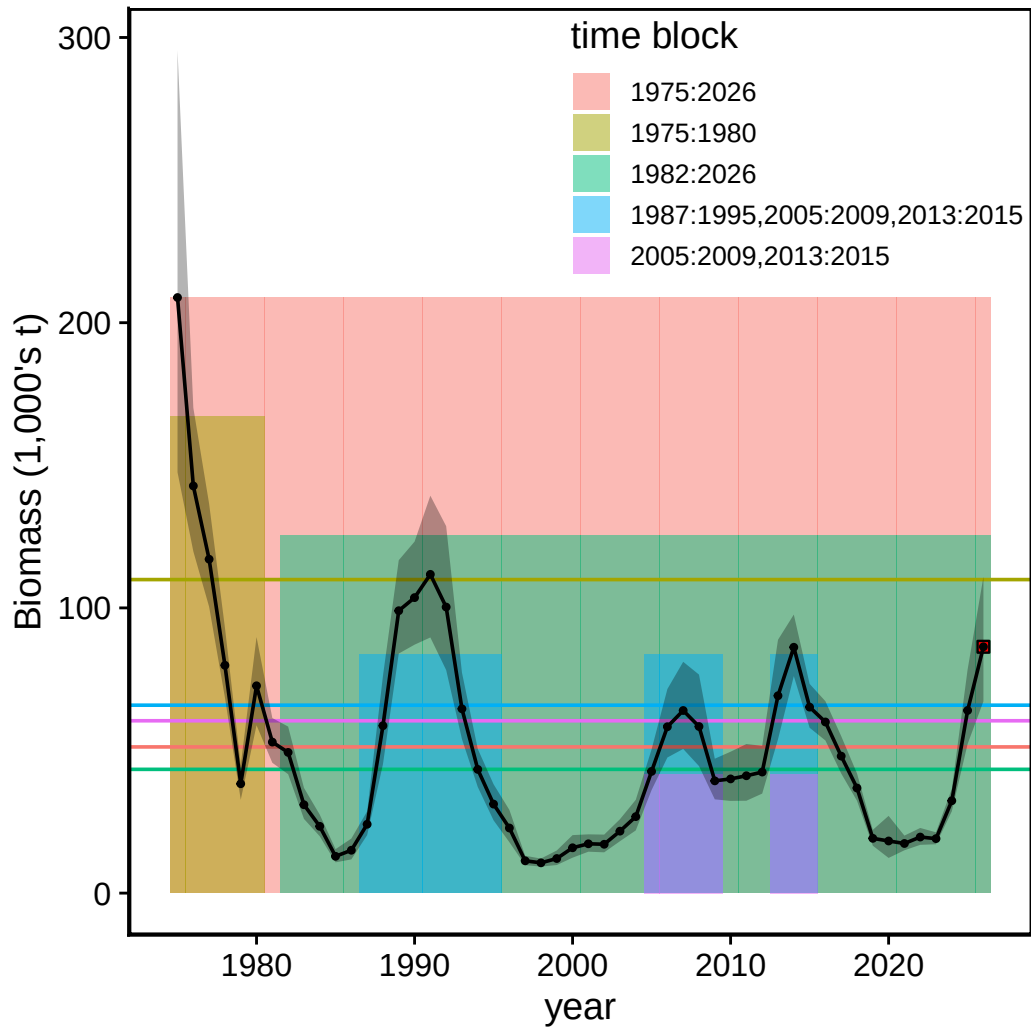


Figure 244. B_{MSY} proxies for different averaging time blocks. REMA-estimated vulnerable male biomass time series: black line and points (estimates), grey shading (80% confidence intervals). Colored rectangles indicate averaging time periods. Colored horizontal colored lines indicate resulting B_{MSY} proxy value.

Appendix A: ABC Buffers History

A.1 Introduction

As requested by the SSC, this appendix provides a table of the values and rationales for recommended (author, CPT) and adopted (SSC) ABC buffers on the Tanner crab OFL for the previous five years.

Table A.1. Rationales for recent recommended (author, CPT) and adopted (SSC) ABC buffers for Tanner crab.

