Bristol Bay Red King Crab Stock Assessment 2026

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Executive Summary

1. **Stock**: Red king crab (RKC), *Paralithodes camtschaticus*, in Bristol Bay, Alaska.
2. **Catches**: The domestic RKC fishery began to expand in the late 1960s and peaked in 1980 with a catch of 129.95 million lb (58,943 t). The catch declined dramatically in the early 1980s and remained at low levels during the last three decades. After rationalization, catches were relatively high before the 2010/11 season but have been on a declining trend since 2014. The directed pot fishery was closed in 2021/22 and 2022/23 due to low mature female abundance in accordance with the State of Alaska harvest strategy. The directed fishery catch has slowly increased from these two years of closures but retained catch remains low compared to historic levels. The decline of the directed pot fishery crab/pot lift (CPUE) has been much less than the retained catch decline, with the 2023/24 CPUE of 20.54 crab/potlift approximately a 13.7% decline from the average since 2000. The 2025/26 CPUE of 29.17 was a 20% increase from the average CPUE since 2000, and similar to the CPUE of the 2024/25 season (29.55). The magnitude of bycatch from groundfish trawl and fixed gear fisheries has been stable and small relative to stock abundance during the last 10 years.
3. **Data sources**: Data extent is provided visually in Figure 3.
4. **Stock biomass**: Estimated mature biomass increased dramatically in the mid-1970s, then decreased precipitously in the early 1980s. Estimated mature crab abundance increased during 1985-2007 with mature females being about four times more abundant in 2007 than in 1985 and mature males being about two times more abundant in 2007 than in 1985. Estimated mature abundance was steadily declining since 2017, but appears to be increasing in the last few years.The estimated mature male survey biomass in 2026 is approximately 80% of the estimated mean survey biomass for the entire time series, which includes many periods of low biomass throughout history. The estimated mature female survey biomass was low from 2018 to 2022, but has increased since with the 2026 estimated value approximately 57.3% of the mean.
5. **Recruitment**: Estimated recruitment was high during the 1970s and early 1980s and has generally been low since 1985 (1979 year class). During 1984-2025, estimated recruitment was above the historical average (1976-2025 reference years) only in 1984, 1986, 1990, 1995, 1999, 2002, 2005, 2006, and 2010. Estimated recruitment has been low during the last 15 years, and even lower during the most recent nine years. With the low recruitment in recent years, the projected mature biomass is expected to decline during the next few years with a below-average fishing mortality of 0.167 to 0.25 yr^{-1}.
6. **Management performance**: The stock was above Minimum Stock Size Threshold (MSST) in 2025/26 (118% of B_{MSY}) and hence was not overfished. Since total catch was below the OFL (overfishing limit), overfishing did not occur. The projection using the lowest recruitment periods during 2015-2025 would not likely result in “approaching an overfished condition” based on the current harvest strategy. The current version of GMACS uses an average of sex ratios of recruitment during the reference period to estimate $B_{35\%}$, which results in a stable sex ratio (about 50%) for the reference point calculation. A 20% buffer was suggested by the CPT and SSC for 2021 - 2025, and is recommended by the author in

2026 with similar justification to previous years; refer to Appendix E for the buffer history and the risk table. Tables below represent the status and catch specifications for model 26.0 in 1,000 t and million lb (Tables 1 and 2).

Table 1: Status and catch specifications (1000 t) for the CPT recommended model (26.0).

Year	MSST	Biomass (MMB_{mating})	TAC	Retained Catch	Total Catch	OFL	ABC
2022/23	9.68	18.34	0	0.02	0.11	3.04	2.43
2023/24	9.35	18.65	0.975	0.96	1.34	4.42	3.54
2024/25	9.26	19.74	1.05	1.05	1.20	5.02	4.02
2025/26	9.61	22.6	1.22	1.22	1.48	5.85	4.68
2026/27		18.77				7.13	5.7

Table 2: Status and catch specifications (million lb) for the CPT recommended model (26.0).

Year	MSST	Biomass (MMB_{mating})	TAC	Retained Catch	Total Catch	OFL	ABC
2022/23	21.34	40.44	0	0.05	0.24	6.70	5.35
2023/24	20.6	41.11	2.15	2.12	2.96	9.75	7.8
2024/25	20.42	43.51	2.31	2.31	2.64	11.07	8.86
2025/26	21.2	49.82	2.68	2.68	3.26	12.9	10.32
2026/27		41.37				15.73	12.58

7. **Basis for the OFL**:

Table 3: Basis for the OFL (1000 t) from the CPT recommended model (26.0).

Year	Tier	B_{MSY}	Biomass (MMB_{mating})	B/B_{MSY}	F_{OFL}	Recruitment years Basis for B_{MSY}	Natural mortality
2022/23	3b	24.03	17.0	0.71	0.20	1984-2021	0.18
2023/24	3b	19.36	14.98	0.77	0.30	1984-2022	0.23
2024/25	3b	18.69	15.43	0.83	0.33	1984-2023	0.23
2025/26	3b	18.52	16.84	0.91	0.37	1984-2024	0.23
2026/27	3b	19.23	18.77	0.98	0.4	1984-2025	0.23

Table 4: Basis for the OFL (million lb) from the CPT recommended model (26.0).

Year	Tier	B_{MSY}	Biomass (MMB_{mating})	B/B_{MSY}	F_{OFL}	Recruitment years Basis for B_{MSY}	Natural mortality
2022/23	3b	53.0	37.4	0.71	0.20	1984-2021	0.18
2023/24	3b	42.7	33.0	0.77	0.30	1984-2022	0.23
2024/25	3b	41.2	34.0	0.83	0.33	1984-2023	0.23
2025/26	3b	40.84	37.12	0.91	0.37	1984-2024	0.23
2026/27	3b	42.39	49.82	0.98	0.4	1984-2025	0.23

Table 5: Status of the stock for the last completed crab year (model 26.0).

Year	Tier	$MSST_t$	$B_{MSY(t-1)}$	Biomass (MMB_{mating})	B/B_{MSY}	OFL	Total catch
2025/26	3a	9.61	18.52	22.60	1.22	5.85	1.48

Total catch is below OFL therefore overfishing did not occur for the 2025/26 season.

8. **Probability density function of the OFL**: The estimated probability distributions of MMB and OFL in 2025 are illustrated in Figures 67 and 70 for models 24.0c.2 and 26.0.

9. **Basis for ABC recommendation**: The ABC (acceptable biological catch) buffer was increased from 10% to 20% in 2018, and an additional buffer of 5% was added in 2020 due to the lack of a 2020 survey. A 20% buffer was recommended by the Crab Plan Team (CPT) and Scientific and Statistical Committee (SSC) for ABC estimation since 2021/22. Concerns for this stock that are still present (cold pool distributional shifts, declining trends in mature biomass, lack of large recruitment pulses, retrospective patterns), as well as low mature female abundance in some of last few years, all contribute to a recommended 20% buffer for 2026/27. Buffer history is detailed in Appendix E.

Risk table considerations for the buffer discussion are provided in Appendix E. This document details some of the same concerns for the stock that have been considered in the ABC buffer discussion but does not raise any new concerns. The process for using risk tables to assist in ABC buffer determination is under development for BSAI crab stocks.

A. Summary of Major Changes

1. Changes in Management of the Fishery

There are no new changes in management of the fishery.

2. Changes to the Input Data

a. Updated crab fisheries data 2025/26: directed, cost-recovery, and bycatch.
b. Updated groundfish fisheries bycatch data during 1986-2025.
c. Updated length composition data for directed and non-directed fisheries.
d. Updated NMFS survey data for 2026: biomass and length compositions.

3. Changes in Assessment Methodology

a. GMACS version was updated for proposed model runs in May 2026 (version 2.20.34a, 2026-01-15); and further updates were made for this document to version 2.20.44, 2026-8-02 due to a small error in size composition aggregation in fishery fleets.
b. The analyses of terminal years of recruitment are updated.
c. Two models are compared in this report (See Section E.3.a for details). These models represent the 2025 accepted model and a model that includes additional size bins for all size composition data sets:

24.0c.2: (2025 data, updated GMACS version) estimates male M with a tight prior + no time blocks for molt probability for males and females + updated ADF&G catch time series

26.0: model 24.0c.2 + additional size bins for all size comp data sets, includes updated bycatch size composition data

d. Modeling bridging for GMACS versions:

Bridging between GMACS versions between May 2026 and this document was performed for both models above. These are designated in figures and tables as "_34a" (May 2026 GMACS version) and "_44" (Sept 2026 GMACS version). A subset of figures and tables is providing for this bridging, but overall changes to likelihood were minimal (Table 17).

4. Changes in Assessment Results

Two models for consideration in setting specifications are reported here - model 24.0c.2, the base model accepted in fall 2025, and model 26.0, the base model with extended size bins for males and females. In the May 2026 draft report both of these models were presented in GMACS version 2.20.34a (**May proposed models BBRKC**). The May 2026 report details the GMACS version updates to that point, however a small error in this version called for an updated version of GMACS here. Both models are presented for bridging to GMACS version 2.20.44 using data available as of May 2026. Versions of both models with new data are presented in version 2.20.44 as well. Small changes in the models from version 34a to 44 were expected due to a correction in how GMACS calculates size comps for the Tanner crab bycatch fleet (Table 17 and Figure 17).

For specification in 2026/27, model 26.0 is recommended as the updated base model for BBRKC. Results for this model are presented in the specification tables in the executive summary and are summarized in Tables 1, 15, and 18.

B. Responses to SSC and CPT

CPT and SSC Comments on Assessments in General

Response to SSC Comments (June 2025, Oct 2025):

"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."

Response: This figure was provided in the 2025 SAFE document and will continue to be provided moving forward.

"The SSC recommended that the CPT provide GMACS version updates in each CPT report with information on changes between versions and that authors clearly identify which GMACS versions were used and a brief summary of the effects on the assessment."

Response: The GMACS version used is clearly defined in "Assessment Methodology" in the full SAFE document, and updates to GMACS versions can be explored in more detail on the **GMACS GitHub repo**. Additionally, starting in May 2026, the CPT will include a "GMACS updates" section in the CPT minutes.

"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."

Response: Historical considerations for buffers are described in the risk table and buffer Appendix of the current years SAFE.

"The SSC recommends continued progress towards making SAFE documents as consistent in structure and content as practicable."

Response: CPT is currently working on standardized SAFE formatting.

Response to SSC Comments (June 2024, Oct 2024):

"The SSC suggests ... guidance for constructing and interpreting jitter analyses... "

Response: The CPT reviewed this guidance and established some SOPs for jitter analysis interpretation at the May 2025 CPT meeting; the author follows this guidance here.

"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 ground fish assessment authors regarding the use of One-Step-Ahead and Pearson residuals."

Response: One-Step-Ahead residuals were incorporated into GMACS output figures for use in assessment output.

"The SSC requests that the CPT consider whether distinguishing between full and update assessments, ..., would be useful for crab assessments."

Response: CPT determined that it utilizes assessment frequency to address prioritization in workload and does not see a need for different assessment types at this time (refer to May and Sept 2025 CPT minutes).

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

Response: This has be taken into consideration in spring reports and full SAFEs.

"The SSC reiterates the request for the CPT to develop a process to ensure the authors have provided responses to all previous SSC recommendations."

Response: The CPT had developed a Google sheet to track requests, but it was becoming to difficult to track so CPT will attempt to track comments via minute leads and internal review.

"The SSC requests the authors and CPT consider coordinating the approach to analyzing the Bering Sea Fisheries Research Foundation (BSFRF) data for two Chionoecetes crab and Bristol Bay red king crab (BBRKC) stocks, and specifically consider developing the results as a prior on selectivity for use in the models (also reiterated in Oct 2025 SSC minutes)."

Response: There was discussion among authors at the Jan 2026 modeling workshop, with reference to Buck Stockhausen's work on this topic. The CPT has not developed a coordinated approach yet to this topic, and both the tanner and snow crab assessments have higher priority items this develoment cycle. The 2026 modeling workshop results illustrated that relationships between the NMFS trawl survey data and the BSFRF data are different for BBRKC than for the two Chionoecetes stocks, and therefore a similar approach may not be appropriate for BBRKC. Exploratory work on this topic was started in model runs in May of 2024 and 2025 but the author chose to postpone future work until the following year to allow more time for consistency in approaches if applicable.

Response to SSC Comments (June 2023, Oct 2023):

"The SSC recommends that a"fallback" Tier 4 alternative be provided, as recommended by the Simpler Modeling workshop. When doing so the SSC asks the authors to provide plots to compare OFLs with the status quo Tier 3 models for previous years, justification for the time series used for status determination and a recommended ABC buffer."

Response: A Tier 4 fallback based on survey data and the REMA model are provided as Appendix C in this document.

"For the inclusion of trawl survey data, the SSC suggests crab assessment authors and the CPT be more explicit about best practices for which standard years are included for bottom trawl survey data."

Response: This was addressed by the CPT at our Jan 2024 meeting. See meeting minutes (**Jan 2024 CPT report**) for agreed upon "best practices".

"The SSC recommends the crab stocks begin using the established risk table format from groundfish for assessing uncertainty around buffer considerations"

Response: After viewing draft risk tables in Sept. 2024 the CPT decided to pick up a risk table format for crab stock discussion at the May 2025 meeting. Draft risk tables were presented for all annual stocks at the Sept 2025 meeting, where the CPT determined that work was still needed to come to a "crab centric" framework for risk tables. At the May 2026 CPT meeting a proposed crab risk table format was developed and is presented here - Appendix E.

"The SSC recommends that uncertainty intervals be included when showing time series of biomass/abundance estimated by models.

Response: These are provided in this document.

CPT and SSC Comments on BBRKC assessment

Responses to CPT / SSC Comments (May / June 2026): *Extend the size bins further, explore ways to look at equilibrium size structure and tail compressions*

Response: The author will explore this in spring of 2027.

Clarifying points in the document on estimating sigma R, the recruitment_rb_females parameter, and when size comp reweighting has occurred so it is clear if likelihoods are comparable.

Response: Clarification was attempted in this document.

Obtaining all available growth data to inform estimation in the model would be useful, particularly with the change in size bins. SSC recommenda reconsidering the molting probabiltiy matrix also.

Response: Author has historic growth data and will work on collecting more recent data, if available. An exploration of this data and growth estimation in the model is a high priority for the author.

Responses to SSC Comments (June 2025):

Look at spatial aggregation of the directed fishery and spatial comparison of NMFS survey metrics (such as CPUE, average size, sex ratio) relative to fleet metrics to the extent possible to see what might be influencing increasing CPUE trends in the fishery.

Response: The author plans to examine this in more detail for future CPT meeting to include the most recent crab season (crab year 2025/26). Currently, CPUE from the directed fishery is not included as a model input therefore while differences in directed fishery CPUE and survey results are interesting they are not creating any assessment model conflict.

"Developing additional size bins for the larger females across the entire time series."

Response: Model 26.0 in this document explores an increased size bin range for both males and females. This document details this model run with results discussed in the Results and Discussion sections.

"Continued evaluation of the Northern District data in the stock assessment."

Response: The author will continue to provide comparisons of sex and maturity groupings from both BB and the Northern Unstratified Area in the final SAFE document. Additionally, the author has preliminary work on a sdmTMB model (below) that incorporates all red king crab caught in the NMFS trawl survey but only predicts abundance within the Bristol Bay (BB) area in an attempt to determine potential influence of movement in / out of Bristol Bay on the biomass and abundance estimates used in the stock assessment. This is preliminary work and still needs more rigorous testing before incorporating into a model run, since this would involve both using model based indices and utilizing data outside of the Bristol Bay boundary. The author plans to collaborate with others to refine this process before incorporating into model runs.

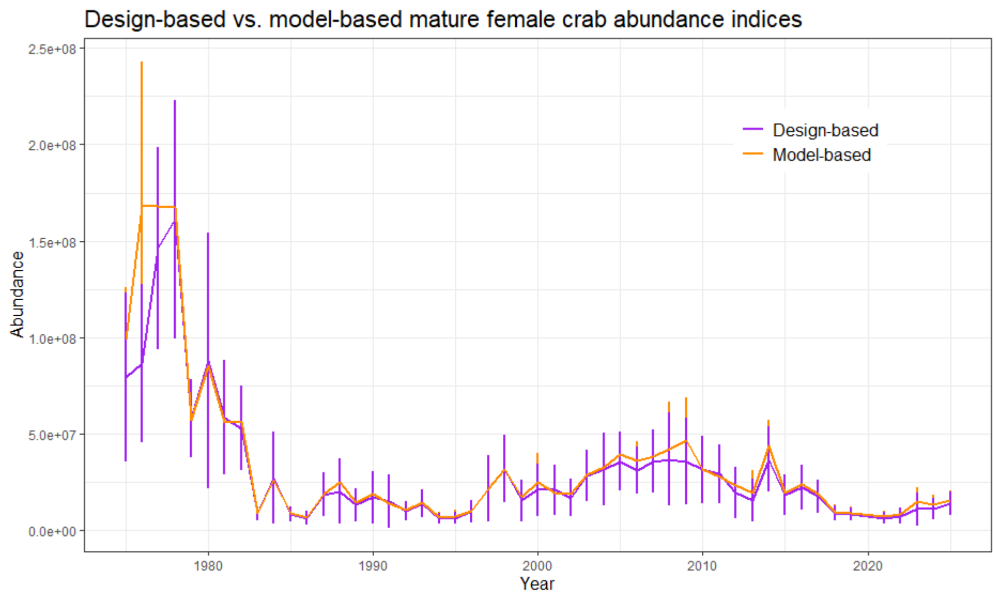

Figure 1: Abundance of mature female red king crab using design based (NMFS trawl survey CPUE data) and model based estimation (sdmTMB).

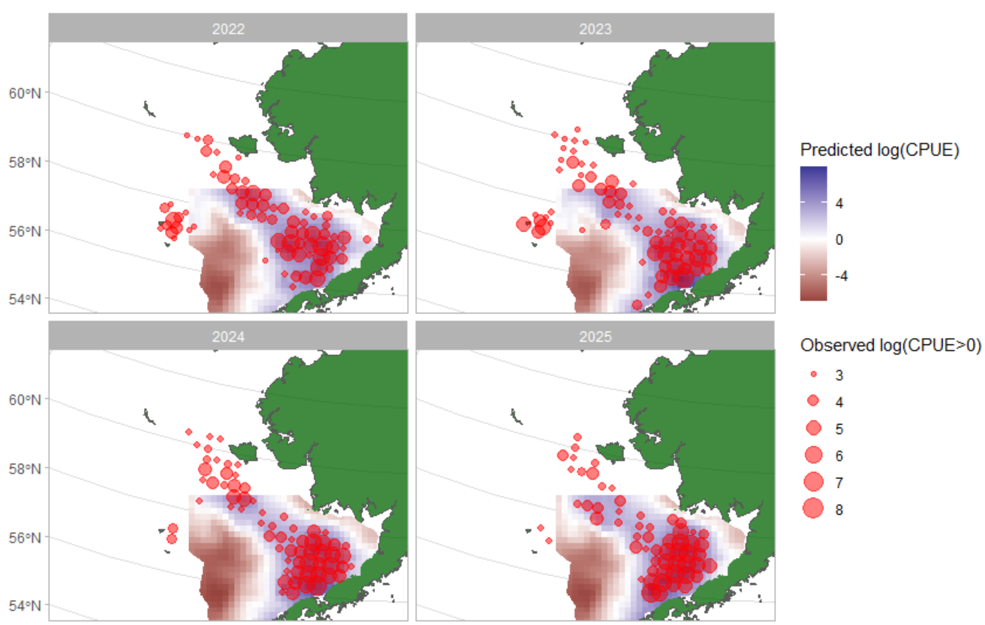

Figure 2: Map of observed (NMFS trawl survey all EBS) vs predicted (model based prediction in Bristol Bay) abundance of mature female red king crab for the last 4 survey years.

"Consideration of Bristol Bay and Pribilof Islands genetics and movement studies and the incorporation of directed crab fisheries data from the State of Alaska observer program to inform the upcoming EFH 5-year review"

Response: Additional genetic work is currently underway as a research project funded by disaster relief research for BBRKC; the author is a collaborator on that project. The ADFG observer program is currently working with the EFH group to incorporate directed fishery crab data; this is being lead by the ADFG Kodiak regional office.

Responses to SSC Comments (June 2024/Oct 2024):

"The SSC recommends that the author bring forward a model that adds the BSFRF prior on selectivity for the 2025 assessment."

Response: The May 2025 model exploration document presented Models 25.1a, 25.1b, and 25.1b2 which all use the BSFRF data as a prior on selectivity. The author determined that these models do not improve model fit and rely on assumptions between the BSFRF and NMFS survey data that may not be valid for BBRKC; further work is planned on this topic for 2027.

"The SSC agrees with the additional considerations by the CPT in their minutes prioritizing; 1) considerations of selectivity time periods based on gear types and 2) considerations of time-varying selectivity in the fishery data relative to the survey data."

Response: The selectivity models presented in the May 2025 document do retain the two time blocks for survey selectivity for the NMFS time series. However, the author has not yet explored time-varying selectivity in the fishery data relative to the survey data and hopes to have some discussion with the CPT on what this exploration could look like.

"The SSC reiterates its request to evaluate whether crab biomass and fishing mortality in the northern district should be included."

Response: Since 2022 the SAFE document has tracked Northern RKC data from the NMFS trawl survey. Overall, the proportions of different size/sex groups of the Northern RKC during recent years are higher than in the past and do not trend higher except for mature females in 2021. The high survey mature female abundance in the Northern area in 2021 was primarily from three tows and one of them is more than 50% of total mature females. The survey abundance of the Northern RKC will continue to be plotted in the SAFE report in the future. After migration patterns between BBRKC and the Northern RKC are fully understood, we will model them in the stock assessment. An assessment model that includes crab outside the Bristol Bay boundary would have to include updates to data inputs for all catch and survey time series, and also include conversations with managers on the implications of a larger spatial model. Explorations into model based indices for other Bering Sea stocks may provide an option for BBRKC to utilize the Northern district crab to design a model based index that only predicts over the traditional Bristol Bay grid. Work on this started this spring but still needs some development and discussion before incorporating a model-based index into model runs.

"The SSC recommends the author revisit previous CPT discussion and rationale on whether 50% handling mortality is appropriate for both pot and long-line (fixed gear) gear and to provide additional information in the next assessment."

Response: The May 2025 document includes a model run, model 24.0c.1a, that has a reduced handling mortality (20%) for the fixed gear groundfish catch in place of the historical 50% level. No measurable changes to model results were observed, only small changes in management quantities that lie within the range of variability for those estimates. This is likely due to the small magnitude of fixed gear catch in the model compared to directed fishery catch. Ultimately a change in the handling mortality rate for fixed gear would have to be approved by the CPT. A review of the data available to inform handling mortality estimations occurred at the May 2022 CPT meeting (**HM May 2022**). At this time there are no direct research studies conducted on mortality of crab caught as bycatch in the longline or pot groundfish fisheries. Historically ranges of 30 to 50% have been used in various Council analyses and since 2008 a 50% rate has been applied when splitting bycatch between fixed and trawl gear.

Response to CPT Comments (from May 2024):

"Including BSFRF as a 'ghost fleet' as a check on model behavior."

Response: Further exploration of the BSFRF data and its use in the BBRKC model is needed and planned for in the future.

Split the selectivity into eras to reflect the change in survey gear, but still use the same priors, perhaps with larger CVs in the early era.

Response: Models explored in May 2025 (25.1a, 25.1b, and 25.1b2) all retain the time blocks for survey selectivity estimation and use the same priors for both periods. Model 25.1b2 has larger CVs for both eras, this resulted in a similar estimation as Model 25.1b for the standard error.

Selectivity and retention explorations that may include: exploring parameters that allow for the retention curve to asymptote below one, exploring splines for selectivity, and exploring models using time-varying selectivity to better understand model dynamics.

Response: Model sensitivity to selectivity and retention assumptions should be explored but was not prioritized this year. Further direction from the CPT on hypotheses for these model runs would help in determining the appropriate parameterizations to explore moving forward.

Explore including larger size bins in the model to explore dome shaped selectivity.

Response: Including larger size bins than the current model uses (>160mm for males specifically) would require re-visiting the growth matrix for this stock. This matrix has been established for some time and would require some historic data recovery to determine if larger size bin growth could be determined from the same data. To include larger size bins assumptions would need to be made for the growth matrix unless the historic data was recoverable, which is what was done in model 26.0 here. Growth was assumed to be the same for all the former "plus size" size bins. Model 26.0 in this document uses extended size bins for both males and females; this is explained in detail in the "model explorations" section of the document.

Remove shell condition from the model since it's not being used currently

Response: Shell condition was removed from the model, reflected as model 24.0c.2, and has no measurable effect on results since it was not being implemented in the current base model.

Response to SSC Comments specific to this assessment (from October 2023):

Provide basis for the tight prior on M and catchability.

Response: The prior on trawl survey catchability is estimated with a mean of 0.896 and a standard deviation of 0.025 (CV about 0.03) that is based on double-bag experiment results (Weinberg et al. 2004). The prior on M is based on the balance of allowing M to be estimated above the default, historic 0.18 value for males but realizing the limitations of the data to estimate M freely. Future work is planned and will continue to explore the most appropriate estimation of M.

Explain why equal sample sizes are used for male and female size composition data.

Response: The size composition data for surveys is entered into the model as aggregate data since they are derived from the same survey samples. Therefore the sample size for each is based on the total number of crab measured not those measured by sex.

Possible effect of high 2011 recruitment as seen in survey size composition figures

Response: Size composition plots in Sept 2023 highlighted a potential recruitment event in 2011 for both males and females from the NMFS survey data (Figures 6 and 7 - Sept 2023 SAFE). This peak occurs as size classes that are not included in the assessment model (< 65mm, figures 43 and 44 - Sept 2023 SAFE), therefore this recruitment likely plays little role in the model estimates and resulting retrospective pattern since it is not seen in subsequent years to be included in the model.

Response to SSC/CPT comments prior to 2024: See Fall 2024 document, found on the NPFMC website, for further historical discussion of CPT and SSC comments.

C. Introduction

1. Scientific Name

Red king crab (RKC), *Paralithodes camtschaticus*, in Bristol Bay, Alaska.

2. Distribution

Red king crab inhabit intertidal waters to depths >200 m of the North Pacific Ocean from British Columbia, Canada, to the Bering Sea, and south to Hokkaido, Japan, and are found in several areas of the Aleutian Islands, eastern Bering Sea, and the Gulf of Alaska.

3. Stock Structure

The State of Alaska divides the Aleutian Islands and eastern Bering Sea into three management registration areas to manage RKC fisheries: Aleutian Islands, Bristol Bay, and Bering Sea (ADF&G 2012). The Bristol Bay area includes all waters north of the latitude of Cape Sarichef (54°36' N lat.), east of 168°00' W long., and south of the latitude of Cape Newenham (58°39' N lat.) and the fishery for RKC in this area is managed separately from fisheries for RKC outside of this area; i.e., the red king crab in the Bristol Bay area are assumed to be a separate stock from red king crab outside of this area. This report summarizes the stock assessment results for the Bristol Bay RKC stock. In 2023 a stock structure template was developed for red king crab in the Bering Sea and can be found on the NPFMC website (**RKC Bering Sea stock structure**).

4. Life History

Red king crab have a complex life history. Fecundity is a function of female size, ranging from tens of thousands to hundreds of thousands of eggs produced (Haynes 1968; Swiney et al. 2012). The eggs are extruded by females, fertilized in the spring, and held by females for about 11 months (Powell and Nickerson 1965). Fertilized eggs are hatched in the spring, most during April-June (Weber 1967). Primiparous females breed a few weeks earlier in the season than multiparous females. Larval duration and juvenile crab growth depend on temperature (Stevens 1990; Stevens and Swiney 2007). Male and female RKC mature at 5–12 years old, depending on stock and temperature (Stevens 1990; Loher et al. 2001) and may live >20 years (Matsuura and Takeshita 1990). Males and females attain a maximum size of 227 mm and 195 mm carapace length (CL), respectively (Powell and Nickerson 1965). Female maturity is evaluated by the size at which females are observed to carry egg clutches. Male maturity can be defined by multiple criteria including spermataphore production and size, chelae vs. carapace allometry, and participation in mating in situ (reviewed by Webb 2014). For management purposes, females >89 mm CL and males >119 mm CL are assumed to be mature for Bristol Bay RKC. Juvenile RKC molt multiple times per year until age 3 or 4; thereafter, molting continues annually in females for life and in males until maturity. Male molting frequency declines after attaining functional maturity.

5. Fishery

The RKC stock in Bristol Bay, Alaska, supports one of the most valuable fisheries in the United States. A review of the history of the Bristol Bay RKC fishery is provided in Fitch et al. (2012) and Otto (1989). The Japanese fleet started the fishery in the early 1930s, stopped fishing from 1940 to 1952, and resumed the fishery from 1953 until 1974. The Russian fleet fished for RKC from 1959 to 1971. The Japanese fleet employed primarily tanglenets with a very small proportion of catch from trawls and pots. The Russian fleet used only tanglenets. United States trawlers started fishing Bristol Bay RKC in 1947, but the effort and catch declined in the 1950s. The domestic RKC pot fishery began to expand in the late 1960s and peaked in 1980 with a catch of 129.95 million lb (58,943 t), worth an estimated $115.3 million ex-vessel value. The catch declined dramatically in the early 1980s and has remained at low levels during the last two decades (Tables 10 and 11). After the early 1980s stock collapse, the Bristol Bay RKC fishery took place during a short period in the fall (usually lasting about a week) with the catch quota based on the stock assessment conducted the previous summer (Zheng and Kruse 2002). Beginning with the 2005/2006 season, new regulations associated with fishery rationalization resulted in an increase in the duration of the fishing season (October 15 to January 15). With the implementation of crab rationalization, the annual guideline harvest level (GHL) was changed to a total allowable catch (TAC). Before rationalization, the implementation errors were quite high for some years and the sum of actual catches from 1980 to 2007 was about 6% less than the sum of GHL/TAC over that period.

6. Management History

King and Tanner crab stocks in the Bering Sea and Aleutian Islands are managed by the State of Alaska through a federal king and Tanner crab fishery management plan (FMP). Under the FMP, management measures are divided into three categories: (1) fixed in the FMP, (2) frame-worked in the FMP, and (3) discretion of the State of Alaska. The State of Alaska is responsible for determining and establishing the GHL/TAC under the framework in the FMP. Harvest strategies for the Bristol Bay RKC fishery have changed over time.

Two major management objectives for the fishery are to maintain a healthy stock that ensures reproductive viability and to provide for sustained levels of harvest over the long term (ADF&G 2012). In attempting to meet these objectives, the GHL/TAC is coupled with size-sex-season restrictions. Only males $\geq$ 6.5 in carapace width (equivalent to 135mm CL) may be harvested and no fishing is allowed during molting and mating periods (ADF&G 2012). Specification of TAC is based on a harvest rate strategy. Before 1990, harvest rates on legal males were based on population size, abundance of prerecruits to the fishery, postrecruit abundance, and rates varied from less than 20% to 60% (Schmidt and Pengilly 1990). In 1990, the harvest strategy was modified, and a 20% mature male harvest rate was applied to the abundance of mature-sized ($\geq$ 120 mm CL) males with a maximum 60% harvest rate cap of legal ($\geq$ 135 mm CL) males (Pengilly and Schmidt 1995). In addition, a minimum threshold of 8.4 million mature-sized females ($\geq$ 90 mm CL) was added to existing management measures to avoid recruitment overfishing (Pengilly and Schmidt 1995). Based on a new assessment model and research findings (Zheng et al. 1995a, 1995b, 1997a, 1997b), the Alaska Board of Fisheries adopted a new harvest strategy in 1996. That strategy had two mature male harvest rates: 10% when effective spawning biomass (ESB) is between 14.5 and 55.0 million lb and 15% when ESB is at or above 55.0 million lb (Zheng et al. 1996). The maximum harvest rate cap of legal males was changed from 60% to 50%. A threshold of 14.5 million lb of ESB was also added. In 1997, a minimum threshold of 4.0 million lb was established as the minimum GHL for opening the fishery and maintaining fishery viability and manageability when the stock abundance is low. The Board modified the current harvest strategy in 2003 by adding a mature harvest rate of 12.5% when the ESB is between 34.75 and 55.0 million lb and in 2012 eliminated the minimum GHL threshold. The current harvest strategy is illustrated in Figure 4.

D. Data

1. Summary of New Information

a. Updated crab fishery data: directed, cost-recovery, and bycatch data for 2025/2026
b. Updated groundfish fisheries bycatch data during 1986-2025.
c. Updated length-frequencies distributions for all fishery data sets for 2025/2026
d. Updated survey data for 2026

Data types and availability periods are illustrated in Figure 3.

2. Catch Data

Data on landings of Bristol Bay RKC by length and year and catch per unit effort from 1960 to 1973 were obtained from annual reports of the International North Pacific Fisheries Commission (Hoopes et al. 1972; Jackson 1974; Phinney 1975) and from the Alaska Department of Fish and Game from 1974 to 2020 (Tables 10 and 11). Bycatch data are available starting from 1990 and were obtained from the ADF&G observer database and reports (Gaeuman 2013, T. Jackson, ADF&G, pers. com.; Table 12). Sample sizes for catch by length and sex are summarized in Table 13. Sample sizes for trawl bycatch were the annual sums of length frequency samples in the National Marine Fisheries Service (NMFS) database.

a. Catch Biomass

Retained catch and estimated bycatch biomasses are summarized in Tables 10 and 11 and illustrated in Figure 5. Retained catch and estimated bycatch from the directed fishery include the general, open-access fishery (prior to rationalization), or the individual fishery quota (IFQ) fishery (after rationalization), as well as the Community Development Quota (CDQ) fishery and the ADF&G cost-recovery harvest. Starting in 1973, the fishery generally occurred during the late summer and fall. Before 1973, a small portion of retained catch in some years was caught from April to June. The years in Tables 10 and 11 are defined as crab year from July 1 to June 30. Bycatch data for the cost-recovery fishery before 2006 were not available. In this report, pot fisheries include both the directed fishery and RKC bycatch in the Tanner crab pot fishery, and trawl fisheries and fixed gear fisheries are groundfish fisheries. Observers did not separate retained and discarded catch of legal-sized crab after 2017 in the directed pot fishery, so the male discarded biomass from the directed fishery has been estimated by the subtraction method (subtracting the retained catch from the estimated total catch) since 2018 (T. Jackson, ADF&G, pers. com.).

b. Catch Size Composition

Retained catches by length and shell condition and bycatches by length, shell condition, and sex were obtained for stock assessments. From 1960 to 1966, only retained catch length compositions from the Japanese fishery were available. Retained catches from the Russian and U.S. fisheries were assumed to have the same length compositions as the Japanese fishery during this period. From 1967 to 1969, the length compositions from the Russian fishery were assumed to be the same as those from the Japanese and U.S. fisheries. After 1969, foreign catch declined sharply and only length compositions from the U.S. fishery were used to distribute catch by length.

c. Catch per Unit Effort

Catch per unit effort (CPUE) is defined as the number of retained crab per tan (a unit of fishing effort for tanglenets) for the Japanese and Russian tanglenet fisheries and the number of retained crab per potlift for the U.S. fishery (Table 11). Soak time, while an important factor influencing CPUE, is difficult to standardize. Furthermore, complete historical soak time data from the U.S. fishery are not available. Based on the approach of Balsiger (1974), all fishing effort from Japan, Russia, and U.S. were standardized to the Japanese tanglenet from 1960 to 1971, and the CPUE was standardized as crab per tan. Except for the peak-to-crash years of the late 1970s and early 1980s, the correspondence between U.S. fishery CPUE and area-swept survey abundance is poor (Figure 6). A model including CPUE was evaluated and not carried forward due to both the difficulty in estimating commercial fishing catchability and consistency of crab availability to the NMFS annual trawl survey data.

3. National Marine Fisheries Service (NMFS) Survey Data

The NMFS has conducted annual trawl surveys of the eastern Bering Sea since 1968. Two vessels, each towing an eastern otter trawl with an 83 ft headrope and a 112 ft footrope, conducted this multispecies, crab-groundfish survey during the summer. Stations were sampled in the center of a systematic 20 X 20 nm grid overlaid in an area of approximately 140,000 nm^2. Since 1972, the trawl survey has covered the full stock distribution except in nearshore waters. The survey in Bristol Bay occurs primarily during late May and June. Tow-by-tow trawl survey data for Bristol Bay RKC during 1975-2025 were provided by NMFS. Due to survey data quality issues, only survey data after 1974 are used in the assessment models.

Abundance estimates by sex, carapace length, and shell condition were derived from survey data using an area-swept approach (Figures 7 and 8). Until the late 1980s, NMFS used a post-stratification approach, but subsequently treated Bristol Bay as a single stratum; the estimates shown for Bristol Bay in Figures 6 – 8 were made without post-stratification. If multiple tows were made at a single station in a given year, the average of the abundances from all tows within that station was used as the estimate of abundance for that station. The new time series since 2015 discards all "hot spot" tows.

In addition to the standard surveys conducted in early June (late May to early June in 1999 and 2000), a portion of the distribution of Bristol Bay RKC was resurveyed in 1999, 2000, 2006-2012, and 2021 to better assess mature female abundance. Resurveys performed in late July, about six weeks after the standard survey, included 31 stations (1999), 23 stations (2000), 31 stations (2006, 1 bad tow and 30 valid tows), 32 stations (2007-2009), 23 stations (2010), and 20 stations (2011, 2012, and 2021) with high female densities. The resurveys were necessary because a high proportion of mature females had not yet molted or mated when sampled during the standard survey time. Differences in area-swept estimates of abundance between the standard surveys and resurveys of these same stations are attributed to survey measurement errors or to seasonal changes in distribution between survey and resurvey periods. More large females were observed in the resurveys than during the standard surveys in 1999 and 2000, presumably because most mature females had not molted prior to the standard surveys. As in 2006, area-swept estimates of males >89 mm CL, mature males, and legal males within the 32 resurvey stations in 2007 were not significantly different (p = 0.74, 0.74 and 0.95; paired t-test of sample means) between the standard survey and resurvey tows. However, similar to 2006, area-swept estimates of mature females within the 32 resurvey stations in 2007 were significantly different (p = 0.03; paired t-test) between the standard survey and resurvey tows. Resurvey stations were close to shore during 2010-2012, and mature and legal male abundance estimates were lower for the re-tow than the standard survey. Following the CPT recommendation, we used the standard survey data for male abundance estimates and only the resurvey data, plus the standard survey data outside the resurveyed stations, to assess female abundances during resurvey years.

The preliminary 2026 survey data for mature females indicated a large percentage of those females (~55%) had not yet completed the molt/mate cycle prior to leg 1 survey sampling, therefore 2026 could have been a resurveyed year. A review of the survey data indicated that while the female crab were late to molt due to cold ecosystem conditions the spatial distribution of females did not suggest that they had moved outside of the survey area. It was determined that the survey adequately sampled females on leg 1, and that while resurveying would provide more appropriate size composition data this could also be taken into account in the modeling process. Explorations of adjustments to the resurveying protocol will be discussed at future plan team and survey planning conversations.

4. Bering Sea Fisheries Research Foundation Survey Data (BSFRF)

The BSFRF conducted trawl surveys for Bristol Bay RKC in 2007 and 2008 with a small-mesh trawl net and 5-minute tows (S. Goodman, BSFRF, pers. com.). The surveys occurred at similar times as the NMFS standard surveys and covered about 97% of the Bristol Bay survey area. Few Bristol Bay RKC were found outside the BSFRF survey area. Because of the small mesh size, the BSFRF surveys were expected to catch more RKC within the swept area. Crab abundances of different size groups were estimated by the kriging method. Mature male abundances were estimated to be 22.331 million crab (CV = 0.0634) in 2007 and 19.747 million crab (CV = 0.0765) in 2008. BSFRF also conducted a side-by-side survey concurrent with the NMFS trawl survey during 2013-2016 in Bristol Bay. In May 2017, survey biomass and size composition estimates from 2016 BSFRF side-by-side trawl survey data were updated. Ratios of NMFS survey abundances/total NMFS and BSFRF side-by-side trawl survey abundances are illustrated in Figures 9 and 10, and ratios of NMFS survey abundances/BSFRF side-by-side trawl survey abundances are shown in Figures 11 – 13.

As a comparison to the estimated NMFS survey catchability (0.896) at 162.5 mm CL by the double-bag experiment (Weinberg et al. 2004), we computed an overall ratio (q=0.891) of NMFS survey abundances/BSFRF side-by-side trawl survey abundances for legal crab ($\geq$ 135mm carapace length) as follows:

$$q = \frac{\sum_{y=2013,l=135mm}^{y=2016,l=\infty} r_{y,l} n_{y,l}}{\sum_{y=2013,l=135mm}^{y=2016,l=\infty} n_{y,l}}$$

where $r_{y,l}$ is the ratio of NMFS survey abundance/BSFRF side-by-side trawl survey abundance in year y and length group l, and $n_{y,l}$ is the combined survey abundance of side-by-side surveys in year y and length group

l. Due to small catch, all haul data were combined to compute the ratios for each length group and year.

E. Analytic Approach

1. History of Modeling Approaches for this Stock

To reduce annual measurement errors associated with abundance estimates derived from the area-swept method, ADF&G developed a catch-survey analysis model using a length-based framework (LBA model) in 1994 that incorporates multiple years of data and multiple data sources in the estimation procedure (Zheng et al. 1995a). Annual abundance estimates of the Bristol Bay RKC stock from the LBA have been used to manage the directed crab fishery and to set crab bycatch limits in the groundfish fisheries since 1995 (Figure 4). An alternative length-based model (research model) was developed in 2004 to include small size crab to determine federal overfishing limits. Given that the crab abundance declined sharply during the early 1980s, the LBA estimated natural mortality for different periods of years, whereas the research model estimated additional mortality beyond a base constant natural mortality during 1980-1984. In this report, we present only the research model that was fit to the data from 1975 to 2025 that has been in the GMACS (General Model for Alaska Crab Stocks) since 2019.

2. Model Description

The original LBA model was described in detail by Zheng et al. (1995a, 1995b) and Zheng and Kruse (2002). The model combines multiple sources of survey, catch, and bycatch data using a maximum likelihood approach to estimate abundance, recruitment, selectivity, fishing mortality, catch, and bycatch of commercial pot fisheries and groundfish trawl fisheries. Since 2019, GMACS (General Model for Alaska Crab Stocks) has been used for this stock assessment. A full model description is provided in Appendix A, and GMACS input files can be found on GitHub (**GMACS Github repo**).

a-f. See Appendix A

g. Critical assumptions of the model:

i. The base male natural mortality is estimated with a prior, a log-normal prior with a mean of 0.18 yr_1 for males and a CV of 0.04. The mean value was estimated assuming a maximum age of 25 and applying the 1% rule (Zheng 2005). A fixed base M of 0.18 yr_1 for males was used in accepted model until Sept. 2023, when the current estimated base male M was adopted.
ii. Survey and fisheries selectivities are a function of length. Selectivities may or may not be a function of sex except for groundfish fisheries bycatch selectivities, which are the same for both sexes. Two different NMFS survey selectivities were estimated: (1) 1975-1981 and (2) 1982-2025, based on modifications to the trawl gear used in the assessment survey.
iii. Growth is a function of length. For females, growth-per-molt increments as a function of length are estimated for three periods (1975-1982, 1983-1993, and 1994-2025) based on sizes at maturity. Once mature, female red king crab have a much smaller growth increment per molt.
iv. Annual molting probabilities are an inverse logistic function of length for males. Females are assumed to molt annually.
v. Annual fishing seasons for the directed fishery are short.
vi. The prior mean for NMFS survey catchability (Q) is estimated to be 0.896 with a standard deviation of 0.025 for some models, based on a trawl experiment by Weinberg et al. (2004); Q is assumed to be constant over time and is estimated in the model. The BSFRF survey catchability is assumed to be 1.0. The prior mean of 0.896 for NMFS survey Q (at 162.5 mm carapace length) is also close to the abundance-weighted average ratio of 0.891 for crab $\geq$ 135 mm CL across four years of side-by-side NMFS and BSFRF survey data (Figure 13).
vii. Males mature at sizes $\geq$ 120 mm CL and females at sizes $\geq$ 90 mm CL are assumed to mature.
viii. Measurement errors are assumed to be normally distributed for length compositions and are log-normally distributed for biomasses.

h. Changes to the above since previous assessment: see Section A.3 for changes to the assessment methodology.

i. Assessment results by GMACS have been compared to the previous assessment models, and the code is online and available from the author and on GitHub (**GMACS GitHub repo**). The May 2026 proposed model runs document (**BBRKC May 2025 proposed models**) details the changes to the GMACS version and base model configuration, which all have minimal affect on the model output (Figure 17).

i. Bridging comparison for GMACS versions

i. May 2026 models were implemented in GMACS version 2.20.34a, however during Tanner crab GMACS development an error in how the size compositions for the catch fleets were being aggregated was discovered and corrected in GMACS version 2.20.37. It was determined appropriate to update the GMACS version for the final assessment in this document to account for that error. The model runs here reflect a more recent version of GMACS - 2.20.44. Updates to GMACS are detailed in the (**GMACS updates**) document on the CPT May 2026 agenda and will be further details during the September 2026 CPT meeting.

ii. Likelihood tables and a small selection of figures are provided for the GMACS bridging using both models from May 2026 - model 24.0c.2 and model 26.0 - for versions 2.20.34a and 2.20.44. Likelihood values are similar with small differences in size composition fits, with the largest likelihood difference, as expected, being with tanner crab bycatch size composition (Table 17). Fits to survey data, and tanner crab size compositions are similar (Figures 14 – 17). Overall estimates of MMB are similar. There were no concerns related to transitioning the model to v2.20.44, therefore this version was used for the 2026 models and asssessment.

3. Model Selection and Evaluation

a. Alternative model configurations (models):

24.0c.2: the base model for September 2025 based on model 24.0c (2024), 23.0a (2023) and 21.1b (2022) that has the accepted updates from Sept 2023 (1 below), May 2022 (2 - 11 below), 2024 (12 - 13 below), and 2025 (14 - 15). Basic features of this model include:

(1) An estimated constant M for males during 1980-1984, and an estimated constant (base) M for males during the other years using a log-normal prior with a mean of 0.18 and a CV of 0.04. There is an estimated constant multiplier being used to multiply male M for female M such that M for females is relative to M for males each year.

(2) Including BSFRF survey data during 2007-2008 and 2013-2016.

(3) Estimating a constant NMFS survey catchability over time in the model and assuming BSFRF survey catchability to be 1.0.

(4) Assuming the BSFRF survey reflects the availability to the NMFS trawl survey because the BSFRF survey gear has very small mesh sizes and has tighter contact to the sea floor. This implies that crab occurring in nearshore areas are not available to trawl survey gears.

(5) Estimating effective sample size from observed sample sizes for length data. Stage-1 effective sample sizes are estimated as min $(0.25 * n$, N) for trawl surveys and min $(0.05 * n$, N) for catch and bycatch, where n is the sum of observed sample sizes for two sexes, and N is the maximum sample size (200 for trawl surveys, 150 for retained catch and total males from the directed pot fishery and 50 for females from the pot fishery and for both males and females from the Tanner crab and groundfish fisheries). There is justification for enforcing a maximum limit to effective sample sizes because the number of length measurements is large (Fournier et al. 1998).

(6) Standard survey data for males and NMFS survey re-tow data (if available during cold years) for females.

(7) Estimating initial year length compositions.

(8) Using total observer male biomass and total observer male length composition data in the directed pot fishery to replace discarded male biomass and discarded male length composition data.

(9) Using total male selectivity and retained proportions in the directed pot fishery to replace retained selectivity and discarded male selectivity; and due to high grading problems in some years since rationalization, estimating two logistic curves for retained proportions: one before rationalization (before 2005) and another after 2004.

(10) Equal annual effective sample sizes of male and female length compositions for all size composition data sets.

(11) Updated groundfish fisheries bycatch data.

(12) Removes the time block for molt probability for males and females which reduces the parameter count by 2.

(13) Updated catch time series for crab fisheries from ADF&G through 2025

(14) Remove shell condition placeholders from input files

(15) Uses the recently updated version of GMACS (version 2.20.44, 2026).

26.0: mode 24.0c.2 + extended size bins for all size composition data sets, including updated bycatch size composition data for the groundfish data sets.

(16) Male size bins were extended from 20 bins to 23 bins with the plus group now representing crab 175 mm CL and larger, and females from 16 bins to 18 bins with the plus group now representing crab 150 mm CL and larger.

b. Progression of results:

See the new results at the beginning of the report.

c. Evidence of search for balance between realistic and simpler models:

Model 24.0c.2 and model 26.0 reflect work towards this balance to determine if simplification of the model could be warranted.

d. Convergence status/criteria: ADMB default convergence criteria.

e. Sample sizes for length composition data: observed sample sizes are summarized in Table 13.

f. Credible parameter estimates: All estimated parameters seem to be credible and within bounds.

g. Model selection criteria: The likelihood values are used to select among alternatives that could be legitimately compared by that criterion.

h. Residual analysis: Residual plots are illustrated in various figures.

i. Model evaluation is provided under Results below.

j. Jittering: The GMACS Approach is used to perform jittering to find the optimum:

The Jitter factor of 0.1 is multiplied by a random normal deviation $rdev = N(0,1)$, to a transformed parameter value based upon the predefined parameter:

$$temp = 0.5 * rdev * Jitter * ln(\frac{P_{max} - P_{min} + 0.0000002}{P_{val} - P_{min} + 0.0000001} - 1)$$

with the final jittered starting parameter value back-transformed as:

$$P_{new} = P_{min} + (\frac{P_{max} - P_{min}}{1.0 + exp(-2.0 * temp)})$$

where P_{max} and P_{min} are upper and lower bounds of parameters and P_{val} is the estimated parameter value before the jittering.

Jittering was performed using GMACS for model 24.0c.2 and model 26.0, at both a 0.12 and 0.3 SD and results are summarized under section 4.f. uncertainty and sensitivity analyses (Table 19).

Assessment Methodology

This assessment model again uses the modeling framework GMACS and is detailed in Appendix A, with GMACS input files available on the GMACS Github and can be requested from the author. An updated version of GMACS (version 2.20.44, 2026-8-02) was used.