Assessment	SSC ABC buffer Rationale	CPT buffer Rationale	Author buffer Rationale
2021	20% The SSC endorsed all of the OFL and ABC recommendations of the CPT	20% The CPT recommends a 20% buffer to account for model uncertainty and stock productivity uncertainty...the 20% buffer is the same that the SSC recommended for determination of the 2020/21 ABC.	20% F35% may not be a realistic proxy for FMSY and/or that MMB may not be a good proxy for reproductive success, as are currently assumed for this stock. In addition, the estimates of survey catchability for this stock remain problematic and contribute to this year's inflated OFL recommendation (relative to last year's) despite a continued decline in survey biomass across the last few years
2022	20% The SSC endorsed all of the OFL and ABC recommendations of the CPT	20% The CPT recommended a 20% buffer to account for model uncertainty and stock productivity uncertainty	20% The author remains concerned that the OFL calculation, based on F35% as a proxy for FMSY, is overly optimistic regarding the actual productivity of the stock. Fishery-related mortality similar to the P-star ABC level has occurred only in the latter half of the 1970s and in 1992/93, coincident with collapses in stock biomass to low levels. This suggests that F35% may not be a realistic proxy for FMSY and/or that MMB may not be a good proxy for reproductive success, as are currently assumed for this stock. In addition, the estimates of survey catchability for this stock remain problematic and contribute to this year's inflated OFL despite a continued decline in survey biomass across the last few years.
2023	20% The SSC endorsed all of the OFL and ABC recommendations of the CPT, with the exception of EBS snow crab and Tanner crab. the SSC recommends a buffer of 20% given that, despite uncertainty in recent recruitment events, the current influx of small crab is both high in magnitude and extensive across space beyond the southern extent of the cold pool.	25% The CPT recommended a 25% buffer to account for model uncertainty and stock productivity uncertainty...the 25% buffer is an increase from previous years due to increased concerns regarding the appropriateness of B35% and F35% as proxies due to uncertainty related to MMB as the currency of management, similar to those expressed for snow crab.	20% F35% may not be a realistic proxy for FMSY and/or that MMB may not be a good proxy for reproductive success, as are currently assumed for this stock. In addition, the estimates of survey catchability for this stock remain problematic and contribute to this year's inflated OFL despite a continued decline in survey biomass across the last few years. Furthermore, the model appears overly-optimistic in terms of recent scale and trends.
2024	20% The SSC endorsed the OFL and ABC recommendations of the CPT, with the exception of EBS snow crab	20% The CPT recommended a 20% buffer to account for model uncertainty and stock productivity uncertainty...the 20% buffer is consistent with previous years' concerns, but the CPT wishes to highlight its increasing concerns regarding the appropriateness of B35% and F35% as proxies for MSY-related management quantities due to uncertainty related to MMB as the appropriate currency of management, similar to concerns expressed for snow crab.	20% The author remains concerned that the OFL calculation, based on F35% as a proxy for FMSY, is overly optimistic regarding the actual productivity of the stock. Fishery-related mortality similar to the P * ABC level has occurred only in the latter half of the 1970s and in 1992/93, coincident with collapses in stock biomass to low levels. This suggests that F35% may not be a realistic proxy for FMSY and/or that MMB may not be a good proxy for reproductive success, as are currently assumed for this stock. In addition, the estimates of survey catchability for this stock remain problematic and contribute to this year's inflated OFL despite a continued decline in survey biomass across the last few years. Furthermore, the model appears overly-optimistic in terms of recent scale and trends. However, these concerns are not new and are reflected in the previous ABC buffer.
2025	20% Since the major uncertainties and concerns about the assessment have not changed, the SSC continues to recommend an ABC buffer of 20% for Tanner crab.	20% The CPT expressed similar concerns to those from 2024.	20% F35% may not be a realistic proxy for FMSY and/or that MMB may not be a good proxy for reproductive success, as are currently assumed for this stock. In addition, estimates of survey catchability and mean recruitment are strongly correlated for this stock, suggesting that the estimated stock size may be problematic. However, these concerns are not new and are reflected in the previous ABC buffer. Other considerations in the evaluation of the Risk Table suggest these are at normal levels of concern and thus do not warrant increasing the buffer.

Appendix B: Risk Table

B.1 Introduction

This appendix documents the risk table and ABC recommendation for the 2026 Tanner crab stock assessment (Stockhausen 2026c). In October 2023, the SSC requested that a draft risk table be developed for the eastern Bering Sea Tanner crab stock. The following was used to complete the draft risk table, based on the template updated in 2023 to reflect only three levels of concern and which implements the SSC’s December 2023 request regarding the labels for these levels:

	<i>Assessment-related considerations</i>	<i>Population dynamics considerations</i>	<i>Environmental/ecosystem considerations</i>	<i>Fishery Performance</i>
Level 1: Normal	Typical to moderately increased uncertainty/minor unresolved issues in assessment.	Stock trends are typical for the stock; recent recruitment is within normal range.	No apparent environmental/ecosystem concerns	No apparent fishery/resource-use performance and/or behavior concerns
Level 2: Increased concern	Major problems with the stock assessment; very poor fits to data; high level of uncertainty; strong retrospective bias.	Stock trends are highly unusual; very rapid changes in stock abundance, or highly atypical recruitment patterns.	Multiple indicators showing consistent adverse signals a) across the same trophic level as the stock, and/or b) up or down trophic levels (i.e., predators and prey of the stock)	Multiple indicators showing consistent adverse signals a) across different sectors, and/or b) different gear types
Level 3: Extreme concern	Severe problems with the stock assessment; severe retrospective bias. Assessment considered unreliable.	Stock trends are unprecedented; More rapid changes in stock abundance than have ever been seen previously, or a very long stretch of poor recruitment compared to previous patterns.	Extreme anomalies in multiple ecosystem indicators that are highly likely to impact the stock; Potential for cascading effects on other ecosystem components	Extreme anomalies in multiple performance indicators that are highly likely to impact the stock

The table is applied by evaluating four types of considerations that could be used to support a scientific recommendation for the buffer on the OFL used to set the ABC. These are stock assessment considerations, population dynamics considerations, environmental/ecosystem considerations, and fishery performance considerations. Examples of the types of concerns that might be relevant in crab assessments include the following:

1. Assessment considerations—data-inputs: skipped surveys, lack of fishery-independent trend data; model fits: poor fits to fishery or survey data, inability to simultaneously fit multiple data inputs; model performance: poor model convergence, multiple minima in the likelihood surface, parameters hitting bounds; estimation uncertainty: poorly-estimated but influential year classes; retrospective bias in biomass estimates.
2. Population dynamics considerations—decreasing biomass trend, poor recent recruitment, inability of the stock to rebuild, abrupt increase or decrease in stock abundance.
3. Environmental/ecosystem considerations—adverse trends in environmental/ecosystem indicators, ecosystem model results, decreases in ecosystem productivity, decreases in prey abundance or availability, increases or decreases in predator abundance or productivity.

4. Fishery performance—fishery CPUE exhibits a contrasting pattern to the stock biomass trend, unusual spatial patterns of fishing, changes in the percent of TAC taken, changes in the duration of fishery openings.

B.2 Summary and ABC Recommendation

The summarized results of the risk table for EBS Tanner crab are in the table below. All scores except that for “Assessment-related considerations” are Level 1, suggesting no need to set the ABC below the maximum permissible. “Assessment-related considerations” are considered of “increased concern”, with a corresponding risk level of 2. However, this does not reflect a change in the level of concern for this category from the previous assessment. Consequently, the assessment author recommends that the overall risk level is the same as in 2025/26 and recommends using the previous (20%) ABC buffer.

Table B.2. Summary of risk-table considerations and concern levels for eastern Bering Sea Tanner crab.

	<i>Assessment-related considerations</i>	<i>Population dynamics considerations</i>	<i>Environmental/ecosystem considerations</i>	<i>Fishery Performance</i>
	Level 2: increased concern	Level 1: Normal	Level 1: Normal	Level 1: Normal
longterm/persistent	Fails to achieve the dynamic range seen in survey biomass, concern regarding currency for reproductive potential, concern regarding proxies used for Fmsy and Bmsy	The majority of stock-specific ecosystem indicators related to natural mortality, growth, and recruitment suggest no additional concerns. While bitter crab disease prevalence was high, the magnitude of impact on the stock remains unknown. The abundance of Tanner/snow crab hybrids in all population categories was the largest seen in the survey time series (which starts in 1998).	Warm conditions with a reduced cold pool extent in 2024; forecast to be warm with delayed sea ice arrival in 2025. While bottom waters were warm in 2025, ecosystem concerns are minor with uncertain impacts on the stock. Corrosive bottom waters remain a concern for growth and survival. Competitive pressure may be low, while predation pressure may be increasing.	Fishery-informed indicators generally support stable stock condition relative to the most recent seasons and the post-2005 historical record. No considerations observed in the most recent fishery suggest greater than normal risk of overfishing, independent of other considerations captured in the assessment and risk table.
	no change	no change	no change	no change
current	no change	The abundance of Tanner/snow crab hybrids decreased dramatically for females and small males (>45%), and only increased slightly (12%) following the largest abundances seen in the survey time series (which starts in 1998) across all population categories.	Increased transport offshore and to the northwest may affect dispersal and survival of pelagic larvae. The summer cold pool was larger than average, potentially affecting growth of immature crab and survival of all life stages.	no change.