4. Results

a. Effective sample sizes and weighting factors

i. CVs are assumed to be 0.03 for retained catch biomass, 0.04 for total male biomass, 0.07 for pot bycatch biomasses, 0.10 for groundfish bycatch biomasses, and 0.23 for recruitment sex ratio. Models also estimate sigmaR for recruitment variation and have a penalty on M variation and many prior-densities.

ii. Initial trawl survey catchability (Q) is estimated to be 0.896 with a standard deviation of 0.025 (CV about 0.03) based on the double-bag experiment results (Weinberg et al. 2004). These values are used to set a prior for estimating Q in all models.

b. Parameter estimates and tables

i. Negative log-likelihood values and parameter estimates are summarized in Tables 18 – 22 for all models.

ii. Natural mortality estimates are shown in Table 14 for all models.

iii. Area-swept estimates of mature female abundance and model estimates of effective spawning biomass (Zheng et al. 1995b) during 2011-2024 for groundfish fisheries bycatch calculation are provided in Table 16.

iv. Abundance and biomass time series are provided in Table 24 for model 24.0c.2 and Table 23 for model 26.0.

v. Recruitment time series for models 24.0c.2 and 26.0 are provided in Tables 24 and 23.

vi. Time series of catch biomass is provided in Tables 10 and 11.

Length-specific fishing mortality is equal to selectivity-at-length times the full selection fishing mortality. Estimated full pot fishing mortalities for females and full fishing mortalities for groundfish fisheries bycatch are low due to low bycatch and handling mortality rates less than 1.0. Estimated recruits varied greatly among years (Tables 24 and 23). Estimated selectivities for female pot bycatch are close to 1.0 for all mature females, and the estimated full fishing mortalities for female pot bycatch are lower than those for male retained catch and bycatch (Tables 20, 22 and 21).

c. Graphs of estimates

i. Estimated selectivities by length are provided in Figures 20 and 29, and estimated molting probabilities by length are illustrated in Figures 23 and 24.

One of the most important results is estimated trawl survey selectivity (Figures 20). Survey selectivity affects not only the fitting of the data but also the absolute abundance estimates. These estimated survey selectivities are generally smaller than the capture probabilities in Figure A1 because survey selectivities include capture probabilities and crab availability. The NMFS survey catchability is estimated to be 0.896 from the trawl experiment. The reliability of estimated survey selectivities will greatly affect the application of the model to fisheries management. Under- or over-estimates of survey selectivities will cause a systematic upward or downward bias of abundance estimates, respectively. Information about crab availability in the survey area at survey times will help estimate the survey selectivities. Higher estimated natural mortalities generally result in lower NMFS survey selectivities, while the estimated survey selectivities after 1981 are similar among the models.

For all models, estimated molting probabilities during 1975-2025 (Figures 23 and 24) are generally lower than those estimated from the 1954-1961 tagging data, but are similar to the 1966-1969 tagging data (Balsiger 1974). Lower molting probabilities mean more oldshell crab, possibly due to changes in molting probabilities over time or shell aging errors. Overestimates or underestimates of oldshell crab will result in lower or higher estimates of male molting probabilities. Molt probabilities for models 24.0c.2 and 26.0 are consistent with the previously accepted models (Figure 24).

ii. Estimated male and female survey biomasses are shown for NMFS surveys (Figures 25 and 26) and BSFRF surveys (Figures 27 and 28). Absolute mature male biomasses are illustrated in Figures 31 and 17. Mature female abundance (a trigger in the State harvest strategy) is illustrated in Figure 32.

The survey male biomass estimates in 2026 was higher than that estimated in 2025, both of which are higher than has been observed since 2015, but the model estimate did not follow this increase.The survey female biomass estimate increased from 2025, and is higher than most values since 2018. Estimated population biomass increased dramatically in the mid-1970s then decreased precipitously in the early 1980s. Estimated biomass generally increased during 1985-2003 for males and during 1985-2007 for females, then declined, and has steadily declined since the late 2000s with only recent increases in the last few years (Figures 25, 26, 31, and 17). Absolute mature male biomass for the proposed models (24.0c.2 and 26.0) is similar to the 2025 base model for the time series (Figures 31 and 17). All models fit the catch and bycatch biomasses very well.

The fit to BSFRF survey data and estimated survey selectivities are illustrated in Figures 27 and 28.

iii. Estimated total recruitment time series are plotted in Figure 33 for both models for both 2026 and 2025. Recruitment is estimated at the end of year in GMACS and is moved up one year for the beginning of next year. The estimated recruitment time series is similar to that estimated in 2025. Compared to the base models used in 2022 and prior years, estimated recruitments among models with higher M values are generally higher.

Like the results of previous models, the terminal year recruitment analysis with models 24.0c.2 and 26.0 suggests the estimated recruitment in the last year should not be used for estimating $B_{35\%}$ (Figures 61 to 65).

iv. Estimated fishing mortality rates are plotted against mature male biomass in Figures 34 and 35 for models 24.0c.2 and 26.0, and estimated M and directed pot fishing mortality values over time are illustrated in Figure 36 and 37.

The average of estimated male recruits from 1984 to 2025 (Figure 33) and mature male biomass per recruit are used to estimate $B_{35\%}$. The full fishing mortalities for the directed pot fishery at the time of fishing are plotted against mature male biomass on Feb. 15 (Figures 34 and 35). Estimated fishing mortalities in most years before the current harvest strategy was adopted in 1996 were above $F_{35\%}$ (Figure 35). Under the current harvest strategy, estimated fishing mortalities were at or above the $F_{35\%}$ limits in 1998, 2005, 2007-2009 for model 24.0c.2, but below the $F_{35\%}$ limits in the other post-1995 years.

For model 24.0c.2, estimated full pot fishing mortalities ranged from 0.00 to 2.68 during 1975-2025, with estimated values over 0.40 during 1975-1982, 1984-1987, 1990-1991, 1993, 1998 and 2008 (Table 24, Figure 35). Estimated fishing mortalities for females caught in the directed pot fishery are generally small in recent years, less than 0.06 since 2000. Groundfish fisheries bycatches, both trawl and fixed gear, since 2000 are generally small and less than 0.02.

For model 26.0, estimated full pot fishing mortalities ranged from 0.00 to 2.21 during 1975-2025, with estimated values over 0.40 during 1975-1982, 1984-1987, 1993, 1998 and 2008 (Table 23, Figure 34). Estimated fishing mortalities for females caught in the directed pot fishery are generally small in recent years, less than 0.06 since 2000. Groundfish fisheries bycatches, both trawl and fixed gear, since 2000 are generally small and less than 0.02.

For models 24.0c.2 and 26.0, estimated M values are 1.01 (1.02) during 1980-1984 and 0.23 for the other years for males, and 1.16 (1.19) during 1980-1984 and 0.26 (0.27) for the other years for females (Figure 36). Biologically, females mature earlier than males and likely have higher M values. M values for all models are listed in Table 14.

v. Estimated mature male biomass and recruitment are plotted to illustrate their relationships for model 24.0c.2 (Figure 38) and model 26.0 (Figure 40). Annual stock productivities are illustrated in Figures 39 and 41. Stock productivity (recruitment/mature male biomass) is generally lower during the last 20 years (Figure 39 and 41). However, there are high variations for the relation of stock productivity to mature male biomass.

Egg clutch data collected during summer surveys may provide information about mature female reproductive conditions (Figures 42 and 43). Although egg clutch data are subject to rating errors as well as sampling errors, data trends over time may be useful. Proportions of empty clutches for newshell mature females >89 mm CL are high in some years before 1990 but have been low since 1990 (Figure 42). The highest proportion of empty clutches was in 1980 and 1986, and primarily involved soft shell females (shell condition 1). Clutch fullness fluctuated annually around average levels during two periods: before 1991 and after 1990 (Figure 42). The average clutch fullness is similar for these two periods (Figure 42). Egg clutch fullness in the last ten years appears to oscillate up and down from the later period average but still remains higher than 75%.

d. Evaluation of the fit to the data.

i. Observed vs. estimated catches are plotted in Figure 44, with bycatch mortalities from different sources shown in Figure 44 for all models.

ii. Model fits to NMFS survey biomass are shown in Figures 25 and 26.

iii. Model fits to catch and survey proportions by length are illustrated in Figures 45 – 52 and one-step-ahead residual plots are shown in Figures 53 – 57.

The model fits the fishery biomass data well and the survey biomass reasonably well (Figures 25, 26, 44). Because the model estimates annual fishing mortality for directed pot male catch, pot female bycatch, and trawl and fixed gear bycatch, the deviations of observed and predicted (estimated) fishery biomass are mainly due to size composition differences. Model fits to the NMFS area-swept biomass data are similar to previous year's base model fits (Figures 25 and 26). Model fit to the length composition data is similar to the previous years (Figures 45 – 52). Modal progressions are tracked well in the trawl survey data, particularly beginning in the mid-1990s (Figures 48, 49, 50 and 7. Cohorts first seen in the trawl survey data in 1975, 1986, 1990, 1995, 1999, 2002 and 2005 can be tracked over time. Some cohorts can be tracked over time in the pot bycatch as well (Figure 45), but the bycatch data did not track the cohorts as well as the survey data. Groundfish bycatch data provide little information to track modal progression.

One-step ahead residuals of survey size comp proportions at length are plotted to examine their patterns. Generally, residuals of proportions of survey males and females appear to be random over length and year for all models (Figures 53 – 57). Models with higher base M values (both models in this document) improve the plus group (males > 160 mm CL and females > 140mm CL) fittings slightly. Model 26.0, with additional size bins, improved the plus group fit, reducing the "build up" of individuals in the largest size bin.

e. Retrospective and historical analyses

Retrospective analyses were conducted for this report using for both models. The 2026 model hindcast results are based on sequentially excluding one-year of data to evaluate the current model performance with fewer data.

i. Retrospective analysis (retrospective pattern in base model or models).
Evaluating the performance of the 2026 model includes sequentially excluding one-year of data. Both

models - 24.0c.2 and 26.0 - produce similar retrospective patterns. These consist of some upward trends during 2016-2020 with higher terminal year estimates of mature male biomass in 2015-2020 (Figures 59 and 58). Higher than expected BSFRF survey biomass during 2007-2008 and 2013-2016 and NMFS survey biomass in 2014 likely caused these patterns. Also, much lower than expected NMFS survey biomass during 2018-2019 results in lower biomass estimates in 2020 and 2021. Mohn's rho calculations for these retrospective runs were the same for both models and generally considered high (Mohn's rho = 0.1428 for model 24.0c.2 and = 0.1749 for model 26.0).

Ratios of estimated retrospective recruitment to terminal estimates in 2026 as a function of number of years estimated in the model converge to 1.0 as the number of years increases (Figures 61 and 64). Standard deviations of the ratios drop sharply from one year estimated in the model to two years (Figures 62 and 65), showing great uncertainty of recruitment estimates for terminal years. Based on these results, we suggest not using recruitment estimates in a terminal year for overfishing/overfished determination.

f. Uncertainty and sensitivity analyses.

i. Estimated standard deviations of parameters are summarized in Tables 20, 22 and 21 for models 24.0c.2 and 26.0. Estimated standard deviations of mature male biomass are listed in Tables 24 and 23.

ii. Probabilities for mature male biomass and OFL in 2026 were illustrated in Figures 66 to 70 for models 24.0c.2 and 26.0 using the MCMC approach.

iii. Probabilities for mature male biomass below the minimum threshold (0.5* $B_{35\%}$) in 2026 were plotted in Figures 68 and 71 for models 24.0c.2 and 26.0 using the MCMC approach.

iv. Sensitivity analysis for handling mortality rate was included in the SAFE report in May 2010. The baseline handling mortality rate for the directed pot fishery was set at 0.2. A 50% reduction and 100% increase respectively resulted in 0.1 and 0.4 as alternatives. Overall, a higher handling mortality rate resulted in slightly higher estimates of mature abundance, and a lower rate resulted in a minor reduction of estimated mature abundance. Differences of estimated legal male abundance and mature male biomass were small for these handling mortality rate changes.

v. Sensitivity of weights. Sensitivity of weights was examined in the SAFE report in May 2010. Weights to biomasses (trawl survey biomass, retained catch biomass, and bycatch biomasses) were reduced to 50% or increased to 200% to examine their sensitivity to abundance estimates. Weights to the penalty terms (recruitment variation and sex ratio) were respectively reduced or increased. Overall, estimated biomasses were similar under different weights except during the mid-1970s. The variation of estimated biomasses in the mid-1970s was mainly caused by the changes in estimates of additional mortalities in the early 1980s.

vi. Jittering. Models 24.0c.2 and 26.0 (using 100 iterations of sd =0.1, and sd = 0.3) converged on the MLE >80% of the time. Those jitter runs that did not converge to the MLE were not an improvement to the MLE (Table 19).

g. Comparison of alternative model scenarios and model development history.

Sensitivity to data weighting comparisons, based on the data through 2010, were reported in the SAFE report in May 2011. Estimating length proportions in the initial year (scenario 1a) resulted in a better fit of survey length compositions at an expense of 36 more parameters than model 1. Abundance and biomass estimates with model 1a were similar between models. Using only standard survey data (scenario 1b) resulted in a poorer fit of survey length compositions and biomass than scenarios using both standard and re-tow data (scenarios 1, 1a, and 1c) and had the lowest likelihood value. Although the likelihood value was higher for using both standard survey and re-tow data for males (scenario 1) than using only standard survey for males (scenario 1c), estimated abundances and biomasses were almost identical. The higher likelihood value for scenario 1 over scenario 1c was due to trawl bycatch length compositions.

In the SAFE report in September 2020, seven models were compared. The population biomass estimates in 2020 were slightly higher than those in 2019. Absolute mature male biomasses for all models had a similar trend over time. Among the seven models, model estimated relative NMFS survey biomasses and mature biomasses were similar, especially for models 19.0a and 19.0b and for models 19.3 and 19.3a. Biomass estimates for models 19.0a and 19.0b were higher during recent years than the other five model scenarios. As expected, model 19.3b estimated a higher trawl survey catchability (>1.0), thus resulting in overall lower absolute biomass estimates. Differences of biomass estimates between models 19.0a and 19.0b and models 19.3, 19.3a, 19.3l, and 19.3h could largely be explained by different structures of natural mortality. All seven models fitted the catch and bycatch biomasses very well.

The SAFE reports in 2021 and 2022 were also focused on the themes of different structures of natural mortality and potential data time series reductions. Additionally, model exploration in May 2023 began explorations on survey catchability estimation, but those are not explored in the models here since they were not deemed appropriate for model selection at this time. In May 2024, model explorations focused on survey selectivity/ availability estimation using the BSFRF survey for prior information instead of an additional survey and removing the time block for molt probability in the base model. The accepted model in 2024 incorporated removal of the molt probability time block. In May 2025, further explorations were performed on selectivity, but only updates to GMACS versions and data updates were incorporated for 2025 specification setting (model 24.0c.2). Model explorations in May of 2026 focused on increasing size bins for males and females in a response to build up at the plus size bin, and additional work is needed on exploring growth assumptions in the model and how they relate to these extended size bins.

In this report (September 2026), two models are brought forward - model 24.0c.2 - the 2025 accepted model; and model 26.0 - this model with extended size bins for size composition data sets. Likelihood value comparisons (Table 18) indicate that the largest difference between these two models is in size composition data set fits, which is expected since that is the only change between these two models.

Model 24.0c.2 - which was the accepted model in 2025 - is considered the “base” model for this assessment, while Model 26.0 is essentially that base model with additional size bins. Both models were bridged to a recent version of GMACS, which is discussed in section E.2.i above, and have updated data for the 2025/26 crab year and 2026 survey year (Figure 3). Both models estimate a base M for males, using a tight prior around an M value of 0.18. In the 2023 assessment it was determined that estimating a base M for males was an improvement in overall model fit for BBRKC.

The extended size bin model, 26.0, is recommended for specification setting in September 2026. This model improves size composition fit and reflects the changes in the data over time. The updates to the version of GMACS are vital to maintaining the base model and have little overall effect on model fit or results. Values for specifications are presented for model 26.0 (Tables 1, 3, and 15).

F. Calculation of the OFL and ABC

1. Bristol Bay RKC is currently placed in Tier 3b (NPFMC 2007).
2. For Tier 3 stocks, estimated biological reference points include $B_{35\%}$ and $F_{35\%}$. Estimated model parameters are used to conduct mature male biomass-per-recruit analysis.
3. Specification of the OFL:

The Tier 3 OFL is calculated using the F_{OFL} control rule:

$$F_{OFL} = \begin{cases} 0_{directedpot} & \frac{B}{B^*} \leq \beta \\ F^* \frac{(\frac{B}{B^*} - \alpha)}{1-\alpha} & \beta < \frac{B}{B^*} \leq 1 \\ F^* & \frac{B}{B^*} > 1 \end{cases} \tag{1}$$

Where

B = a measure of the productive capacity of the stock such as spawning biomass or fertilized egg production. A proxy of B is mature male biomass (MMB) estimated at the time of primiparous female mating (February 15).

F^* = $F_{35\%}$, a proxy for F_{MSY}, which is a full selection instantaneous F that will produce MSY at the MSY producing biomass.

B^* = $B_{35\%}$, a proxy for B_{MSY}, which is the value of biomass at the MSY producing level.

β = a parameter with restriction that $0 \leq \beta < 1$. A default value of 0.25 is used.

α = a parameter with restriction that $0 \leq \alpha \leq \beta$. A default value of 0.1 is used.

Because trawl bycatch fishing mortality is not related to pot fishing mortality, average trawl bycatch fishing mortality during 2020 to 2024 is used for the per recruit analysis as well as for projections in the next section. Some discards of legal males occurred after the Individual Fishery Quota (IFQ) fishery started in 2005, but the discard rates were much lower during 2007-2013 than in 2005 after the fishing industry minimized discards of legal males. However, due to high proportions of large oldshell males, the discard rate increased greatly in 2014. The current models estimate two levels of retained proportions before 2005 and after 2004. The retained proportions after 2004 and total male selectivities are used to represent current trends for per recruit analysis and projections. Average molting probabilities during 2016-2025 are used for per recruit analysis and projections. For the models in 2026, the averages are the same since they are constant over time during at least the last 15 years.

Average recruitments during 1984-2025 are used to estimate $B_{35\%}$ (Figure 33). Estimated $B_{35\%}$ is compared with historical mature male biomass in Figure 38. The period of 1984-2025 corresponds to the 1976/77 regime shift, and the recruitment period 1984-present has been used since 2011 to set the overfishing limits. Several factors support our recommendation. First, estimated recruitment was lower after 1983 than before 1984, which corresponded to brood years 1978 and later, after the 1976/77 regime shift. Second, high recruitments during the late 1960s and 1970s generally occurred when the spawning stock was primarily located in southern Bristol Bay, whereas the recent spawning stock has been concentrated in the middle of Bristol Bay. Oceanic current flows favor larvae hatched in southern Bristol Bay (see the section on Ecosystem Considerations for SAFE reports in 2008 and 2009). Finally, stock productivity (recruitment/mature male biomass) was higher before the 1976/1977 regime shift.

The control rule is used for stock status determination. If total catch exceeds OFL estimated at B, then "overfishing" occurs. If B equals or declines below $_{50\%}$ B_{MSY} (i.e., MSST), the stock is "overfished." If B/B_{MSY} or $B/B_{MSYproxy}$ equals or declines below β, then the stock productivity is severely depleted, and the directed fishery is closed.

The estimated probability distributions of MMB and OFL in 2025 are illustrated in Figures 69 and 70 for model 26.0. Based on SSC suggestions in 2011, $ABC = 0.9 * OFL$ and in October 2018, $ABC = 0.8 * OFL$. The CPT then recommended $ABC = 0.8 * OFL$ in May 2018 (accepted by the SSC), which is used to estimate ABC in this report. Due to the stock being at low levels and the lack of a 2020 survey, the CPT recommended an additional 5% buffer in September 2020, resulting in $ABC = 0.75 * OFL$ for 2020. A 20% buffer was suggested by the CPT for 2021 - 2025, and is recommended by the author in 2026 for similar reasons to previous years (Appendix E). A risk table, which is still under development for crab stocks, is provided in appendix E, which details concerns for this stock which are similar to those listed above.

MCMC runs with 500,000 replicates and 500 draws for both models 26.0 and 24.0c.2 are used for estimating the probability of estimated mature male biomass on Feb 15th, 2027 being below the minimum threshold $(0.5 * B_{35})$ (Figures 68 and 71). The probability (converted to a percentage) is estimated to be about 0% for both models (Figures 72 and 73).

Status and catch specifications (1,000 t) (model 26.0):

Table 6: Status and catch specifications (1000 t) for model 26.0.

Year	MSST	Biomass (MMB_{mating})	TAC	Retained Catch	Total Catch	OFL	ABC
2022/23	9.68	18.34	0	0.02	0.07	3.04	2.43
2023/24	9.35	18.65	0.975	0.96	1.34	4.42	3.54
2024/25	9.26	19.74	1.05	1.05	1.20	5.02	4.02
2025/26	9.61	22.6	2.68	2.68	3.26	12.9	10.32
2026/27		18.77				7.13	5.7

Status and catch specifications (million lb, model 26.0):

Table 7: Status and catch specifications (million lb) for model 26.0.

Year	MSST	Biomass (MMB_{mating})	TAC	Retained Catch	Total Catch	OFL	ABC
2022/23	21.34	40.44	0	0.05	0.24	6.70	5.35
2023/24	20.6	41.11	2.15	2.12	2.96	9.75	7.8
2024/25	20.42	43.51	2.31	2.31	2.64	11.07	8.86
2025/26	21.2	49.82	2.68	2.68	3.26	12.9	10.32
2026/27		41.37				15.73	12.58

Table 8: Basis for the OFL (1000 t) from model 26.0.

Year	Tier	B_{MSY}	Biomass (MMB_{mating})	B/B_{MSY}	F_{OFL}	Recruitment years Basis for B_{MSY}	Natural mortality
2022/23	3b	24.03	17.0	0.71	0.20	1984-2021	0.18
2023/24	3b	19.36	14.98	0.77	0.30	1984-2022	0.23
2024/25	3b	18.69	15.43	0.83	0.33	1984-2023	0.23
2025/26	3b	18.52	16.84	0.91	0.37	1984-2024	0.23
2026/27	3b	19.23	18.77	0.98	0.4	1984-2025	0.23

The biological reference points and OFL are illustrated in Tables 15 and 18, these are based on the $B_{35\%}$ estimated from the average male recruitment during 1984-2024.

Table 9: Basis for the OFL (million lb) from model 26.0.

Year	Tier	B_{MSY}	Biomass (MMB_{mating})	B/B_{MSY}	F_{OFL}	Recruitment years Basis for B_{MSY}	Natural mortality
2022/23	3b	53.0	37.4	0.71	0.20	1984-2021	0.18
2023/24	3b	42.7	33.0	0.77	0.30	1984-2022	0.23
2024/25	3b	41.2	34.0	0.83	0.33	1984-2023	0.23
2025/26	3b	40.84	37.12	0.91	0.37	1984-2024	0.23
2026/27	3b	42.39	49.82	0.98	0.4	1984-2025	0.23

G. Rebuilding Analysis

NA, not applicable for this stock

H. Data Gaps and Research Priorities

1. The following data gaps exist for this stock:

a. Information about changes in natural mortality in the early 1980s,
b. Unobserved trawl bycatch in the early 1980s,
c. Natural mortality,
d. Crab availability to the trawl surveys,
e. Juvenile crab abundance,
f. Female growth per molt as a function of size and maturity,
g. Changes in male molting probability over time,
h. A better understanding of larval distribution and subsequent recruit distribution.

2. Research priorities:

a. Estimating natural mortality,
b. Estimating crab availability to the trawl surveys,
c. Surveying juvenile crab abundance in nearshore,
d. Studying environmental factors that affect the survival rates from larvae to recruitment.

I. Projections and outlook

1. Projections

Future population projections primarily depend on future recruitment, but crab recruitment is difficult to predict due to a lack of a stock recruit relationship. Therefore, annual recruitment for the projections is a random selection from estimated recruitments during 2015-2025, a low recruitment period. Five levels of fishing mortality for the directed pot fishery are used in the projections: 0, 0.07, 0.10, 0.15 and 0.22. A fishing mortality of 0.15 is similar to the estimated F_{OFL} of 0.15 in 2020/2021, and 0.07 is similar to the F_{OFL} of 0.065 and 0.075 estimated from the last two open fishery seasons (2024/25 and 2025/26). MCMC runs with 500,000 replicates and 500 draws are used for the projection.

As expected, projected mature male biomasses are much higher without the directed fishing mortality than under other positive mortality values. At the end of 10 years, projected mature male biomass is below $B_{35\%}$ for only those projections with a fishing mortality of 0.22 due to low recruitments in recent years compared to the entire time series (Figures 72 and 73). Due to the poor recruitment in recent years, the projected biomass is expected to decline during the next few years with a fishing mortality of greater than F = 0.15.

The stock status has been slowing increasing since 2020/21 and is approaching B_{MSY} and therefore not overfished in 2025/26. Projections can be used to determine whether the stock is “approaching an overfished condition", which is defined as "when it is projected that there is more than a 50 percent chance that the biomass of the stock or stock complex will decline below the MSST within two years" by the National Standards 1 (NS1). If the stock is not fished more than a fishing mortality of 0.22 for the directed pot fishery in the 2026/27 and 2027/28 seasons, the projection using the lowest recruitment periods during 2015-2025 would not likely result in "approaching an overfished condition" for either model (Figures 74 and 75). Model projections are highly dependent on recruitment expectations for this stock.

The projections are subject to many uncertainties. Constant population parameters estimated in the models used for the projections include M, growth, and fishery selectivities. The uncertainty of abundance and biomass estimates in the terminal year also affects the projections. Uncertainties of the projections caused by these constant parameters and abundance estimates in the terminal year would be reduced by the 20% ABC buffer. However, if an extreme event occurs, like a sharp increase of M during the projection period, the ABC buffer would be inadequate, and the projections might underestimate uncertainties. The largest uncertainty is likely from recruitments used for the projections. Higher or lower assumed recruitments would cause too optimistic or too pessimistic projections. Overall, recruitments and M used for projections are main factors for projection uncertainties.

2. Near Future Outlook

The near future outlook for the Bristol Bay RKC stock ranges had improved over the last few years suggested a steady state or population improvement instead of a decreasing trend. The three recent above-average year classes (hatching years 1990, 1994, and 1997) had entered the legal population by 2006 (Figures 7 and 8). The above-average year class (hatching year 2000) with lengths centered around 87.5 mm CL for both males and females in 2006 and with lengths centered around 112.5-117.5 mm CL for males and around 107.5 mm CL for females in 2008 has largely entered the mature male population in 2009 and the legal population by 2014 (Figures 7 and 8). However, no additional strong cohorts were observed in the survey data after this cohort through the 2010s or 2020s (Figure 7, 8, 76 and 77). A huge tow of juvenile crab of size 45-55 mm in 2011 was not tracked during 2012-2025 surveys and is unlikely to be a strong cohort. The high survey abundances of large males and mature females in 2014 cannot be explained by the survey data during the previous years and were also inconsistent with the 2016-2025 survey results (Figures 76 and 77). Due to lack of improved recruitment, mature and legal crab may continue to decline next year in the presence of higher fishing pressure.

The closure of the directed fishery for seasons 2021/22 and 2022/23 appears to have allowed abundance of male and female crab to hold steady, with survey data observing only small increases in the overall population. Effects of fishery closures on recruitment are unknown due to the 5 to 7 year lag between spawning and crab recruitment into the assessment model. Current crab abundance is still low relative to the late 1970s, and without favorable environmental conditions, recovery to the high levels of the late 1970s is unlikely in the near future.

Understanding the mechanisms behind the recruitment failure is essential to the future health of the BBRKC stock. The 5 to 7 years between spawning and recruitment to the survey size crab are an unknown for this stock. Identifying critical life history conditions would assist in predicting the future outlook of the stock. These include, but are not limited to, identifying juvenile nursery grounds and understanding juvenile survival within Bristol Bay.

Although mature crab abundance in Bristol Bay has declined in recent years, mature crab abundance and biomass north of Bristol Bay has been generally stable during the last 16 years (Figures 79 and 78). Overall, the proportions of different size groups of the Northern RKC during the most recent dozen years are higher than in the past and do not trend higher except for mature females in 2021. The high mature female abundance in the Northern area survey in 2021 was primarily from three tows and one of them is more than 50% of total mature females. The survey abundance of the Northern RKC will continue to be provided in figures in the SAFE report in the future. After migration patterns between BBRKC and the Northern RKC are more fully understood, we will examine their relationships and model them in the stock assessment.

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K. Literature Cited

Alaska Department of Fish and Game (ADF&G). 2012. Commercial king and Tanner crab fishing regulations, 2012-2013. Alaska Department of Fish and Game, Division of Commercial Fisheries, Juneau. 170 pp.

Balsiger, J.W. 1974. A computer simulation model for the eastern Bering Sea king crab. Ph.D. dissertation, Univ. Washington, Seattle, WA. 198 pp.

Fitch, H., M. Deiman, J. Shaishnikoff, and K. Herring. 2012. Annual management report for the commercial shellfish fisheries of the Bering Sea, 2010/11. In Fitch, H. M. Schwenzfeier, B. Baechler, T. Hartill, M. Salmon, M. Deiman, E. Evans, E. Henry, L. Wald, J. Shaishnikoff, K. Herring, and J. Wilson. 2012. Annual management report for the commercial and subsistence fisheries of the Aleutian Islands, Bering Sea and the Westward Region's shellfish observer program, 2010/11. Alaska Department of Fish and Game, Fishery Management report No. 12-22, Anchorage.

Fournier, D.A., J. Hampton, and J.R. Sibert. 1998. MULTIFAN-CL: a length-based, age-structured model for fisheries stock assessment, with application to South Pacific albacore, *Thunnus alalunga*. Can.J.Fish.Aquat. Sci., 55: 2105-2116.

Fournier, D.A., H.J. Skaug, J. Ancheta, J. Ianelli, A. Magnusson, M.N. Maunder, A. Nielsen, and J. Sibert. 2012. AD Model Builder: using automatic differentiation for statistical inference of highly parameterized complex nonlinear models. Optim. Methods Softw. 27: 233-249.

Gaeuman, W.G. 2013. Summary of the 2012/13 mandatory crab observer program database for the Bering Sea/Aleutian Islands commercial crab fisheries. Alaska Department of Fish and Game, Fishery Data Series No. 13-54, Anchorage.

Gray, G.W. 1963. Growth of mature female king crab *Paralithodes camtschaticus* (Tilesius). Alaska Dept. Fish and Game, Inf. Leafl. 26.

Griffin, K. L., M. F. Eaton, and R. S. Otto. 1983. An observer program to gather in season and post-season on-the-grounds red king crab catch data in the southeastern Bering Sea. Contract 82-2, North Pacific Fishery Management Council, Anchorage.

Haynes, E.B. 1968. Relation of fecundity and egg length to carapace length in the king crab, *Paralithodes camtschaticus*. Proc. Nat. Shellfish Assoc. 58: 60-62.

Hoopes, D.T., J.F. Karinen, and M. J. Pelto. 1972. King and Tanner crab research. Int. North Pac. Fish. Comm. Annu. Rep. 1970: 110-120.

Ianelli, J.N., S. Barbeaux, G. Walters, and N. Williamson. 2003. Eastern Bering Sea walleye pollock stock assessment. Pages 39-126 in Stock assessment and fishery evaluation report for the groundfish resources of the Bering Sea/Aleutian Islands regions. North Pacific Fishery Management Council, Anchorage.

Jackson, P.B. 1974. King and Tanner crab fishery of the United States in the Eastern Bering Sea, 1972. Int. North Pac. Fish. Comm. Annu. Rep. 1972: 90-102.

Loher, T., D.A. Armstrong, and B.G. Stevens. 2001. Growth of juvenile red king crab (*Paralithodes camtschaticus*) in Bristol Bay (Alaska) elucidated from field sampling and analysis of trawl-survey data. Fish. Bull. 99: 572-587.

Matsuura, S., and K. Takeshita. 1990. Longevity of red king crab, *Paralithodes camtschaticus*, revealed by long-term rearing study. Pages 247-266 in Proceedings of the International Symposium on King and Tanner Crabs. University Alaska Fairbanks, Alaska Sea Grant College Program Report 90-04, Fairbanks.

McCaughran, D.A., and G.C. Powell. 1977. Growth model for Alaskan king crab (*Paralithodes camtschaticus*). J. Fish. Res. Board Can. 34: 989-995.

North Pacific Fishery Management Council (NPFMC). 2007. Environmental assessment for proposed amendment 24 to the fishery management plan for Bering Sea and Aleutian Islands king and Tanner crabs to revise overfishing definitions.

Otto, R.S. 1989. An overview of eastern Bering Sea king and Tanner crab fisheries. Pages 9–26 in Proceedings of the International Symposium on King and Tanner Crabs, Alaska Sea Grant College Program Report No. 90-04.

Parma, A.M. 1993. Retrospective catch-at-age analysis of Pacific halibut: implications on assessment of harvesting policies. Pages 247-266 in G. Kruse, D.M. Eggers, R.J. Marasco, C. Pautzke, and T.J. Quinn II (eds.). Proceedings of the international symposium on management strategies for exploited fish populations. University of Alaska Fairbanks, Alaska Sea Grant Rep. 90-04.

Paul, J.M., and A.J. Paul. 1990. Breeding success of sublegal size male red king crab *Paralithodes camtschaticus* (Tilesius, 1815) (Decapopa, Lithodidae). J. Shellfish Res. 9: 29-32.

Paul, J.M., A.J. Paul, R.S. Otto, and R.A. MacIntosh. 1991. Spermatophore presence in relation to carapace length for eastern Bering Sea blue king crab (Paralithodes platypus, Brandt, 1850) and red king crab (*P. camtschaticus*, Tilesius, 1815). J. Shellfish Res. 10: 157-163.

Pengilly, D., S.F. Blau, and J.E. Blackburn. 2002. Size at maturity of Kodiak area female red king crab. Pages 213-224 in A.J. Paul, E.G. Dawe, R. Elner, G.S. Jamieson, G.H. Kruse, R.S. Otto, B. Sainte-Marie, T.C. Shirley, and D. Woodby (eds.). Crabs in Cold Water Regions: Biology, Management, and Economics. University of Alaska Sea Grant, AK-SG-02-01, Fairbanks.

Pengilly, D., and D. Schmidt. 1995. Harvest strategy for Kodiak and Bristol Bay red king crab and St. Matthew Island and Pribilof Islands blue king crab. Alaska Dep. Fish and Game, Comm. Fish. Manage. and Dev. Div., Special Publication 7. Juneau, AK.

Phinney, D.E. 1975. United States fishery for king and Tanner crabs in the eastern Bering Sea, 1973. Int. North Pac. Fish. Comm. Annu. Rep. 1973: 98-109.

Powell, G.C. 1967. Growth of king crabs in the vicinity of Kodiak, Alaska. Alaska Dept. Fish and Game, Inf. Leafl. 92. 106 pp.

Powell, G. C., and R.B. Nickerson. 1965. Aggregations among juvenile king crab (*Paralithodes camtschaticus*, Tilesius) Kodiak, Alaska. Animal Behavior 13: 374–380.

Schmidt, D., and D. Pengilly. 1990. Alternative red king crab fishery management practices: modeling the effects of varying size-sex restrictions and harvest rates, Pages 551-566 in Proc. Int. Symp. King and Tanner Crabs, Alaska Sea Grant Rep. 90-04.

Sparks, A.K., and J.F. Morado. 1985. A preliminary report on diseases of Alaska king crabs, Pages 333-340 in Proc. Int. Symp. King and Tanner Crabs, Alaska Sea Grant Rep. 85-12.

Stevens, B.G. 1990. Temperature-dependent growth of juvenile red king crab (*Paralithodes camtschaticus*), and its effects on size-at-age and subsequent recruitment in the eastern Bering Sea. Can. J. Fish. Aquat. Sci. 47: 1307-1317.

Stevens, B.G., and K. Swiney. 2007. Hatch timing, incubation period, and reproductive cycle for primiparous and multiparous red king crab, Paralithodes camtschaticus. J. Crust. Bio. 27(1): 37-48.

Swiney, K. M., W.C. Long, G.L. Eckert, and G.H. Kruse. 2012. Red king crab, *Paralithodes camtschaticus*, size-fecundity relationship, and interannual and seasonal variability in fecundity. Journal of Shellfish Research, 31:4, 925-933.

Then, A. Y., J. M. Hoenig, N. G. Hall, and D. A. Hewitt. 2015. Evaluating the predictive performance of empirical estimators of natural mortality rate using information on over 200 fish species. ICES J. Mar. Sci. 72: 82–92.

Webb. J. 2014. Reproductive ecology of commercially important Lithodid crabs. Pages 285-314 in B.G. Stevens (ed.): King Crabs of the World: Biology and Fisheries Management. CRC Press, Taylor & Francis Group, New York.

Weber, D.D. 1967. Growth of the immature king crab *Paralithodes camtschaticus* (Tilesius). Int. North Pac. Fish. Comm. Bull. 21:21-53.

Weber, D.D., and T. Miyahara. 1962. Growth of the adult male king crab, *Paralithodes camtschaticus* (Tilesius). Fish. Bull. U.S. 62:53-75.

Weinberg, K.L., R.S. Otto, and D.A. Somerton. 2004. Capture probability of a survey trawl for red king crab (*Paralithodes camtschaticus*). Fish. Bull. 102:740-749.

Zheng, J. 2005. A review of natural mortality estimation for crab stocks: data-limited for every stock? Pages 595-612 in G.H. Kruse, V.F. Gallucci, D.E. Hay, R.I. Perry, R.M. Peterman, T.C. Shirley, P.D. Spencer, B. Wilson, and D. Woodby (eds.). Fisheries Assessment and Management in Data-limited Situation. Alaska Sea Grant College Program, AK-SG-05-02, Fairbanks.

Zheng, J., and G.H. Kruse. 2002. Retrospective length-based analysis of Bristol Bay red king crabs: model evaluation and management implications. Pages 475-494 in A.J. Paul, E.G. Dawe, R. Elner, G.S. Jamieson, G.H. Kruse, R.S. Otto, B. Sainte-Marie, T.C. Shirley, and D. Woodby (eds.). Crabs in Cold Water Regions: Biology, Management, and Economics. University of Alaska Sea Grant, AK-SG-02-01, Fairbanks.

Zheng, J., M.C. Murphy, and G.H. Kruse. 1995a. A length-based population model and stock-recruitment relationships for red king crab, *Paralithodes camtschaticus*, in Bristol Bay, Alaska. Can. J. Fish. Aquat. Sci. 52:1229-1246.

Zheng, J., M.C. Murphy, and G.H. Kruse. 1995b. Updated length-based population model and stock-recruitment relationships for red king crab, *Paralithodes camtschaticus*, in Bristol Bay, Alaska. Alaska Fish. Res. Bull. 2:114-124.

Zheng, J., M.C. Murphy, and G.H. Kruse. 1996. Overview of population estimation methods and recommended harvest strategy for red king crabs in Bristol Bay. Alaska Department of Fish and Game, Reg. Inf. Rep. 5J96-04, Juneau, Alaska. 37 pp.

Zheng, J., M.C. Murphy, and G.H. Kruse. 1997a. Analysis of the harvest strategies for red king crab, *Paralithodes camtschaticus*, in Bristol Bay, Alaska. Can. J. Fish. Aquat. Sci. 54:1121-1134.

Zheng, J., M.C. Murphy, and G.H. Kruse. 1997b. Alternative rebuilding strategies for the red king crab *Paralithodes camtschaticus* fishery in Bristol Bay, Alaska. J. Shellfish Res. 16:205-217.

Tables

Table 10: Bristol Bay red king crab annual catch and bycatch mortality biomass (t) from July 1 to June 30. A handling mortality rate of 0.20 for the directed pot fishery, 0.25 for the Tanner fishery, 0.80 for trawl, and 0.50 for fixed gear was assumed to estimate bycatch mortality biomass. The male bycatch biomass in the directed pot fishery is not estimated outside of a model and not included in this table. Pot bycatch and Tanner crab fishery bycatch are estimated through expanding the mean observer bycatch per pot to total fishery pot. The pot male bycatch after 2017 is estimated through the subtraction method (B. Daly, ADFG, pers. com.). The trawl and fixed gear fishery bycatches are obtained from the NMFS database. The directed pot bycatch before 1990 and Tanner crab fishery bycatch before 1991 are not available from the observer data and thus not included in this table. These include recently updated estimates from the pot fisheries observer data in 2022.

	Retained				Bycatch			
Year	US	Cost Recovery	Foreign	Total	Females	Trawl	Fixed	Tanner
1953	1331.30		4705.60	6036.90				
1954	1149.90		3720.40	4870.20				
1955	1029.20		3712.70	4741.90				
1956	973.40		3572.90	4546.40				
1957	339.70		3718.10	4057.80				
1958	3.20		3541.60	3544.80				
1959	0.00		6062.30	6062.30				
1960	272.20		12200.70	12472.90				
1961	193.70		20226.60	20420.30				
1962	30.80		24618.70	24649.60				
1963	296.20		24930.80	25227.00				
1964	373.30		26385.50	26758.80				
1965	648.20		18730.60	19378.80				
1966	452.20		19212.40	19664.60				
1967	1407.00		15257.00	16664.10				
1968	3939.90		12459.70	16399.60				
1969	4718.70		6524.00	11242.70				
1970	3882.30		5889.40	9771.70				
1971	5872.20		2782.30	8654.50				
1972	9863.40		2141.00	12004.30				
1973	12207.80		103.40	12311.20				
1974	19171.70		215.90	19387.60				
1975	23281.20		0.00	23281.20				
1976	28993.60		0.00	28993.60		682.80		
1977	31736.90		0.00	31736.90		1249.90		
1978	39743.00		0.00	39743.00		1320.60		
1979	48910.00		0.00	48910.00		1331.90		
1980	58943.60		0.00	58943.60		1036.50		
1981	15236.80		0.00	15236.80		219.40		
1982	1361.30		0.00	1361.30		574.90		
1983	0.00		0.00	0.00		420.40		
1984	1897.10		0.00	1897.10		1094.00		
1985	1893.80		0.00	1893.80		390.10		
1986	5168.20		0.00	5168.20		200.60		
1987	5574.20		0.00	5574.20		186.40		
1988	3351.10		0.00	3351.10		598.40		
1989	4656.00		0.00	4656.00		175.20		
1990	9236.20	36.60	0.00	9272.80	639.20	259.90		
1991	7791.80	93.40	0.00	7885.10	46.80	349.40		1401.80

1992	3648.20	33.60	0.00	3681.80	395.30	293.50		244.40
1993	6635.40	24.10	0.00	6659.60	628.30	401.40		54.60
1994	0.00	42.30	0.00	42.30	0.40	87.30		10.80
1995	0.00	36.40	0.00	36.40	0.30	82.10		0.00
1996	3812.70	49.00	0.00	3861.70	1.00	90.80	41.40	0.00
1997	3971.90	70.20	0.00	4042.10	36.50	57.50	22.50	0.00
1998	6693.80	85.40	0.00	6779.20	553.90	186.10	18.50	0.00
1999	5293.50	84.30	0.00	5377.90	5.60	150.50	50.10	0.00
2000	3698.80	39.10	0.00	3737.90	164.40	81.70	4.70	0.00
2001	3811.50	54.60	0.00	3866.20	120.80	192.80	35.30	0.00
2002	4340.90	43.60	0.00	4384.50	9.10	151.20	29.20	0.00
2003	7120.00	15.30	0.00	7135.30	356.90	136.90	12.70	0.00
2004	6915.20	91.40	0.00	7006.70	171.80	173.50	15.20	0.00
2005	8305.00	94.70	0.00	8399.70	405.40	124.70	19.90	0.00
2006	7005.30	137.90	0.00	7143.20	37.50	151.70	19.60	3.80
2007	9237.90	66.10	0.00	9303.90	159.90	154.10	32.30	1.80
2008	9216.10	0.00	0.00	9216.10	144.80	136.60	15.60	4.00
2009	7226.90	45.50	0.00	7272.50	88.30	87.20	5.80	1.60
2010	6728.50	33.00	0.00	6761.50	118.50	78.70	2.40	0.00
2011	3553.30	53.80	0.00	3607.10	25.00	53.80	10.90	0.00
2012	3560.60	61.10	0.00	3621.70	11.20	32.40	14.90	0.00
2013	3901.10	89.90	0.00	3991.00	98.10	61.90	39.50	28.50
2014	4530.00	8.60	0.00	4538.60	84.90	32.00	82.70	42.00
2015	4522.30	91.40	0.00	4613.70	239.10	41.70	67.90	84.20
2016	3840.40	83.40	0.00	3923.90	123.40	59.80	27.60	0.00
2017	2994.10	99.60	0.00	3093.70	53.40	91.40	86.70	0.00
2018	1954.10	72.40	0.00	2026.50	150.10	72.60	117.30	0.00
2019	1719.80	55.50	0.00	1775.30	43.30	75.70	48.30	0.00
2020	1200.60	56.40	0.00	1257.00	15.20	78.70	17.40	0.00
2021	0.00	17.40	0.00	17.40	5.90	34.50	57.40	0.00
2022	0.00	23.10	0.00	23.10	0.90	15.20	61.90	0.00
2023	972.60	0.00	0.00	972.60	13.10	20.50	35.60	0.00
2024	1049.00	35.50	0.00	1084.50	2.10	37.30	18.90	0.04
2025	1234.00		0.00	1234.00	54.00	25.30	22.20	0.60

Table 11: Annual retained catch (millions of crab) and catch per unit effort (CPUE) of the Bristol Bay red king crab fishery.

	Japanese Tanglenet		Russian Tanglenet		US Pot		Standardized
Year	Catch	CPUE	Catch	CPUE	Catch	CPUE	CPUE
1960	1.95	15.20	2.00	10.40	0.088		15.80
1961	3.03	11.80	3.44	8.90	0.062		12.90
1962	4.95	11.30	3.02	7.20	0.01		11.30
1963	5.48	8.50	3.02	5.60	0.101		8.60
1964	5.89	9.20	2.80	4.60	0.123		8.50
1965	4.22	9.30	2.23	3.60	0.223		7.70
1966	4.21	9.40	2.56	4.10	0.14	52	8.10
1967	3.76	8.30	1.59	2.40	0.397	37	6.30
1968	3.85	7.50	0.55	2.30	1.278	27	7.80
1969	2.07	7.20	0.37	1.50	1.749	18	5.60
1970	2.08	7.30	0.32	1.40	1.683	17	5.60
1971	0.89	6.70	0.26	1.30	2.405	20	5.80
1972	0.87	6.70			3.994	19	
1973	0.23				4.826	25	
1974	0.48				7.71	36	
1975					8.745	43	
1976					10.603	33	
1977					11.733	26	
1978					14.746	36	
1979					16.809	53	
1980					20.845	37	
1981					5.308	10	
1982					0.541	4	
1983					No directed	fishery	
1984					0.794	7	
1985					0.796	9	
1986					2.1	12	
1987					2.122	10	
1988					1.236	8	
1989					1.685	8	
1990					3.13	12	
1991					2.661	12	
1992					1.208	6	
1993					2.27	9	
1994					No directed	fishery	
1995					No directed	fishery	
1996					1.264	16	
1997					1.338	15	
1998					2.238	15	
1999					1.923	12	
2000					1.272	12	
2001					1.287	19	
2002					1.484	20	
2003					2.51	18	
2004					2.272	23	
2005					2.763	30	
2006					2.477	31	
2007					3.154	28	
2008					3.064	22	

2009	2.553	21
2010	2.41	18
2011	1.298	28
2012	1.176	30
2013	1.272	27
2014	1.501	26
2015	1.527	31
2016	1.281	38
2017	0.997	20
2018	0.63	20
2019	0.549	16
2020	0.455	21
2021	No directed	fishery
2022	No directed	fishery
2023	0.322	21
2024	0.34	29.6
2025	0.39	29.2

Table 12: Total observer catch and bycatch (metric ton) of Bristol Bay red king crab. No handling mortality rates are applied. These include recently updated estimates from the pot fishery observer data in 2022. Directed pot fishery data are the result of the cost-recovery fishery when the directed fishery was closed for the 2021/22 and 2022/23 seasons

	Directed Pot Total		Bycatch Fisheries		
Year	Males	Females	Trawl	Fixed	Tanner
1975			0		
1976			853.494		
1977			1,562.31		
1978			1,650.78		
1979			1,664.93		
1980			1,295.63		
1981			274.229		
1982			718.61		
1983			525.554		
1984			1,367.55		
1985			487.576		
1986			250.758		
1987			233.045		
1988			747.996		
1989			219.023		
1990	11621.80	3196.20	324.883		
1991	9792.90	233.90	436.783		5,580.84
1992	5916.20	1976.30	366.816		962.846
1993	9516.80	3141.50	501.77		218.112
1994	62.30	1.88	109.129		39.395
1995	52.80	1.61	102.623		0
1996	3845.20	5.10	113.495	82.86	0
1997	3758.80	182.70	71.862	44.98	0
1998	15644.80	2769.30	232.58	36.92	0
1999	12112.30	28.00	188.101	100.24	0
2000	6579.70	821.90	102.161	9.45	0
2001	5711.50	604.00	241.011	70.55	0
2002	6961.40	45.60	189.018	58.38	0
2003	12166.50	1784.40	171.114	25.35	0
2004	10692.00	859.20	216.889	30.42	0
2005	13615.90	2027.10	155.924	39.80	0
2006	9254.00	187.40	189.66	39.13	15.217
2007	13871.90	799.40	192.571	64.66	7.142
2008	14894.90	724.20	170.754	31.16	16.07
2009	12218.80	441.30	109	10.00	6.499
2010	10095.40	592.60	98.4	4.60	0
2011	5665.30	124.80	67.2	18.80	0
2012	4495.50	55.90	40.5	29.70	0
2013	5305.90	490.70	77.3	78.90	113.063
2014	8113.80	424.30	40	165.40	137.786
2015	6726.80	1195.60	52.1	135.90	639.573
2016	5651.80	617.20	74.8	55.20	0
2017	4077.20	266.90	114.3	173.30	0
2018	3423.20	750.40	90.8	234.60	0
2019	3144.60	218.00	94.6	96.60	0
2020	2299.70	76.10	98.4	34.80	0
2021	33.80	29.40	43.1	114.80	0

2022	28.30	4.60	19	123.90	0
2023	1543.50	65.40	25.7	71.30	0
2024	1369.10	10.60	46.6	37.90	0.15
2025	1943.20	270.10	31.7	44.40	2.41

Table 13: Annual sample sizes (>64 mm CL) in numbers of crab for trawl surveys, retained catch, directed pot, Tanner crab, trawl, and fixed gear fishery bycatches of Bristol Bay red king crab.