B.3 Details

B.3.1 Assessment considerations

Historical considerations - Risk Level 2: Increased concern

Current considerations - unchanged

The TCSAM02-based assessment model 22.03d5c has been, and remains, a cause for moderate concern regarding this assessment. While the model fits the fishery catch and bycatch data extremely well, it fails to achieve the dynamic range seen in survey biomass: underestimating the peaks and overestimating the valleys in a time series that exhibits decadal-scale variability. This inflexibility in the model points to constraints on processes in the model that should be allowed to vary with time, with natural mortality and survey selectivity as the most obvious candidates. Similar models using the GMACS framework were brought forward this year but rejected by the assessment author on the inability to conduct retrospective analyses and faulty projection results. If one of these models were adopted for harvest specifications, the author recommends increasing the buffer to 30% to reflect the increased uncertainty associated with the GMACS models difficulties and the general transition to a different modeling framework.

Mature male biomass is currently used as the “currency” of Tanner crab spawning biomass for assessment purposes. However, its relationship to stock-level reproductive potential is unclear. Similarly, mature female biomass does not have a clear relationship to reproductive potential.

Whether F_{35} and B_{35} , developed considering fish life histories and population dynamics (not crabs), are appropriate proxies for F_{MSY} and B_{MSY} for this stock is uncertain.

These considerations are not new to the assessment (other than the possible transition to GMACS), however, nor are the results for this year extreme.

B.3.2 Population dynamics considerations

Historical considerations - Risk Level 1: Normal

Current considerations - unchanged

The Tanner crab Ecosystem and Socioeconomic Profile (ESP) was not updated for this assessment due to staffing issues. The 2025 ESP (Hennessey and Garber-Yonts (2025)) identified two predictive indicators that quantitatively predict recruitment using a Bayesian Adaptive Sampling importance method. These predictive indicators explain a large amount of variation in EBS Tanner crab recruitment using survey design-based estimates ($R^2 = 0.46$) and are emphasized below in **BOLD** (see [Hennessey and Garber-Yonts 2025](#) for more details).

- **Juvenile Tanner crab temperature occupied**, integrating ecological effects of bottom temperature, cold pool extent, and species interactions, increased to above average in 2025 (ESP: Hennessey, 2025c), suggesting opportunity for elevated growth and survival. An extensive cold pool in 2026 may the opposite effect.

- **Visual prevalence of bitter crab disease (BCD)** doubled in 2025 from the previous year to the 2nd highest value to date (ESP: Hennessey, 2025h). However, it is unclear if BCD has large and lasting effects on the stock, and increased prevalence often coincides with high recruitment of small Tanner crab. No update was available for 2026.
- Male size at terminal molt estimates increased dramatically in 2025 from slightly below the time series mean to the highest value since 1997 (ESP: Richar, 2025). No update was available for 2026.
- Female size at maturity increased from below average to near average sizes (ESP: Hennessey, 2024b), and mature female Tanner crab reproductive failure remains below average (ESP: Hennessey, 2025a), which may support elevated stock reproductive output. No update was available for 2026.

In addition to the above considerations, it was noted that hybrid Tanner/snow crab abundance in 2025 was the highest across all population categories in the NMFS EBS bottom trawl survey (Zacher et al, 2025). While exceptional, it is unclear what effect this might have on Tanner crab stock dynamics. The abundance of hybrid crab decreased in 2026 dramatically ($> 45\%$) across females and small males, but increased slightly (12%) for males larger than 101 mm (the snow crab industry-preferred size).