	Trawl Survey		Retained	Pot Total		Bycatch Combined		
Year	Males	Females	Catch	Males	Females	Trawl	Fixed	Tanner
1975	2,815	2,042	29,570					
1976	2,699	1,466	26,450			3,003		
1977	2,734	2,424	32,596			14,703		
1978	2,735	2,793	27,529			10,439		
1979	1,158	1,456	27,900			10,049		
1980	1,917	1,301	34,747			87,152		
1981	591	664	18,029			91,806		
1982	1,911	1,948	11,466			131,469		
1983	1,343	733	0			309,374		
1984	1,209	778	4,404			505,115		
1985	790	414	4,582			200,460		
1986	959	341	5,773			2,126		
1987	1,123	1,011	4,230			998		
1988	708	478	9,833			630		
1989	764	403	32,858			4,641		
1990	729	535	7,218	2,544	696	908		
1991	1,180	490	36,928	4,696	375	275		3,131
1992	509	357	25,550	4,775	2,379	333		965
1993	725	576	32,942	10,200	5,944	5		497
1994	416	239	0	0	0	571		17
1995	685	407	0	0	0	120		
1996	755	753	8,896	642	11	1,209	756	
1997	1,280	702	16,143	10,016	906	339	1,269	
1998	1,067	1,123	17,116	24,537	9,655	1,430	1,036	
1999	765	618	18,685	6,892	40	629	1,602	
2000	734	730	14,143	32,709	8,470	729	591	
2001	599	736	13,735	25,135	5,436	795	5,029	
2002	972	826	16,837	32,317	706	1,139	3,503	
2003	1,360	1,250	18,178	44,600	12,474	516	1,872	
2004	1,852	1,271	22,465	38,772	6,666	636	2,184	
2005	1,198	1,563	27,971	94,622	26,782	1,040	2,146	
2006	1,178	1,432	18,451	73,315	3,991	1,168	1,868	140
2007	1,228	1,305	22,809	115,507	12,691	1,225	785	53
2008	1,228	1,183	24,997	89,771	8,564	1,596	1,164	145
2009	837	941	19,336	97,868	6,055	1,170	1,089	193
2010	708	1,004	20,347	69,276	6,872	901	513	
2011	531	912	10,904	42,931	1,920	439	1,190	
2012	585	707	9,084	21,404	563	281	2,977	
2013	647	569	10,396	32,332	6,051	481	8,523	814
2014	1,107	1,257	9,718	31,216	2,663	261	4,285	631
2015	615	681	11,971	24,533	7,457	409	4,472	2,872
2016	378	812	11,003	30,030	5,832	617	4,329	
2017	385	508	10,067	30,002	4,043	718	1,415	
2018	285	359	7,825	25,635	9,840	893	5,382	
2019	273	299	8,134	25,999	2,894	823	863	
2020			3,850	16,650	961	764	246	
2021	324	247	101	1,100	1433	503	120	
2022	401	319	100	1088	299	90	50	
2023	407	435	3,651	11,767	909	124	428	

2024	559	436	3,022	7,461	180	243	936
2025	540	563	4,079	9,709	2556	242	1009
2026	1117	778					

Table 14: Natural mortality estimates for model scenarios during different year blocks.

Model	Sex	baseM	1980-84
m24.0c.2	female	0.26	1.16
m24.0c.2	male	0.23	1.01
m26.0	female	0.27	1.19
m26.0	male	0.23	1.02

Table 15: Changes in management quantities for each scenario explored. Report quantities are derived from maximum likelihood estimates. Average recruitment is males and females combined in millions of animals.

Model	Current MMB	B35	MMB/B_{MSY}	F35	F_{OFL}	OFL	Avg Male Rec	Male M
m24.0c.2	18.40	19.01	0.97	0.40	0.39	6.81	9.88	0.23
m26.0	18.77	19.23	0.98	0.41	0.39	7.13	10.29	0.23

Table 16: Area-swept estimates of mature female abundance (million crab >89mm) and model estimates of effective spawning biomass (ESB, LBA model from Zheng et al. 1995b; 1000 t) during 2011-2026 for groundfish fisheries bycatch (prohibited species catch, PSC) calculation. (*mature female abundance in 2020 is the model projected value). Note that PSC limits apply to previous-year ESB.

Year	Mature Female Abundance	Effective Spawning Biomass (1000t)
2011	28.52	19.54
2012	21.121	20.03
2013	15.694	22.38
2014	38.58	23.27
2015	18.666	21.10
2016	22.633	19.15
2017	18.497	18.04
2018	9.106	15.09
2019	8.587	12.71
2020	9.668*	11.39
2021	6.432	9.46
2022	8.004	8.89
2023	11.054	9.32
2024	11.7	10.19
2025	14.6	11.75
2026	17.99	14.38

Table 17: Comparisons of negative log-likelihood values and some parameters for models 24.0c.2 and 26.0, versions 34a (May 2026) and version 44.

Component	m24.0c.2-v34a	m24.0c.2-v44a	diff	m26.0-v34a	m26.0-v44	diff
Pot-ret-catch	-63.56	-63.81	0.25	-64.98	-65.27	0.28
Pot-totM-catch	28.82	28.47	0.35	27.56	27.37	0.18
Pot-F-discC	-60.93	-60.93	0.00	-60.94	-60.94	0.00
Trawl-discC	-67.91	-67.91	0.00	-67.90	-67.90	0.00
Tanner-M-discC	-45.28	-45.28	0.00	-45.28	-45.28	0.00
Tanner-F-discC	-45.24	-45.24	0.00	-45.24	-45.25	0.00
Fixed-discC	-40.20	-40.20	0.00	-40.20	-40.20	0.00
Traw-suv-bio	-41.39	-42.11	0.72	-38.52	-39.63	1.11
BSFRF-sur-bio	-5.13	-5.14	0.01	-5.81	-5.43	-0.38
Pot-ret-comp	-4173.13	-4172.86	-0.27	-4808.88	-4809.02	0.14
Pot-totM-comp	-2603.18	-2602.87	-0.31	-3045.89	-3048.96	3.07
Pot-discF-comp	-1583.69	-1583.81	0.12	-1832.65	-1831.95	-0.70
Trawl-disc-comp	-6171.05	-6171.17	0.12	-7070.20	-7065.67	-4.54
Tanner-disc-comp	-1276.73	-1087.27	-189.45	-1487.69	-1305.34	-182.35
Fixed-disc-comp	-3734.15	-3732.61	-1.54	-4301.64	-4301.33	-0.31
Trawl-sur-comp	-7440.87	-7443.06	2.19	-8724.29	-8727.73	3.44
BSFRF-sur-comp	-844.86	-845.23	0.37	-988.86	-988.35	-0.51
Recruit-dev	74.65	74.64	0.01	74.54	74.74	-0.20
Recruit-ini	0.00	0.00	0.00	0.00	0.00	0.00
Recruit-sex-R	82.02	81.98	0.04	81.98	81.97	0.01
Sex-specific-R	0.00	0.00	0.00	0.00	0.00	0.00
Ini-size-struct	223.68	223.08	0.60	242.11	240.18	1.93
PriorDensity	0.07	0.08	-0.01	0.05	0.06	-0.01
Tot-likelihood	-27754.69	-27567.96	-186.73	-32131.88	-31952.87	-179.01
Tot-parms	390.00	391.00	-1.00	395.00	396.00	-1.00
MMB35	18524.40	18590.55	-66.14	18911.08	18831.68	79.40
MMB-terminal	16836.02	16891.45	-55.43	17309.41	17291.97	17.45
F35	0.40	0.40	0.00	0.40	0.40	0.00
$Fofl$	0.36	0.36	0.00	0.36	0.37	-0.01
OFL	5851.79	5864.22	-12.43	6165.62	6161.98	3.64

Table 18: Comparisons of negative log-likelihood values and some parameters for models 24.0c.2 (2025 accepted model), and model 26.0.

Component	m24.0c.2	m26.0	diff
Pot-ret-catch	-65.66	-67.27	-1.61
Pot-totM-catch	27.47	26.16	-1.31
Pot-F-discC	-62.67	-62.68	-0.01
Trawl-discC	-69.30	-69.29	0.01
Tanner-M-discC	-47.02	-47.02	0.00
Tanner-F-discC	-46.98	-46.99	-0.00
Fixed-discC	-41.58	-41.58	0.00
Traw-suv-bio	-43.34	-40.85	2.49
BSFRF-sur-bio	-5.24	-5.51	-0.26
Pot-ret-comp	-4261.13	-4910.25	-649.11
Pot-totM-comp	-2680.66	-3139.43	-458.77
Pot-discF-comp	-1634.45	-1890.13	-255.68
Trawl-disc-comp	-6284.63	-7196.05	-911.41
Tanner-disc-comp	-1087.27	-1305.34	-218.07
Fixed-disc-comp	-3875.54	-4464.36	-588.82
Trawl-sur-comp	-7576.57	-8884.72	-1308.16
BSFRF-sur-comp	-845.14	-988.24	-143.10
Recruit-dev	74.84	74.87	0.03
Recruit-ini	0.00	0.00	0.00
Recruit-sex-R	83.63	83.60	-0.03
Sex-specific-R	0.00	0.00	0.00
Ini-size-struct	223.44	240.92	17.48
PriorDensity	0.07	0.05	-0.03
Tot-likelihood	-28184.59	-32663.32	-4478.73
Tot-parms	399.00	404.00	5.00
MMB35	19012.32	19229.76	217.44
MMB-terminal	18397.75	18765.73	367.99
F35	0.40	0.41	0.01
$Fofl$	0.39	0.39	0.00
OFL	6814.20	7134.44	320.24

Table 19: Summary of convergence diagnostics from jitter runs for models 24.0c.2 (2025 accepted model), and model 26.0.

Model	SD	No converged jitters	No runs with min value	max gradient at MLE
26	0.12	108	105	0.0039559500
24.0c.2	0.12	89	89	0.0152592000
26	0.30	103	91	0.0000016976
24.0c.2	0.30	93	80	0.0005015880

Table 20: Summary of key estimated model parameter values and standard deviations for models 26.0 and 24.0c.2 for Bristol Bay red king crab.

Parameter	Value-m24.0c.2	StdDev-m24.0c.2	Value-m26.0	StdDev-m26.0
Log(Rinitial):	20.0574	0.0549	20.0809	0.0705
Log(Rbar):	16.5730	0.1382	16.6346	0.1384
Recruitment-rb-males:	0.7872	0.1367	0.8193	0.1588
Recruitment-rb-females-(ln-scale-offset-to-males!):	-0.5878	0.2205	-0.6044	0.2366
Gscale-base-male:	1.0665	0.1964	0.9033	0.1770
Gscale-base-female:	1.3851	0.1235	1.4287	0.1230
Molt-probability-mu-base-male-period-1:	140.9111	0.5610	140.7665	0.5160
Molt-probability-CV-base-male-period-1:	0.0674	0.0030	0.0603	0.0021
M-base-male-mature:	0.2285	0.0063	0.2321	0.0063
M-male-mature-block-group-1-block-1:	1.4868	0.0309	1.4839	0.0312
M-base-female-mature:	0.1404	0.0186	0.1531	0.0186
Sel-Pot-Fishery-male-base-Logistic-mean:	4.7808	0.0078	4.7714	0.0072
Sel-Pot-Fishery-male-base-Logistic-cv:	2.2500	0.0414	2.2115	0.0409
Sel-Trawl-Bycatch-male-base-Logistic-mean:	5.1352	0.0461	4.9948	0.0261
Sel-Trawl-Bycatch-male-base-Logistic-cv:	2.7948	0.0405	2.6913	0.0440
Sel-Bairdi-Bycatch-male-base-Logistic-mean:	4.6501	0.2330	4.6696	0.2319
Sel-Bairdi-Bycatch-male-base-Logistic-cv:	2.1662	0.3043	2.1664	0.3042
Sel-Fixed-Gear-male-base-Logistic-mean:	4.7894	0.0187	4.7880	0.0168
Sel-Fixed-Gear-male-base-Logistic-cv:	2.2970	0.0737	2.2905	0.0702
Sel-NMFS-Trawl-male-base-Logistic-mean:	4.0735	0.1944	4.0646	0.2474
Sel-NMFS-Trawl-male-base-Logistic-cv:	2.2473	0.4577	2.2423	0.4967
Sel-NMFS-Trawl-m-Logistic-mean-block-gr-5-bl-1:	4.0597	0.2604	3.8610	0.4429
Sel-NMFS-Trawl-m-Logistic-cv-block-gr-5-bl-1:	3.5060	0.3941	3.4194	0.3955
Sel-BSFRF-male-base-Logistic-mean:	4.4661	0.0246	4.4912	0.0227
Sel-BSFRF-male-base-Logistic-cv:	2.4960	0.0759	2.5032	0.0672
Sel-Pot-Fishery-female-base-Logistic-mean:	4.5855	0.0225	4.6048	0.0216
Sel-Pot-Fishery-female-base-Logistic-cv:	2.2823	0.0928	2.3164	0.0831
Sel-Bairdi-Fishery-Bycatch-f-base-Logistic-mean:	4.7254	0.0914	4.7561	0.0927
Sel-Bairdi-Fishery-Bycatch-f-base-Logistic-cv:	0.9024	0.3028	0.9037	0.3025
Ret-Pot-Fishery-male-base-Logistic-mean:	4.9242	0.0015	4.9238	0.0015
Ret-Pot-Fishery-male-base-Logistic-cv:	0.6916	0.0523	0.6851	0.0512
Ret-Pot-Fishery-m-Logistic-mean-block-gr-6-bl-1:	4.9327	0.0019	4.9318	0.0019
Ret-Pot-Fishery-m-Logistic-cv-block-gr-6-bl-1:	0.7319	0.0931	0.7184	0.0923
Log-fbar-Pot-Fishery:	-1.7938	0.0429	-1.8366	0.0433
Log-fbar-Trawl-Bycatch:	-4.5200	0.0735	-4.6355	0.1024
Log-fbar-Bairdi-Fishery-Bycatch:	-5.4319	0.2371	-5.4522	0.2589
Log-fbar-Fixed-Gear:	-6.5872	0.0657	-6.6008	0.0650
Survey-q-survey-1:	0.9242	0.0258	0.9134	0.0258
Log-add-cvt-survey-2:	-1.0278	0.2885	-1.0593	0.2960

Table 21: Summary of estimated model parameter values and standard deviations for model 26.0 for Bristol Bay red king crab.

Index	Name	Value	StdDev
1	Log(Rinitial):	20.0809	0.0705
2	Log(Rbar):	16.6346	0.1384
3	Recruitment-rb-males:	0.8193	0.1588
4	Recruitment-rb-females-(ln-scale-offset-to-males!):	-0.6044	0.2366
5	Scaled-logN-for-male-mature-mature-newshell-class-2:	1.4264	0.4816
6	Scaled-logN-for-male-mature-mature-newshell-class-3:	1.1342	0.5575
7	Scaled-logN-for-male-mature-mature-newshell-class-4:	1.3994	0.3409
8	Scaled-logN-for-male-mature-mature-newshell-class-5:	1.2090	0.3073
9	Scaled-logN-for-male-mature-mature-newshell-class-6:	1.0166	0.2920
10	Scaled-logN-for-male-mature-mature-newshell-class-7:	0.9403	0.2724
11	Scaled-logN-for-male-mature-mature-newshell-class-8:	0.7645	0.2744
12	Scaled-logN-for-male-mature-mature-newshell-class-9:	0.7658	0.2639
13	Scaled-logN-for-male-mature-mature-newshell-class-10:	0.7665	0.2582
14	Scaled-logN-for-male-mature-mature-newshell-class-11:	0.5345	0.2784
15	Scaled-logN-for-male-mature-mature-newshell-class-12:	0.5156	0.2708
16	Scaled-logN-for-male-mature-mature-newshell-class-13:	0.3781	0.2831
17	Scaled-logN-for-male-mature-mature-newshell-class-14:	0.4835	0.2555
18	Scaled-logN-for-male-mature-mature-newshell-class-15:	0.3059	0.1970
19	Scaled-logN-for-male-mature-mature-newshell-class-16:	0.0412	0.1899
20	Scaled-logN-for-male-mature-mature-newshell-class-17:	-0.1616	0.1947
21	Scaled-logN-for-male-mature-mature-newshell-class-18:	-0.5479	0.2132
22	Scaled-logN-for-male-mature-mature-newshell-class-19:	-0.9632	0.2333
23	Scaled-logN-for-male-mature-mature-newshell-class-20:	-1.5478	0.2644
24	Scaled-logN-for-male-mature-mature-newshell-class-21:	-2.0816	0.2954
25	Scaled-logN-for-male-mature-mature-newshell-class-22:	-2.3311	0.2884
26	Scaled-logN-for-male-mature-mature-newshell-class-23:	-2.6262	0.2929
27	Scaled-logN-for-female-mature-mature-newshell-class-1:	1.5621	1.8751
28	Scaled-logN-for-female-mature-mature-newshell-class-2:	2.0256	0.7104
29	Scaled-logN-for-female-mature-mature-newshell-class-3:	1.9233	0.4311
30	Scaled-logN-for-female-mature-mature-newshell-class-4:	1.6524	0.3662
31	Scaled-logN-for-female-mature-mature-newshell-class-5:	1.5348	0.3106
32	Scaled-logN-for-female-mature-mature-newshell-class-6:	0.9853	0.3470
33	Scaled-logN-for-female-mature-mature-newshell-class-7:	0.5795	0.3821
34	Scaled-logN-for-female-mature-mature-newshell-class-8:	0.3299	0.3856
35	Scaled-logN-for-female-mature-mature-newshell-class-9:	0.1465	0.3686
36	Scaled-logN-for-female-mature-mature-newshell-class-10:	-0.1827	0.3855
37	Scaled-logN-for-female-mature-mature-newshell-class-11:	-0.5740	0.3970
38	Scaled-logN-for-female-mature-mature-newshell-class-12:	-0.8440	0.4020
39	Scaled-logN-for-female-mature-mature-newshell-class-13:	-1.1048	0.4011
40	Scaled-logN-for-female-mature-mature-newshell-class-14:	-1.5354	0.3879
41	Scaled-logN-for-female-mature-mature-newshell-class-15:	-1.7201	0.3823
42	Scaled-logN-for-female-mature-mature-newshell-class-16:	-2.0050	0.3715
43	Scaled-logN-for-female-mature-mature-newshell-class-17:	-2.2948	0.3597
44	Scaled-logN-for-female-mature-mature-newshell-class-18:	-2.3162	0.3349
45	Gscale-base-male:	0.9033	0.1770
46	Gscale-base-female:	1.4287	0.1230
47	Molt-probability-mu-base-male-period-1:	140.7665	0.5160
48	Molt-probability-CV-base-male-period-1:	0.0603	0.0021
49	M-base-male-mature:	0.2321	0.0063
50	M-male-mature-block-group-1-block-1:	1.4839	0.0312

51	M-base-female-mature:	0.1531	0.0186
52	Sel-Pot-Fishery-male-base-Logistic-mean:	4.7714	0.0072
53	Sel-Pot-Fishery-male-base-Logistic-cv:	2.2115	0.0409
54	Sel-Trawl-Bycatch-male-base-Logistic-mean:	4.9948	0.0261
55	Sel-Trawl-Bycatch-male-base-Logistic-cv:	2.6913	0.0440
56	Sel-Bairdi-Fishery-Bycatch-male-base-Logistic-mean:	4.6696	0.2319
57	Sel-Bairdi-Fishery-Bycatch-male-base-Logistic-cv:	2.1664	0.3042
58	Sel-Fixed-Gear-male-base-Logistic-mean:	4.7880	0.0168
59	Sel-Fixed-Gear-male-base-Logistic-cv:	2.2905	0.0702
60	Sel-NMFS-Trawl-male-base-Logistic-mean:	4.0646	0.2474
61	Sel-NMFS-Trawl-male-base-Logistic-cv:	2.2423	0.4967
62	Sel-NMFS-Trawl-male-Logistic-mean-block-group-5-block-1:	3.8610	0.4429
63	Sel-NMFS-Trawl-male-Logistic-cv-block-group-5-block-1:	3.4194	0.3955
64	Sel-BSFRF-male-base-Logistic-mean:	4.4912	0.0227
65	Sel-BSFRF-male-base-Logistic-cv:	2.5032	0.0672
66	Sel-Pot-Fishery-female-base-Logistic-mean:	4.6048	0.0216
67	Sel-Pot-Fishery-female-base-Logistic-cv:	2.3164	0.0831
68	Sel-Bairdi-Fishery-Bycatch-female-base-Logistic-mean:	4.7561	0.0927
69	Sel-Bairdi-Fishery-Bycatch-female-base-Logistic-cv:	0.9037	0.3025
70	Ret-Pot-Fishery-male-base-Logistic-mean:	4.9238	0.0015
71	Ret-Pot-Fishery-male-base-Logistic-cv:	0.6851	0.0512
72	Ret-Pot-Fishery-male-Logistic-mean-block-group-6-block-1:	4.9318	0.0019
73	Ret-Pot-Fishery-male-Logistic-cv-block-group-6-block-1:	0.7184	0.0923
74	Log-fbar-Pot-Fishery:	-1.8366	0.0433
75	Log-fbar-Trawl-Bycatch:	-4.6355	0.1024
76	Log-fbar-Bairdi-Fishery-Bycatch:	-5.4522	0.2589
77	Log-fbar-Fixed-Gear:	-6.6008	0.0650
78	Log-fdev-Pot-Fishery-year-1975-season-3:	0.9482	0.0881
79	Log-fdev-Pot-Fishery-year-1976-season-3:	0.9524	0.0711
80	Log-fdev-Pot-Fishery-year-1977-season-3:	0.8906	0.0648
81	Log-fdev-Pot-Fishery-year-1978-season-3:	0.9858	0.0592
82	Log-fdev-Pot-Fishery-year-1979-season-3:	1.1963	0.0559
83	Log-fdev-Pot-Fishery-year-1980-season-3:	2.0817	0.0600
84	Log-fdev-Pot-Fishery-year-1981-season-3:	2.6296	0.1267
85	Log-fdev-Pot-Fishery-year-1982-season-3:	1.0709	0.1673
86	Log-fdev-Pot-Fishery-year-1983-season-3:	-8.5920	0.1082
87	Log-fdev-Pot-Fishery-year-1984-season-3:	1.5279	0.0983
88	Log-fdev-Pot-Fishery-year-1985-season-3:	1.5429	0.0944
89	Log-fdev-Pot-Fishery-year-1986-season-3:	1.5991	0.0804
90	Log-fdev-Pot-Fishery-year-1987-season-3:	1.0782	0.0680
91	Log-fdev-Pot-Fishery-year-1988-season-3:	0.1240	0.0552
92	Log-fdev-Pot-Fishery-year-1989-season-3:	0.2456	0.0493
93	Log-fdev-Pot-Fishery-year-1990-season-3:	0.8974	0.0404
94	Log-fdev-Pot-Fishery-year-1991-season-3:	0.8935	0.0435
95	Log-fdev-Pot-Fishery-year-1992-season-3:	0.3754	0.0480
96	Log-fdev-Pot-Fishery-year-1993-season-3:	1.0279	0.0522
97	Log-fdev-Pot-Fishery-year-1994-season-3:	-4.1491	0.0493
98	Log-fdev-Pot-Fishery-year-1995-season-3:	-4.5514	0.0425
99	Log-fdev-Pot-Fishery-year-1996-season-3:	-0.0632	0.0410
100	Log-fdev-Pot-Fishery-year-1997-season-3:	0.0095	0.0414
101	Log-fdev-Pot-Fishery-year-1998-season-3:	0.9354	0.0439
102	Log-fdev-Pot-Fishery-year-1999-season-3:	0.5597	0.0437
103	Log-fdev-Pot-Fishery-year-2000-season-3:	-0.0357	0.0418

104	Log-fdev-Pot-Fishery-year-2001-season-3:	-0.0994	0.0412
105	Log-fdev-Pot-Fishery-year-2002-season-3:	0.0289	0.0401
106	Log-fdev-Pot-Fishery-year-2003-season-3:	0.4934	0.0390
107	Log-fdev-Pot-Fishery-year-2004-season-3:	0.4501	0.0390
108	Log-fdev-Pot-Fishery-year-2005-season-3:	0.7330	0.0395
109	Log-fdev-Pot-Fishery-year-2006-season-3:	0.4842	0.0388
110	Log-fdev-Pot-Fishery-year-2007-season-3:	0.8516	0.0387
111	Log-fdev-Pot-Fishery-year-2008-season-3:	1.0204	0.0403
112	Log-fdev-Pot-Fishery-year-2009-season-3:	0.8070	0.0412
113	Log-fdev-Pot-Fishery-year-2010-season-3:	0.6573	0.0412
114	Log-fdev-Pot-Fishery-year-2011-season-3:	0.0219	0.0403
115	Log-fdev-Pot-Fishery-year-2012-season-3:	-0.0432	0.0390
116	Log-fdev-Pot-Fishery-year-2013-season-3:	0.1583	0.0385
117	Log-fdev-Pot-Fishery-year-2014-season-3:	0.4884	0.0384
118	Log-fdev-Pot-Fishery-year-2015-season-3:	0.5586	0.0394
119	Log-fdev-Pot-Fishery-year-2016-season-3:	0.5651	0.0422
120	Log-fdev-Pot-Fishery-year-2017-season-3:	0.4792	0.0472
121	Log-fdev-Pot-Fishery-year-2018-season-3:	0.3010	0.0531
122	Log-fdev-Pot-Fishery-year-2019-season-3:	0.2403	0.0576
123	Log-fdev-Pot-Fishery-year-2020-season-3:	-0.2117	0.0581
124	Log-fdev-Pot-Fishery-year-2021-season-3:	-4.6591	0.0560
125	Log-fdev-Pot-Fishery-year-2022-season-3:	-4.7058	0.0541
126	Log-fdev-Pot-Fishery-year-2023-season-3:	-0.9839	0.0556
127	Log-fdev-Pot-Fishery-year-2024-season-3:	-1.0092	0.0589
128	Log-fdev-Pot-Fishery-year-2025-season-3:	-0.8066	0.0630
129	Log-fdev-Trawl-Bycatch-year-1976-season-5:	0.3244	0.1106
130	Log-fdev-Trawl-Bycatch-year-1977-season-5:	0.8011	0.1088
131	Log-fdev-Trawl-Bycatch-year-1978-season-5:	0.8025	0.1079
132	Log-fdev-Trawl-Bycatch-year-1979-season-5:	0.8947	0.1089
133	Log-fdev-Trawl-Bycatch-year-1980-season-5:	1.5871	0.1128
134	Log-fdev-Trawl-Bycatch-year-1981-season-5:	1.2742	0.1257
135	Log-fdev-Trawl-Bycatch-year-1982-season-5:	2.5812	0.1223
136	Log-fdev-Trawl-Bycatch-year-1983-season-5:	2.3516	0.1125
137	Log-fdev-Trawl-Bycatch-year-1984-season-5:	3.5690	0.1118
138	Log-fdev-Trawl-Bycatch-year-1985-season-5:	2.3376	0.1130
139	Log-fdev-Trawl-Bycatch-year-1986-season-5:	1.2324	0.1129
140	Log-fdev-Trawl-Bycatch-year-1987-season-5:	0.7745	0.1096
141	Log-fdev-Trawl-Bycatch-year-1988-season-5:	1.5866	0.1051
142	Log-fdev-Trawl-Bycatch-year-1989-season-5:	0.1896	0.1038
143	Log-fdev-Trawl-Bycatch-year-1990-season-5:	0.6458	0.1038
144	Log-fdev-Trawl-Bycatch-year-1991-season-5:	1.0592	0.1051
145	Log-fdev-Trawl-Bycatch-year-1992-season-5:	0.8990	0.1052
146	Log-fdev-Trawl-Bycatch-year-1993-season-5:	1.3249	0.1075
147	Log-fdev-Trawl-Bycatch-year-1994-season-5:	-0.4305	0.1047
148	Log-fdev-Trawl-Bycatch-year-1995-season-5:	-0.6837	0.1032
149	Log-fdev-Trawl-Bycatch-year-1996-season-5:	-0.5972	0.1034
150	Log-fdev-Trawl-Bycatch-year-1997-season-5:	-1.0500	0.1033
151	Log-fdev-Trawl-Bycatch-year-1998-season-5:	0.2104	0.1036
152	Log-fdev-Trawl-Bycatch-year-1999-season-5:	-0.0911	0.1035
153	Log-fdev-Trawl-Bycatch-year-2000-season-5:	-0.8280	0.1030
154	Log-fdev-Trawl-Bycatch-year-2001-season-5:	-0.0319	0.1028
155	Log-fdev-Trawl-Bycatch-year-2002-season-5:	-0.3210	0.1024
156	Log-fdev-Trawl-Bycatch-year-2003-season-5:	-0.4211	0.1023

157	Log-fdev-Trawl-Bycatch-year-2004-season-5:	-0.1862	0.1022
158	Log-fdev-Trawl-Bycatch-year-2005-season-5:	-0.4741	0.1021
159	Log-fdev-Trawl-Bycatch-year-2006-season-5:	-0.3079	0.1018
160	Log-fdev-Trawl-Bycatch-year-2007-season-5:	-0.2378	0.1018
161	Log-fdev-Trawl-Bycatch-year-2008-season-5:	-0.2886	0.1021
162	Log-fdev-Trawl-Bycatch-year-2009-season-5:	-0.6663	0.1022
163	Log-fdev-Trawl-Bycatch-year-2010-season-5:	-0.8193	0.1023
164	Log-fdev-Trawl-Bycatch-year-2011-season-5:	-1.2600	0.1020
165	Log-fdev-Trawl-Bycatch-year-2012-season-5:	-1.7570	0.1021
166	Log-fdev-Trawl-Bycatch-year-2013-season-5:	-1.0310	0.1021
167	Log-fdev-Trawl-Bycatch-year-2014-season-5:	-1.5999	0.1022
168	Log-fdev-Trawl-Bycatch-year-2015-season-5:	-1.2193	0.1026
169	Log-fdev-Trawl-Bycatch-year-2016-season-5:	-0.6896	0.1034
170	Log-fdev-Trawl-Bycatch-year-2017-season-5:	-0.2512	0.1045
171	Log-fdev-Trawl-Bycatch-year-2018-season-5:	-0.3133	0.1055
172	Log-fdev-Trawl-Bycatch-year-2019-season-5:	-0.2943	0.1065
173	Log-fdev-Trawl-Bycatch-year-2020-season-5:	-0.2914	0.1071
174	Log-fdev-Trawl-Bycatch-year-2021-season-5:	-1.2326	0.1071
175	Log-fdev-Trawl-Bycatch-year-2022-season-5:	-2.1532	0.1078
176	Log-fdev-Trawl-Bycatch-year-2023-season-5:	-1.8889	0.1097
177	Log-fdev-Trawl-Bycatch-year-2024-season-5:	-1.3128	0.1116
178	Log-fdev-Trawl-Bycatch-year-2025-season-5:	-1.7168	0.1138
179	Log-fdev-Bairdi-Fishery-Bycatch-year-1975-season-5:	0.9202	0.0683
180	Log-fdev-Bairdi-Fishery-Bycatch-year-1976-season-5:	1.7061	0.0683
181	Log-fdev-Bairdi-Fishery-Bycatch-year-1977-season-5:	2.2642	0.0683
182	Log-fdev-Bairdi-Fishery-Bycatch-year-1978-season-5:	2.1289	0.0683
183	Log-fdev-Bairdi-Fishery-Bycatch-year-1979-season-5:	2.4187	0.0683
184	Log-fdev-Bairdi-Fishery-Bycatch-year-1980-season-5:	2.4611	0.0683
185	Log-fdev-Bairdi-Fishery-Bycatch-year-1981-season-5:	2.0297	0.0684
186	Log-fdev-Bairdi-Fishery-Bycatch-year-1982-season-5:	1.5132	0.0683
187	Log-fdev-Bairdi-Fishery-Bycatch-year-1983-season-5:	0.0493	0.0683
188	Log-fdev-Bairdi-Fishery-Bycatch-year-1984-season-5:	0.4578	0.0683
189	Log-fdev-Bairdi-Fishery-Bycatch-year-1987-season-5:	-0.0628	0.0683
190	Log-fdev-Bairdi-Fishery-Bycatch-year-1988-season-5:	0.7802	0.0683
191	Log-fdev-Bairdi-Fishery-Bycatch-year-1989-season-5:	1.9765	0.0683
192	Log-fdev-Bairdi-Fishery-Bycatch-year-1990-season-5:	2.4547	0.0683
193	Log-fdev-Bairdi-Fishery-Bycatch-year-1991-season-5:	2.8771	0.0782
194	Log-fdev-Bairdi-Fishery-Bycatch-year-1992-season-5:	0.8954	0.1183
195	Log-fdev-Bairdi-Fishery-Bycatch-year-1993-season-5:	0.1414	0.1143
196	Log-fdev-Bairdi-Fishery-Bycatch-year-1994-season-5:	-1.1563	0.0859
197	Log-fdev-Bairdi-Fishery-Bycatch-year-2006-season-5:	-2.4669	0.0726
198	Log-fdev-Bairdi-Fishery-Bycatch-year-2007-season-5:	-3.3471	0.1043
199	Log-fdev-Bairdi-Fishery-Bycatch-year-2008-season-5:	-2.7889	0.1034
200	Log-fdev-Bairdi-Fishery-Bycatch-year-2009-season-5:	-3.8752	0.0733
201	Log-fdev-Bairdi-Fishery-Bycatch-year-2013-season-5:	-1.1974	0.0902
202	Log-fdev-Bairdi-Fishery-Bycatch-year-2014-season-5:	-0.4641	0.1117
203	Log-fdev-Bairdi-Fishery-Bycatch-year-2015-season-5:	0.7266	0.1289
204	Log-fdev-Bairdi-Fishery-Bycatch-year-2024-season-5:	-6.5858	0.0899
205	Log-fdev-Bairdi-Fishery-Bycatch-year-2025-season-5:	-3.8567	0.0954
206	Log-fdev-Fixed-Gear-year-1996-season-5:	0.5074	0.1033
207	Log-fdev-Fixed-Gear-year-1997-season-5:	-0.1356	0.1027
208	Log-fdev-Fixed-Gear-year-1998-season-5:	-0.3584	0.1032
209	Log-fdev-Fixed-Gear-year-1999-season-5:	0.5522	0.1026

210	Log-fdev-Fixed-Gear-year-2000-season-5:	-1.8702	0.1021
211	Log-fdev-Fixed-Gear-year-2001-season-5:	0.0972	0.1017
212	Log-fdev-Fixed-Gear-year-2002-season-5:	-0.1528	0.1013
213	Log-fdev-Fixed-Gear-year-2003-season-5:	-0.9866	0.1012
214	Log-fdev-Fixed-Gear-year-2004-season-5:	-0.8083	0.1010
215	Log-fdev-Fixed-Gear-year-2005-season-5:	-0.5360	0.1008
216	Log-fdev-Fixed-Gear-year-2006-season-5:	-0.5791	0.1006
217	Log-fdev-Fixed-Gear-year-2007-season-5:	-0.0345	0.1005
218	Log-fdev-Fixed-Gear-year-2008-season-5:	-0.7425	0.1008
219	Log-fdev-Fixed-Gear-year-2009-season-5:	-1.7495	0.1007
220	Log-fdev-Fixed-Gear-year-2010-season-5:	-2.5917	0.1004
221	Log-fdev-Fixed-Gear-year-2011-season-5:	-1.1044	0.1000
222	Log-fdev-Fixed-Gear-year-2012-season-5:	-0.5367	0.0998
223	Log-fdev-Fixed-Gear-year-2013-season-5:	0.6133	0.0996
224	Log-fdev-Fixed-Gear-year-2014-season-5:	1.4693	0.0997
225	Log-fdev-Fixed-Gear-year-2015-season-5:	1.1598	0.0998
226	Log-fdev-Fixed-Gear-year-2016-season-5:	0.2657	0.1002
227	Log-fdev-Fixed-Gear-year-2017-season-5:	1.5426	0.1009
228	Log-fdev-Fixed-Gear-year-2018-season-5:	1.9319	0.1015
229	Log-fdev-Fixed-Gear-year-2019-season-5:	1.0653	0.1022
230	Log-fdev-Fixed-Gear-year-2020-season-5:	0.0098	0.1028
231	Log-fdev-Fixed-Gear-year-2021-season-5:	1.1194	0.1030
232	Log-fdev-Fixed-Gear-year-2022-season-5:	1.1363	0.1038
233	Log-fdev-Fixed-Gear-year-2023-season-5:	0.7186	0.1052
234	Log-fdev-Fixed-Gear-year-2024-season-5:	-0.0688	0.1068
235	Log-fdev-Fixed-Gear-year-2025-season-5:	0.0664	0.1087
236	Log-foff-Pot-Fishery:	-2.6149	0.0513
237	Log-foff-Bairdi-Fishery-Bycatch:	-1.3265	0.4894
238	Log-fdov-Pot-Fishery-year-1990-season-3:	1.9184	0.0853
239	Log-fdov-Pot-Fishery-year-1991-season-3:	-0.7411	0.0844
240	Log-fdov-Pot-Fishery-year-1992-season-3:	1.9345	0.0860
241	Log-fdov-Pot-Fishery-year-1993-season-3:	1.7595	0.0873
242	Log-fdov-Pot-Fishery-year-1994-season-3:	-0.4543	0.0853
243	Log-fdov-Pot-Fishery-year-1995-season-3:	-0.2297	0.0825
244	Log-fdov-Pot-Fishery-year-1996-season-3:	-3.7313	0.0816
245	Log-fdov-Pot-Fishery-year-1997-season-3:	-0.3275	0.0822
246	Log-fdov-Pot-Fishery-year-1998-season-3:	1.4203	0.0832
247	Log-fdov-Pot-Fishery-year-1999-season-3:	-2.8036	0.0823
248	Log-fdov-Pot-Fishery-year-2000-season-3:	1.1278	0.0811
249	Log-fdov-Pot-Fishery-year-2001-season-3:	0.8424	0.0810
250	Log-fdov-Pot-Fishery-year-2002-season-3:	-1.9233	0.0805
251	Log-fdov-Pot-Fishery-year-2003-season-3:	1.1863	0.0804
252	Log-fdov-Pot-Fishery-year-2004-season-3:	0.4041	0.0807
253	Log-fdov-Pot-Fishery-year-2005-season-3:	0.9156	0.0804
254	Log-fdov-Pot-Fishery-year-2006-season-3:	-1.2735	0.0798
255	Log-fdov-Pot-Fishery-year-2007-season-3:	-0.2269	0.0797
256	Log-fdov-Pot-Fishery-year-2008-season-3:	-0.4958	0.0800
257	Log-fdov-Pot-Fishery-year-2009-season-3:	-0.7516	0.0799
258	Log-fdov-Pot-Fishery-year-2010-season-3:	-0.2564	0.0798
259	Log-fdov-Pot-Fishery-year-2011-season-3:	-1.1337	0.0793
260	Log-fdov-Pot-Fishery-year-2012-season-3:	-1.8430	0.0787
261	Log-fdov-Pot-Fishery-year-2013-season-3:	0.1745	0.0786
262	Log-fdov-Pot-Fishery-year-2014-season-3:	-0.2385	0.0786

263	Log-fdov-Pot-Fishery-year-2015-season-3:	0.8225	0.0790
264	Log-fdov-Pot-Fishery-year-2016-season-3:	0.2642	0.0801
265	Log-fdov-Pot-Fishery-year-2017-season-3:	-0.3908	0.0819
266	Log-fdov-Pot-Fishery-year-2018-season-3:	0.9214	0.0841
267	Log-fdov-Pot-Fishery-year-2019-season-3:	-0.1562	0.0857
268	Log-fdov-Pot-Fishery-year-2020-season-3:	-0.6686	0.0854
269	Log-fdov-Pot-Fishery-year-2021-season-3:	2.9109	0.0845
270	Log-fdov-Pot-Fishery-year-2022-season-3:	1.1967	0.0839
271	Log-fdov-Pot-Fishery-year-2023-season-3:	0.1420	0.0843
272	Log-fdov-Pot-Fishery-year-2024-season-3:	-1.6563	0.0852
273	Log-fdov-Pot-Fishery-year-2025-season-3:	1.3558	0.0873
274	Log-fdov-Bairdi-Fishery-Bycatch-year-1975-season-5:	0.0001	0.0965
275	Log-fdov-Bairdi-Fishery-Bycatch-year-1976-season-5:	0.0005	0.0964
276	Log-fdov-Bairdi-Fishery-Bycatch-year-1977-season-5:	0.0010	0.0964
277	Log-fdov-Bairdi-Fishery-Bycatch-year-1978-season-5:	0.0006	0.0965
278	Log-fdov-Bairdi-Fishery-Bycatch-year-1979-season-5:	0.0008	0.0965
279	Log-fdov-Bairdi-Fishery-Bycatch-year-1980-season-5:	-0.0002	0.0965
280	Log-fdov-Bairdi-Fishery-Bycatch-year-1981-season-5:	-0.0005	0.0965
281	Log-fdov-Bairdi-Fishery-Bycatch-year-1982-season-5:	-0.0003	0.0965
282	Log-fdov-Bairdi-Fishery-Bycatch-year-1983-season-5:	-0.0002	0.0965
283	Log-fdov-Bairdi-Fishery-Bycatch-year-1984-season-5:	0.0000	0.0964
284	Log-fdov-Bairdi-Fishery-Bycatch-year-1987-season-5:	-0.0001	0.0965
285	Log-fdov-Bairdi-Fishery-Bycatch-year-1988-season-5:	0.0002	0.0964
286	Log-fdov-Bairdi-Fishery-Bycatch-year-1989-season-5:	0.0004	0.0964
287	Log-fdov-Bairdi-Fishery-Bycatch-year-1990-season-5:	0.0007	0.0965
288	Log-fdov-Bairdi-Fishery-Bycatch-year-1991-season-5:	2.9236	0.2171
289	Log-fdov-Bairdi-Fishery-Bycatch-year-1992-season-5:	3.1983	0.1437
290	Log-fdov-Bairdi-Fishery-Bycatch-year-1993-season-5:	2.0164	0.1379
291	Log-fdov-Bairdi-Fishery-Bycatch-year-1994-season-5:	-2.0333	0.1115
292	Log-fdov-Bairdi-Fishery-Bycatch-year-2006-season-5:	-0.7563	0.1611
293	Log-fdov-Bairdi-Fishery-Bycatch-year-2007-season-5:	0.6261	0.1442
294	Log-fdov-Bairdi-Fishery-Bycatch-year-2008-season-5:	1.4618	0.1252
295	Log-fdov-Bairdi-Fishery-Bycatch-year-2009-season-5:	1.8117	0.1013
296	Log-fdov-Bairdi-Fishery-Bycatch-year-2013-season-5:	2.3440	0.2057
297	Log-fdov-Bairdi-Fishery-Bycatch-year-2014-season-5:	1.5734	0.1812
298	Log-fdov-Bairdi-Fishery-Bycatch-year-2015-season-5:	2.3042	0.1793
299	Log-fdov-Bairdi-Fishery-Bycatch-year-2024-season-5:	-6.3719	0.1127
300	Log-fdov-Bairdi-Fishery-Bycatch-year-2025-season-5:	-9.1011	0.1172
301	Rec-dev-est-1975:	1.0346	0.3482
302	Rec-dev-est-1976:	0.4884	0.3223
303	Rec-dev-est-1977:	0.9771	0.2422
304	Rec-dev-est-1978:	1.5856	0.2051
305	Rec-dev-est-1979:	1.9075	0.2161
306	Rec-dev-est-1980:	1.0974	0.2637
307	Rec-dev-est-1981:	2.3827	0.1590
308	Rec-dev-est-1982:	1.4196	0.1752
309	Rec-dev-est-1983:	1.0079	0.1607
310	Rec-dev-est-1984:	-0.8091	0.2439
311	Rec-dev-est-1985:	0.2515	0.1578
312	Rec-dev-est-1986:	-0.8097	0.2303
313	Rec-dev-est-1987:	-1.2732	0.2679
314	Rec-dev-est-1988:	-1.0977	0.2278
315	Rec-dev-est-1989:	-0.0889	0.1591

316	Rec-dev-est-1990:	-0.4221	0.1758
317	Rec-dev-est-1991:	-1.8759	0.3397
318	Rec-dev-est-1992:	-0.9901	0.1989
319	Rec-dev-est-1993:	-2.1633	0.4115
320	Rec-dev-est-1994:	0.8605	0.1400
321	Rec-dev-est-1995:	-0.6957	0.2242
322	Rec-dev-est-1996:	-1.5306	0.3154
323	Rec-dev-est-1997:	-0.7521	0.2067
324	Rec-dev-est-1998:	0.3724	0.1488
325	Rec-dev-est-1999:	-0.5059	0.2104
326	Rec-dev-est-2000:	-0.7389	0.2622
327	Rec-dev-est-2001:	0.7340	0.1491
328	Rec-dev-est-2002:	-0.5715	0.2427
329	Rec-dev-est-2003:	-0.7375	0.2597
330	Rec-dev-est-2004:	0.4691	0.1523
331	Rec-dev-est-2005:	-0.1012	0.1721
332	Rec-dev-est-2006:	-0.5412	0.1821
333	Rec-dev-est-2007:	-1.0233	0.2175
334	Rec-dev-est-2008:	-1.0143	0.2310
335	Rec-dev-est-2009:	-0.2135	0.1765
336	Rec-dev-est-2010:	-0.5454	0.2152
337	Rec-dev-est-2011:	-1.0742	0.2220
338	Rec-dev-est-2012:	-1.4784	0.2243
339	Rec-dev-est-2013:	-1.8896	0.2617
340	Rec-dev-est-2014:	-1.4349	0.2551
341	Rec-dev-est-2015:	-0.7500	0.1670
342	Rec-dev-est-2016:	-1.5106	0.2306
343	Rec-dev-est-2017:	-0.8728	0.1801
344	Rec-dev-est-2018:	-1.4441	0.2442
345	Rec-dev-est-2019:	-1.2743	0.2174
346	Rec-dev-est-2020:	-1.4563	0.2377
347	Rec-dev-est-2021:	-0.5895	0.1695
348	Rec-dev-est-2022:	-0.7919	0.1899
349	Rec-dev-est-2023:	-1.2884	0.2521
350	Rec-dev-est-2024:	-0.1632	0.1947
351	Rec-dev-est-2025:	-0.9376	0.3494
352	Logit-rec-prop-est-1975:	-0.0869	0.5947
353	Logit-rec-prop-est-1976:	-0.8383	0.5508
354	Logit-rec-prop-est-1977:	-0.1744	0.3654
355	Logit-rec-prop-est-1978:	-0.3863	0.2617
356	Logit-rec-prop-est-1979:	0.2585	0.2586
357	Logit-rec-prop-est-1980:	0.4801	0.3538
358	Logit-rec-prop-est-1981:	0.4889	0.1461
359	Logit-rec-prop-est-1982:	0.6294	0.2533
360	Logit-rec-prop-est-1983:	0.0498	0.1810
361	Logit-rec-prop-est-1984:	0.5365	0.4894
362	Logit-rec-prop-est-1985:	-0.5065	0.1718
363	Logit-rec-prop-est-1986:	0.3448	0.4311
364	Logit-rec-prop-est-1987:	-0.2306	0.4749
365	Logit-rec-prop-est-1988:	0.3912	0.4265
366	Logit-rec-prop-est-1989:	-0.1243	0.1742
367	Logit-rec-prop-est-1990:	0.3118	0.2515
368	Logit-rec-prop-est-1991:	0.6615	0.8027

369	Logit-rec-prop-est-1992:	0.2529	0.3265
370	Logit-rec-prop-est-1993:	-1.0726	0.9771
371	Logit-rec-prop-est-1994:	-0.3484	0.0942
372	Logit-rec-prop-est-1995:	1.4099	0.6519
373	Logit-rec-prop-est-1996:	0.2670	0.6494
374	Logit-rec-prop-est-1997:	0.5675	0.3890
375	Logit-rec-prop-est-1998:	-0.1372	0.1397
376	Logit-rec-prop-est-1999:	0.2783	0.3540
377	Logit-rec-prop-est-2000:	-0.6139	0.4579
378	Logit-rec-prop-est-2001:	-0.4709	0.1315
379	Logit-rec-prop-est-2002:	-0.4367	0.3992
380	Logit-rec-prop-est-2003:	-0.0897	0.4506
381	Logit-rec-prop-est-2004:	-0.3997	0.1480
382	Logit-rec-prop-est-2005:	-0.1661	0.2209
383	Logit-rec-prop-est-2006:	0.4260	0.2883
384	Logit-rec-prop-est-2007:	-0.1188	0.3496
385	Logit-rec-prop-est-2008:	-0.5319	0.3759
386	Logit-rec-prop-est-2009:	-0.5733	0.2145
387	Logit-rec-prop-est-2010:	-0.4804	0.3059
388	Logit-rec-prop-est-2011:	-0.6746	0.3499
389	Logit-rec-prop-est-2012:	-0.1368	0.3714
390	Logit-rec-prop-est-2013:	-0.3429	0.4629
391	Logit-rec-prop-est-2014:	-0.4930	0.4080
392	Logit-rec-prop-est-2015:	0.2762	0.2244
393	Logit-rec-prop-est-2016:	0.3832	0.4232
394	Logit-rec-prop-est-2017:	0.5463	0.2783
395	Logit-rec-prop-est-2018:	-0.1828	0.4283
396	Logit-rec-prop-est-2019:	0.4493	0.3968
397	Logit-rec-prop-est-2020:	0.3184	0.4389
398	Logit-rec-prop-est-2021:	-0.0577	0.2027
399	Logit-rec-prop-est-2022:	-0.3194	0.2636
400	Logit-rec-prop-est-2023:	0.0775	0.4316
401	Logit-rec-prop-est-2024:	0.2344	0.2784
402	Logit-rec-prop-est-2025:	0.3547	0.6470
403	Survey-q-survey-1:	0.9134	0.0258
404	Log-add-cvt-survey-2:	-1.0593	0.2960

Table 22: Summary of estimated model parameter values and standard deviations for model 24.0c.2 for Bristol Bay red king crab.

Index	Name	Value	StdDev
1	Log(Rinitial):	20.0574	0.0549
2	Log(Rbar):	16.5730	0.1382
3	Recruitment-rb-males:	0.7872	0.1367
4	Recruitment-rb-females-(ln-scale-offset-to-males!):	-0.5878	0.2205
5	Scaled-logN-for-male-mature-mature-newshell-class-2:	1.0484	0.4405
6	Scaled-logN-for-male-mature-mature-newshell-class-3:	0.7307	0.4815
7	Scaled-logN-for-male-mature-mature-newshell-class-4:	0.9346	0.3386
8	Scaled-logN-for-male-mature-mature-newshell-class-5:	0.7538	0.3122
9	Scaled-logN-for-male-mature-mature-newshell-class-6:	0.5599	0.3018
10	Scaled-logN-for-male-mature-mature-newshell-class-7:	0.5165	0.2800
11	Scaled-logN-for-male-mature-mature-newshell-class-8:	0.3496	0.2798
12	Scaled-logN-for-male-mature-mature-newshell-class-9:	0.3842	0.2658
13	Scaled-logN-for-male-mature-mature-newshell-class-10:	0.4124	0.2581
14	Scaled-logN-for-male-mature-mature-newshell-class-11:	0.1934	0.2762
15	Scaled-logN-for-male-mature-mature-newshell-class-12:	0.1836	0.2696
16	Scaled-logN-for-male-mature-mature-newshell-class-13:	0.0701	0.2790
17	Scaled-logN-for-male-mature-mature-newshell-class-14:	0.1727	0.2541
18	Scaled-logN-for-male-mature-mature-newshell-class-15:	0.0009	0.1981
19	Scaled-logN-for-male-mature-mature-newshell-class-16:	-0.2682	0.1914
20	Scaled-logN-for-male-mature-mature-newshell-class-17:	-0.4345	0.1937
21	Scaled-logN-for-male-mature-mature-newshell-class-18:	-0.7844	0.2074
22	Scaled-logN-for-male-mature-mature-newshell-class-19:	-1.2491	0.2288
23	Scaled-logN-for-male-mature-mature-newshell-class-20:	-1.3059	0.2286
24	Scaled-logN-for-female-mature-mature-newshell-class-1:	1.5202	0.5775
25	Scaled-logN-for-female-mature-mature-newshell-class-2:	1.4657	0.4800
26	Scaled-logN-for-female-mature-mature-newshell-class-3:	1.3747	0.3840
27	Scaled-logN-for-female-mature-mature-newshell-class-4:	1.1419	0.3534
28	Scaled-logN-for-female-mature-mature-newshell-class-5:	1.0735	0.3045
29	Scaled-logN-for-female-mature-mature-newshell-class-6:	0.6117	0.3254
30	Scaled-logN-for-female-mature-mature-newshell-class-7:	0.1999	0.3612
31	Scaled-logN-for-female-mature-mature-newshell-class-8:	-0.0404	0.3641
32	Scaled-logN-for-female-mature-mature-newshell-class-9:	-0.2329	0.3544
33	Scaled-logN-for-female-mature-mature-newshell-class-10:	-0.5785	0.3729
34	Scaled-logN-for-female-mature-mature-newshell-class-11:	-0.9679	0.3831
35	Scaled-logN-for-female-mature-mature-newshell-class-12:	-1.2279	0.3873
36	Scaled-logN-for-female-mature-mature-newshell-class-13:	-1.4574	0.3857
37	Scaled-logN-for-female-mature-mature-newshell-class-14:	-1.8298	0.3742
38	Scaled-logN-for-female-mature-mature-newshell-class-15:	-1.9356	0.3703
39	Scaled-logN-for-female-mature-mature-newshell-class-16:	-1.8831	0.3505
40	Gscale-base-male:	1.0665	0.1964
41	Gscale-base-female:	1.3851	0.1235
42	Molt-probability-mu-base-male-period-1:	140.9111	0.5610
43	Molt-probability-CV-base-male-period-1:	0.0674	0.0030
44	M-base-male-mature:	0.2285	0.0063
45	M-male-mature-block-group-1-block-1:	1.4868	0.0309
46	M-base-female-mature:	0.1404	0.0186
47	Sel-Pot-Fishery-male-base-Logistic-mean:	4.7808	0.0078
48	Sel-Pot-Fishery-male-base-Logistic-cv:	2.2500	0.0414
49	Sel-Trawl-Bycatch-male-base-Logistic-mean:	5.1352	0.0461
50	Sel-Trawl-Bycatch-male-base-Logistic-cv:	2.7948	0.0405

51	Sel-Bairdi-Fishery-Bycatch-male-base-Logistic-mean:	4.6501	0.2330
52	Sel-Bairdi-Fishery-Bycatch-male-base-Logistic-cv:	2.1662	0.3043
53	Sel-Fixed-Gear-male-base-Logistic-mean:	4.7894	0.0187
54	Sel-Fixed-Gear-male-base-Logistic-cv:	2.2970	0.0737
55	Sel-NMFS-Trawl-male-base-Logistic-mean:	4.0735	0.1944
56	Sel-NMFS-Trawl-male-base-Logistic-cv:	2.2473	0.4577
57	Sel-NMFS-Trawl-male-Logistic-mean-block-group-5-block-1:	4.0597	0.2604
58	Sel-NMFS-Trawl-male-Logistic-cv-block-group-5-block-1:	3.5060	0.3941
59	Sel-BSFRF-male-base-Logistic-mean:	4.4661	0.0246
60	Sel-BSFRF-male-base-Logistic-cv:	2.4960	0.0759
61	Sel-Pot-Fishery-female-base-Logistic-mean:	4.5855	0.0225
62	Sel-Pot-Fishery-female-base-Logistic-cv:	2.2823	0.0928
63	Sel-Bairdi-Fishery-Bycatch-female-base-Logistic-mean:	4.7254	0.0914
64	Sel-Bairdi-Fishery-Bycatch-female-base-Logistic-cv:	0.9024	0.3028
65	Ret-Pot-Fishery-male-base-Logistic-mean:	4.9242	0.0015
66	Ret-Pot-Fishery-male-base-Logistic-cv:	0.6916	0.0523
67	Ret-Pot-Fishery-male-Logistic-mean-block-group-6-block-1:	4.9327	0.0019
68	Ret-Pot-Fishery-male-Logistic-cv-block-group-6-block-1:	0.7319	0.0931
69	Log-fbar-Pot-Fishery:	-1.7938	0.0429
70	Log-fbar-Trawl-Bycatch:	-4.5200	0.0735
71	Log-fbar-Bairdi-Fishery-Bycatch:	-5.4319	0.2371
72	Log-fbar-Fixed-Gear:	-6.5872	0.0657
73	Log-fdev-Pot-Fishery-year-1975-season-3:	0.8629	0.0917
74	Log-fdev-Pot-Fishery-year-1976-season-3:	0.8415	0.0722
75	Log-fdev-Pot-Fishery-year-1977-season-3:	0.7848	0.0634
76	Log-fdev-Pot-Fishery-year-1978-season-3:	0.9095	0.0563
77	Log-fdev-Pot-Fishery-year-1979-season-3:	1.1485	0.0547
78	Log-fdev-Pot-Fishery-year-1980-season-3:	2.0410	0.0588
79	Log-fdev-Pot-Fishery-year-1981-season-3:	2.5569	0.1148
80	Log-fdev-Pot-Fishery-year-1982-season-3:	0.9893	0.1494
81	Log-fdev-Pot-Fishery-year-1983-season-3:	-8.6428	0.0997
82	Log-fdev-Pot-Fishery-year-1984-season-3:	1.5325	0.1000
83	Log-fdev-Pot-Fishery-year-1985-season-3:	1.5645	0.0915
84	Log-fdev-Pot-Fishery-year-1986-season-3:	1.6379	0.0782
85	Log-fdev-Pot-Fishery-year-1987-season-3:	1.1172	0.0670
86	Log-fdev-Pot-Fishery-year-1988-season-3:	0.1493	0.0548
87	Log-fdev-Pot-Fishery-year-1989-season-3:	0.2564	0.0488
88	Log-fdev-Pot-Fishery-year-1990-season-3:	0.9012	0.0400
89	Log-fdev-Pot-Fishery-year-1991-season-3:	0.9008	0.0432
90	Log-fdev-Pot-Fishery-year-1992-season-3:	0.3838	0.0476
91	Log-fdev-Pot-Fishery-year-1993-season-3:	1.0399	0.0516
92	Log-fdev-Pot-Fishery-year-1994-season-3:	-4.1198	0.0489
93	Log-fdev-Pot-Fishery-year-1995-season-3:	-4.5095	0.0423
94	Log-fdev-Pot-Fishery-year-1996-season-3:	-0.0161	0.0408
95	Log-fdev-Pot-Fishery-year-1997-season-3:	0.0491	0.0411
96	Log-fdev-Pot-Fishery-year-1998-season-3:	0.9675	0.0438
97	Log-fdev-Pot-Fishery-year-1999-season-3:	0.5824	0.0432
98	Log-fdev-Pot-Fishery-year-2000-season-3:	-0.0082	0.0416
99	Log-fdev-Pot-Fishery-year-2001-season-3:	-0.0739	0.0411
100	Log-fdev-Pot-Fishery-year-2002-season-3:	0.0432	0.0398
101	Log-fdev-Pot-Fishery-year-2003-season-3:	0.5041	0.0386
102	Log-fdev-Pot-Fishery-year-2004-season-3:	0.4612	0.0387
103	Log-fdev-Pot-Fishery-year-2005-season-3:	0.7421	0.0392

104	Log-fdev-Pot-Fishery-year-2006-season-3:	0.4869	0.0386
105	Log-fdev-Pot-Fishery-year-2007-season-3:	0.8538	0.0387
106	Log-fdev-Pot-Fishery-year-2008-season-3:	1.0261	0.0409
107	Log-fdev-Pot-Fishery-year-2009-season-3:	0.8179	0.0420
108	Log-fdev-Pot-Fishery-year-2010-season-3:	0.6710	0.0415
109	Log-fdev-Pot-Fishery-year-2011-season-3:	0.0344	0.0398
110	Log-fdev-Pot-Fishery-year-2012-season-3:	-0.0317	0.0384
111	Log-fdev-Pot-Fishery-year-2013-season-3:	0.1660	0.0379
112	Log-fdev-Pot-Fishery-year-2014-season-3:	0.4944	0.0379
113	Log-fdev-Pot-Fishery-year-2015-season-3:	0.5616	0.0391
114	Log-fdev-Pot-Fishery-year-2016-season-3:	0.5626	0.0424
115	Log-fdev-Pot-Fishery-year-2017-season-3:	0.4778	0.0480
116	Log-fdev-Pot-Fishery-year-2018-season-3:	0.3083	0.0544
117	Log-fdev-Pot-Fishery-year-2019-season-3:	0.2595	0.0590
118	Log-fdev-Pot-Fishery-year-2020-season-3:	-0.1751	0.0587
119	Log-fdev-Pot-Fishery-year-2021-season-3:	-4.6254	0.0559
120	Log-fdev-Pot-Fishery-year-2022-season-3:	-4.6872	0.0538
121	Log-fdev-Pot-Fishery-year-2023-season-3:	-0.9767	0.0555
122	Log-fdev-Pot-Fishery-year-2024-season-3:	-1.0094	0.0589
123	Log-fdev-Pot-Fishery-year-2025-season-3:	-0.8125	0.0631
124	Log-fdev-Trawl-Bycatch-year-1976-season-5:	0.2637	0.1130
125	Log-fdev-Trawl-Bycatch-year-1977-season-5:	0.7320	0.1101
126	Log-fdev-Trawl-Bycatch-year-1978-season-5:	0.7417	0.1084
127	Log-fdev-Trawl-Bycatch-year-1979-season-5:	0.8437	0.1094
128	Log-fdev-Trawl-Bycatch-year-1980-season-5:	1.5839	0.1131
129	Log-fdev-Trawl-Bycatch-year-1981-season-5:	1.3388	0.1254
130	Log-fdev-Trawl-Bycatch-year-1982-season-5:	2.6390	0.1217
131	Log-fdev-Trawl-Bycatch-year-1983-season-5:	2.4042	0.1125
132	Log-fdev-Trawl-Bycatch-year-1984-season-5:	3.6697	0.1123
133	Log-fdev-Trawl-Bycatch-year-1985-season-5:	2.4539	0.1122
134	Log-fdev-Trawl-Bycatch-year-1986-season-5:	1.3462	0.1127
135	Log-fdev-Trawl-Bycatch-year-1987-season-5:	0.8559	0.1101
136	Log-fdev-Trawl-Bycatch-year-1988-season-5:	1.6151	0.1055
137	Log-fdev-Trawl-Bycatch-year-1989-season-5:	0.1793	0.1043
138	Log-fdev-Trawl-Bycatch-year-1990-season-5:	0.6253	0.1043
139	Log-fdev-Trawl-Bycatch-year-1991-season-5:	1.0367	0.1058
140	Log-fdev-Trawl-Bycatch-year-1992-season-5:	0.8731	0.1059
141	Log-fdev-Trawl-Bycatch-year-1993-season-5:	1.3335	0.1085
142	Log-fdev-Trawl-Bycatch-year-1994-season-5:	-0.4230	0.1053
143	Log-fdev-Trawl-Bycatch-year-1995-season-5:	-0.6951	0.1037
144	Log-fdev-Trawl-Bycatch-year-1996-season-5:	-0.6137	0.1037
145	Log-fdev-Trawl-Bycatch-year-1997-season-5:	-1.0638	0.1036
146	Log-fdev-Trawl-Bycatch-year-1998-season-5:	0.2327	0.1042
147	Log-fdev-Trawl-Bycatch-year-1999-season-5:	-0.0611	0.1041
148	Log-fdev-Trawl-Bycatch-year-2000-season-5:	-0.8251	0.1034
149	Log-fdev-Trawl-Bycatch-year-2001-season-5:	-0.0481	0.1032
150	Log-fdev-Trawl-Bycatch-year-2002-season-5:	-0.3403	0.1028
151	Log-fdev-Trawl-Bycatch-year-2003-season-5:	-0.4376	0.1026
152	Log-fdev-Trawl-Bycatch-year-2004-season-5:	-0.2068	0.1026
153	Log-fdev-Trawl-Bycatch-year-2005-season-5:	-0.4869	0.1025
154	Log-fdev-Trawl-Bycatch-year-2006-season-5:	-0.3212	0.1022
155	Log-fdev-Trawl-Bycatch-year-2007-season-5:	-0.2504	0.1023
156	Log-fdev-Trawl-Bycatch-year-2008-season-5:	-0.2835	0.1028

157	Log-fdev-Trawl-Bycatch-year-2009-season-5:	-0.6513	0.1029
158	Log-fdev-Trawl-Bycatch-year-2010-season-5:	-0.8112	0.1028
159	Log-fdev-Trawl-Bycatch-year-2011-season-5:	-1.2723	0.1023
160	Log-fdev-Trawl-Bycatch-year-2012-season-5:	-1.7843	0.1022
161	Log-fdev-Trawl-Bycatch-year-2013-season-5:	-1.0599	0.1022
162	Log-fdev-Trawl-Bycatch-year-2014-season-5:	-1.6205	0.1023
163	Log-fdev-Trawl-Bycatch-year-2015-season-5:	-1.2368	0.1027
164	Log-fdev-Trawl-Bycatch-year-2016-season-5:	-0.7070	0.1035
165	Log-fdev-Trawl-Bycatch-year-2017-season-5:	-0.2640	0.1048
166	Log-fdev-Trawl-Bycatch-year-2018-season-5:	-0.3151	0.1061
167	Log-fdev-Trawl-Bycatch-year-2019-season-5:	-0.2752	0.1074
168	Log-fdev-Trawl-Bycatch-year-2020-season-5:	-0.2620	0.1080
169	Log-fdev-Trawl-Bycatch-year-2021-season-5:	-1.2212	0.1075
170	Log-fdev-Trawl-Bycatch-year-2022-season-5:	-2.1682	0.1080
171	Log-fdev-Trawl-Bycatch-year-2023-season-5:	-1.9261	0.1098
172	Log-fdev-Trawl-Bycatch-year-2024-season-5:	-1.3636	0.1119
173	Log-fdev-Trawl-Bycatch-year-2025-season-5:	-1.7729	0.1143
174	Log-fdev-Bairdi-Fishery-Bycatch-year-1975-season-5:	0.9201	0.0683
175	Log-fdev-Bairdi-Fishery-Bycatch-year-1976-season-5:	1.7060	0.0683
176	Log-fdev-Bairdi-Fishery-Bycatch-year-1977-season-5:	2.2644	0.0683
177	Log-fdev-Bairdi-Fishery-Bycatch-year-1978-season-5:	2.1291	0.0683
178	Log-fdev-Bairdi-Fishery-Bycatch-year-1979-season-5:	2.4190	0.0683
179	Log-fdev-Bairdi-Fishery-Bycatch-year-1980-season-5:	2.4611	0.0683
180	Log-fdev-Bairdi-Fishery-Bycatch-year-1981-season-5:	2.0296	0.0683
181	Log-fdev-Bairdi-Fishery-Bycatch-year-1982-season-5:	1.5132	0.0683
182	Log-fdev-Bairdi-Fishery-Bycatch-year-1983-season-5:	0.0493	0.0683
183	Log-fdev-Bairdi-Fishery-Bycatch-year-1984-season-5:	0.4578	0.0683
184	Log-fdev-Bairdi-Fishery-Bycatch-year-1987-season-5:	-0.0628	0.0683
185	Log-fdev-Bairdi-Fishery-Bycatch-year-1988-season-5:	0.7801	0.0683
186	Log-fdev-Bairdi-Fishery-Bycatch-year-1989-season-5:	1.9764	0.0683
187	Log-fdev-Bairdi-Fishery-Bycatch-year-1990-season-5:	2.4544	0.0683
188	Log-fdev-Bairdi-Fishery-Bycatch-year-1991-season-5:	2.8745	0.0811
189	Log-fdev-Bairdi-Fishery-Bycatch-year-1992-season-5:	0.8919	0.1096
190	Log-fdev-Bairdi-Fishery-Bycatch-year-1993-season-5:	0.1649	0.0962
191	Log-fdev-Bairdi-Fishery-Bycatch-year-1994-season-5:	-1.1143	0.0871
192	Log-fdev-Bairdi-Fishery-Bycatch-year-2006-season-5:	-2.4782	0.0736
193	Log-fdev-Bairdi-Fishery-Bycatch-year-2007-season-5:	-3.3639	0.1062
194	Log-fdev-Bairdi-Fishery-Bycatch-year-2008-season-5:	-2.8026	0.0985
195	Log-fdev-Bairdi-Fishery-Bycatch-year-2009-season-5:	-3.8785	0.0726
196	Log-fdev-Bairdi-Fishery-Bycatch-year-2013-season-5:	-1.1972	0.0859
197	Log-fdev-Bairdi-Fishery-Bycatch-year-2014-season-5:	-0.4637	0.1069
198	Log-fdev-Bairdi-Fishery-Bycatch-year-2015-season-5:	0.7286	0.1240
199	Log-fdev-Bairdi-Fishery-Bycatch-year-2024-season-5:	-6.5930	0.0880
200	Log-fdev-Bairdi-Fishery-Bycatch-year-2025-season-5:	-3.8662	0.0940
201	Log-fdev-Fixed-Gear-year-1996-season-5:	0.5467	0.1033
202	Log-fdev-Fixed-Gear-year-1997-season-5:	-0.1112	0.1026
203	Log-fdev-Fixed-Gear-year-1998-season-5:	-0.3422	0.1033
204	Log-fdev-Fixed-Gear-year-1999-season-5:	0.5713	0.1026
205	Log-fdev-Fixed-Gear-year-2000-season-5:	-1.8508	0.1020
206	Log-fdev-Fixed-Gear-year-2001-season-5:	0.1095	0.1016
207	Log-fdev-Fixed-Gear-year-2002-season-5:	-0.1471	0.1012
208	Log-fdev-Fixed-Gear-year-2003-season-5:	-0.9825	0.1011
209	Log-fdev-Fixed-Gear-year-2004-season-5:	-0.8092	0.1009

210	Log-fdev-Fixed-Gear-year-2005-season-5:	-0.5427	0.1008
211	Log-fdev-Fixed-Gear-year-2006-season-5:	-0.5892	0.1006
212	Log-fdev-Fixed-Gear-year-2007-season-5:	-0.0474	0.1006
213	Log-fdev-Fixed-Gear-year-2008-season-5:	-0.7563	0.1009
214	Log-fdev-Fixed-Gear-year-2009-season-5:	-1.7614	0.1007
215	Log-fdev-Fixed-Gear-year-2010-season-5:	-2.6014	0.1003
216	Log-fdev-Fixed-Gear-year-2011-season-5:	-1.1135	0.0999
217	Log-fdev-Fixed-Gear-year-2012-season-5:	-0.5475	0.0998
218	Log-fdev-Fixed-Gear-year-2013-season-5:	0.5996	0.0996
219	Log-fdev-Fixed-Gear-year-2014-season-5:	1.4531	0.0996
220	Log-fdev-Fixed-Gear-year-2015-season-5:	1.1416	0.0998
221	Log-fdev-Fixed-Gear-year-2016-season-5:	0.2468	0.1002
222	Log-fdev-Fixed-Gear-year-2017-season-5:	1.5252	0.1009
223	Log-fdev-Fixed-Gear-year-2018-season-5:	1.9208	0.1014
224	Log-fdev-Fixed-Gear-year-2019-season-5:	1.0663	0.1021
225	Log-fdev-Fixed-Gear-year-2020-season-5:	0.0197	0.1027
226	Log-fdev-Fixed-Gear-year-2021-season-5:	1.1298	0.1029
227	Log-fdev-Fixed-Gear-year-2022-season-5:	1.1447	0.1038
228	Log-fdev-Fixed-Gear-year-2023-season-5:	0.7247	0.1053
229	Log-fdev-Fixed-Gear-year-2024-season-5:	-0.0655	0.1068
230	Log-fdev-Fixed-Gear-year-2025-season-5:	0.0681	0.1088
231	Log-foff-Pot-Fishery:	-2.7199	0.0510
232	Log-foff-Bairdi-Fishery-Bycatch:	-1.4974	0.4117
233	Log-fdov-Pot-Fishery-year-1990-season-3:	1.9560	0.0852
234	Log-fdov-Pot-Fishery-year-1991-season-3:	-0.7033	0.0844
235	Log-fdov-Pot-Fishery-year-1992-season-3:	1.9740	0.0860
236	Log-fdov-Pot-Fishery-year-1993-season-3:	1.7997	0.0871
237	Log-fdov-Pot-Fishery-year-1994-season-3:	-0.4337	0.0853
238	Log-fdov-Pot-Fishery-year-1995-season-3:	-0.2292	0.0827
239	Log-fdov-Pot-Fishery-year-1996-season-3:	-3.7547	0.0818
240	Log-fdov-Pot-Fishery-year-1997-season-3:	-0.3552	0.0827
241	Log-fdov-Pot-Fishery-year-1998-season-3:	1.3984	0.0835
242	Log-fdov-Pot-Fishery-year-1999-season-3:	-2.8144	0.0824
243	Log-fdov-Pot-Fishery-year-2000-season-3:	1.1096	0.0814
244	Log-fdov-Pot-Fishery-year-2001-season-3:	0.8253	0.0812
245	Log-fdov-Pot-Fishery-year-2002-season-3:	-1.9322	0.0806
246	Log-fdov-Pot-Fishery-year-2003-season-3:	1.1717	0.0805
247	Log-fdov-Pot-Fishery-year-2004-season-3:	0.3837	0.0808
248	Log-fdov-Pot-Fishery-year-2005-season-3:	0.8981	0.0804
249	Log-fdov-Pot-Fishery-year-2006-season-3:	-1.2844	0.0798
250	Log-fdov-Pot-Fishery-year-2007-season-3:	-0.2369	0.0799
251	Log-fdov-Pot-Fishery-year-2008-season-3:	-0.5056	0.0804
252	Log-fdov-Pot-Fishery-year-2009-season-3:	-0.7628	0.0805
253	Log-fdov-Pot-Fishery-year-2010-season-3:	-0.2689	0.0802
254	Log-fdov-Pot-Fishery-year-2011-season-3:	-1.1469	0.0793
255	Log-fdov-Pot-Fishery-year-2012-season-3:	-1.8567	0.0787
256	Log-fdov-Pot-Fishery-year-2013-season-3:	0.1668	0.0786
257	Log-fdov-Pot-Fishery-year-2014-season-3:	-0.2414	0.0786
258	Log-fdov-Pot-Fishery-year-2015-season-3:	0.8255	0.0790
259	Log-fdov-Pot-Fishery-year-2016-season-3:	0.2762	0.0803
260	Log-fdov-Pot-Fishery-year-2017-season-3:	-0.3769	0.0823
261	Log-fdov-Pot-Fishery-year-2018-season-3:	0.9292	0.0848
262	Log-fdov-Pot-Fishery-year-2019-season-3:	-0.1566	0.0865

263	Log-fdov-Pot-Fishery-year-2020-season-3:	-0.6835	0.0857
264	Log-fdov-Pot-Fishery-year-2021-season-3:	2.9013	0.0844
265	Log-fdov-Pot-Fishery-year-2022-season-3:	1.2039	0.0838
266	Log-fdov-Pot-Fishery-year-2023-season-3:	0.1610	0.0844
267	Log-fdov-Pot-Fishery-year-2024-season-3:	-1.6301	0.0854
268	Log-fdov-Pot-Fishery-year-2025-season-3:	1.3885	0.0876
269	Log-fdov-Bairdi-Fishery-Bycatch-year-1975-season-5:	0.0001	0.0964
270	Log-fdov-Bairdi-Fishery-Bycatch-year-1976-season-5:	0.0005	0.0964
271	Log-fdov-Bairdi-Fishery-Bycatch-year-1977-season-5:	0.0008	0.0964
272	Log-fdov-Bairdi-Fishery-Bycatch-year-1978-season-5:	0.0004	0.0965
273	Log-fdov-Bairdi-Fishery-Bycatch-year-1979-season-5:	0.0005	0.0965
274	Log-fdov-Bairdi-Fishery-Bycatch-year-1980-season-5:	-0.0002	0.0965
275	Log-fdov-Bairdi-Fishery-Bycatch-year-1981-season-5:	-0.0004	0.0965
276	Log-fdov-Bairdi-Fishery-Bycatch-year-1982-season-5:	-0.0003	0.0965
277	Log-fdov-Bairdi-Fishery-Bycatch-year-1983-season-5:	-0.0002	0.0965
278	Log-fdov-Bairdi-Fishery-Bycatch-year-1984-season-5:	0.0000	0.0964
279	Log-fdov-Bairdi-Fishery-Bycatch-year-1987-season-5:	-0.0001	0.0965
280	Log-fdov-Bairdi-Fishery-Bycatch-year-1988-season-5:	0.0003	0.0964
281	Log-fdov-Bairdi-Fishery-Bycatch-year-1989-season-5:	0.0006	0.0964
282	Log-fdov-Bairdi-Fishery-Bycatch-year-1990-season-5:	0.0011	0.0965
283	Log-fdov-Bairdi-Fishery-Bycatch-year-1991-season-5:	2.9124	0.1417
284	Log-fdov-Bairdi-Fishery-Bycatch-year-1992-season-5:	3.2340	0.1319
285	Log-fdov-Bairdi-Fishery-Bycatch-year-1993-season-5:	2.0386	0.1201
286	Log-fdov-Bairdi-Fishery-Bycatch-year-1994-season-5:	-2.0385	0.1136
287	Log-fdov-Bairdi-Fishery-Bycatch-year-2006-season-5:	-0.8039	0.1641
288	Log-fdov-Bairdi-Fishery-Bycatch-year-2007-season-5:	0.6058	0.1327
289	Log-fdov-Bairdi-Fishery-Bycatch-year-2008-season-5:	1.4517	0.1216
290	Log-fdov-Bairdi-Fishery-Bycatch-year-2009-season-5:	1.7917	0.1017
291	Log-fdov-Bairdi-Fishery-Bycatch-year-2013-season-5:	2.3695	0.1576
292	Log-fdov-Bairdi-Fishery-Bycatch-year-2014-season-5:	1.5816	0.1473
293	Log-fdov-Bairdi-Fishery-Bycatch-year-2015-season-5:	2.3104	0.1679
294	Log-fdov-Bairdi-Fishery-Bycatch-year-2024-season-5:	-6.3648	0.1112
295	Log-fdov-Bairdi-Fishery-Bycatch-year-2025-season-5:	-9.0916	0.1160
296	Rec-dev-est-1975:	0.9213	0.2817
297	Rec-dev-est-1976:	0.5219	0.3051
298	Rec-dev-est-1977:	0.9618	0.2403
299	Rec-dev-est-1978:	1.5739	0.2023
300	Rec-dev-est-1979:	1.8446	0.2119
301	Rec-dev-est-1980:	1.0251	0.2571
302	Rec-dev-est-1981:	2.3972	0.1586
303	Rec-dev-est-1982:	1.4234	0.1754
304	Rec-dev-est-1983:	1.0146	0.1610
305	Rec-dev-est-1984:	-0.7818	0.2445
306	Rec-dev-est-1985:	0.2592	0.1585
307	Rec-dev-est-1986:	-0.8443	0.2383
308	Rec-dev-est-1987:	-1.2736	0.2723
309	Rec-dev-est-1988:	-1.0651	0.2278
310	Rec-dev-est-1989:	-0.0901	0.1596
311	Rec-dev-est-1990:	-0.5276	0.1831
312	Rec-dev-est-1991:	-1.8865	0.3444
313	Rec-dev-est-1992:	-0.9119	0.1932
314	Rec-dev-est-1993:	-2.1118	0.4029
315	Rec-dev-est-1994:	0.9326	0.1396

316	Rec-dev-est-1995:	-0.8628	0.2486
317	Rec-dev-est-1996:	-1.5995	0.3355
318	Rec-dev-est-1997:	-0.6403	0.1995
319	Rec-dev-est-1998:	0.4043	0.1493
320	Rec-dev-est-1999:	-0.5409	0.2182
321	Rec-dev-est-2000:	-0.6651	0.2571
322	Rec-dev-est-2001:	0.8190	0.1484
323	Rec-dev-est-2002:	-0.6737	0.2674
324	Rec-dev-est-2003:	-0.6893	0.2597
325	Rec-dev-est-2004:	0.5306	0.1518
326	Rec-dev-est-2005:	-0.1170	0.1756
327	Rec-dev-est-2006:	-0.5205	0.1842
328	Rec-dev-est-2007:	-1.0665	0.2285
329	Rec-dev-est-2008:	-0.9687	0.2314
330	Rec-dev-est-2009:	-0.1235	0.1733
331	Rec-dev-est-2010:	-0.5897	0.2188
332	Rec-dev-est-2011:	-1.0462	0.2201
333	Rec-dev-est-2012:	-1.4880	0.2280
334	Rec-dev-est-2013:	-1.9151	0.2638
335	Rec-dev-est-2014:	-1.4628	0.2228
336	Rec-dev-est-2015:	-0.7726	0.1648
337	Rec-dev-est-2016:	-1.5400	0.2360
338	Rec-dev-est-2017:	-0.8374	0.1796
339	Rec-dev-est-2018:	-1.4636	0.2526
340	Rec-dev-est-2019:	-1.2540	0.2184
341	Rec-dev-est-2020:	-1.4306	0.2377
342	Rec-dev-est-2021:	-0.5701	0.1701
343	Rec-dev-est-2022:	-0.7873	0.1919
344	Rec-dev-est-2023:	-1.2716	0.2540
345	Rec-dev-est-2024:	-0.1548	0.1954
346	Rec-dev-est-2025:	-0.9530	0.3549
347	Logit-rec-prop-est-1975:	0.0296	0.4828
348	Logit-rec-prop-est-1976:	-0.8126	0.5468
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358	Logit-rec-prop-est-1986:	0.3166	0.4464
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365	Logit-rec-prop-est-1993:	-1.3046	1.0071
366	Logit-rec-prop-est-1994:	-0.3088	0.0899
367	Logit-rec-prop-est-1995:	1.4035	0.7267
368	Logit-rec-prop-est-1996:	0.1705	0.6925

369	Logit-rec-prop-est-1997:	0.5483	0.3599
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372	Logit-rec-prop-est-2000:	-0.7380	0.4687
373	Logit-rec-prop-est-2001:	-0.4703	0.1301
374	Logit-rec-prop-est-2002:	-0.4396	0.4681
375	Logit-rec-prop-est-2003:	-0.1316	0.4511
376	Logit-rec-prop-est-2004:	-0.4187	0.1482
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379	Logit-rec-prop-est-2007:	-0.1800	0.3801
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381	Logit-rec-prop-est-2009:	-0.6352	0.2091
382	Logit-rec-prop-est-2010:	-0.3127	0.3288
383	Logit-rec-prop-est-2011:	-0.7089	0.3632
384	Logit-rec-prop-est-2012:	-0.0655	0.3897
385	Logit-rec-prop-est-2013:	-0.4772	0.4898
386	Logit-rec-prop-est-2014:	-0.4086	0.3578
387	Logit-rec-prop-est-2015:	0.2408	0.2107
388	Logit-rec-prop-est-2016:	0.4234	0.4416
389	Logit-rec-prop-est-2017:	0.6278	0.2822
390	Logit-rec-prop-est-2018:	-0.2222	0.4568
391	Logit-rec-prop-est-2019:	0.4807	0.3990
392	Logit-rec-prop-est-2020:	0.3338	0.4354
393	Logit-rec-prop-est-2021:	-0.0238	0.2061
394	Logit-rec-prop-est-2022:	-0.3023	0.2717
395	Logit-rec-prop-est-2023:	0.0825	0.4368
396	Logit-rec-prop-est-2024:	0.2252	0.2797
397	Logit-rec-prop-est-2025:	0.3083	0.6577
398	Survey-q-survey-1:	0.9242	0.0258
399	Log-add-cvt-survey-2:	-1.0278	0.2885

Table 23: Annual abundance estimates (mature males, legal males, and mature females in million crab), mature male biomass (MMB, 1000 t), and total survey biomass (1000 t) both estimated by the model and area swept calculated for red king crab in Bristol Bay estimated by length-based model 26.0 during 1975-2026. MMB for year t is on Feb. 15, year t+1.

	Males				Females	Total	Total Survey Biomass	
Year	Mature >119mm	Legal >134mm	MMB >119mm	sd MMB	Mature >89mm	Recruits	Model Est >64mm	Area-Swept >64mm
1975	64.236	31.988	92.860	6.297	67.118		253.270	199.640
1976	74.803	39.426	107.669	6.142	104.160	94.337	293.930	327.610
1977	83.618	45.254	121.650	5.743	138.417	54.632	314.780	371.220
1978	89.019	50.979	128.207	4.853	140.906	89.063	314.560	343.190
1979	76.531	51.552	105.293	3.997	132.220	163.670	299.380	165.450
1980	55.741	40.601	27.102	1.503	133.662	225.835	284.380	247.230
1981	15.874	8.526	5.783	0.891	59.731	100.445	114.340	131.140
1982	7.464	2.298	5.537	0.667	26.444	363.217	66.830	141.900
1983	6.543	2.202	5.959	0.460	18.235	138.642	58.910	48.480
1984	6.676	2.217	4.254	0.359	18.074	91.846	50.900	152.610
1985	8.122	1.886	9.611	0.693	12.457	14.927	34.140	34.140
1986	13.379	4.981	15.753	1.088	17.130	43.109	45.720	47.430
1987	16.274	7.482	22.120	1.354	21.618	14.918	52.770	69.240
1988	16.571	9.697	27.238	1.437	27.319	9.385	57.240	54.600
1989	17.815	11.069	30.160	1.403	25.462	11.185	60.180	55.140
1990	17.149	11.775	26.269	1.342	22.508	30.671	59.850	59.450
1991	13.137	9.840	20.453	1.257	21.993	21.981	54.760	83.890
1992	10.739	7.435	19.035	1.211	23.972	5.136	50.970	37.330
1993	12.477	7.095	18.324	1.327	22.305	12.456	51.260	52.910
1994	13.067	7.355	25.162	1.478	18.789	3.853	47.350	32.100
1995	13.429	9.675	28.297	1.452	17.092	79.263	52.530	38.070
1996	13.155	10.169	26.058	1.338	25.234	16.719	60.650	43.960
1997	12.103	9.004	23.900	1.271	36.324	7.254	66.760	84.030
1998	18.037	8.689	27.075	1.545	31.417	15.803	71.020	84.100
1999	19.789	11.150	31.784	1.735	26.138	48.652	70.060	64.750
2000	17.178	12.446	31.978	1.693	28.171	20.214	71.730	67.380
2001	16.693	11.756	31.836	1.624	32.713	16.012	75.280	52.460
2002	19.901	11.783	35.926	1.670	31.373	69.842	79.860	69.090
2003	20.798	13.648	35.644	1.644	38.053	18.931	85.370	115.760
2004	18.526	13.203	32.679	1.536	46.864	16.034	86.950	130.560
2005	20.671	12.147	33.410	1.535	43.302	53.588	87.780	105.730
2006	19.583	12.939	33.596	1.494	43.710	30.296	87.630	94.480
2007	17.565	12.505	28.380	1.386	48.684	19.513	89.400	103.330
2008	18.283	10.684	27.420	1.443	45.817	12.048	86.620	113.080
2009	18.468	10.901	28.918	1.545	39.693	12.157	81.400	90.550
2010	17.496	11.383	28.719	1.539	34.559	27.079	76.370	80.500
2011	15.005	10.929	28.310	1.435	33.299	19.431	71.340	66.410
2012	13.211	10.193	26.160	1.294	34.560	11.451	68.930	60.700
2013	12.991	9.163	24.731	1.195	33.025	7.644	65.670	62.220
2014	12.588	8.784	22.542	1.111	29.199	5.067	60.450	113.140
2015	10.697	8.016	19.152	1.017	24.616	7.983	53.190	64.170
2016	8.610	6.684	15.678	0.938	20.924	15.835	46.140	60.960
2017	6.791	5.372	12.726	0.870	19.334	7.401	41.040	52.930
2018	5.966	4.309	11.289	0.844	17.966	14.005	38.240	28.800
2019	7.056	4.021	12.511	0.953	16.107	7.910	37.230	28.540
2020	7.800	4.761	14.406	1.081	15.169	9.374		

2021	8.940	5.487	17.999	1.203	14.121	7.814	37.440	28.480
2022	9.563	6.729	20.310	1.267	12.980	18.593	39.020	36.200
2023	9.897	7.260	20.827	1.304	13.448	15.185	41.040	37.970
2024	9.978	7.282	21.240	1.358	15.790	9.243	42.480	46.130
2025	10.978	7.405	22.598	1.504	16.538	28.475	44.620	49.070
2026	11.524	8.014	18.766	1.063	17.453	13.127	47.340	67.050

Table 24: Annual abundance estimates (mature males, legal males, and mature females in million crab), mature male biomass (MMB, 1000 t), and total survey biomass (1000 t) both estimated by the model and area swept calculated for red king crab in Bristol Bay estimated by length-based model 24.0c.2 during 1975-2026. MMB for year t is on Feb. 15, year t+1.

	Males				Females	Total	Total Survey Biomass	
Year	Mature >119mm	Legal >134mm	MMB >119mm	sd MMB	Mature >89mm	Recruits	Model Est >64mm	Area-Swept >64mm
1975	67.841	33.747	98.797	6.813	66.373		265.100	199.640
1976	77.765	41.644	114.366	6.327	98.444	79.201	304.670	327.610
1977	84.357	47.126	125.892	5.527	130.772	53.121	323.100	371.220
1978	88.392	51.431	129.773	4.729	133.978	82.474	320.520	343.190
1979	76.270	51.208	106.100	3.906	126.036	152.094	304.070	165.450
1980	55.561	40.276	27.419	1.458	126.832	199.395	287.630	247.230
1981	15.881	8.563	6.030	0.841	57.319	87.858	115.780	131.140
1982	7.479	2.358	5.656	0.626	25.696	346.482	65.090	141.900
1983	6.265	2.202	5.803	0.450	17.760	130.848	57.540	48.480
1984	6.412	2.122	4.065	0.333	17.959	86.941	49.890	152.610
1985	7.855	1.819	9.224	0.646	12.359	14.423	33.660	34.140
1986	12.954	4.731	15.003	1.020	16.903	40.849	44.940	47.430
1987	15.718	7.069	21.051	1.283	21.031	13.550	51.650	69.240
1988	16.033	9.156	26.094	1.368	26.282	8.820	55.910	54.600
1989	17.341	10.581	29.124	1.339	24.462	10.865	58.890	55.140
1990	16.632	11.318	25.226	1.275	21.651	28.805	58.700	59.450
1991	12.730	9.396	19.556	1.192	21.088	18.597	53.500	83.890
1992	10.426	7.104	18.304	1.150	22.847	4.779	49.340	37.330
1993	11.953	6.818	17.356	1.242	21.302	12.664	49.180	52.910
1994	11.939	6.877	23.268	1.357	18.102	3.815	44.970	32.100
1995	12.207	8.782	25.960	1.324	16.723	80.098	50.430	38.070
1996	12.217	9.241	23.977	1.232	25.025	13.301	59.070	43.960
1997	11.539	8.263	22.388	1.189	36.445	6.367	65.400	84.030
1998	17.593	8.253	25.920	1.468	31.439	16.616	69.660	84.100
1999	18.890	10.636	30.078	1.644	26.330	47.225	68.670	64.750
2000	16.159	11.650	29.940	1.604	28.352	18.353	70.440	67.380
2001	15.956	10.969	30.141	1.551	32.632	16.208	74.130	52.460
2002	19.213	11.180	34.430	1.598	31.360	71.493	79.070	69.090
2003	20.031	13.015	34.070	1.569	38.696	16.070	85.040	115.760
2004	17.904	12.545	31.284	1.468	47.900	15.822	86.870	130.560
2005	20.178	11.649	32.300	1.474	43.892	53.586	87.930	105.730
2006	19.097	12.449	32.551	1.438	44.468	28.042	87.960	94.480
2007	17.128	12.056	27.431	1.342	49.493	18.730	89.780	103.330
2008	17.786	10.315	26.439	1.401	46.260	10.850	86.820	113.080
2009	17.907	10.445	27.813	1.486	40.126	11.964	81.380	90.550
2010	16.867	10.872	27.472	1.461	34.969	27.859	76.350	80.500
2011	14.335	10.378	26.969	1.357	34.022	17.478	71.450	66.410
2012	12.642	9.650	24.946	1.227	35.308	11.072	69.160	60.700
2013	12.513	8.713	23.702	1.140	33.207	7.118	65.940	62.220
2014	12.217	8.389	21.708	1.068	29.357	4.644	60.750	113.140
2015	10.417	7.693	18.495	0.986	24.758	7.300	53.490	64.170
2016	8.368	6.440	15.140	0.916	21.008	14.556	46.340	60.960
2017	6.540	5.168	12.210	0.853	19.249	6.757	41.030	52.930
2018	5.690	4.111	10.747	0.822	17.816	13.643	37.950	28.800
2019	6.568	3.797	11.667	0.900	15.893	7.294	36.690	28.540
2020	7.262	4.373	13.374	1.006	14.924	8.995		

2021	8.466	5.067	16.995	1.130	13.893	7.539	36.690	28.480
2022	9.144	6.322	19.388	1.201	12.793	17.824	38.360	36.200
2023	9.511	6.905	19.997	1.243	13.210	14.345	40.470	37.970
2024	9.649	6.962	20.536	1.303	15.430	8.838	41.930	46.130
2025	10.641	7.131	21.942	1.449	16.157	27.001	44.070	49.070
2026	11.183	7.722	18.398	1.036	17.051	12.153	46.710	67.050

Figures

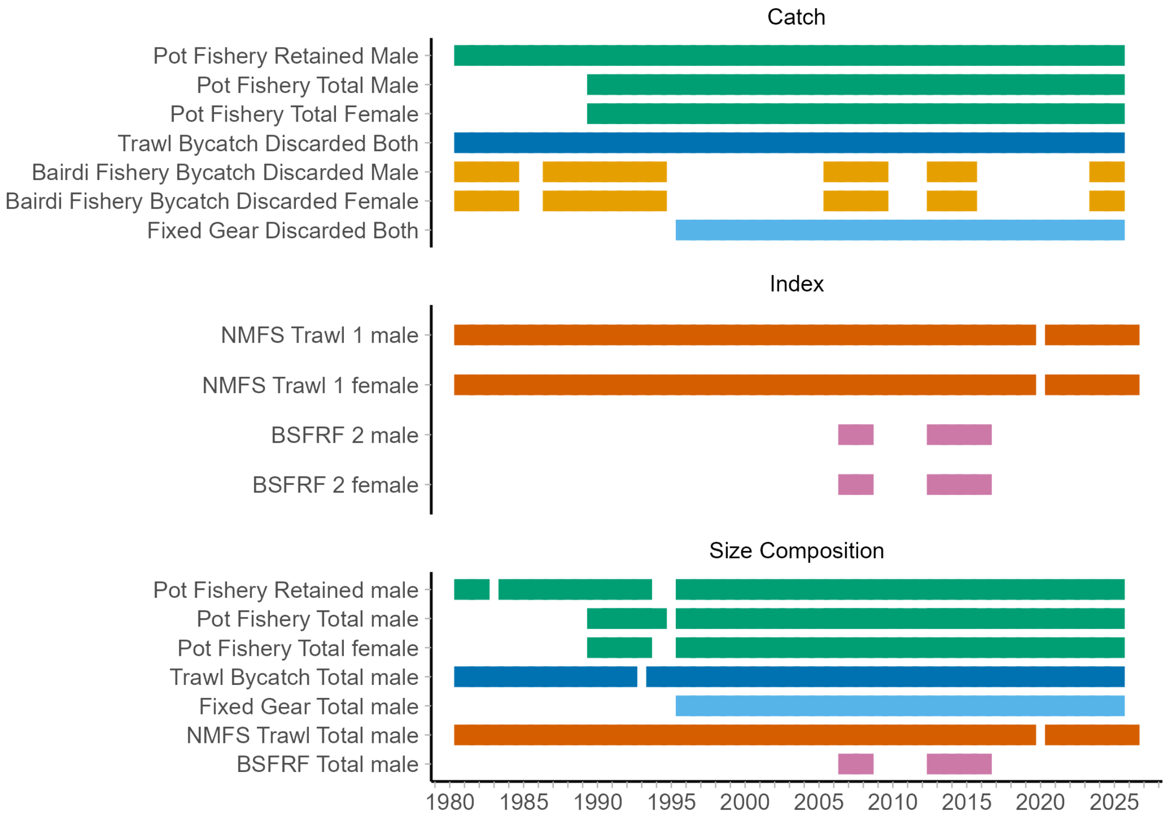

Figure 3: Data types and ranges used for the BBRKC stock assessment.

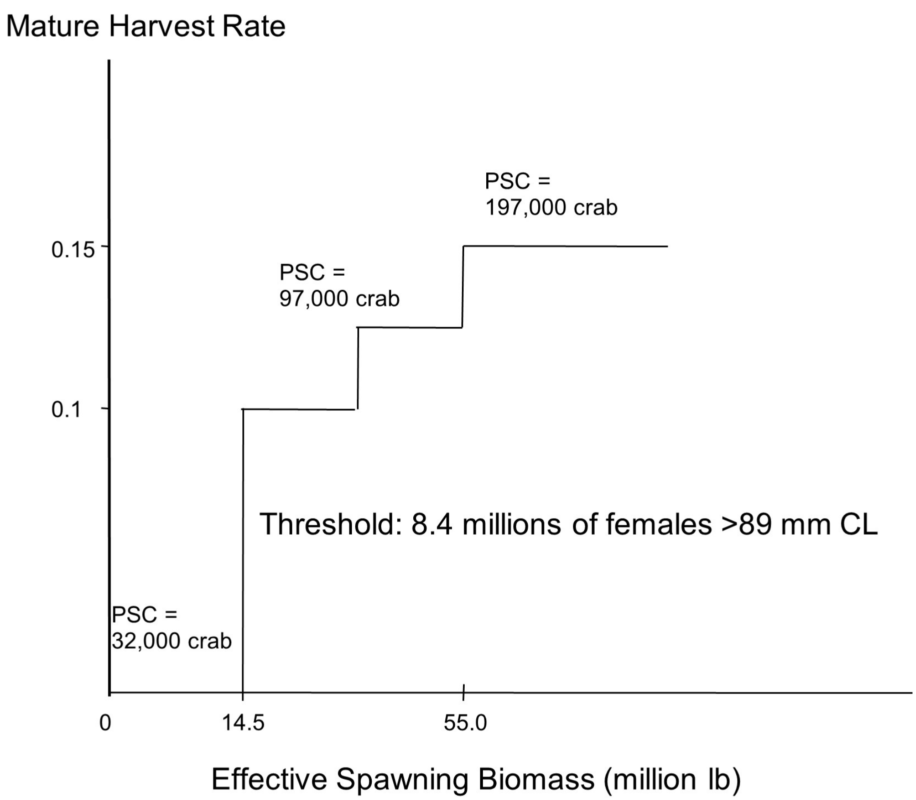

Figure 4: Current harvest rate strategy (line) for the Bristol Bay red king crab fishery and the associated annual prohibited species catch (PSC) limits (numbers of crab) of Bristol Bay red king crab in the groundfish fisheries in zone 1 in the eastern Bering Sea. Harvest rates are based on current-year estimates of effective spawning biomass (ESB, Zheng et al. 1995b), whereas PSC limits apply to previous-year ESB (Effective Spawning Biomass).