B.3.3 Environmental/Ecosystem considerations

Historical considerations - Risk Level 1: Normal

Current considerations - unchanged

Ecosystem indicators are organized into several categories to capture the scope of considerations available in the ESP and ESR reports:

Distribution

- The along-shelf winds in June, July, and August 2025 were weakly favorable to on-shelf Ekman transport. Onshelf transport may have retained pelagic crab stages over the shelf and over suitable benthic habitat in 2025. March 2026 along-shelf winds drove strong offshelf transport and cross-shelf winds that drove transport to the northwest (Hennon 2026, in AFSC Spring PEEC 2026; Hennon 2026, in Siddon 2026, in press). Transport offshelf and to the northwest may have dispersed pelagic crab stages away from suitable benthic habitat in March 2026.

Environmental Processes

- During winter 2025-2026 (Dec 2025 - Mar 2026), the Aleutian Low Pressure Index was weak, which tends to result in fewer storms and weaker winds (Overland & Wang 2026, in AFSC Spring PEEC 2026; Overland & Wang 2026, in Siddon 2026, in press). Sea ice extent was near average through February 2026 (ice advanced over residual warm SSTs), then winds from the Arctic during March/April led to record ice extent (for 6 weeks), but ice was thin (Lemagie 2026, in AFSC Spring PEEC 2026; Lemagie 2026, in Siddon 2026, in press).
- The forecasted summer 2026 cold pool was expected to be larger than average; a narrow cold tongue over the middle shelf extending to the Aleutian chain and into Bristol Bay (Kearney 2026, in AFSC Spring PEEC 2026; Kearney 2026, in Siddon 2026, in press).

- The NMME ensemble forecasts as of August 21, 2026 through November 2026 show cool SST anomalies over much of the SEBS (-0.5 - 0°C) and warm anomalies over the NBS (0.25 - 1°C), with warmer anomalies near shore (Lemagie 2026, in Siddon 2026, in press; *forecast will be updated for final ESR*).
- Forecast projections for summer 2026 showed increased pH due to changes in thermal conditions over the shelf (Pilcher et al., 2026, in AFSC Spring PEEC 2026; Pilcher et al., 2026, in Siddon 2026, in press). However, this time series has shown a declining trend for the past two decades, and continued declines to pH levels of 7.8 could negatively affect growth, shell hardening, and survival.
- Taken together, thermal conditions over the EBS shelf from winter 2025 through summer 2026 have been cool with an extensive cold pool in summer 2026. High sea ice extent and cold pool extent are potentially unfavorable for tanner crab, though impacts of a single cold year remain unknown.

Prey

- Diatom abundance anomalies, based on the Continuous Plankton Recorder, remained positive from 2023 through 2025 (Ostle & Batten 2026, in AFSC Spring PEEC 2026; Ostle & Batten 2026, in Siddon 2026, in press), indicating above-average feeding conditions for pelagic crab stages.
- Satellite chlorophyll data showed an early spring bloom associated with ice retreat. Spatially, large areas with ice associated blooms occurred over the shelf; ice associated blooms tend to lead to higher deposition of algae to the seafloor, indicating good feeding conditions for benthic crab stages (Nielsen 2026, in AFSC Spring PEEC 2026; Gann & Callahan 2026, in Siddon 2026, in press).
- Taken together, feeding conditions for pelagic crab stages have been favorable in 2025 (CPR) and 2026 (satellite chlorophyll). No direct measurements of prey for benthic crab stages are available; the benthic forager guild is used as an indicator of benthic foraging conditions. The benthic forager guild remained one standard deviation below the time series mean in 2025, suggesting continued low availability of prey in 2025 (ESR: Siddon, 2026).

Competitors

- Over the southern shelf, motile epifauna (e.g., sea stars, brittle stars, crabs) biomass increased from 2024 to 2025 and is more than two standard deviations above the long term mean (Whitehouse 2026, in Siddon 2026, in press). Nearly all functional groups within this guild increased from 2024 to 2025, including commercial crabs. Benthic forager (i.e., small-mouthed flatfish) biomass increased slightly from 2024 to 2025 but remained one standard deviation below the time series mean, suggesting competition for prey resources remained low in 2025 (Whitehouse 2026, in Siddon 2026, in press).
- The presence of hybrid crabs in Pacific cod diets remained high between 2023-2025, indicating increased competition (Aydin 2026, in AFSC Spring PEEC 2026; Aydin 2026, in Siddon 2026, in press)

- Taken together, competition for space continues to be high, but competition for prey resources remains low.