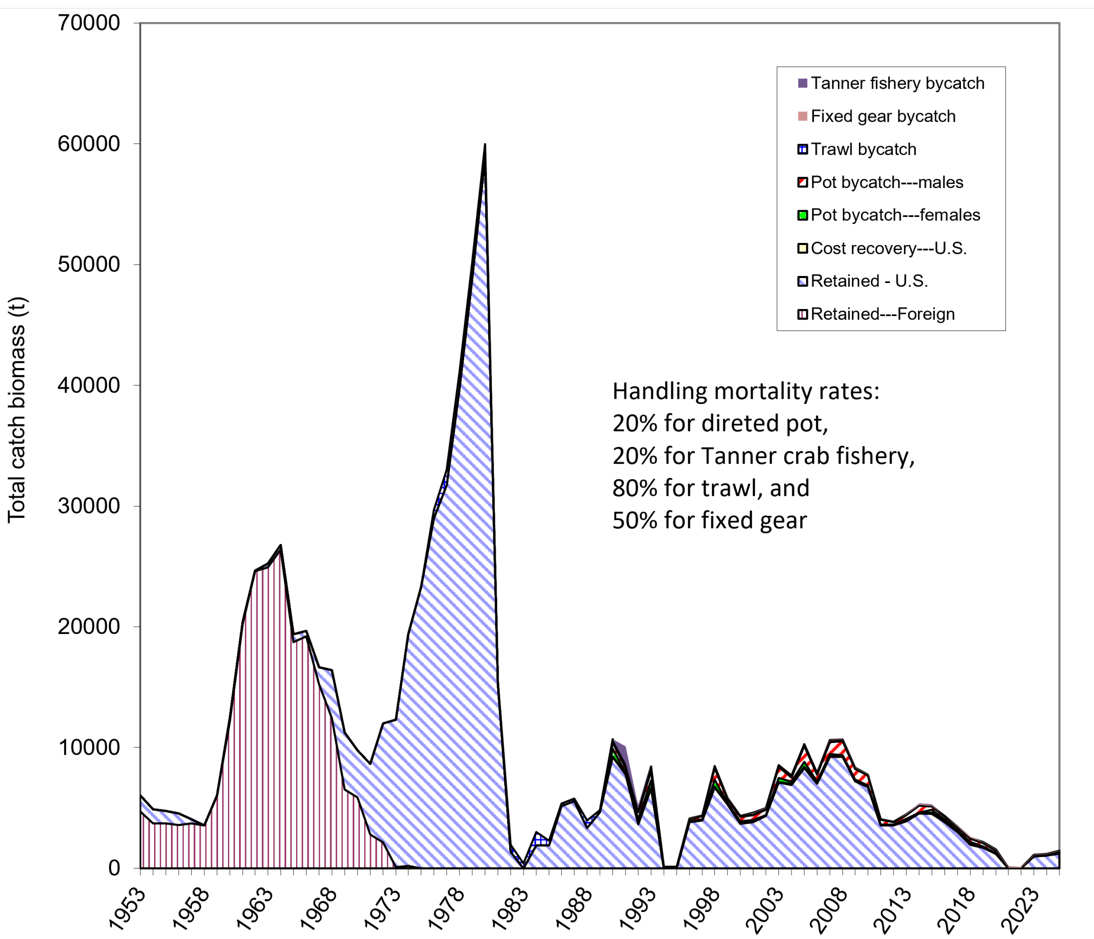

Figure 5: Retained catch biomass and bycatch mortality biomass (t) for Bristol Bay red king crab from 1953 to 2024. Directed pot bycatch data were not available from the observer program before 1990 and are not included in this figure.

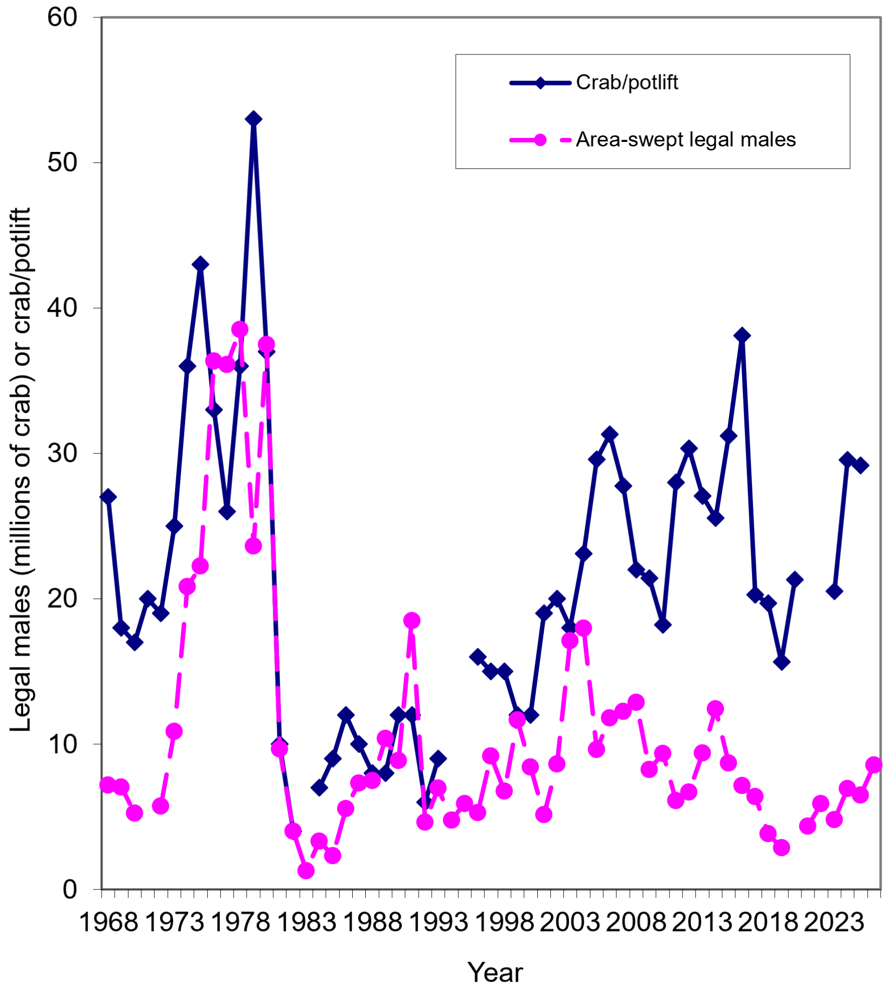

Figure 6: Comparison of survey legal male abundances and catches per unit effort for Bristol Bay red king crab from 1968 to 2024.

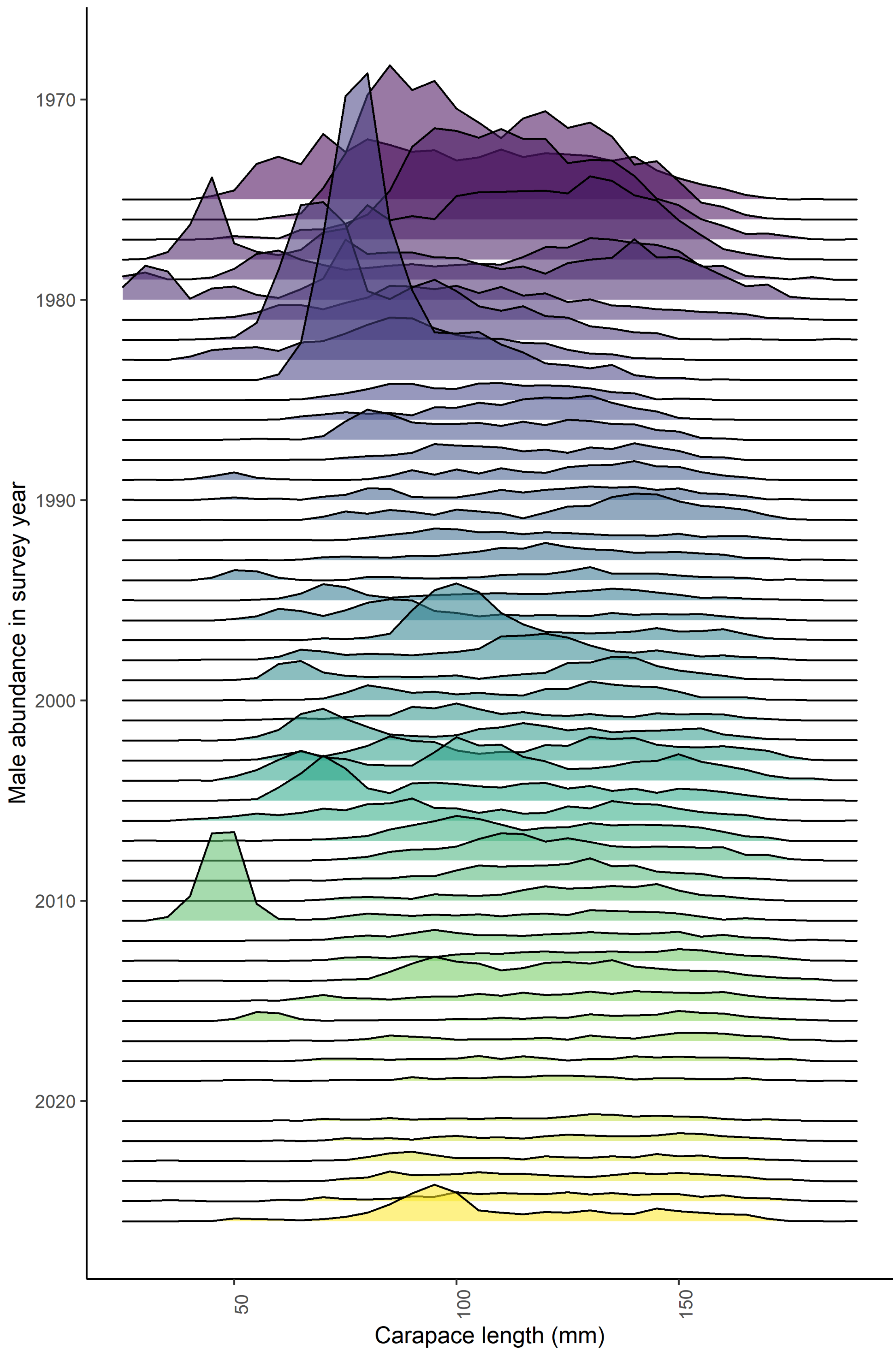

Figure 7: Survey abundances by 5-mm carapace length bin for male Bristol Bay red king crab from 1975 to 2025.

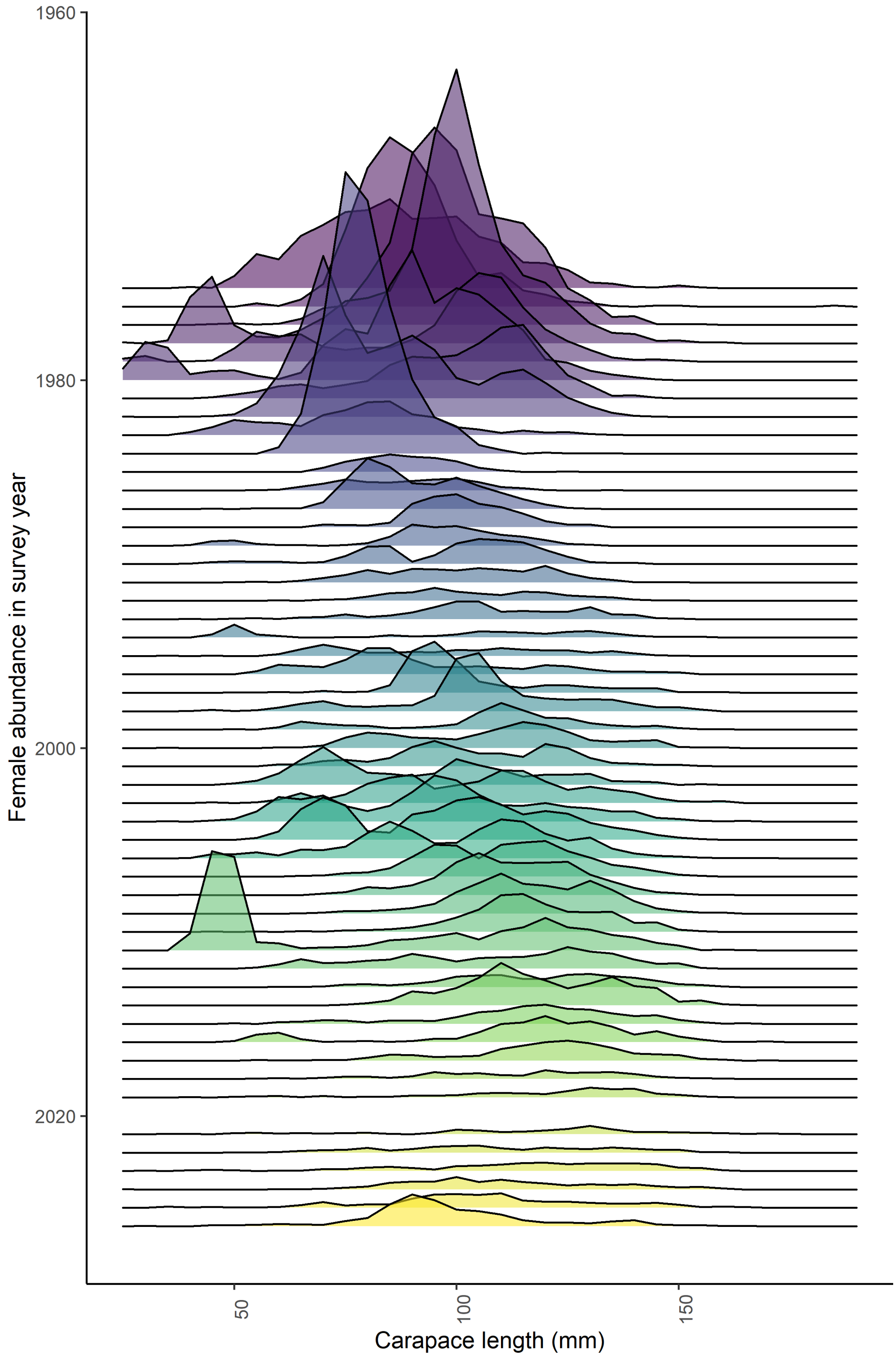

Figure 8: Survey abundances by 5-mm carapace length bin for female Bristol Bay red king crab from 1975 to 2025.

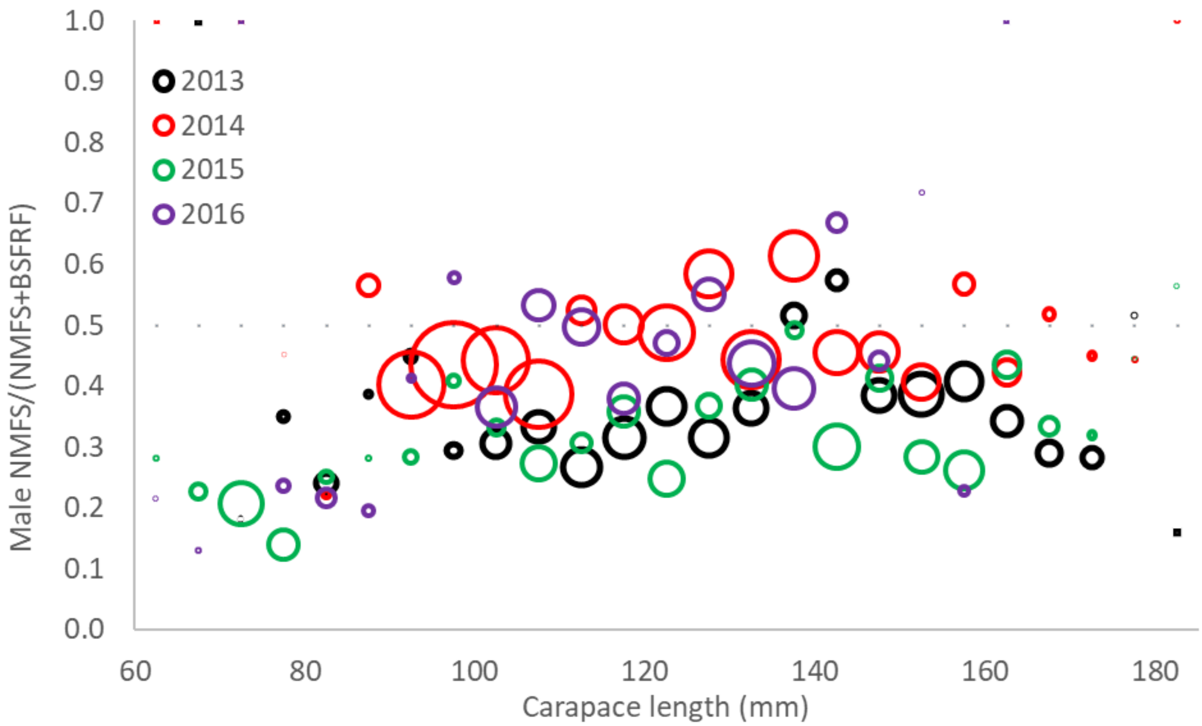

Figure 9: Comparison of NMFS survey abundance proportions of total NMFS and BSFRF side-by-side trawl surveys during 2013-2016 for male Bristol Bay red king crab. Sizes of circles are proportional to total abundances.

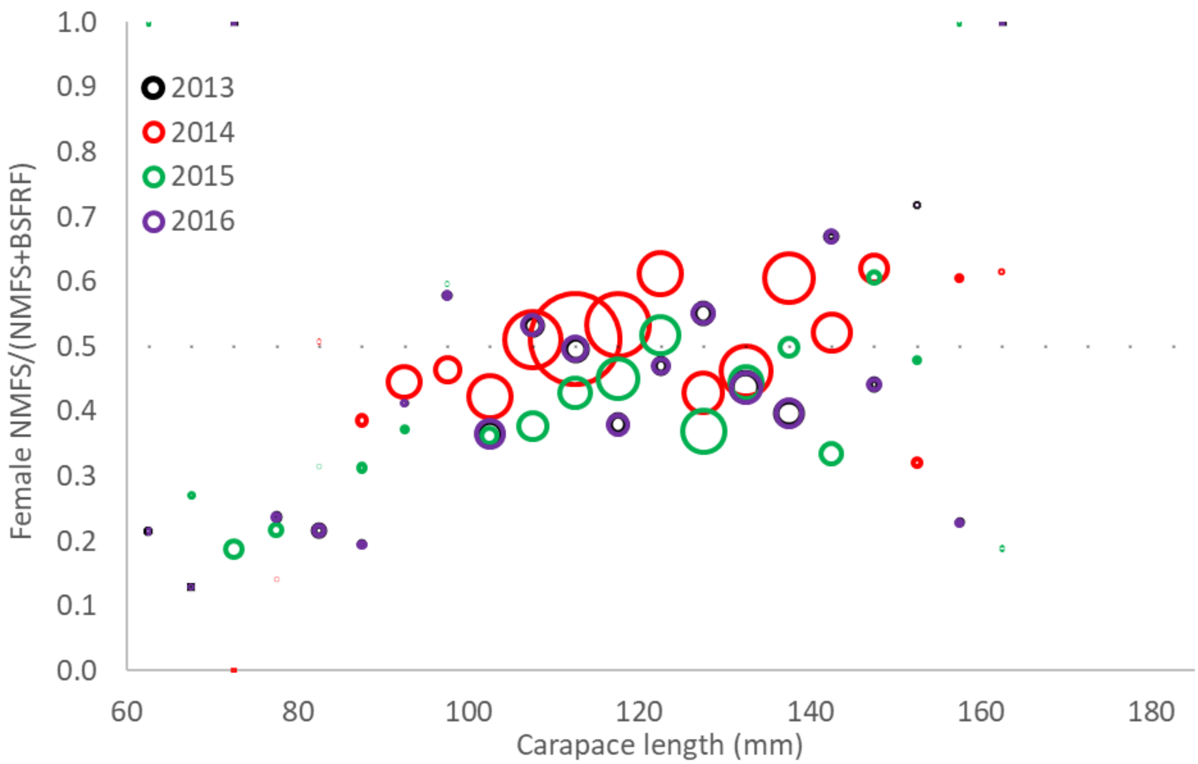

Figure 10: Comparison of NMFS survey abundance proportions of total NMFS and BSFRF side-by-side trawl surveys during 2013-2016 for female Bristol Bay red king crab. Sizes of circles are proportional to total abundances.

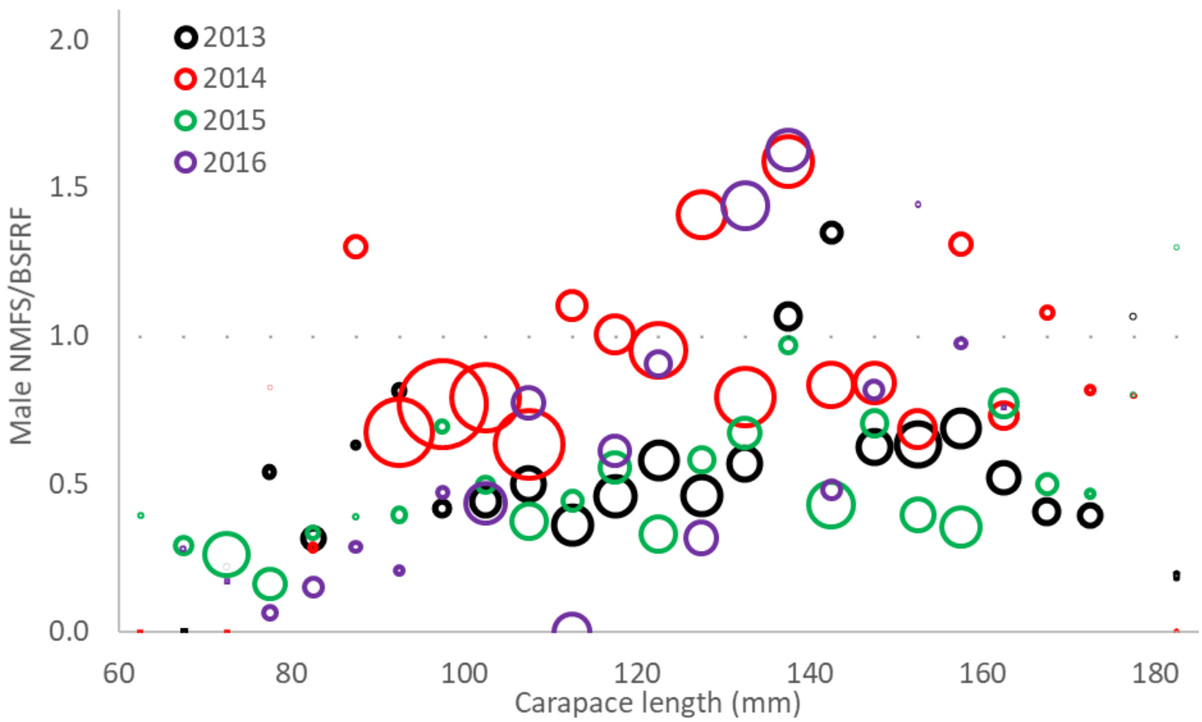

Figure 11: Comparison of ratios of NMFS survey abundances to BSFRF side-by-side survey abundances during 2013-2016 for male Bristol Bay red king crab. Sizes of circles are proportional to total abundances.

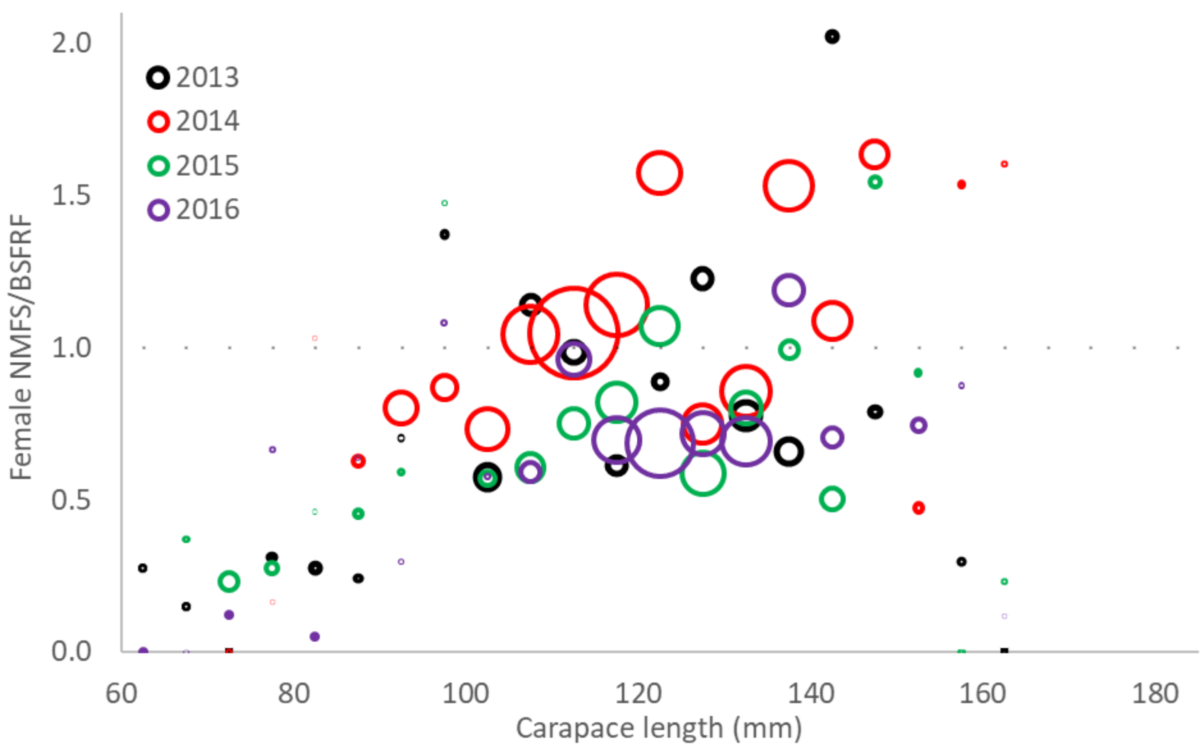

Figure 12: Comparison of ratios of NMFS survey abundances to BSFRF side-by-side survey abundances during 2013-2016 for female Bristol Bay red king crab. Sizes of circles are proportional to total abundances.

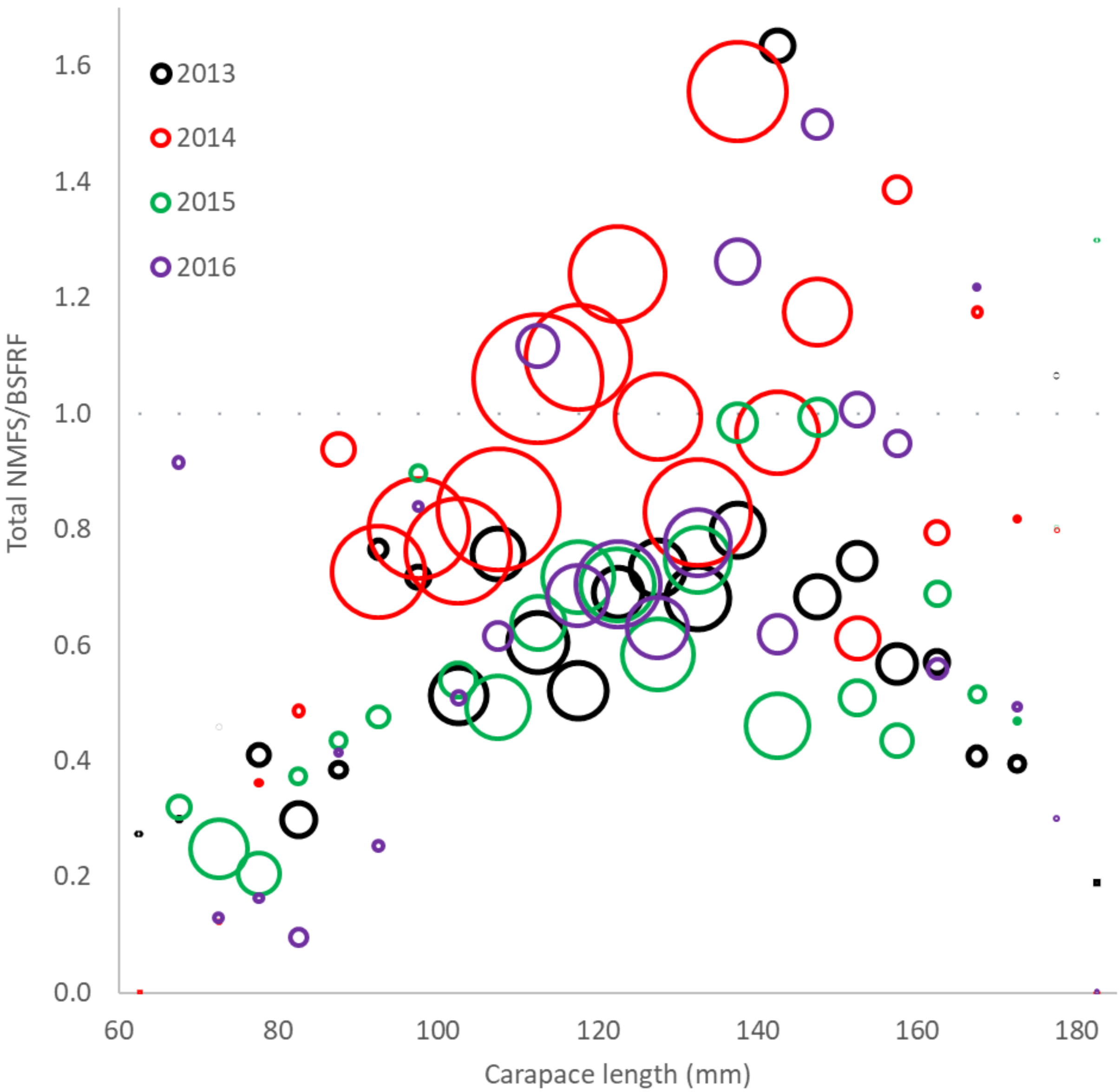

Figure 13: Comparison of ratios of NMFS survey abundances to BSFRF side-by-side survey abundances during 2013-2016 for male Bristol Bay red king crab. Sizes of circles are proportional to total abundances. The abundance-weighted average ratio is 0.891 for crab GE 135 mm carapace length from all four years of data. The approach to compute this overall ratio is documented in section D. Data, 4. Bering Sea Fisheries Research Foundation Survey Data.

Bridging figures

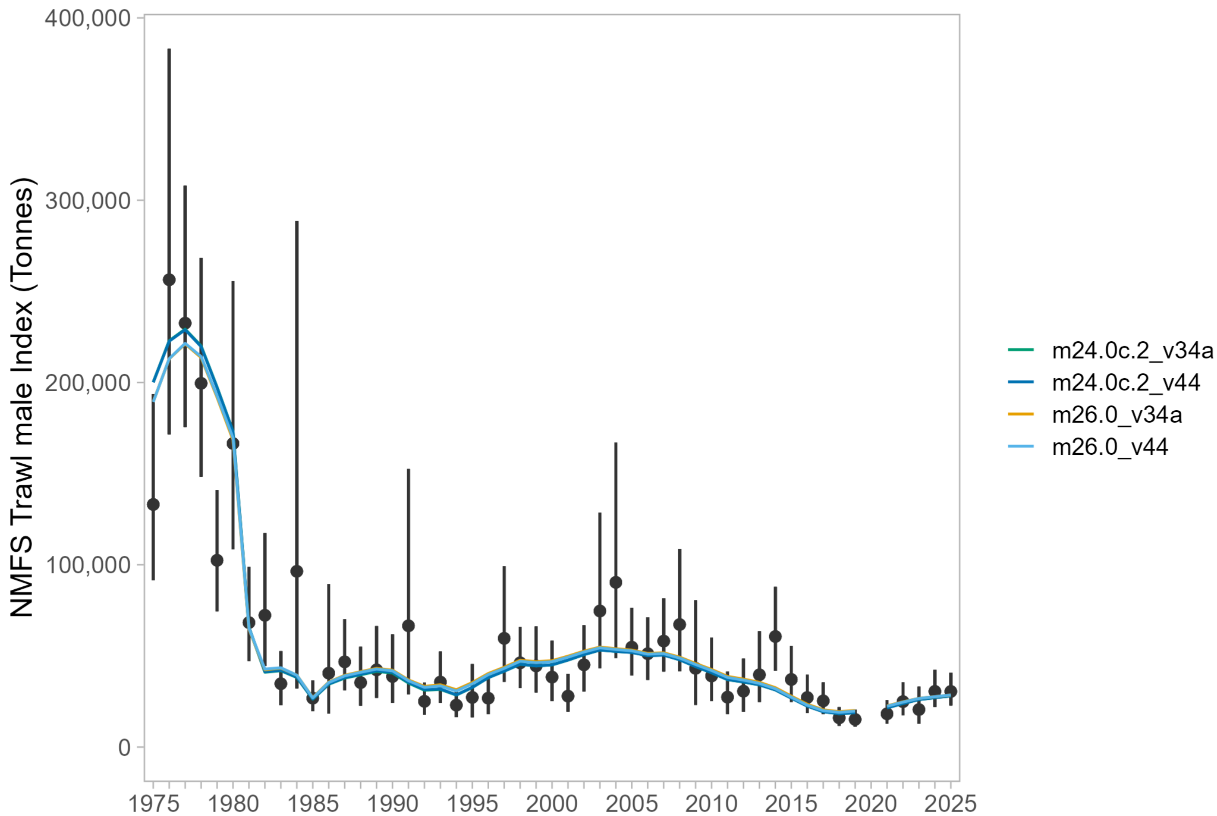

Figure 14: Comparisons of area-swept estimates of total male NMFS survey biomass and model prediction for model estimates in 2025 for bridging GMACS versions from v2.20.24a to v2.20.44 for both models considered. The error bars are plus and minus 2 standard deviations.

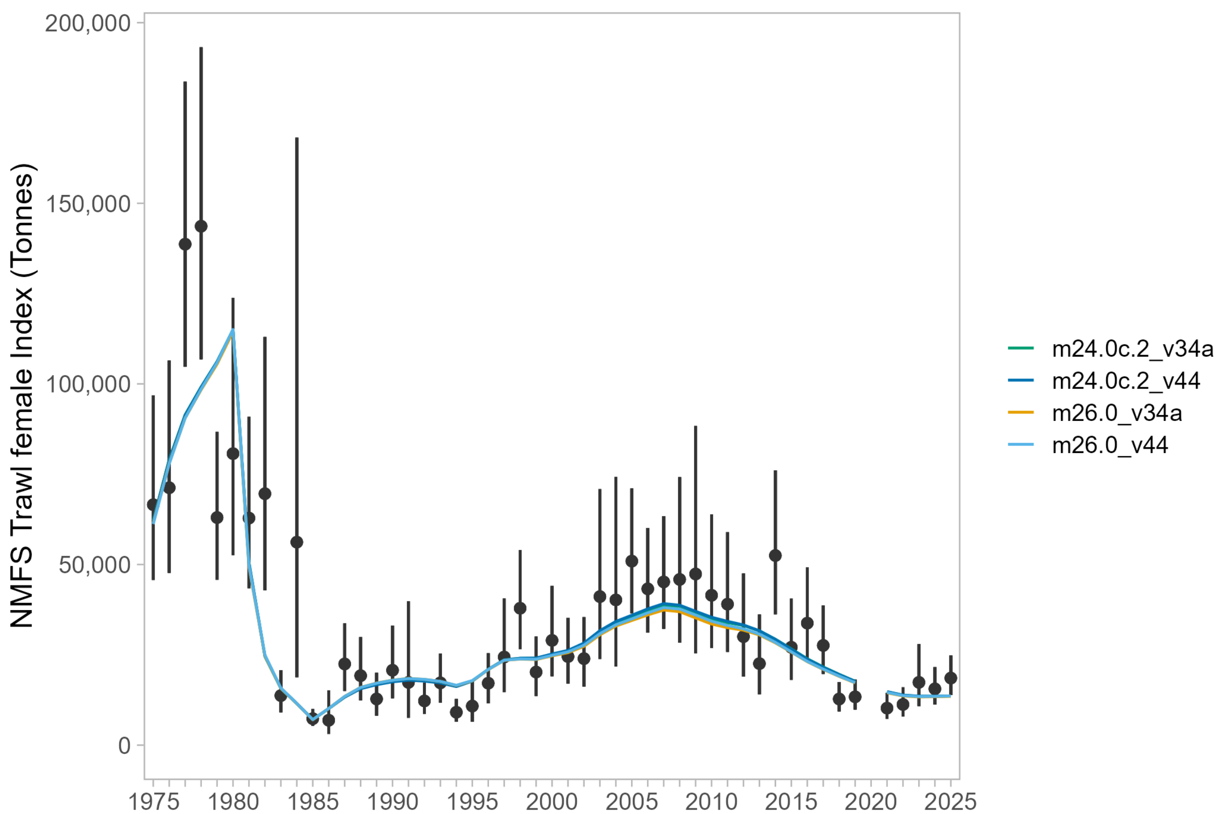

Figure 15: Comparisons of area-swept estimates of total female NMFS survey biomass and model prediction for model estimates 2025 for bridging GMACS versions from v2.20.24a to v2.20.44 for both models considered. The error bars are plus and minus 2 standard deviations.

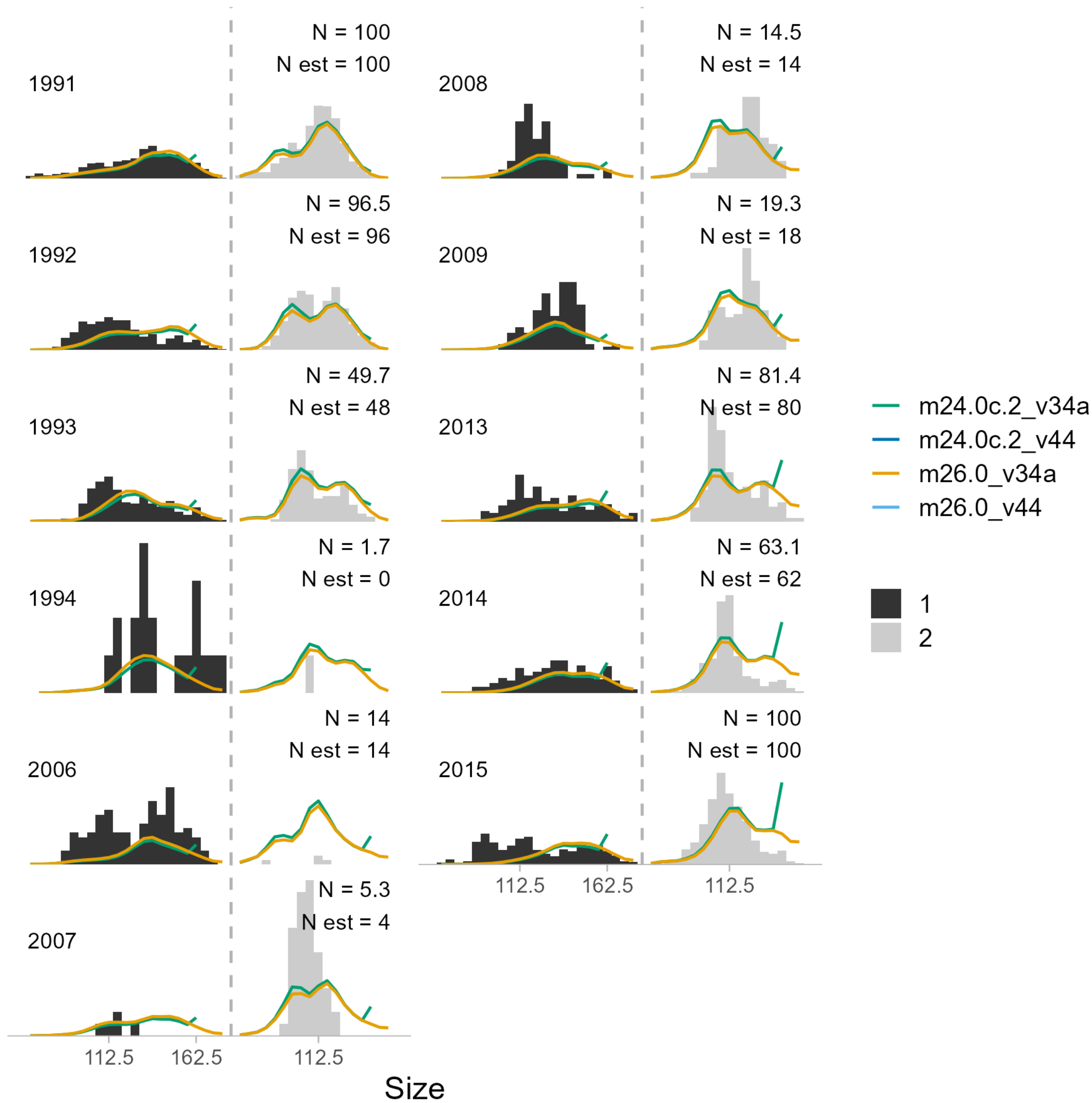

Figure 16: Comparison of observer and model estimated discarded length frequencies of Bristol Bay male red king crab males (1) and females (2) by year in the tanner crab directed fisheries for bridging models from GMACS v2.20.34a to v2.20.44.

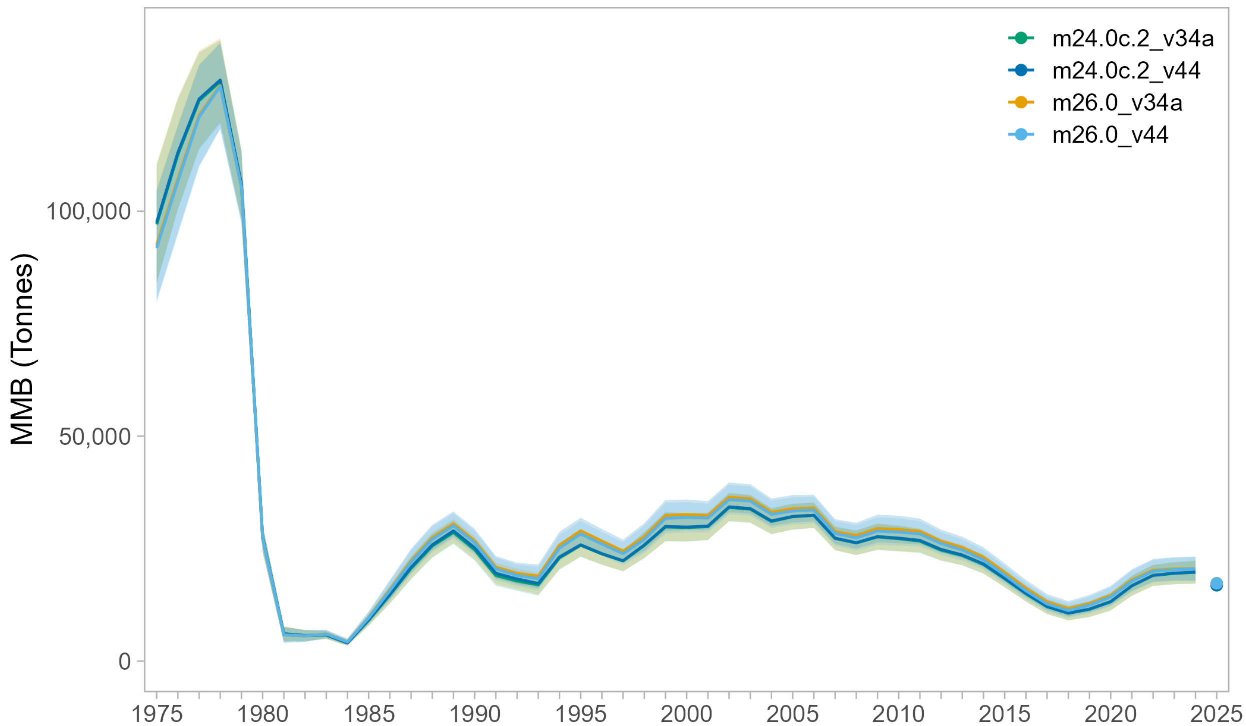

Figure 17: Estimated absolute mature male biomasses during 1975-2025 for models 24.0c and 26.0 (GMACS versions 34a and 44). Mature male biomass is estimated on Feb. 15, year+1.

2026 model and data figures

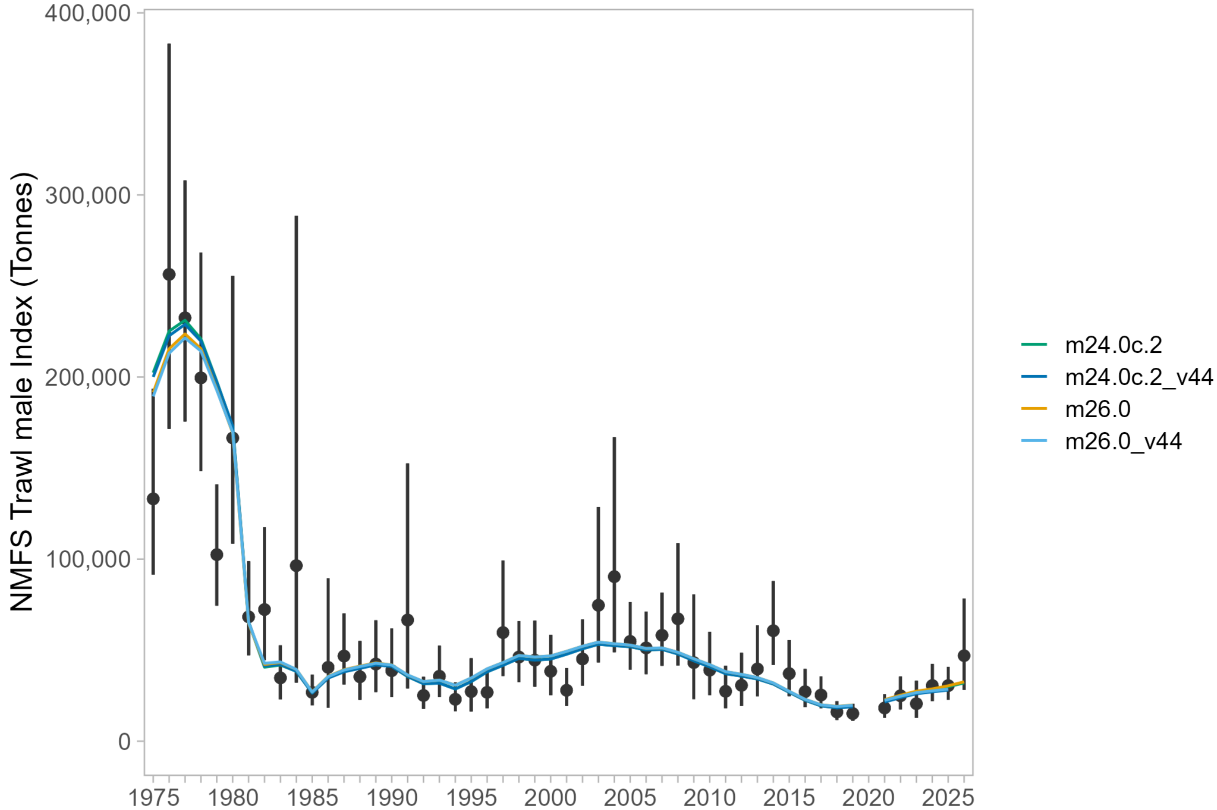

Figure 18: Comparisons of area-swept estimates of total male NMFS survey biomass and model prediction for model estimates in 2025 and 2026 under models 24.0c.2 and 26.0. The error bars are plus and minus 2 standard deviations.

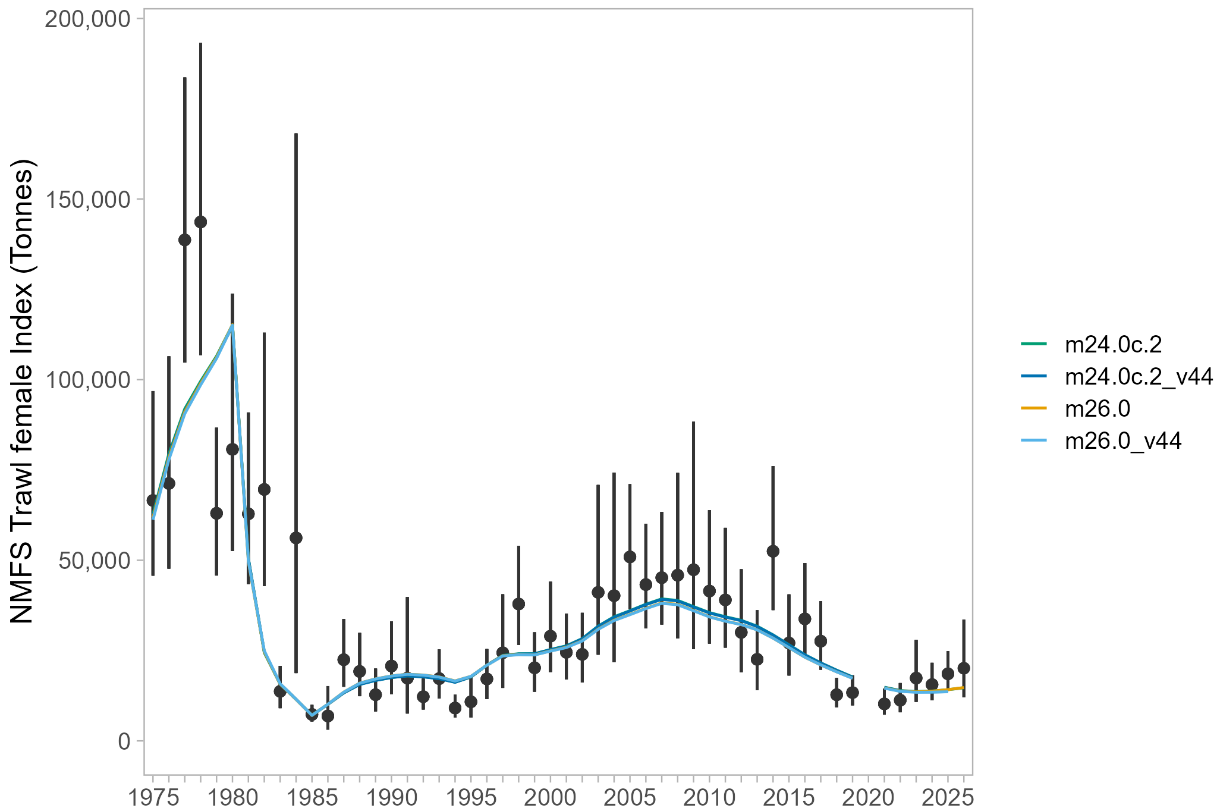

Figure 19: Comparisons of area-swept estimates of total female NMFS survey biomass and model prediction for model estimates in 2025 and 2026 under models 24.0c.2 and 26.0. The error bars are plus and minus 2 standard deviations.

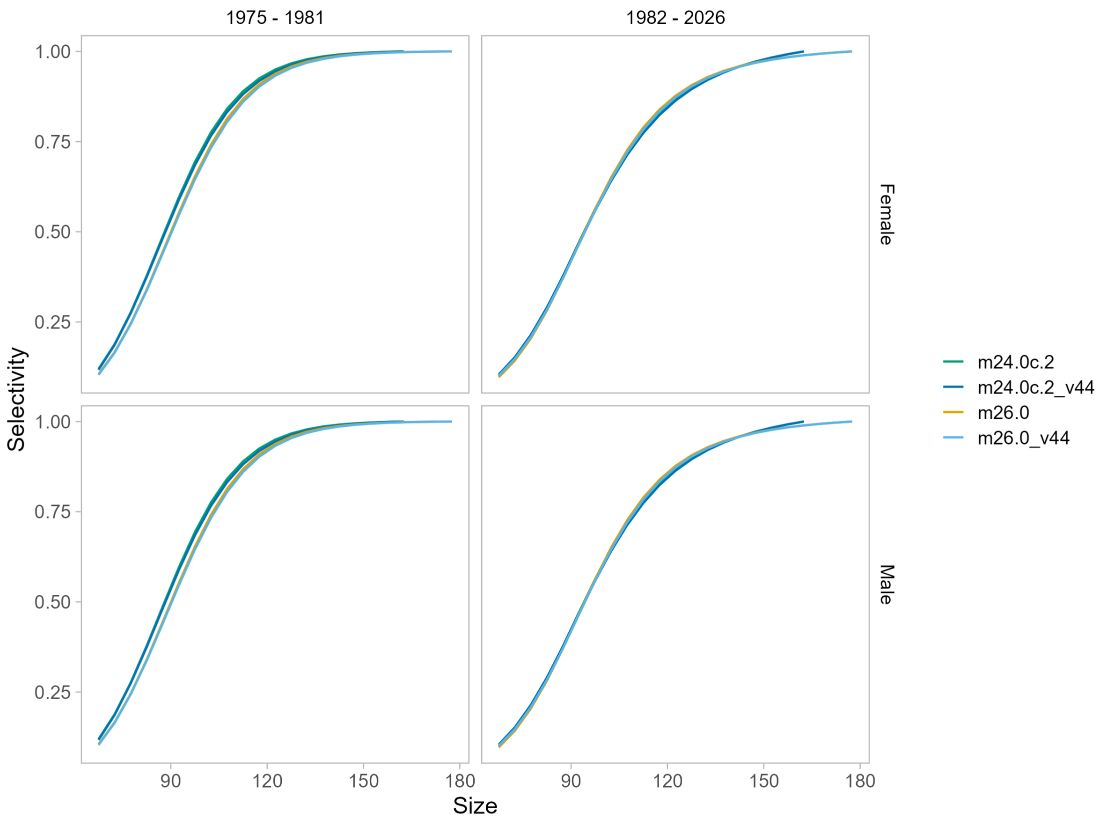

Figure 20: Estimated NMFS trawl survey selectivities under model 24.0c.2 and 26.0, for 2025 and 2026 data.

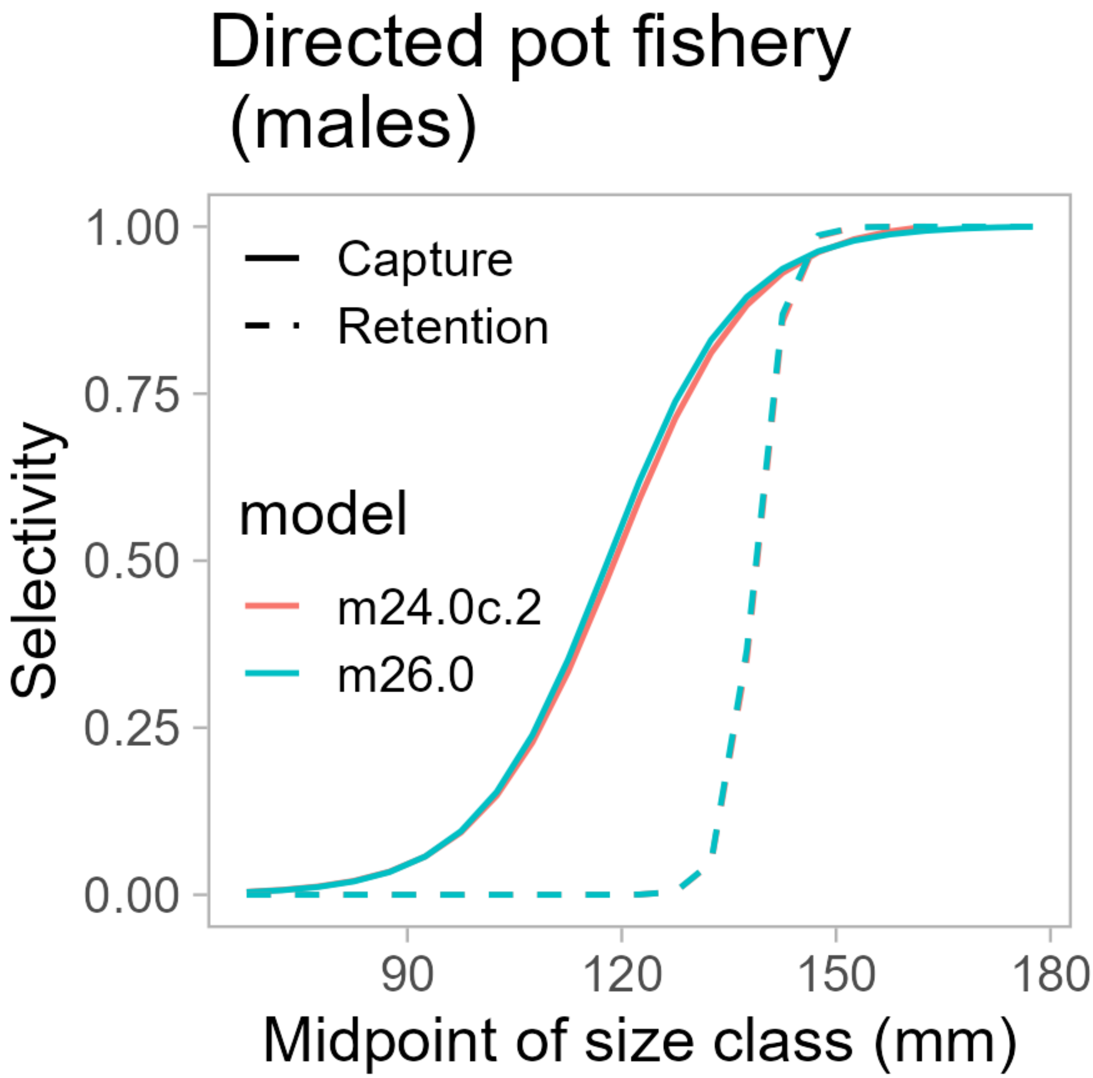

Figure 21: Estimated directed pot fishery capture and retained selectivities for males under models 24.0c.2 and 26.0.

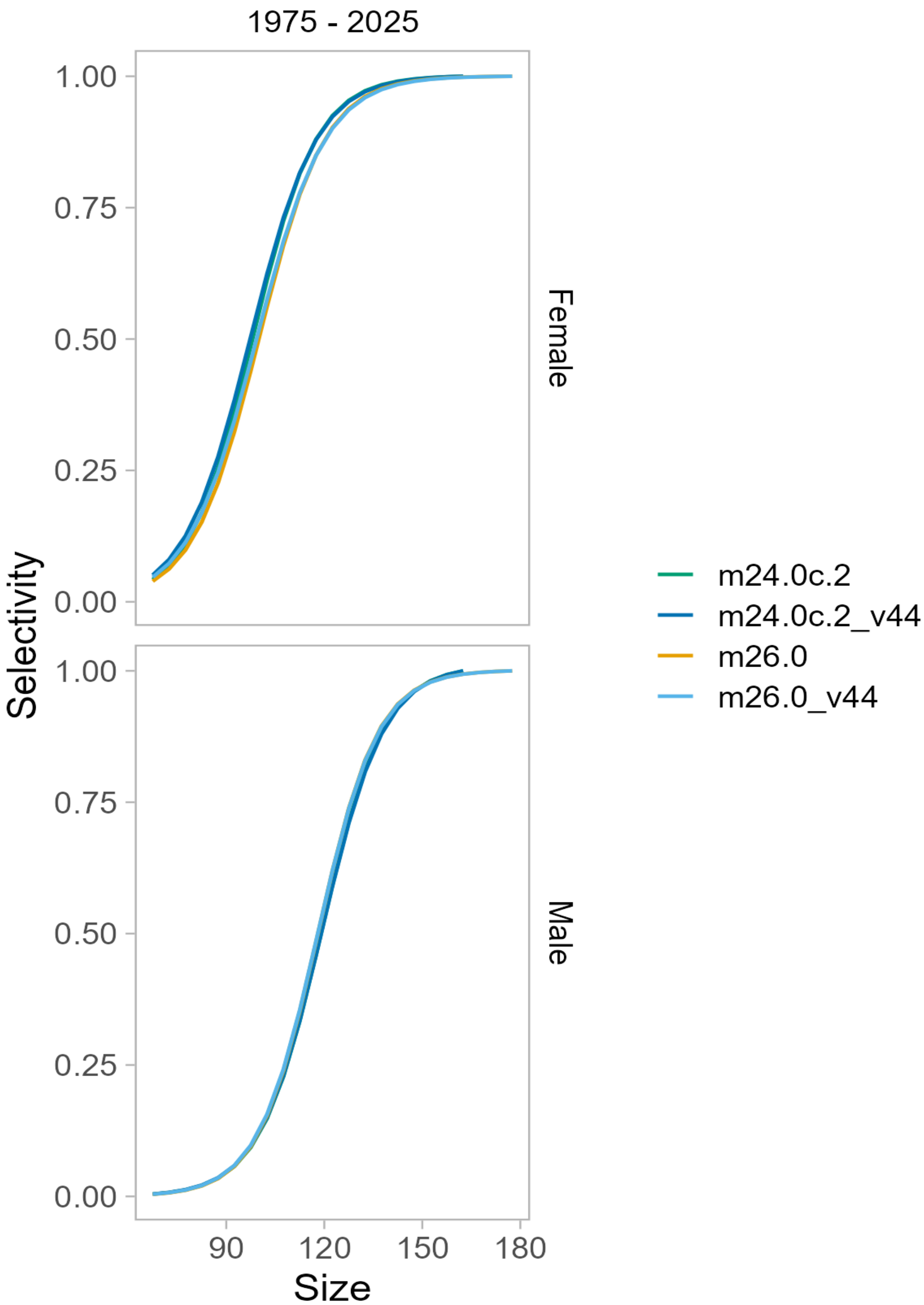

Figure 22: Estimated directed pot fishery selectivities for females and males under model 24.0c.2.

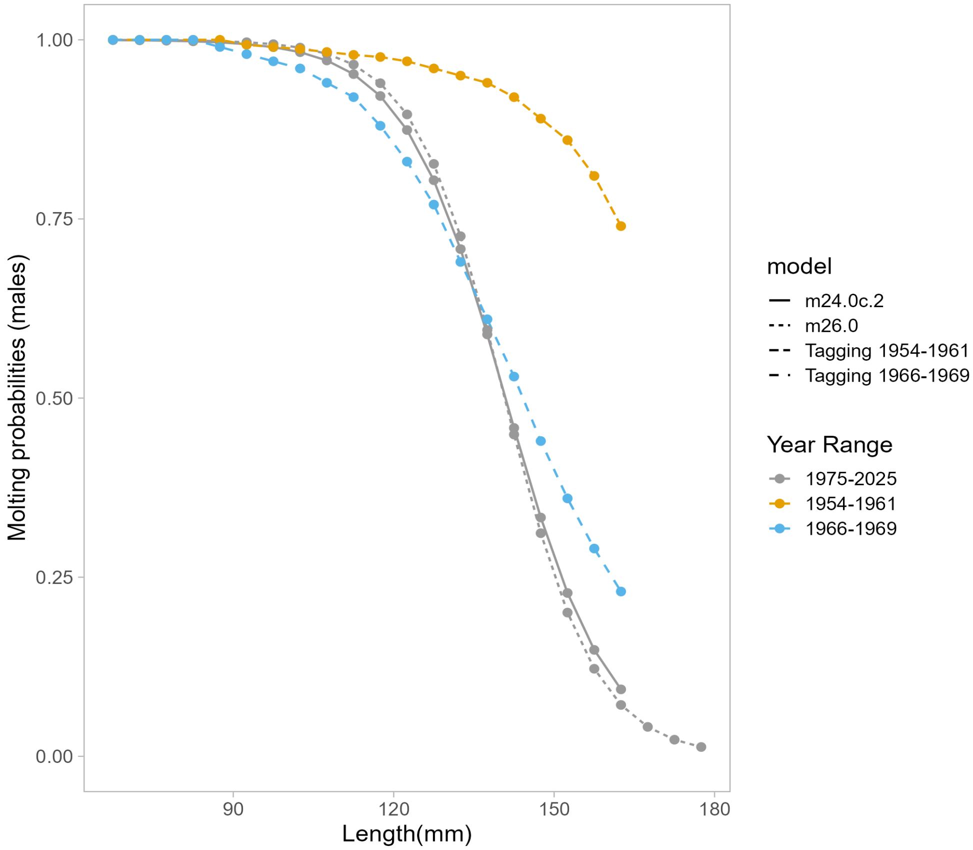

Figure 23: Comparison of estimated probabilities of molting of male red king crab in Bristol Bay for different periods with models 24.0c.2 and 26.0. The 1980 to 2025 molt probability for reflects the entire time series from 1975 to 2025. Molting probabilities for periods 1954-1961 and 1966-1969 were estimated by Balsiger (1974) from tagging data.

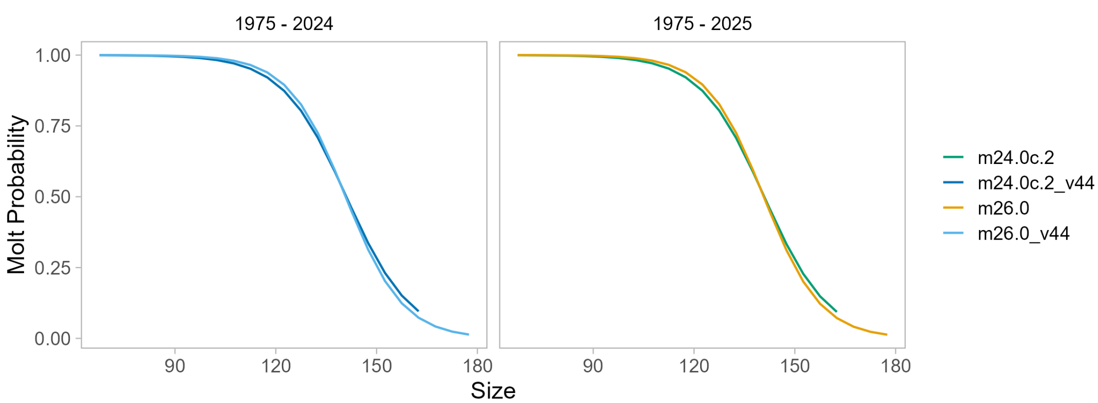

Figure 24: Comparison of estimated probabilities of molting of male red king crab in Bristol Bay with model 24.0c.2 and model 26.0, using both the 2025 and 2026 data.

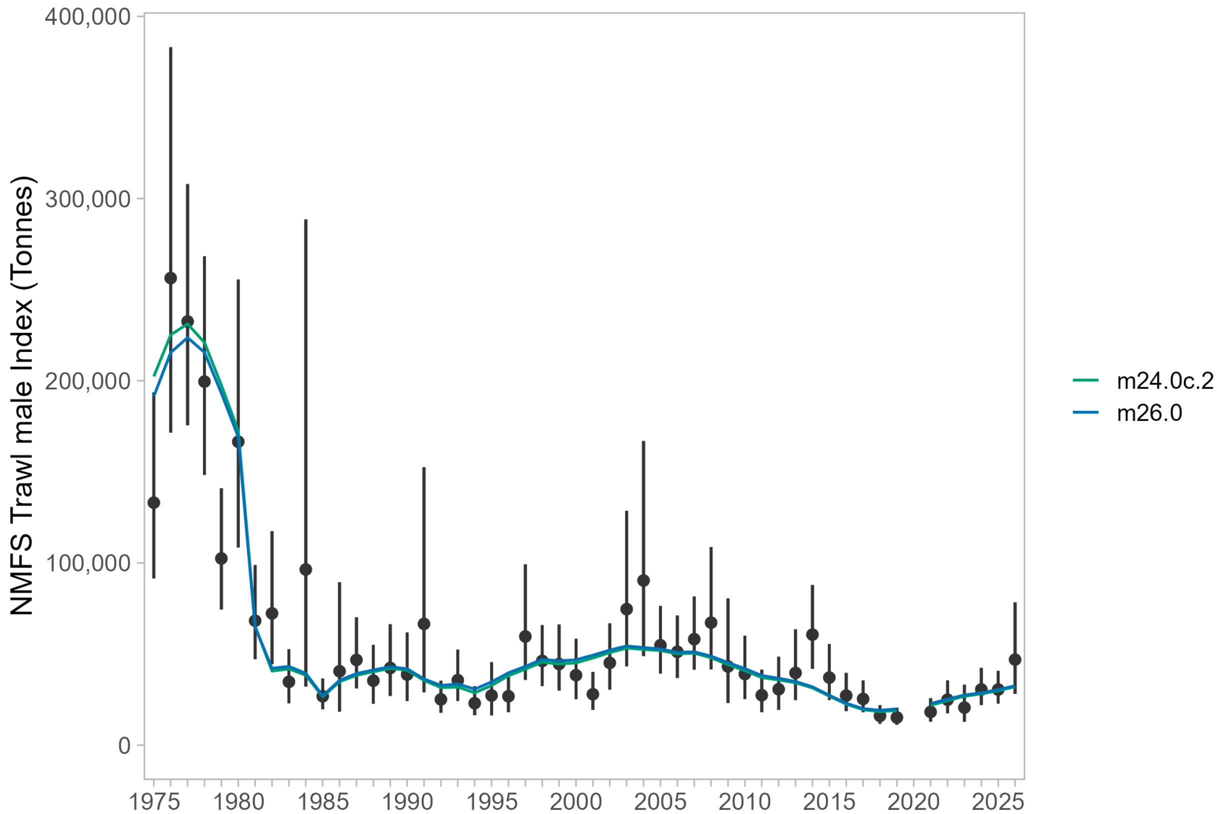

Figure 25: Comparisons of area-swept estimates of total male NMFS survey biomass and model prediction for model estimates in 2026 under models 24.0c.2 and 26.0. The error bars are plus and minus 2 standard deviations.

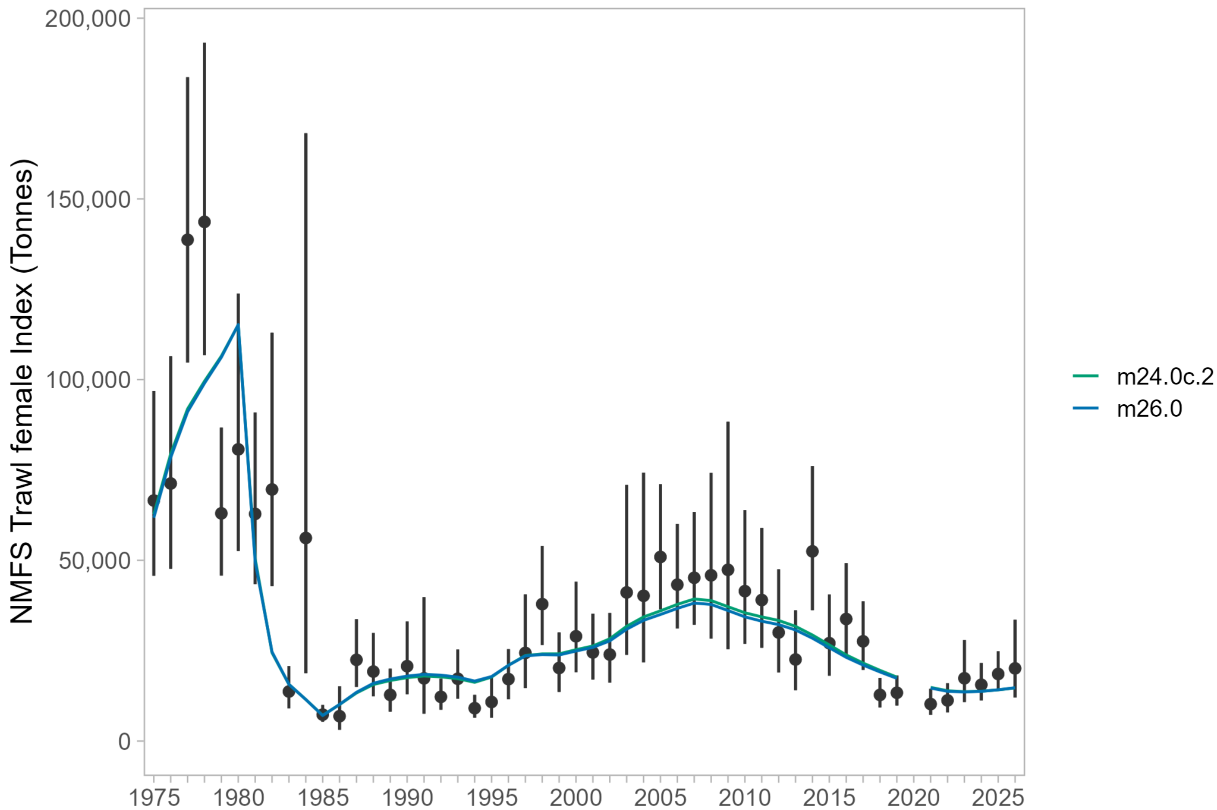

Figure 26: Comparisons of area-swept estimates of total female NMFS survey biomass and model prediction for model estimates in 2026 under models 24.0c.2 and 26.0. The error bars are plus and minus 2 standard deviations.

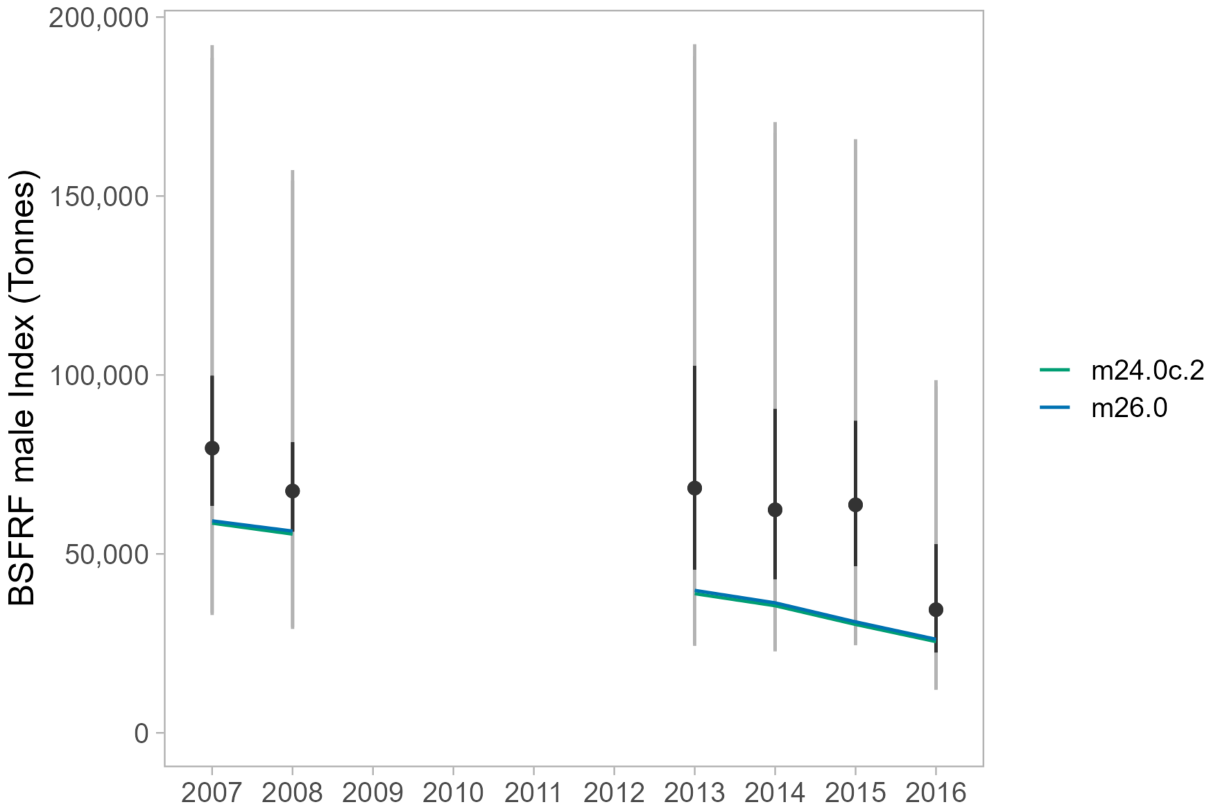

Figure 27: Comparisons of survey biomass estimates for males from the BSFRF survey and model prediction for model estimates in 2026 for models 24.0c.2 and 26.0. The error bars are plus and minus 2 standard deviations of model 24.0c.2. The BSFRF survey catchability is assumed to be 1.0 for all models.

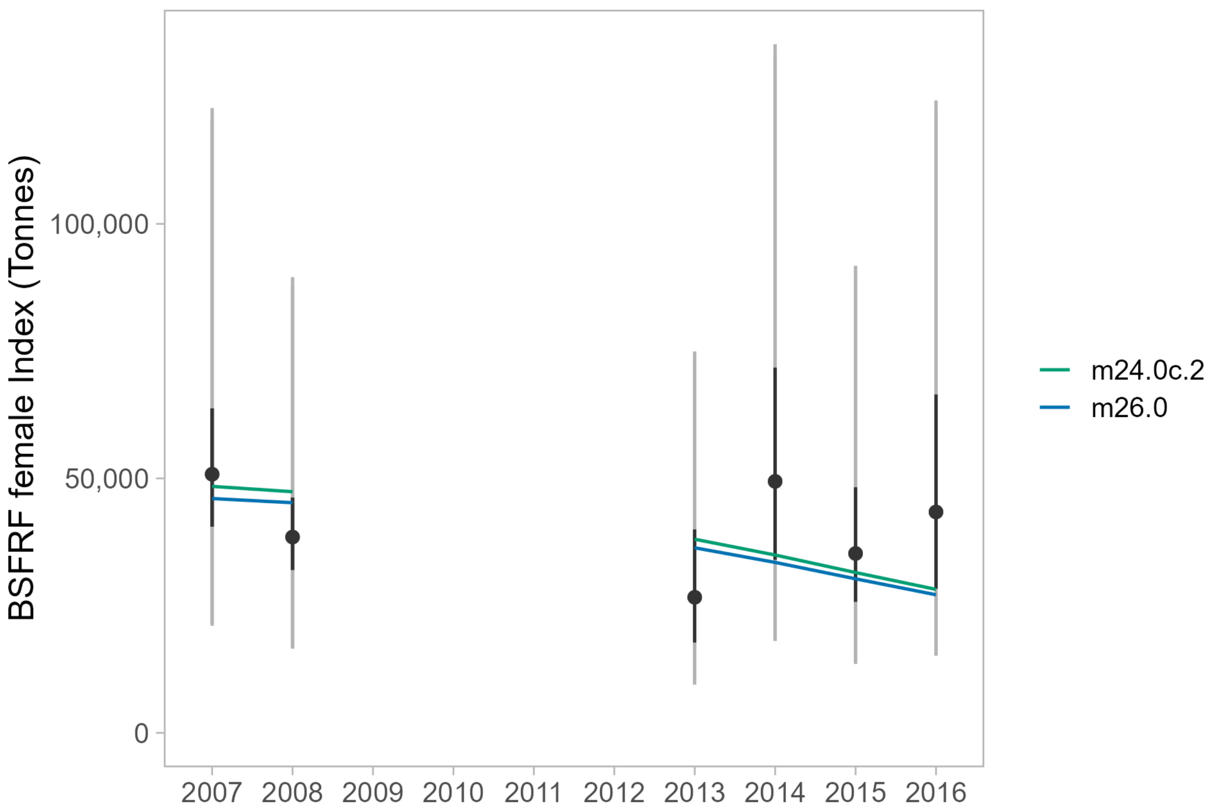

Figure 28: Comparisons of survey biomass estimates for females from the BSFRF survey and model prediction for model estimates in 2026 for models 24.0c.2 and 26.0. The error bars are plus and minus 2 standard deviations of model 24.0c.2. The BSFRF survey catchability is assumed to be 1.0 for all models.

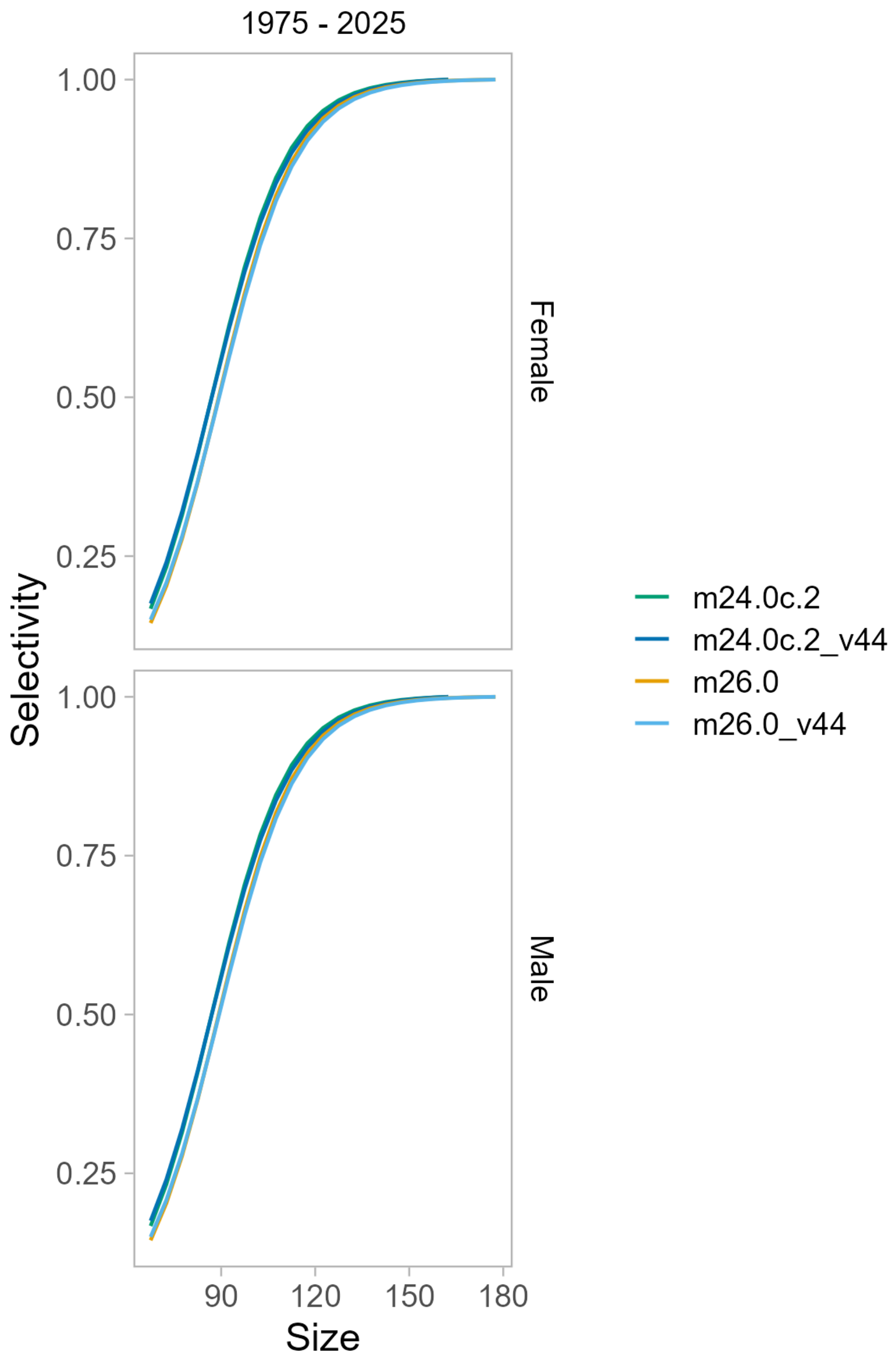

Figure 29: Estimated BSFRF trawl survey selectivities under models 24.0c.2 and 26.0, for 2025 (v44) and 2026.

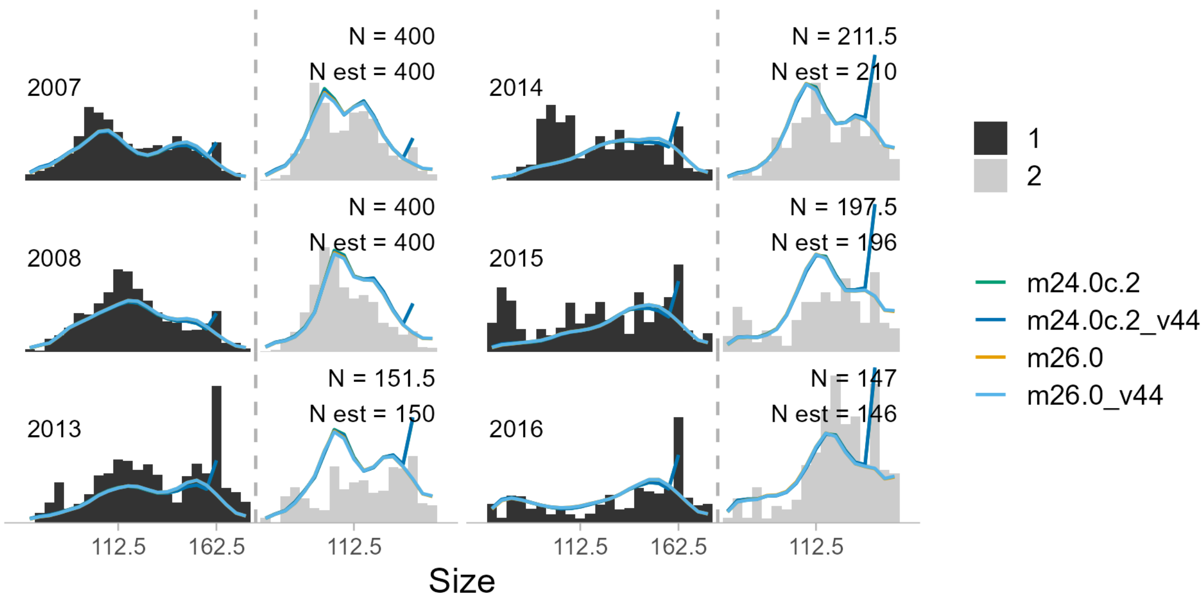

Figure 30: Comparisons of length compositions for males (1) and females (2) for the BSFRF survey and the model estimates during 2007-2008 and 2013-2016 for models 24.0c.2 and 26.0, for 2025 (v44) and 2026.

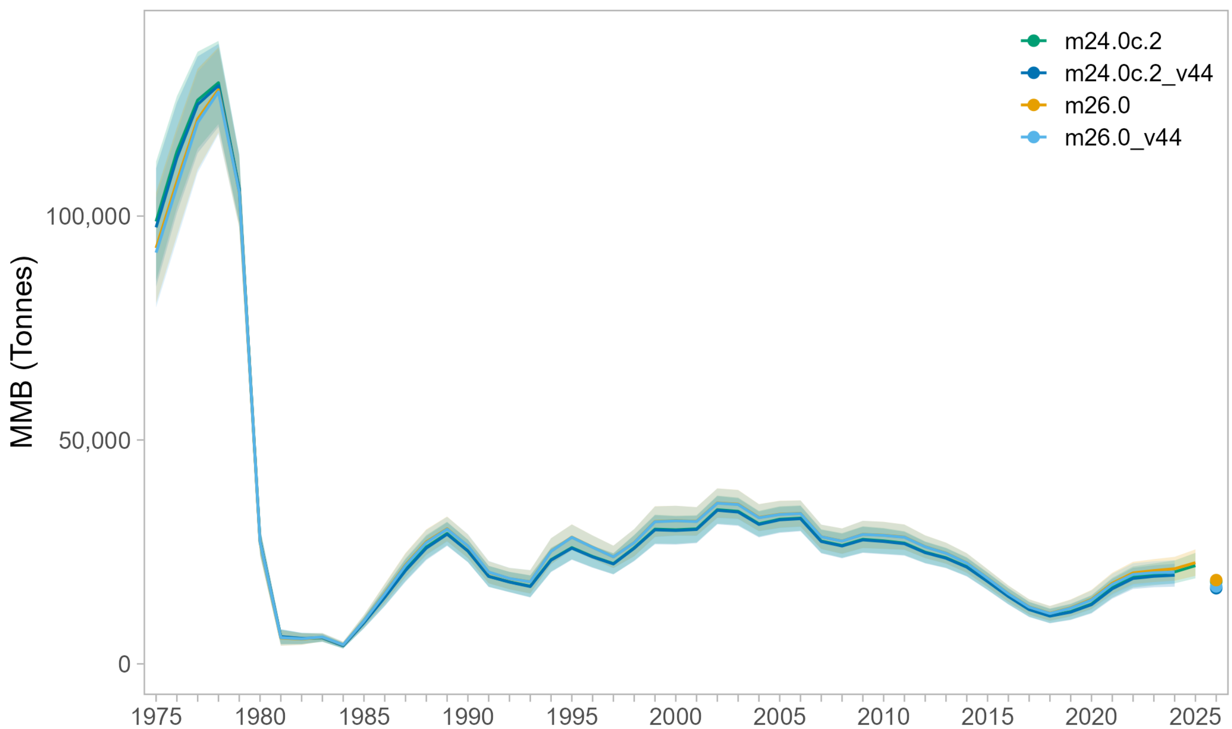

Figure 31: Estimated absolute mature male biomasses during 1975-2026 for models 24.0c.2 and 26.0 for 2026 and 2025 (models labeled v44 reflect the 2025 model output). Mature male biomass is estimated on Feb. 15, year+1.

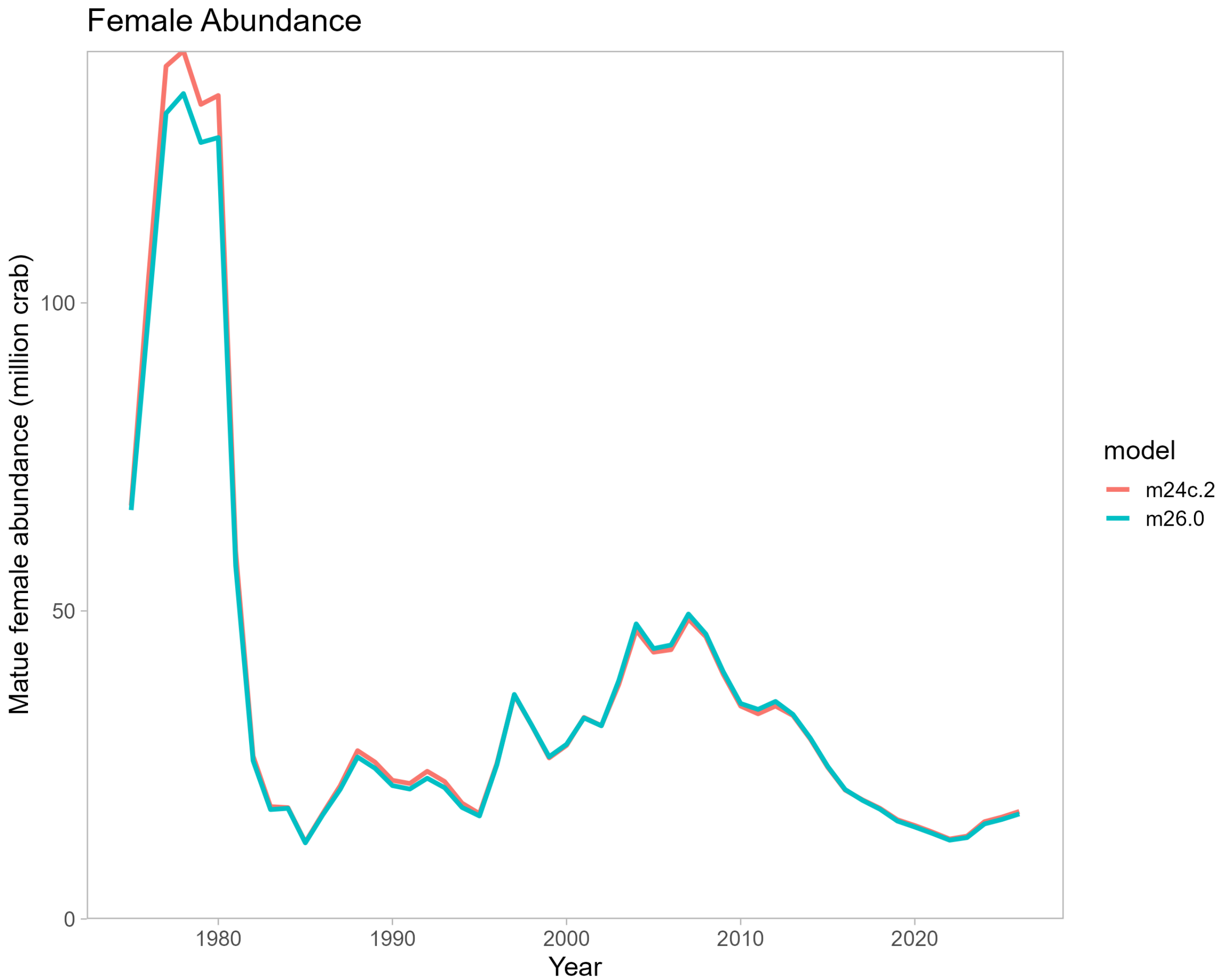

Figure 32: Estimated absolute mature female abundance during 1985-2026 for models 24.0c.2 and 26.0.

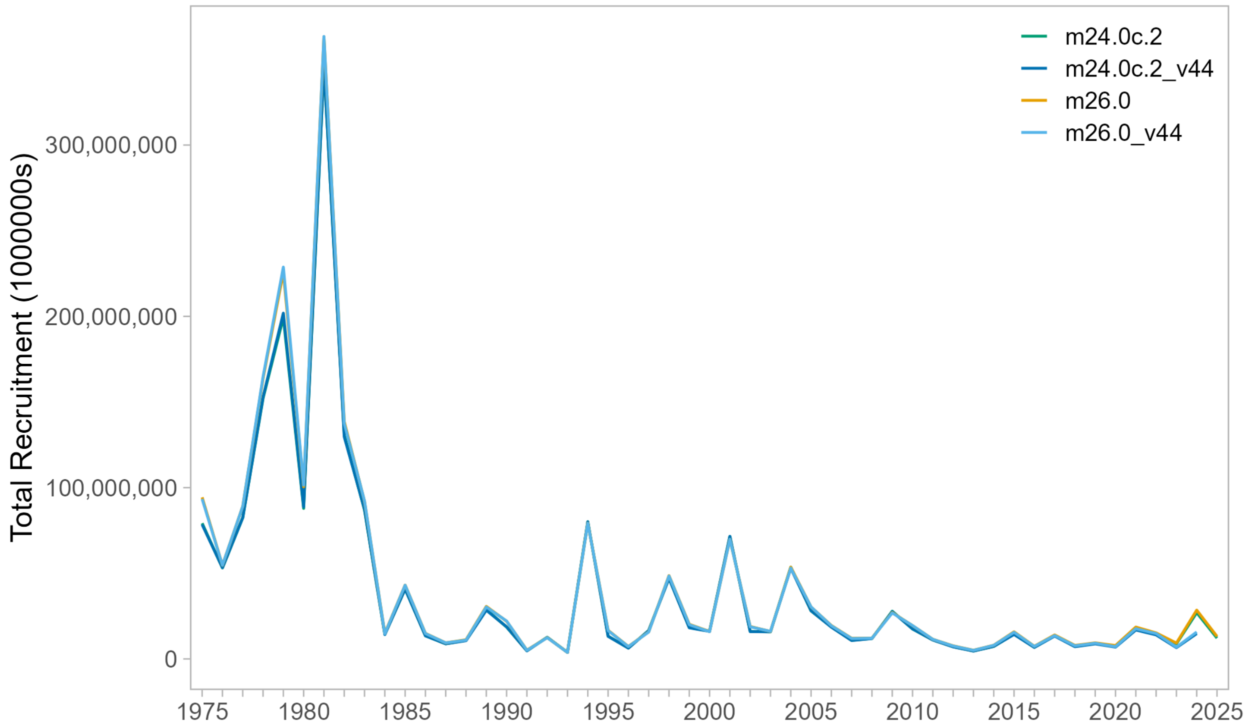

Figure 33: Estimated total (male and female) recruitment time series during 1976-2025 for models m24.0c.2 and m26.0, for both 2025 and 2026 model version (v44 reflects fall 2025 model in version 44). Mean male recruits during 1984-2024 was used to estimate B35. Recruitment estimates in the terminal year (2026) are unreliable.

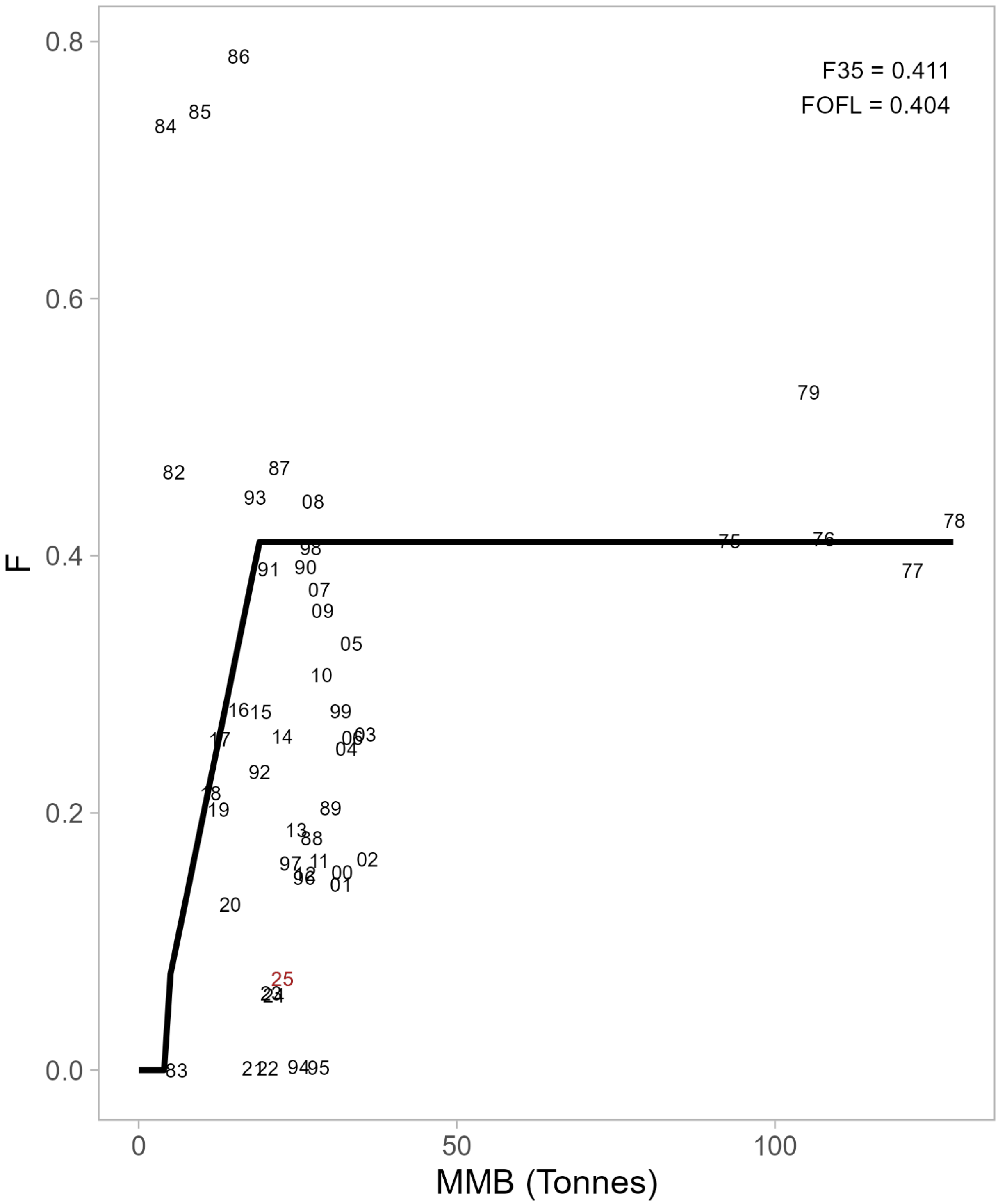

Figure 34: Relationships between full fishing mortalities for the directed pot fishery and mature male biomass on Feb. 15 during 1975-2025 under model 26.0. Average of recruitment from 1984 to 2025 was used to estimate B35.