Predators

- **Benthic predator density** in core juvenile Tanner crab habitats reached all-time lows during the 2018-2021 marine heatwave, but density has been increasing annually since 2021 to just below average (ESP: Hennessey, 2025g). This, coupled with increasing Pacific cod consumption on juvenile Tanner crab (ESP: Aydin 2025 in Hennessey, 2025), suggests an elevation in predator-prey interactions and the potential for reduced survival of juvenile cohorts if this trend continues.
- The biomass of Pacific cod during the standard bottom trawl survey decreased 10% from 2024 to 2025 (Whitehouse 2026, in Siddon 2026, in press), indicating a reduction in predation pressure in 2025.
- Pacific cod consumption of snow and tanner crab in 2025 was similar to 2023-2024 (Aydin 2026, in AFSC Spring PEEC 2026; Aydin 2026, in Siddon 2026, in press).

B.3.4 Fishery performance

Historical considerations - Risk Level 1: Normal

Current considerations - unchanged

The following summary considerations are from the fishery performance indicators included in the 2025 ESP (Hennessey and Garber-Yonts, 2025 from personal communication with Tyler Jackson (ADF&G) and Ethan Nichols (ADF&G), both of whom are contributors to the Tanner crab ESP.

- Fishing effort in the 2025/26 fishery, as measured by number of active vessels and total potlifts, decreased East of 166°W Long but continued to increase West of 166°W Long as it has since 2022. The eastern fishery's 11,000 potlifts remained well below the post-2005 average, while the western fishery's 68,000 potlifts were substantially greater than the historical average. The number of active vessels in the eastern fishery decreased to 15 vessels while the number of active vessels in the western fishery increased to 34 vessels, relative to the previous year (T. Jackson and E. Nichols, pers. comm.)
- TAC utilization in both the eastern and western Tanner fisheries was at near-100% in the 2025/26 fishery (east of 166 was 99% harvested, while west of 166 was 100% harvested), consistent with limited availability of other targets for crab vessels and continued robust market demand for Tanner crab (E. Nichols, pers. comm.).
- CPUE of retained crab in the 2025/26 eastern fishery increased from the previous season to 54.0, and is now above the post-2005 average; CPUE in the western fishery continued to increase substantially from the previous season to a time series high of 98, well above the post-2005 average (T. Jackson pers. comm.).

- The center of distribution of fishing activity in the 2025/26 fishery has generally been stationary in recent years and remained well within the historical range in both the east and west components (T. Jackson pers. comm.).

AFSC Spring PEEC 2026. Preview of Ecosystem and Economic Conditions Workshop. May 25-28, 2026. NOAA Alaska Fisheries Science Center, Seattle, WA, USA. [link](#)

Hennessey, S. and B. Garber-Yonts. 2025. Appendix C. Ecosystem and Socioeconomic Profile of the Tanner crab stock in the Eastern Bering Sea. In: Stockhausen, W.T. 2025. Stock Assessment and Fishery Evaluation Report for the Tanner Crab Fisheries of the Bering Sea and Aleutian Islands Regions. North Pacific Fishery Management Council, Anchorage, AK. Available from <https://www.npfmc.org/about-the-council/plan-teams/bsai-crab-planning-team/>.

Siddon, E. 2024. Ecosystem Status Report 2024: Eastern Bering Sea, Stock Assessment and Fishery Evaluation Report, North Pacific Fishery Management Council, 1007 West 3rd Ave., Suite 400, Anchorage, Alaska 99501. Available from <https://www.npfmc.org/wp-content/PDFdocuments/SAFE/2024/EBSecosys.pdf>

Siddon, E. 2025. Ecosystem Status Report 2025: Eastern Bering Sea, Stock Assessment and Fishery Evaluation Report, North Pacific Fishery Management Council, 1007 West 3rd Ave., Suite 400, Anchorage, Alaska 99501.

Siddon, E. 2026 (in press). Ecosystem Status Report 2026: Eastern Bering Sea, Stock Assessment and Fishery Evaluation Report, North Pacific Fishery Management Council, 1007 West 3rd Ave., Suite 400, Anchorage, Alaska 99501.

Zacher, E. and authors. (2026, in prep). 2026 Eastern Bering Sea Crab Survey Results.