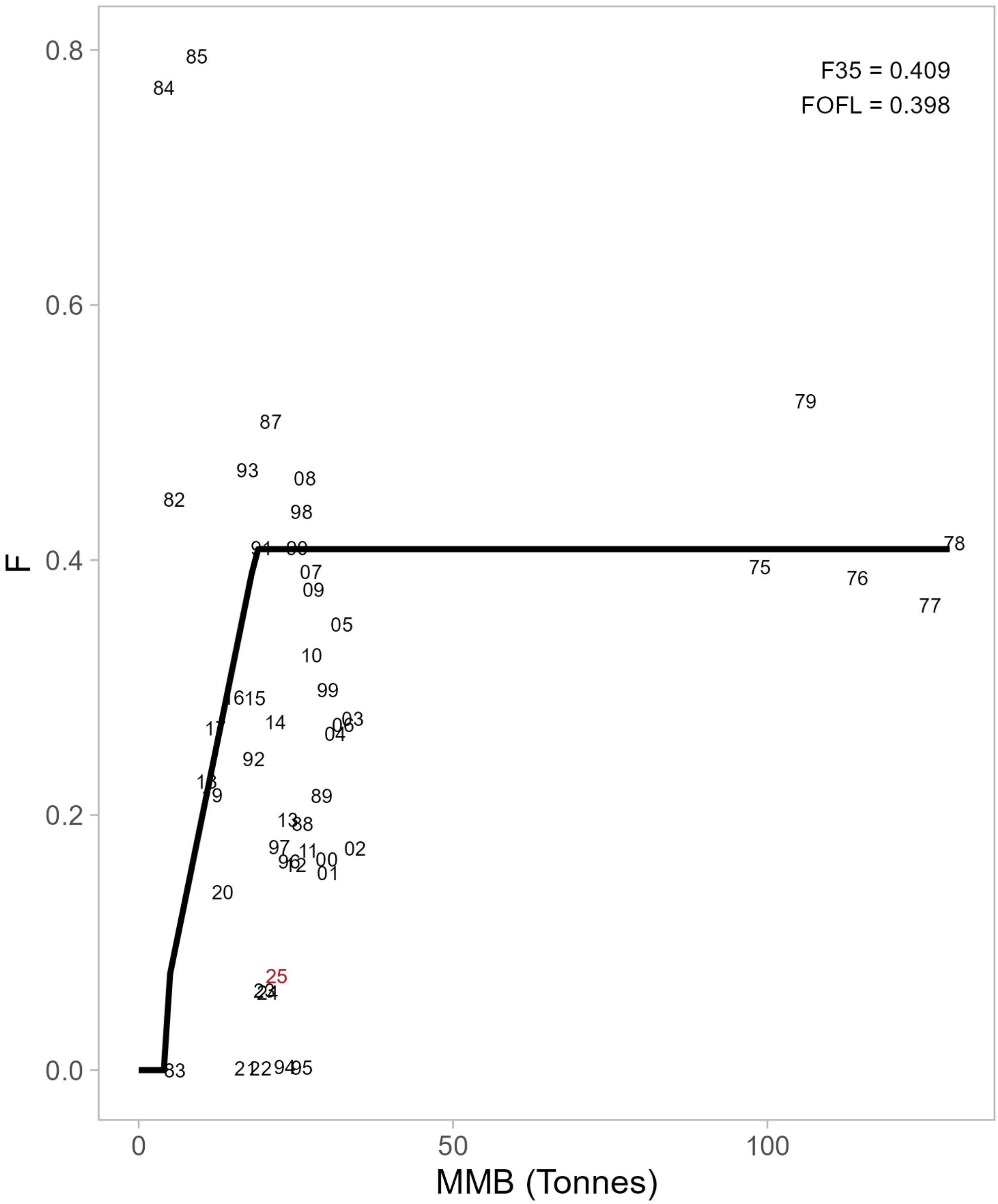

Figure 35: Relationships between full fishing mortalities for the directed pot fishery and mature male biomass on Feb. 15 during 1975-2025 under model 24.0c.2. Average of recruitment from 1984 to 2025 was used to estimate B35.

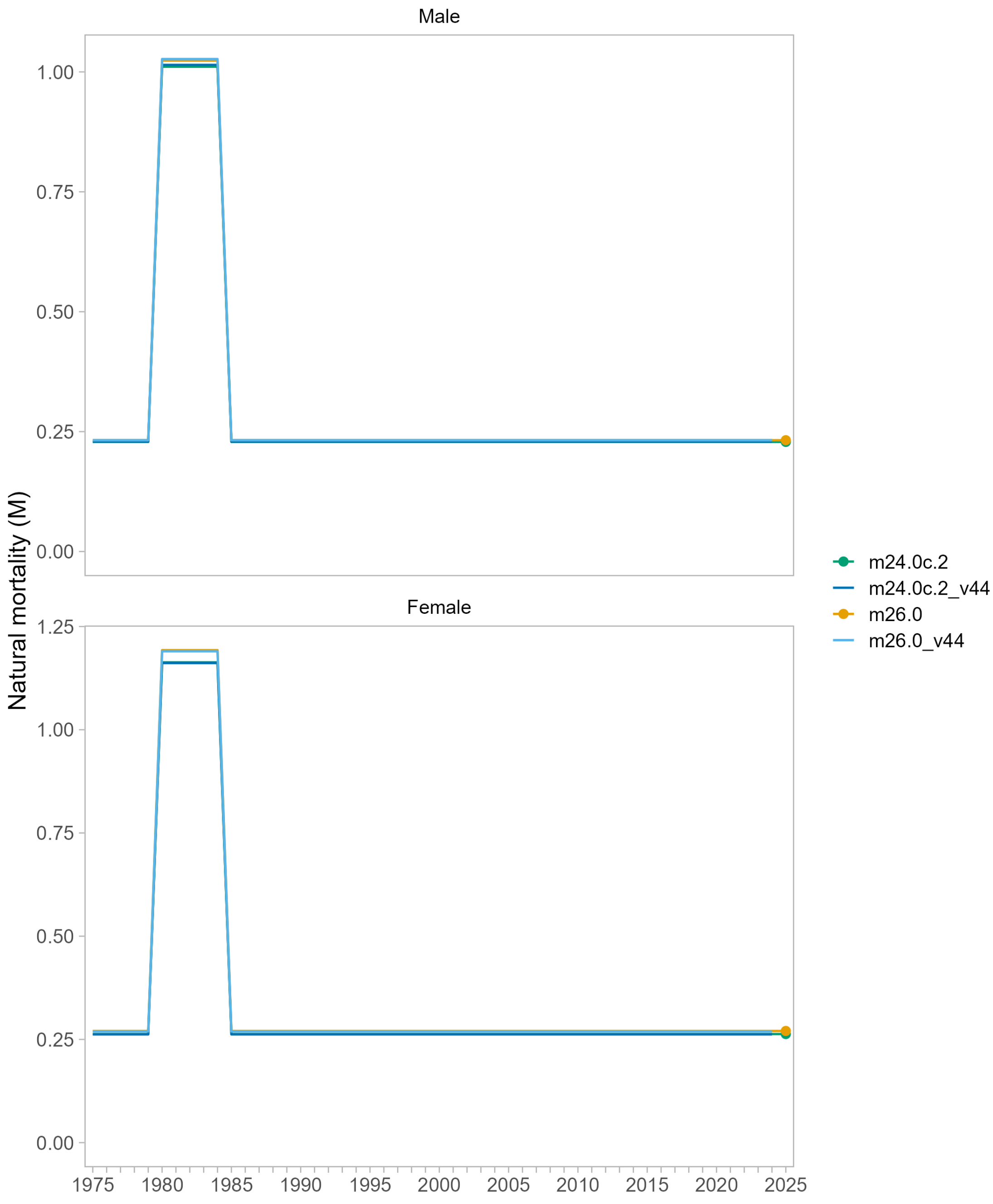

Figure 36: Comparison of estimated natural mortality for models 24.0c.2 and 26.0 (2025 and 2026).

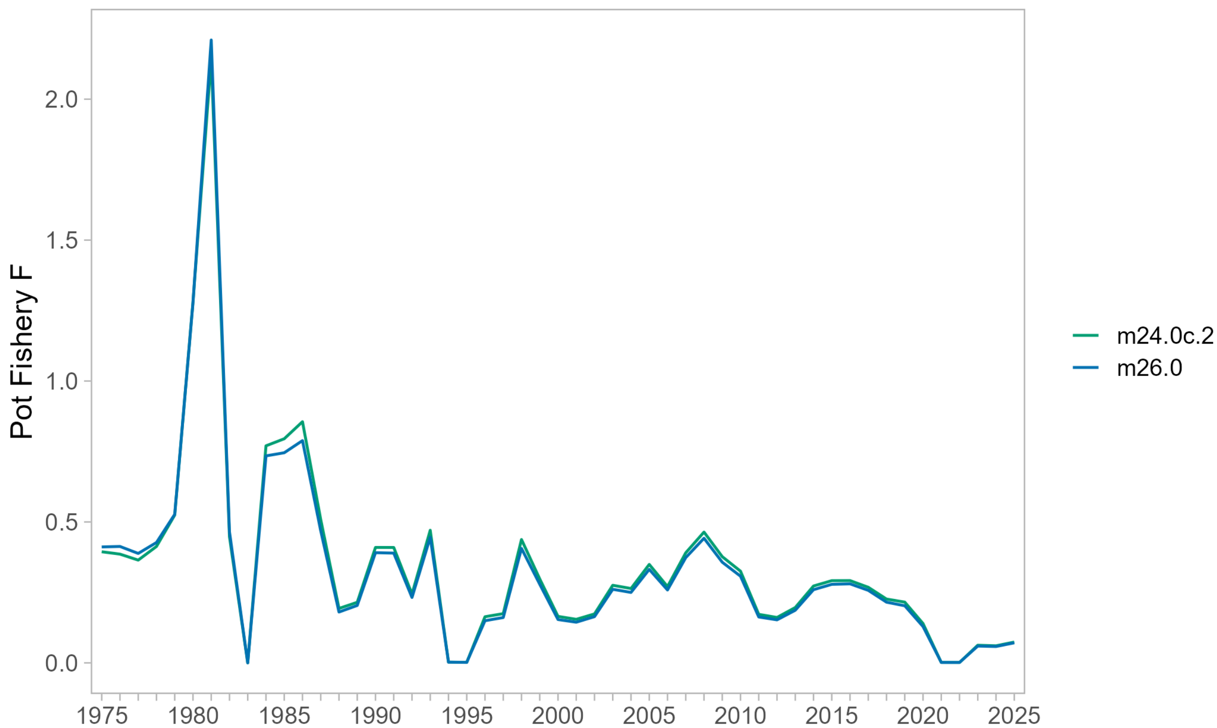

Figure 37: Comparison of estimated fishing mortality for the directed pot fishery for models 24.0c.2 and 26.0.

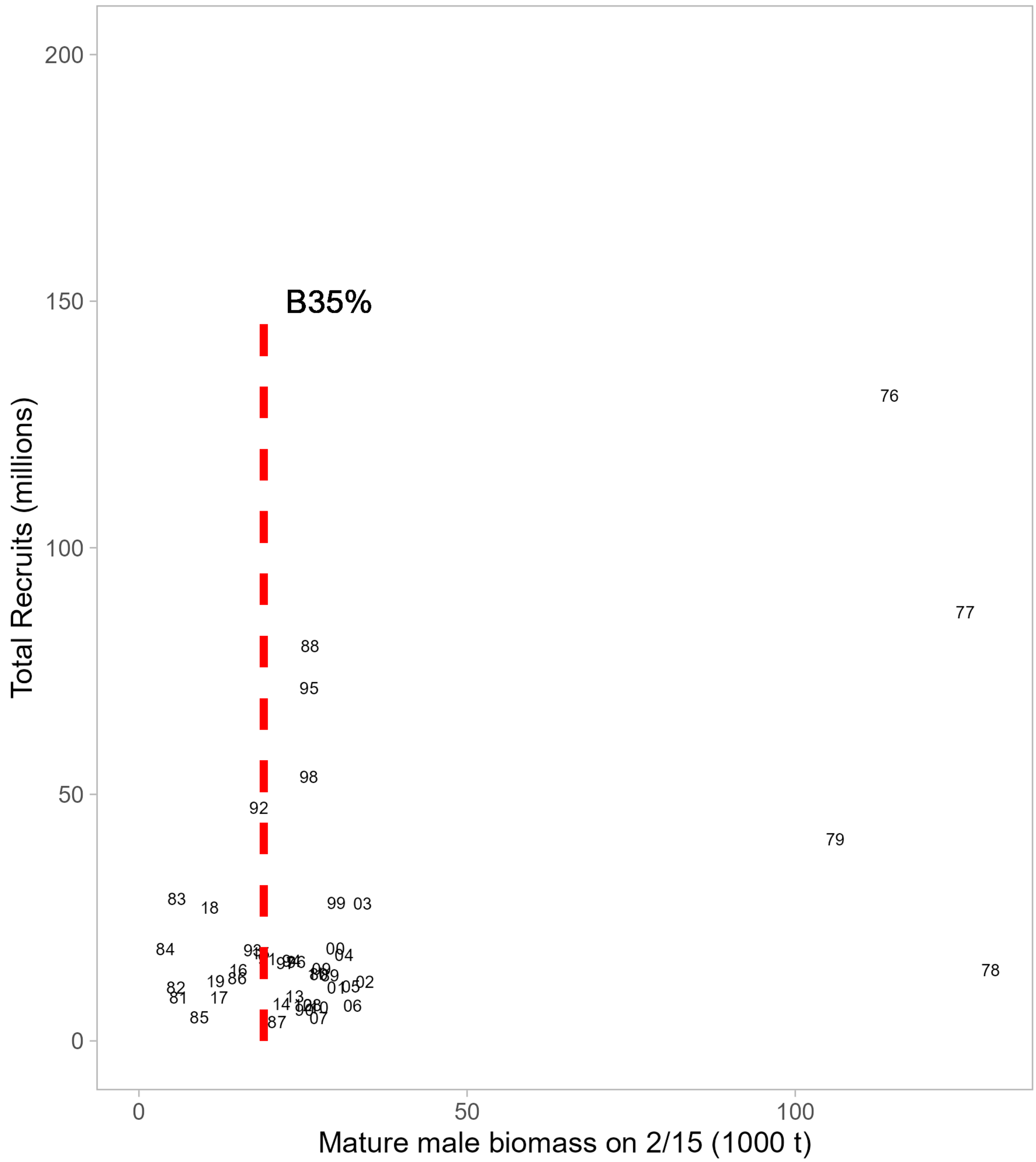

Figure 38: Relationships between mature male biomass on Feb. 15 and total recruits at age 5 (i.e., 6 year time lag) for Bristol Bay red king crab under model 24.0c.2. Numerical labels are years of mating, and the vertical dotted line is the estimated B35 based on the mean recruitment level during 1984 to 2025.

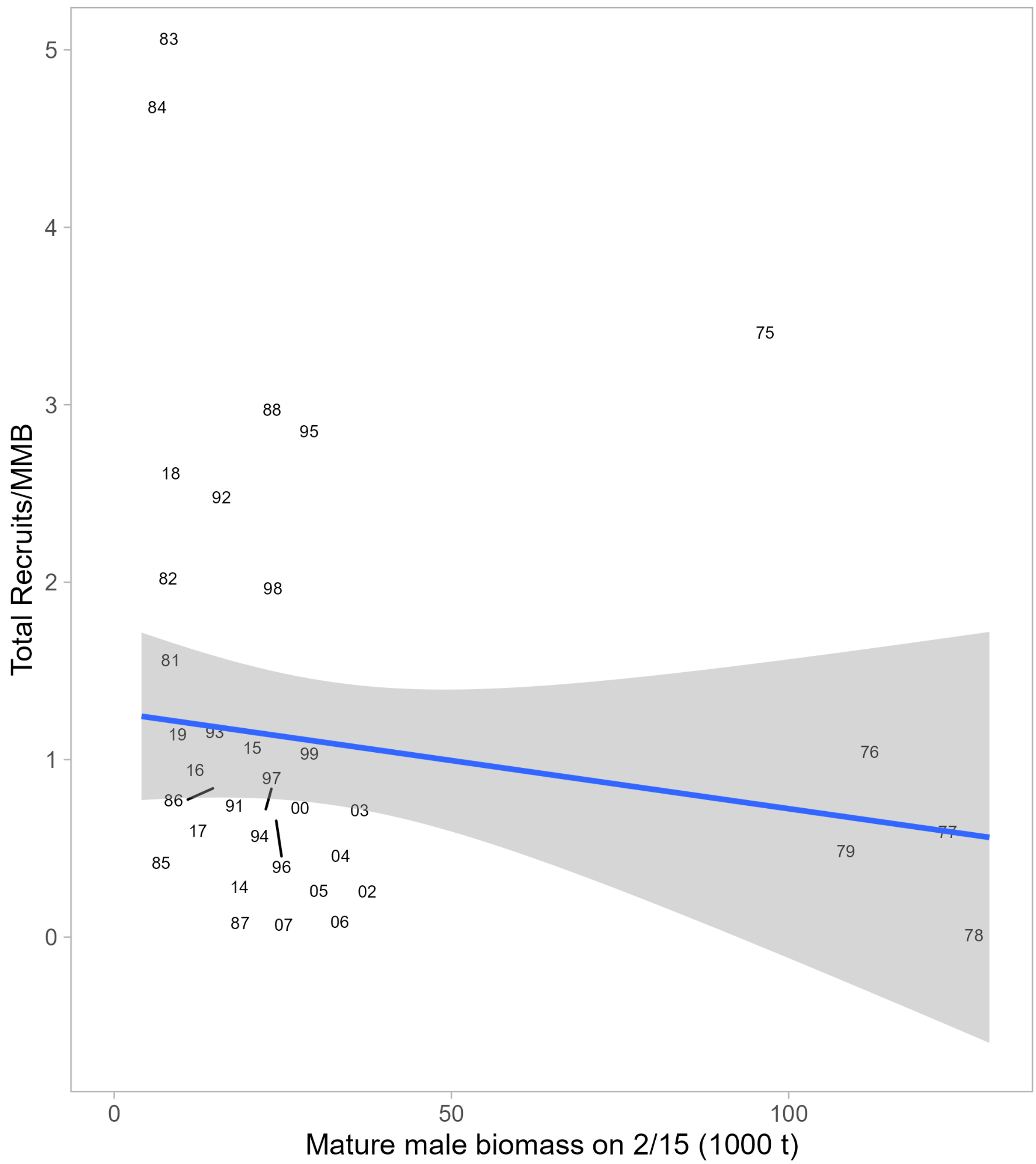

Figure 39: Relationships between recruitment per mature male biomass and mature male biomass on Feb. 15 for Bristol Bay red king crab under model 24.0c.2. Numerical labels are years of mating, and the line is the regression line for data of 1978-2019.

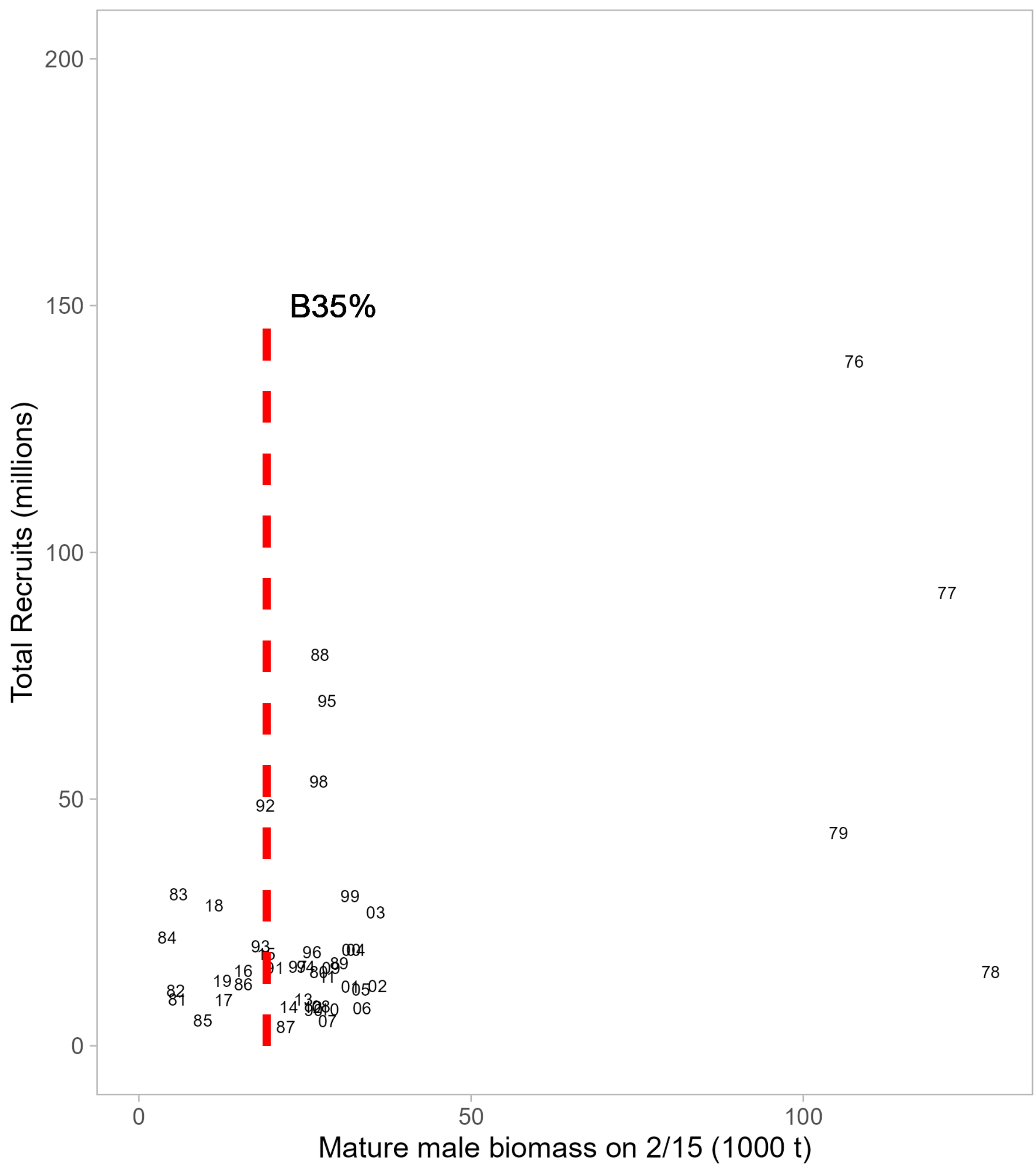

Figure 40: Relationships between mature male biomass on Feb. 15 and total recruits at age 5 (i.e., 6 year time lag) for Bristol Bay red king crab under model 26.0. Numerical labels are years of mating, and the vertical dotted line is the estimated B35 based on the mean recruitment level during 1984 to 2025.

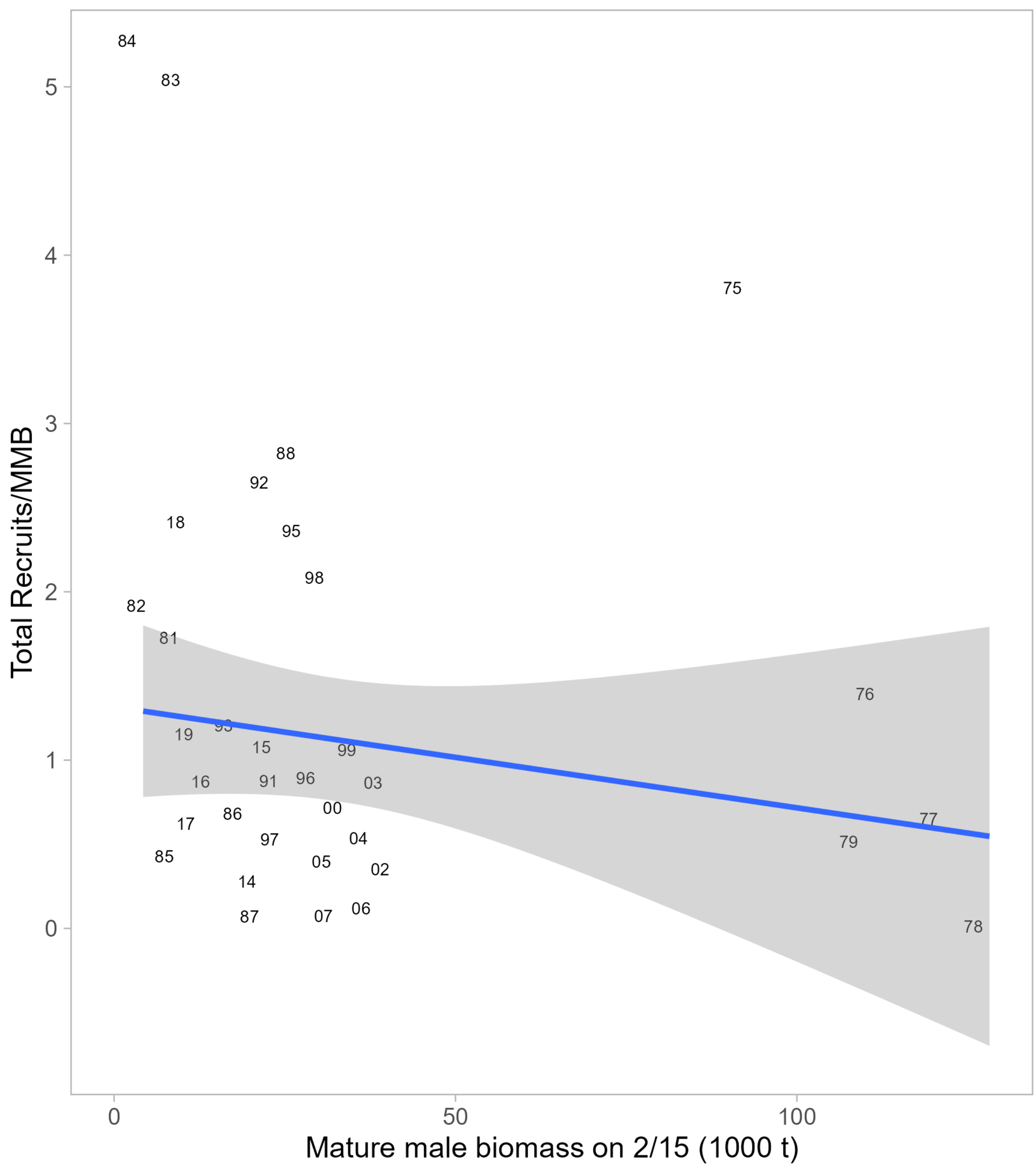

Figure 41: Relationships between recruitment per mature male biomass and mature male biomass on Feb. 15 for Bristol Bay red king crab under model 26.0. Numerical labels are years of mating, and the line is the regression line for data of 1978-2019.

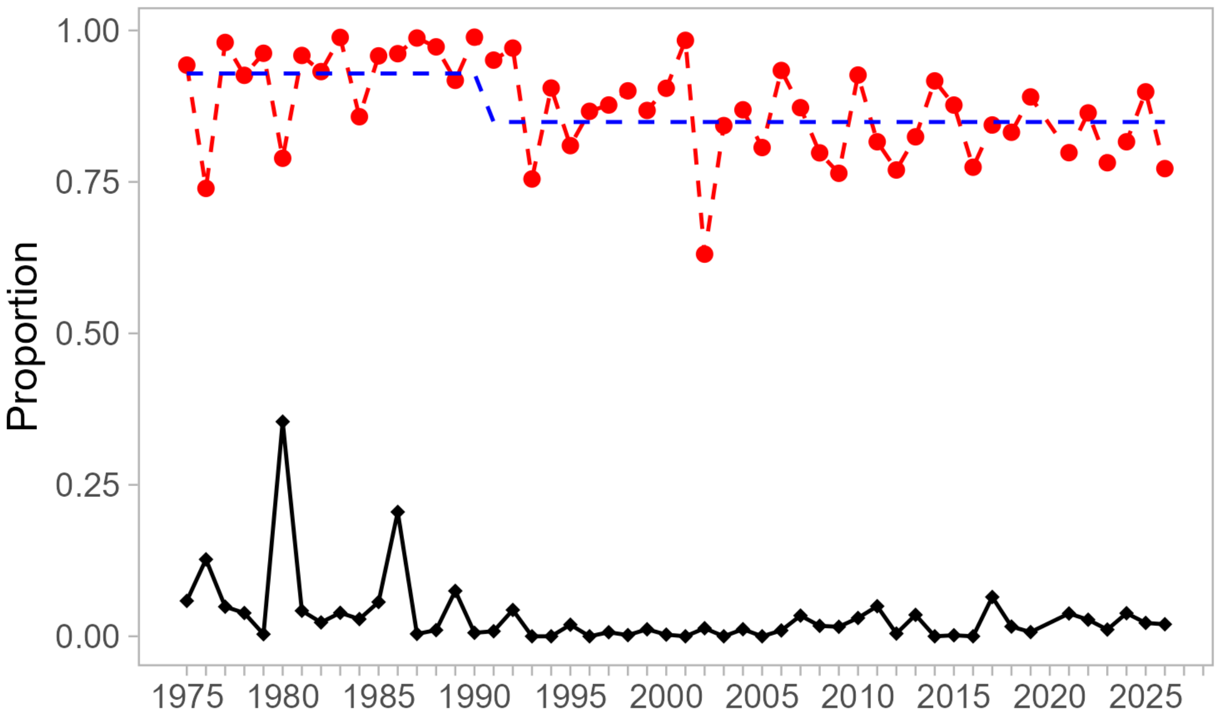

Figure 42: Average clutch fullness and proportion of empty clutches of newshell (shell conditions 1 and 2) mature female crab >89 mm CL from 1975 to 2026 from survey data. Oldshell females were excluded. The blue dashed line is the mean clutch fullness during two periods before 1992 and after 1991.

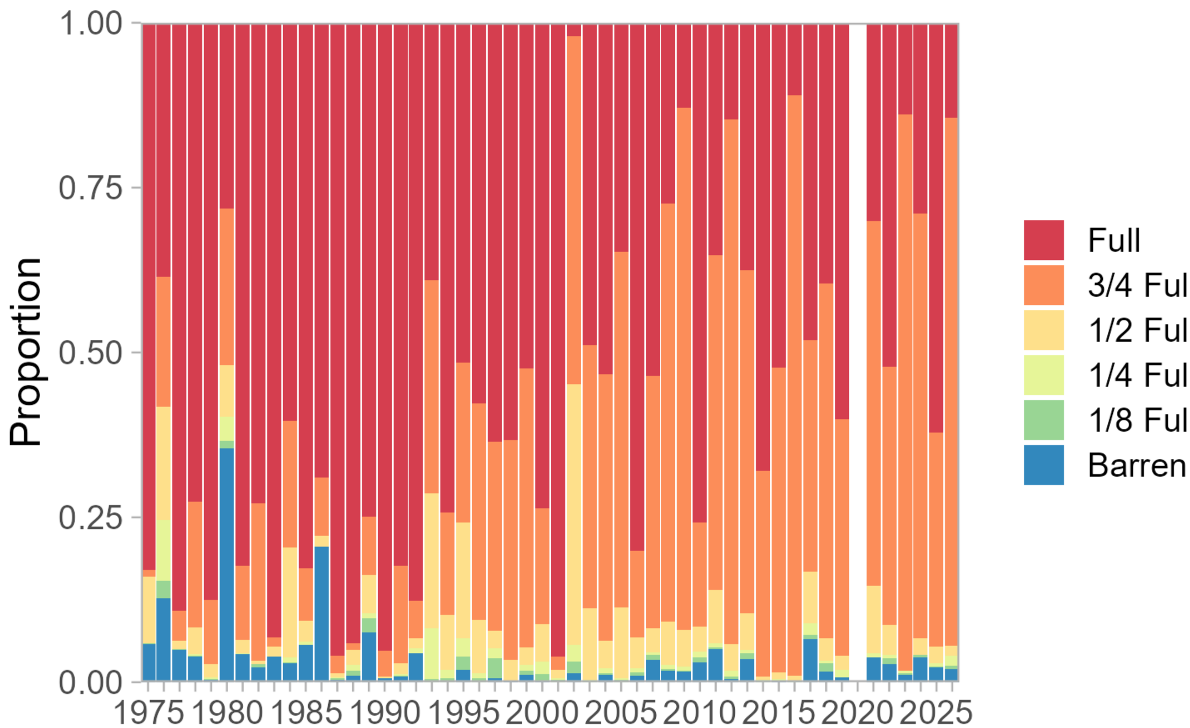

Figure 43: Clutch fullness distribution of newshell (shell conditions 1 and 2) mature female crab >89 mm CL from 1975 to 2026 from survey data. Oldshell females were excluded.

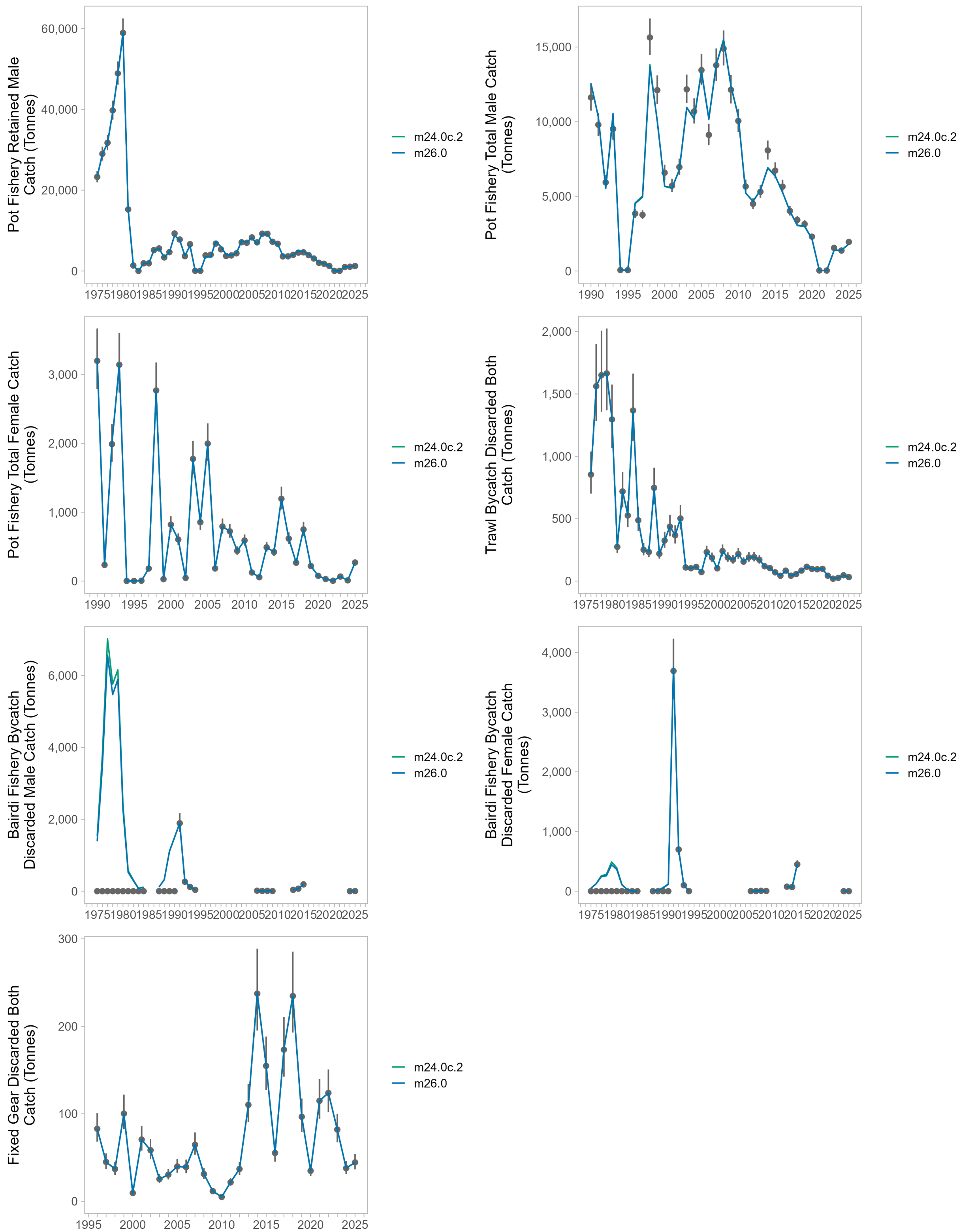

Figure 44: Observed (dots) and predicted (lines) RKC catch and bycatch biomass under models 24.0c.2 and 26.0. Note that model fit for Tanner crab fishery bycatch reflects utilizing effort data for extrapolation to bycatch in the early part of the time series.

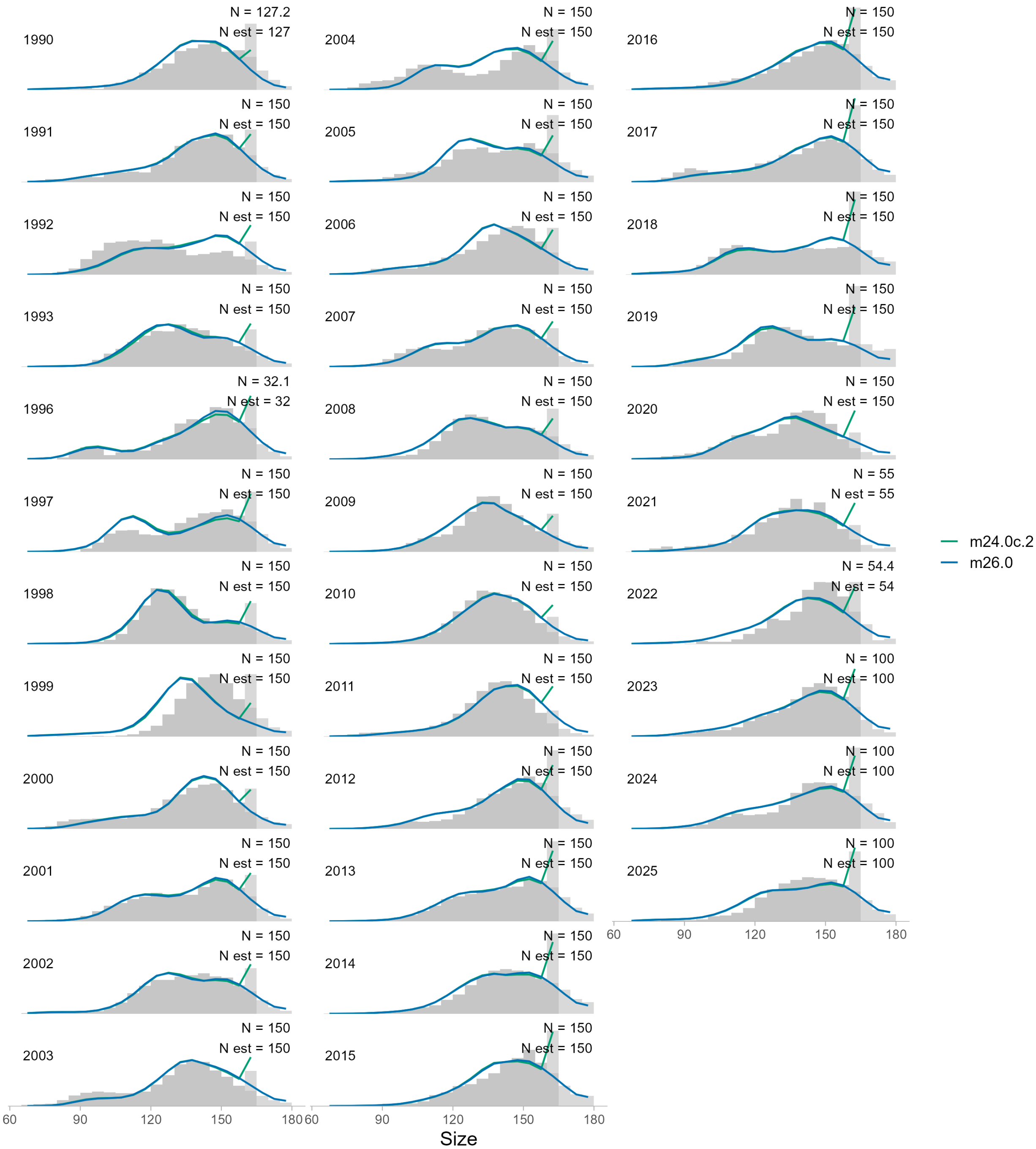

Figure 45: Observed and model estimated total observer length-frequencies of male BBRKC by year in the directed pot fishery for models 24.0c.2 and 26.0.

Figure 46: Observed and model estimated length-frequencies of male BBRKC by year retained in the directed pot fishery for models 24.0c.2 and 26.0.

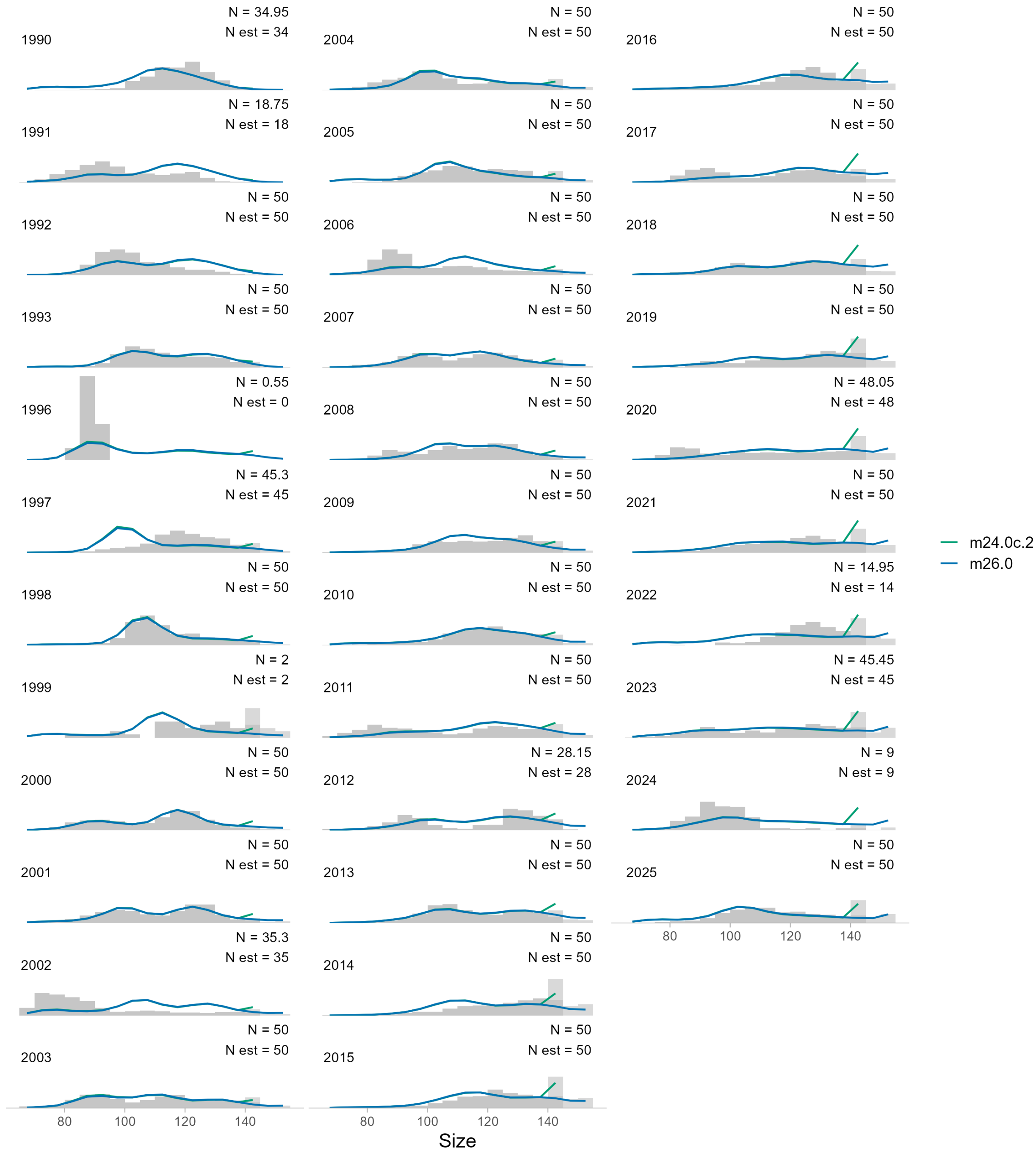

Figure 47: Observed and model estimated total observer length-frequencies of discarded female BBRKC by year in the directed pot fishery for models 24.0c.2 and 26.0.

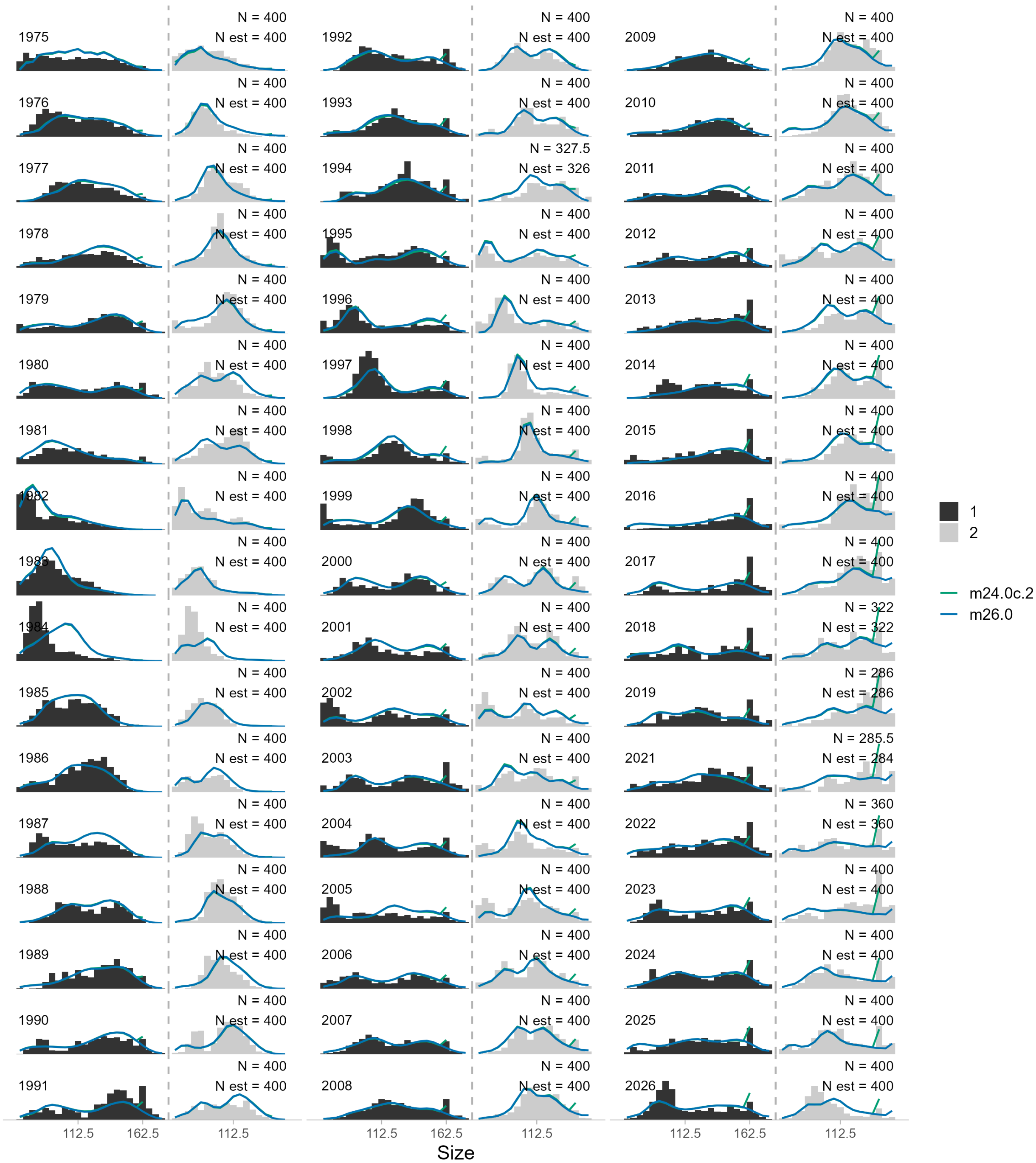

Figure 48: Comparison of area-swept and model estimated NMFS survey length frequencies of Bristol Bay male (black) and female (gray) red king crab by year for models 24.0c.2 and 26.0.

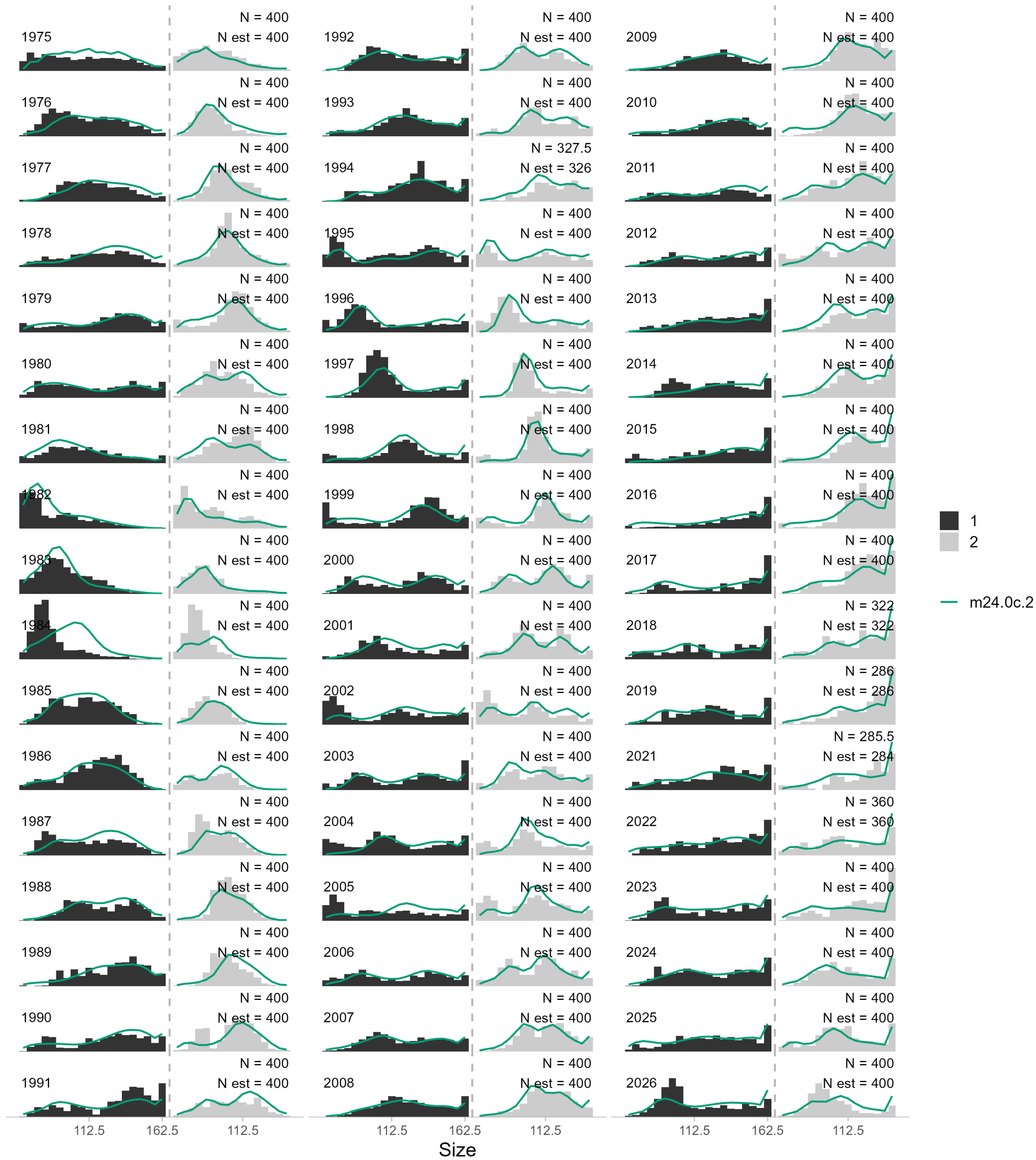

Figure 49: Comparison of area-swept and model estimated NMFS survey length frequencies of Bristol Bay male (black) and female (gray) red king crab by year for model 24.0c.2.

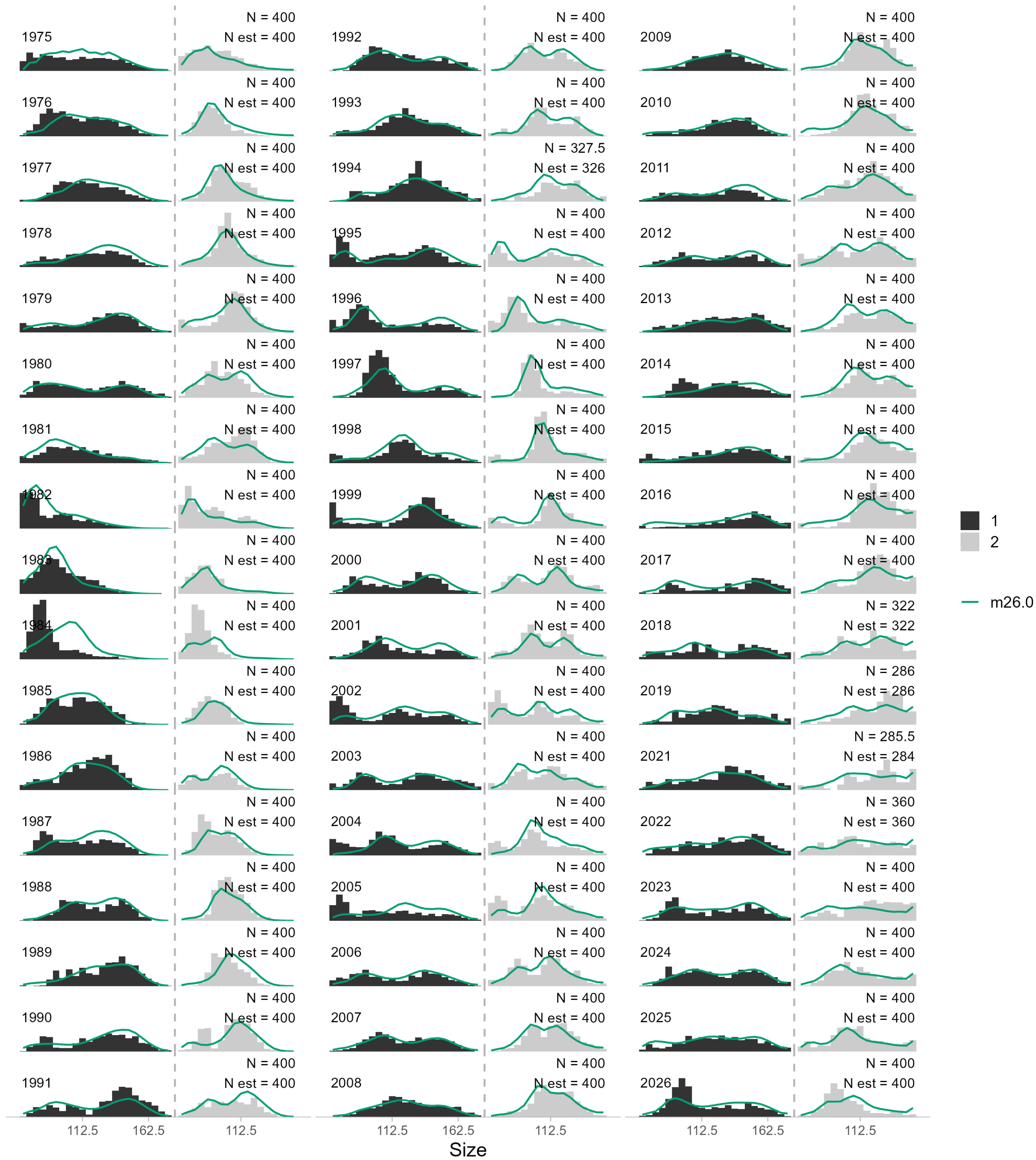

Figure 50: Comparison of area-swept and model estimated NMFS survey length frequencies of Bristol Bay male (black) and female (gray) red king crab by year for model 26.0.

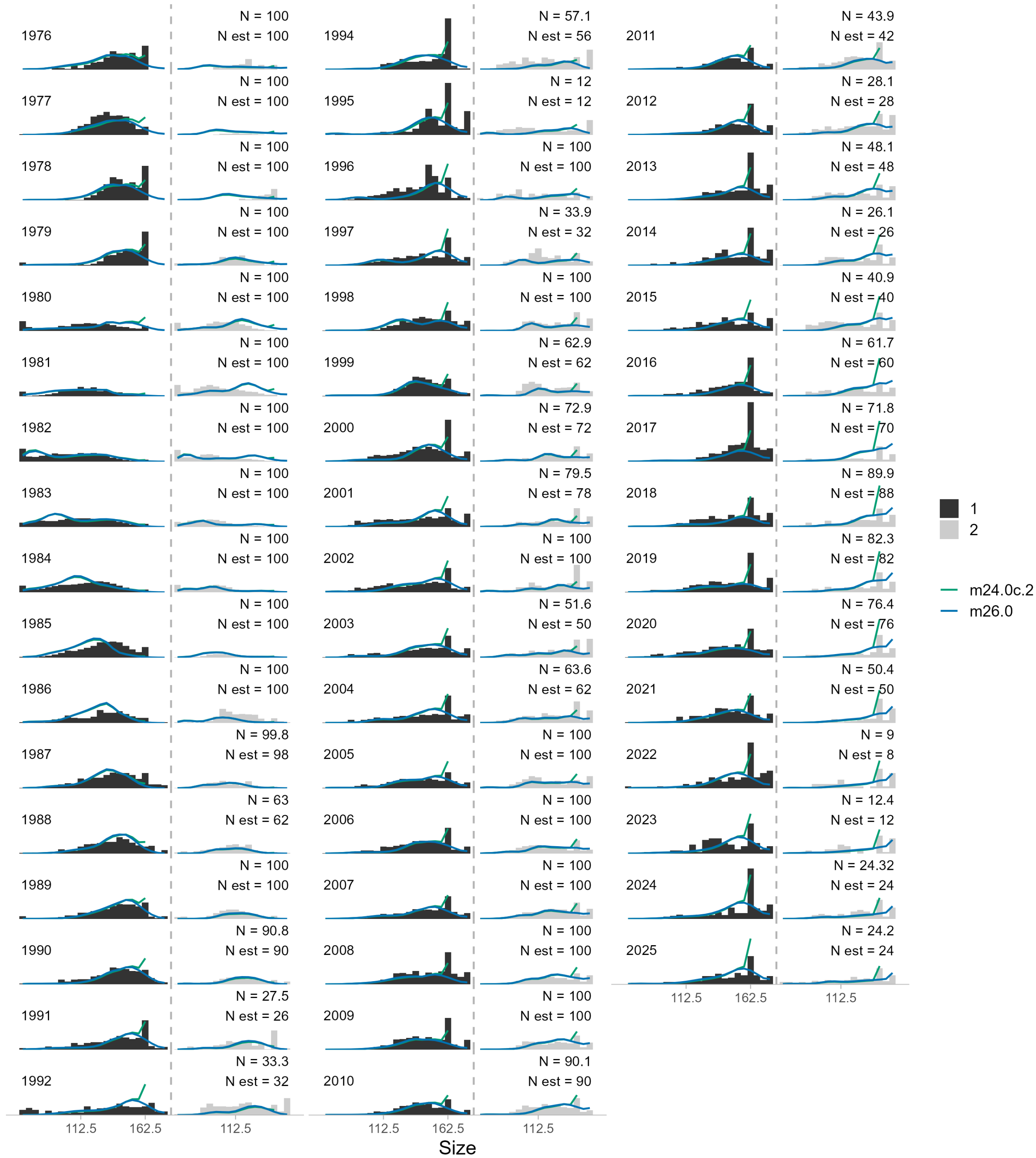

Figure 51: Comparison of observer and model estimated discarded length frequencies of Bristol Bay male (black) and female (gray) red king crab by year in the groundfish trawl fisheries bycatch for models 24.0c.2 and 26.0.

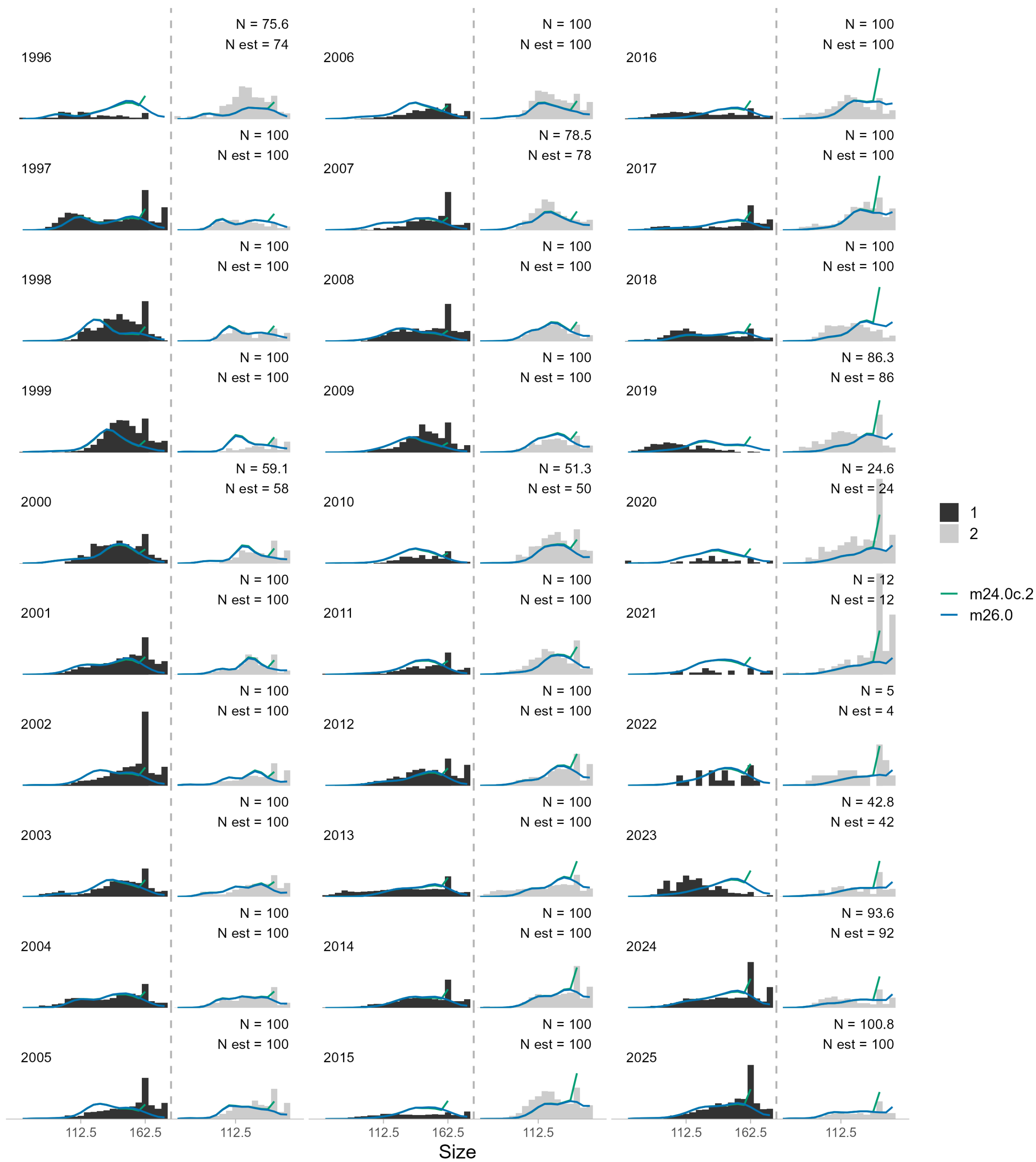

Figure 52: Comparison of observer and model estimated discarded length frequencies of Bristol Bay male (black) and female (gray) red king crab by year in the groundfish fixed gear fisheries bycatch for models 24.0c.2 and 26.0.

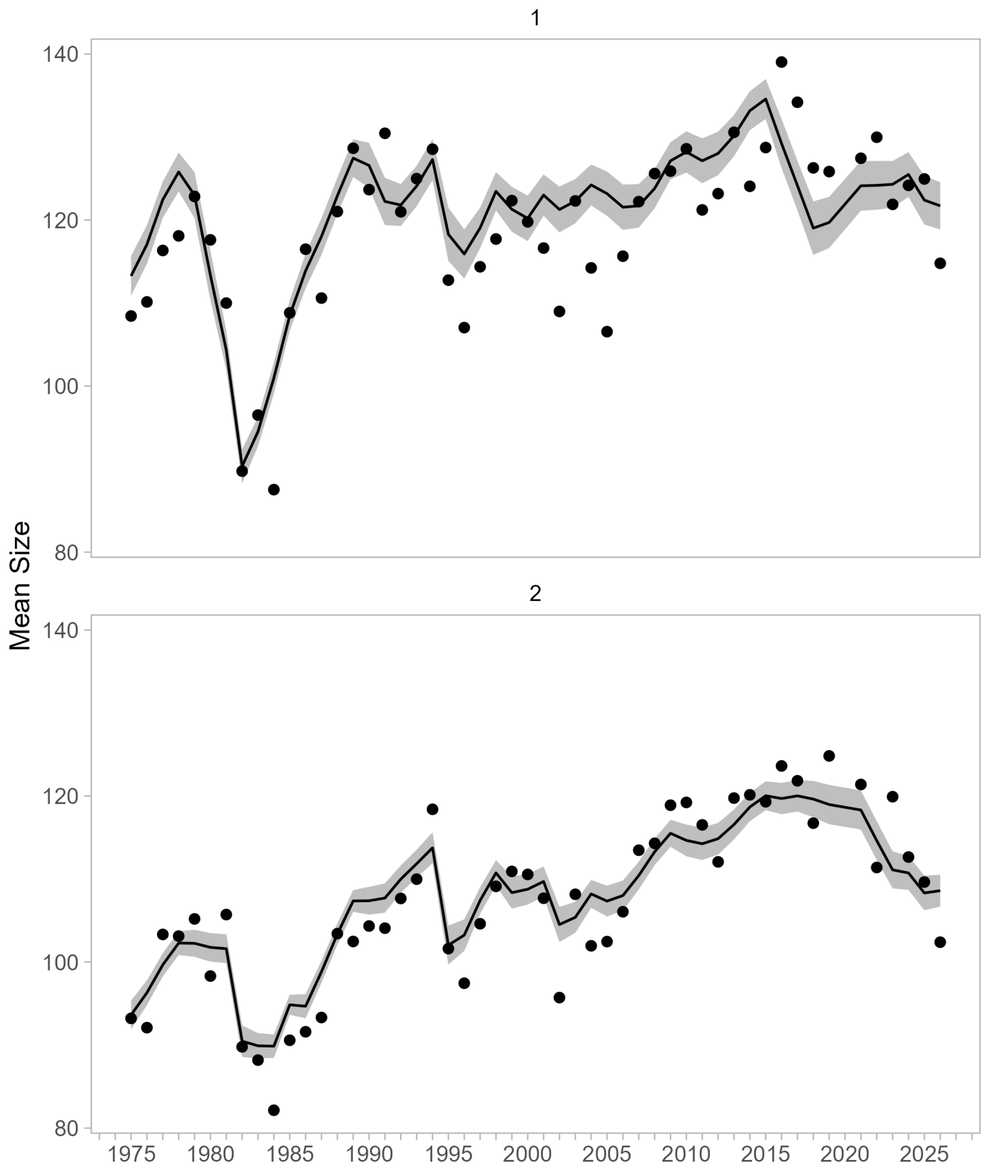

Figure 53: Mean size over all years for the NMFS survey for males (1) and females (2) under model 24.0c.2.

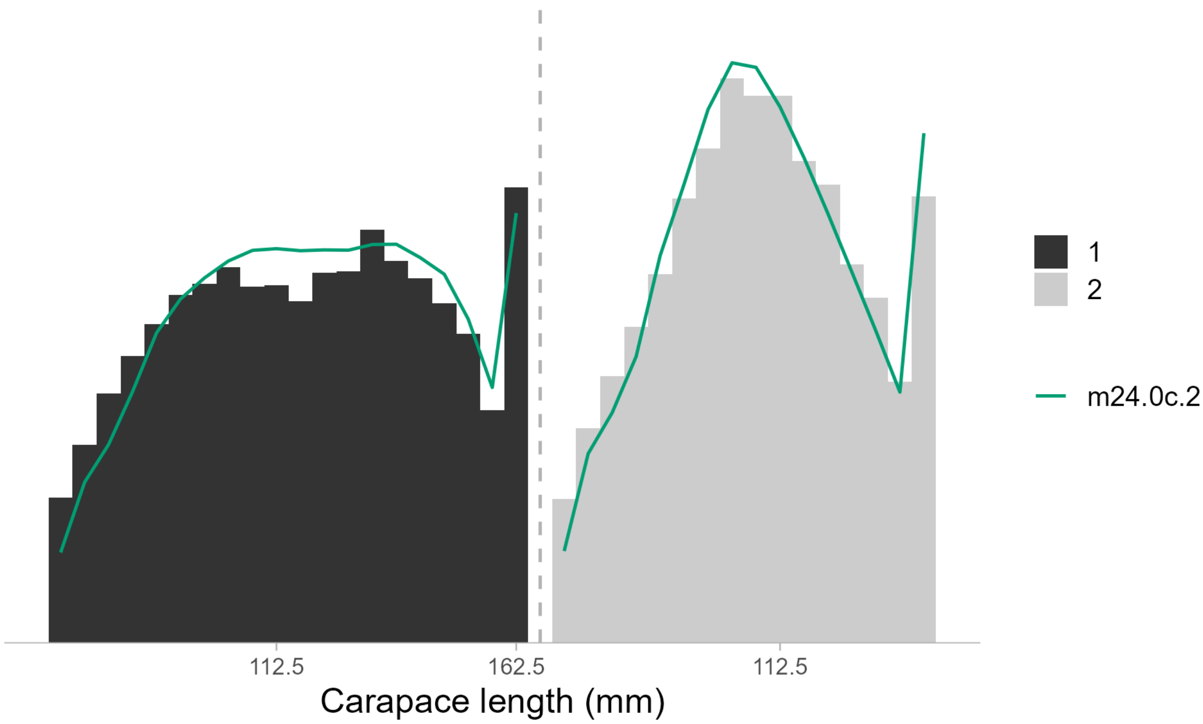

Figure 54: Aggregated size comps over all years for the NMFS survey for males (black) and females (grey) for model 24.0c.2.

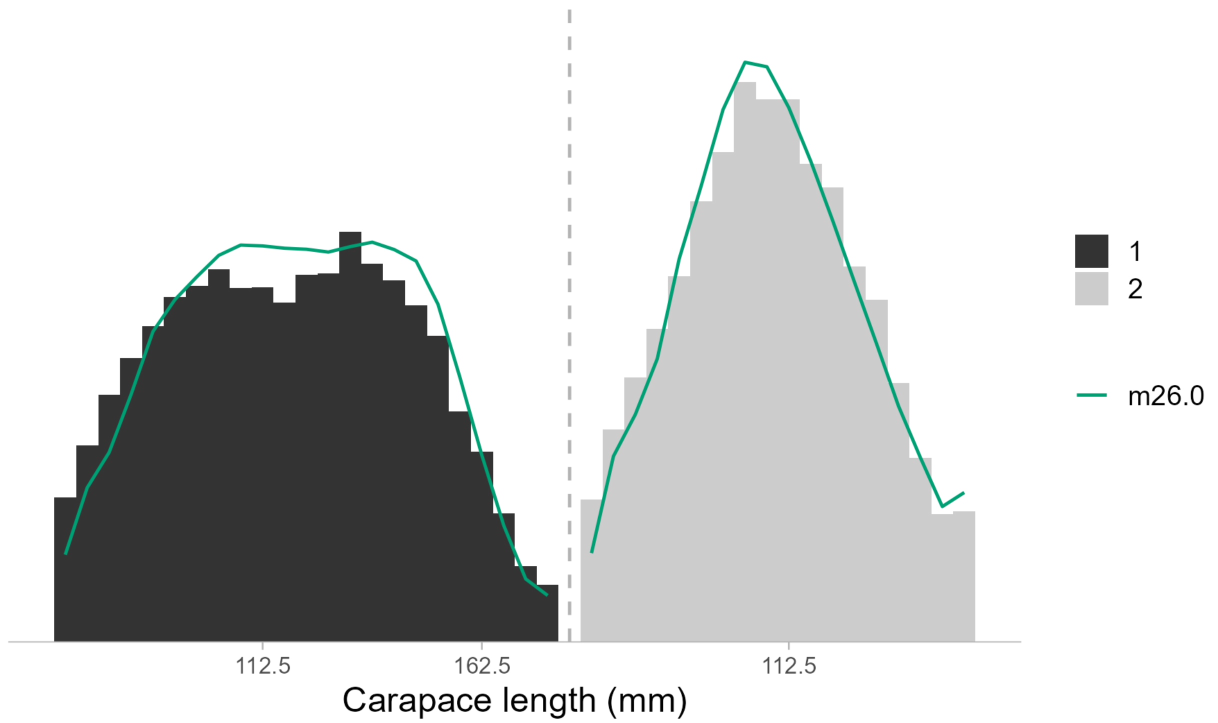

Figure 55: Aggregated size comps over all years for the NMFS survey for males (black) and females (grey) for model 26.0.

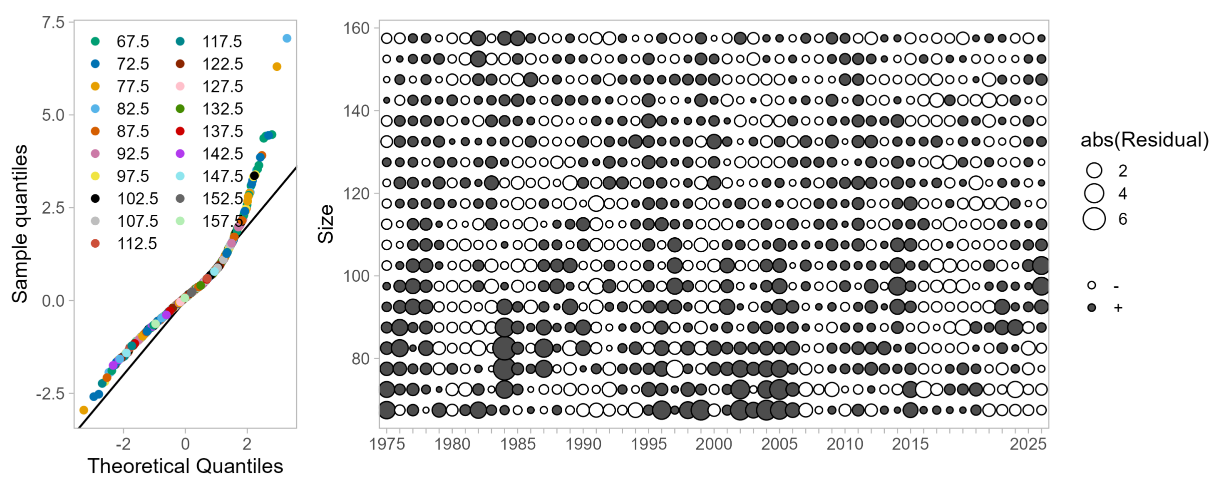

Figure 56: One-step-ahead residuals of size comps for males for the NMFS survey under model 24.0c.2 (updated base model based on 2025 accepted model).

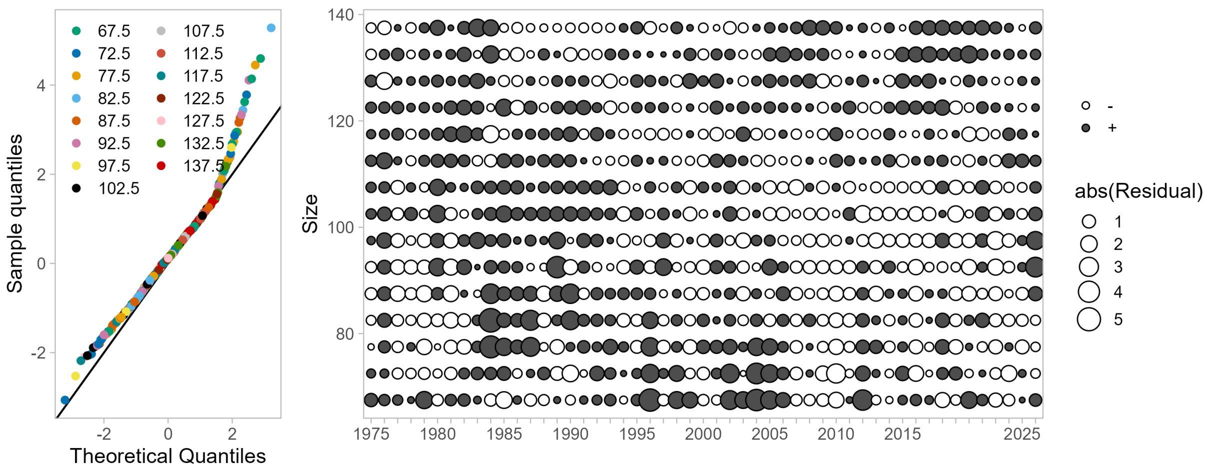

Figure 57: One-step-ahead residuals of size comps for females for the NMFS survey under model 24.0c.2 (updated base model based on 2025 accepted model).

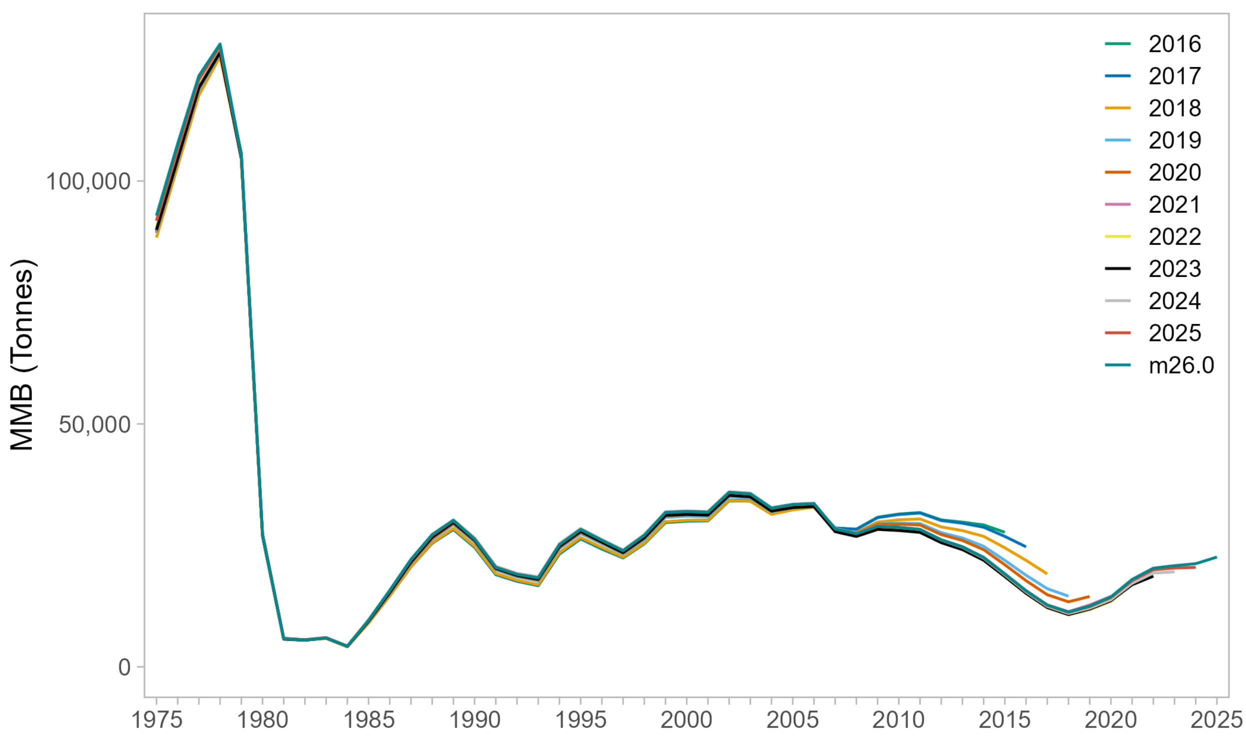

Figure 58: Comparison of retrospective estimates of mature male biomass on Feb. 15 of Bristol Bay red king crab with terminal years 2016-2026 using model 26.0. These are results using the 2026 model (Mohn's rho = 0.1749). Legend shows the terminal year.

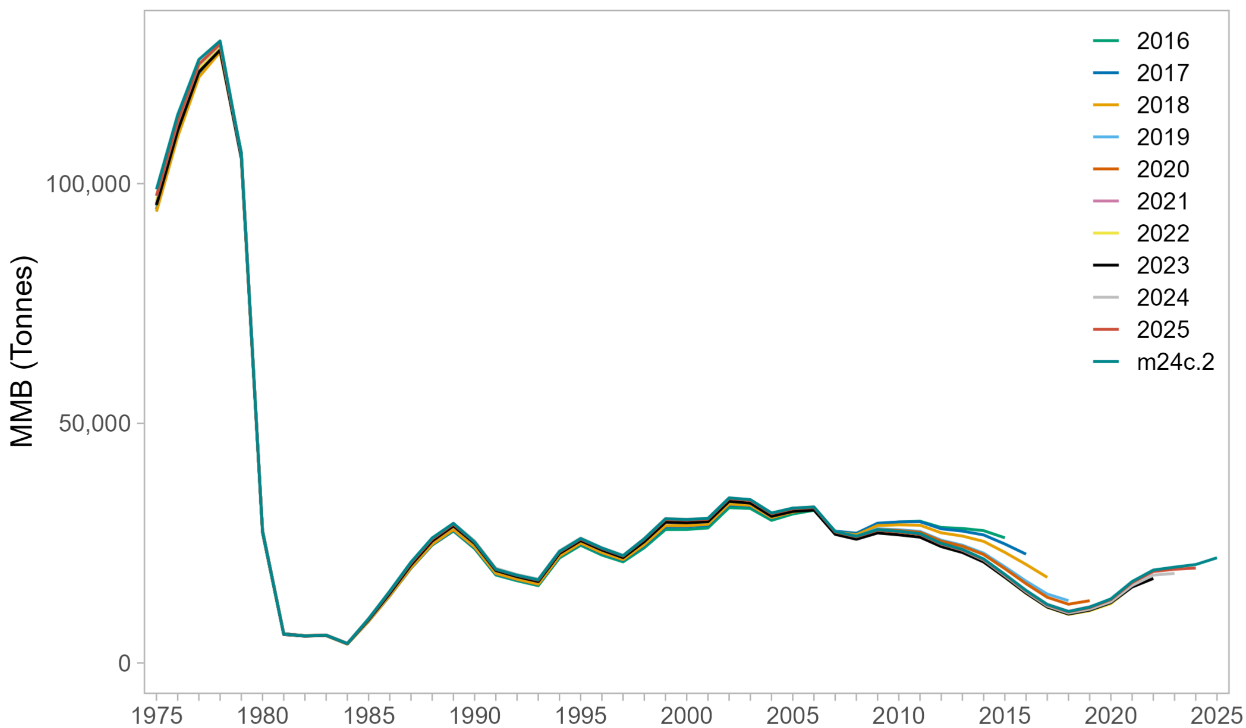

Figure 59: Comparison of retrospective estimates of mature male biomass on Feb. 15 of Bristol Bay red king crab with terminal years 2016-2026 using model 24.0c.2. These are results using the 2026 model (Mohn's rho = 0.1428). Legend shows the terminal year.

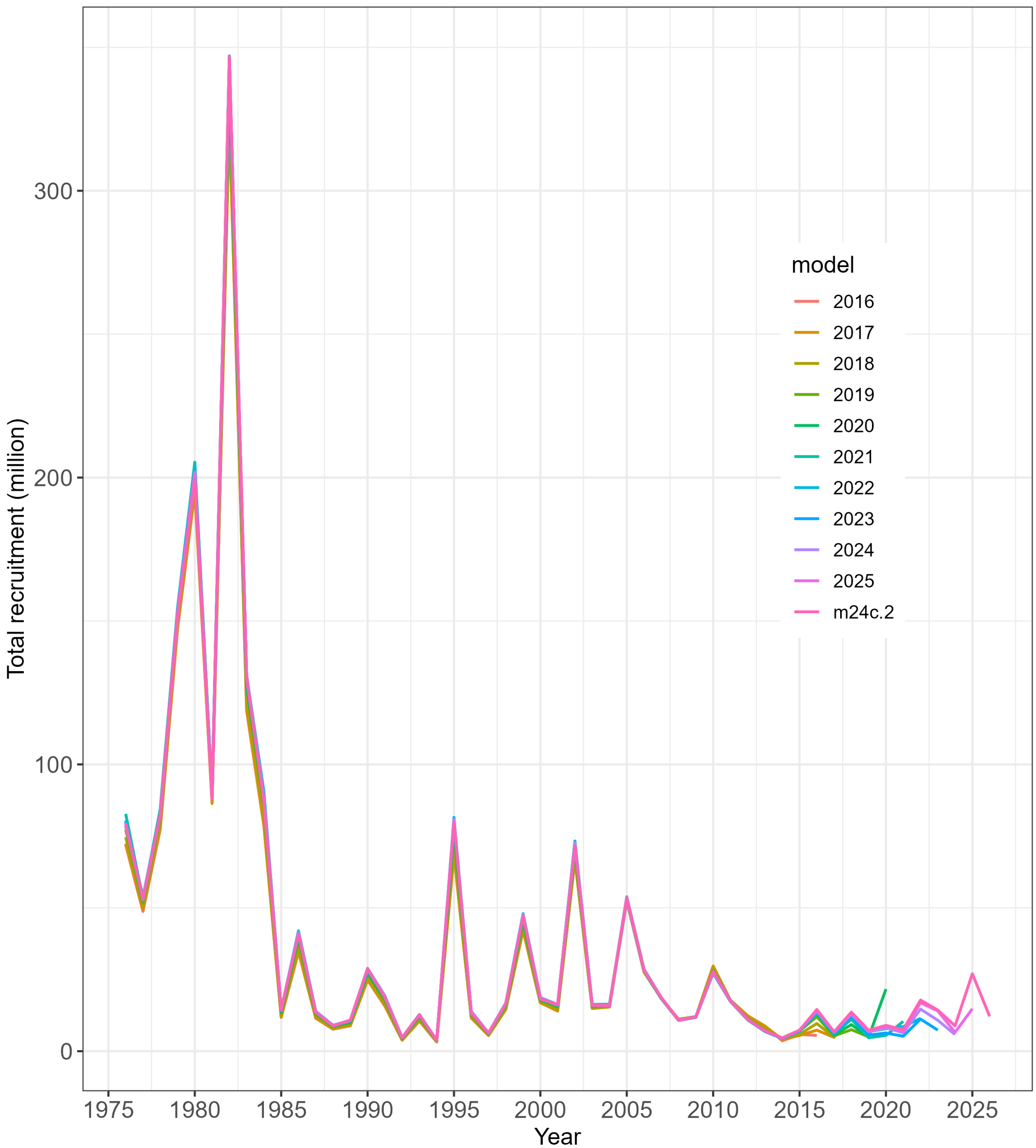

Figure 60: Comparison of retrospective estimates of total recruitment for model 24.0c.2 of Bristol Bay red king crab from 1976 to 2026 made with terminal years 2015-2026. Legend shows the terminal year.

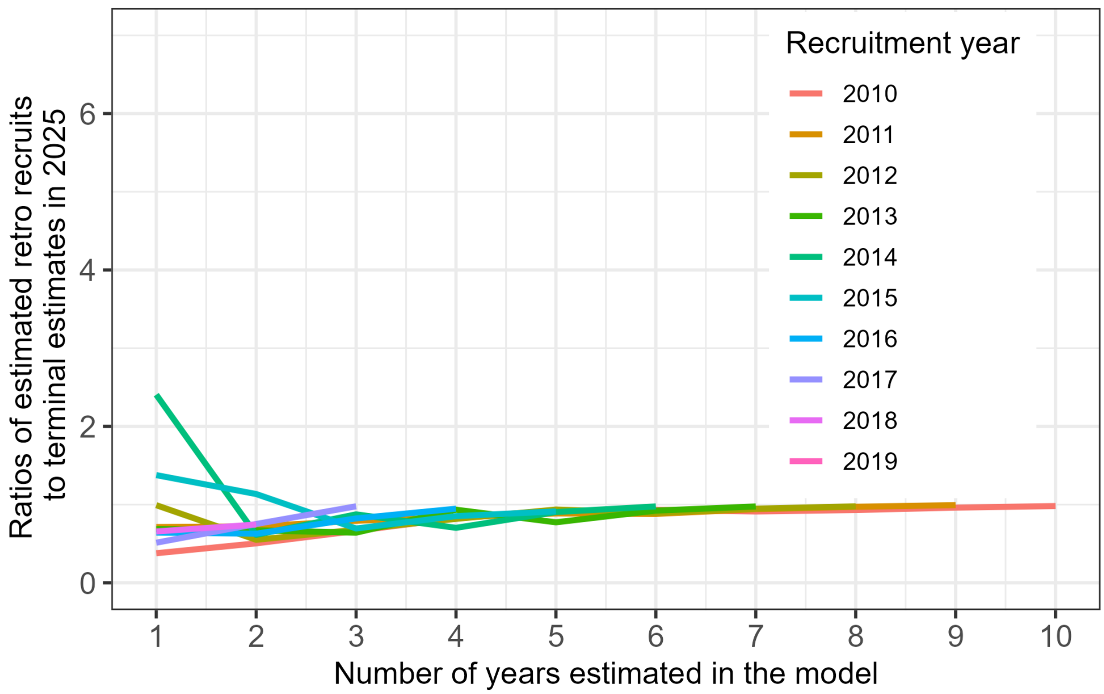

Figure 61: Evaluation of Bristol Bay red king crab retrospective errors on recruitment estimates as a function of the number of years in the model for model 24.0c.2.

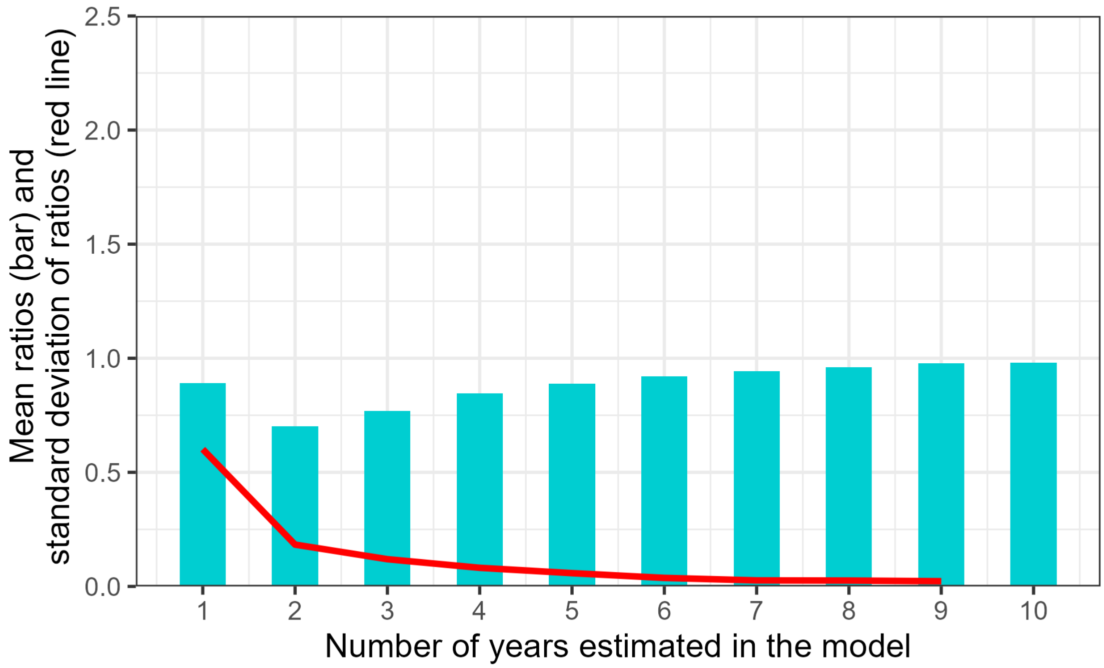

Figure 62: Mean ratios of retrospective estimates of recruitments to those estimated in the most recent year (2025) and standard deviations (red line) of the ratios as a function of the number of years in the model for model 24.0c.2.

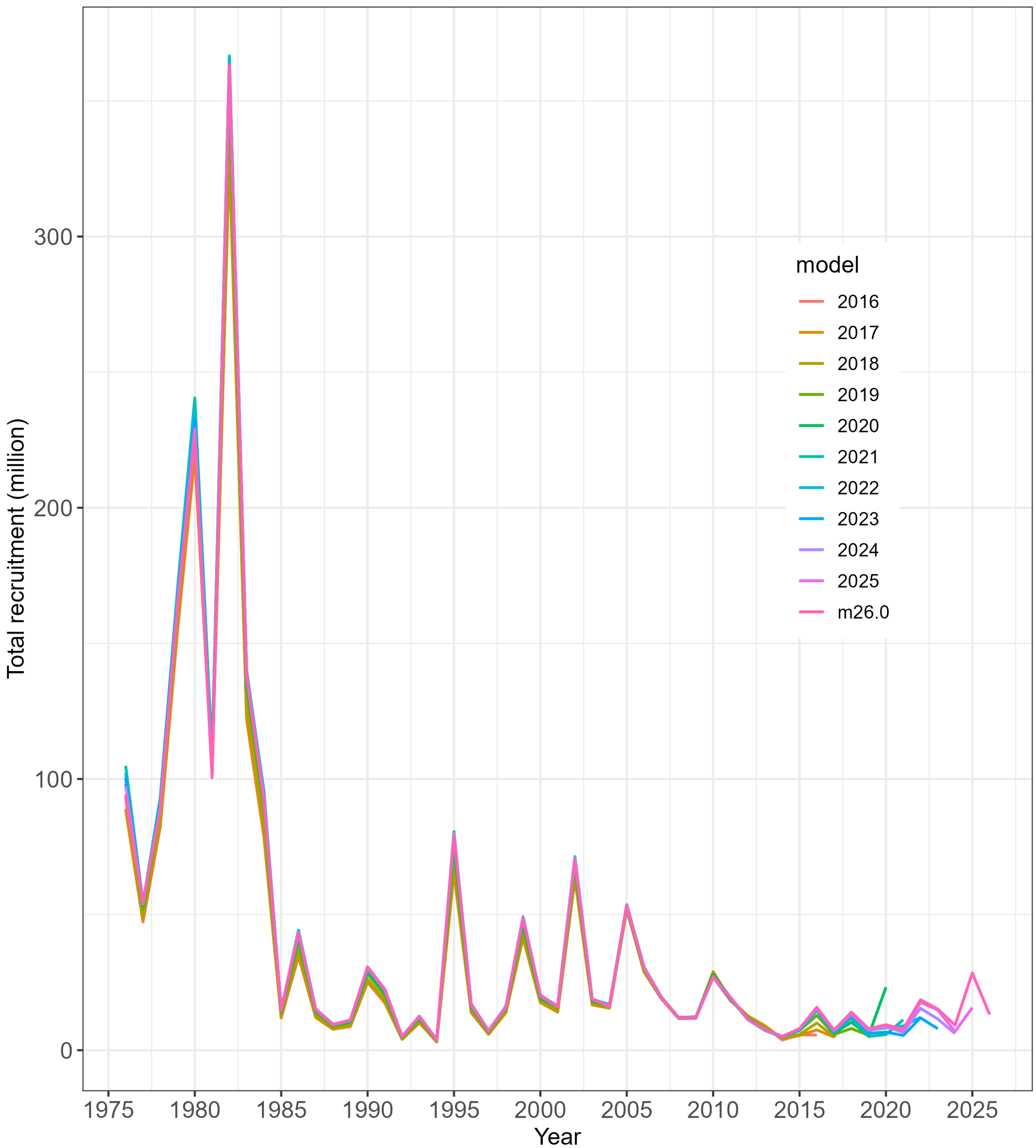

Figure 63: Comparison of retrospective estimates of total recruitment for model 26.0 of Bristol Bay red king crab from 1976 to 2026 made with terminal years 2015-2026. Legend shows the terminal year.

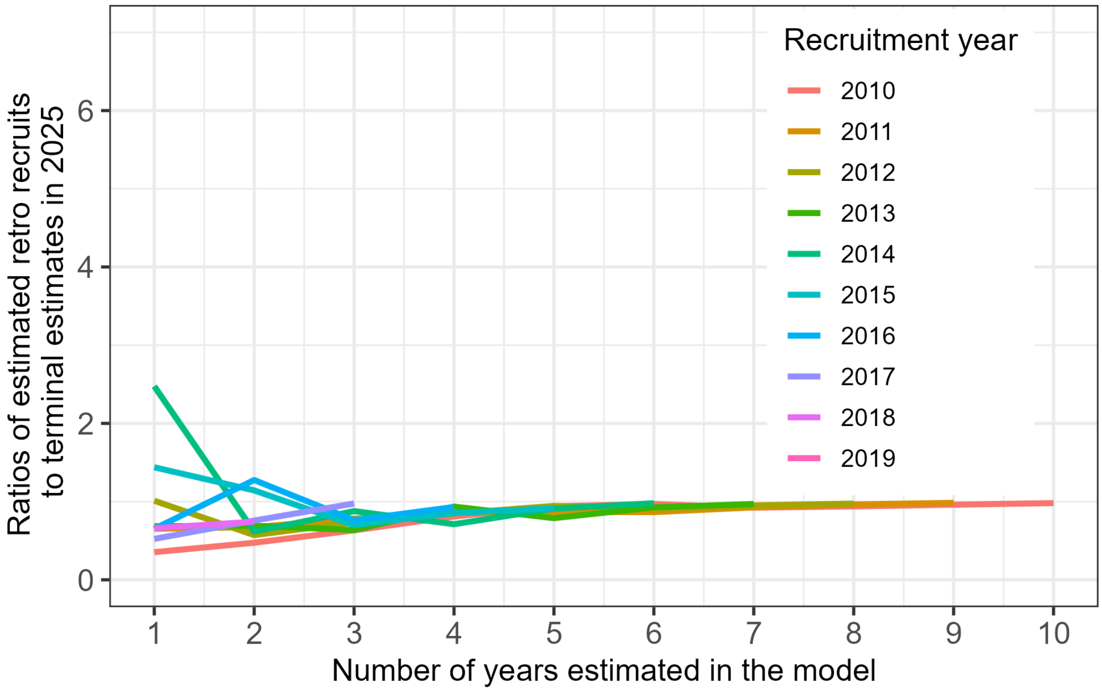

Figure 64: Evaluation of Bristol Bay red king crab retrospective errors on recruitment estimates as a function of the number of years in the model for model 26.0.

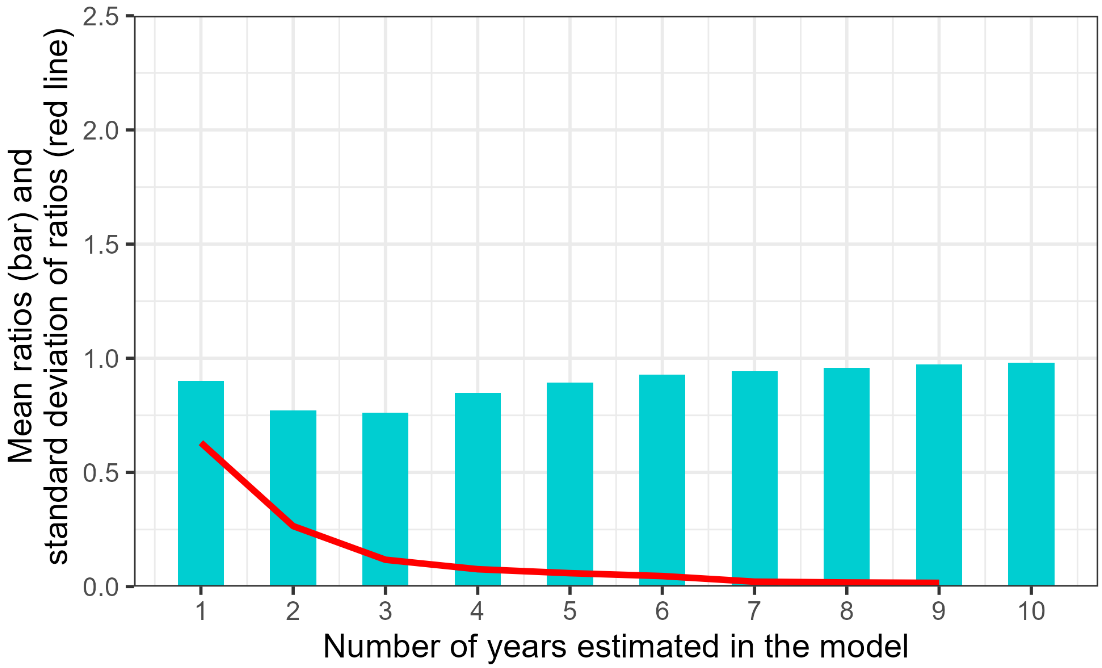

Figure 65: Mean ratios of retrospective estimates of recruitments to those estimated in the most recent year (2025) and standard deviations (red line) of the ratios as a function of the number of years in the model for model 26.0.

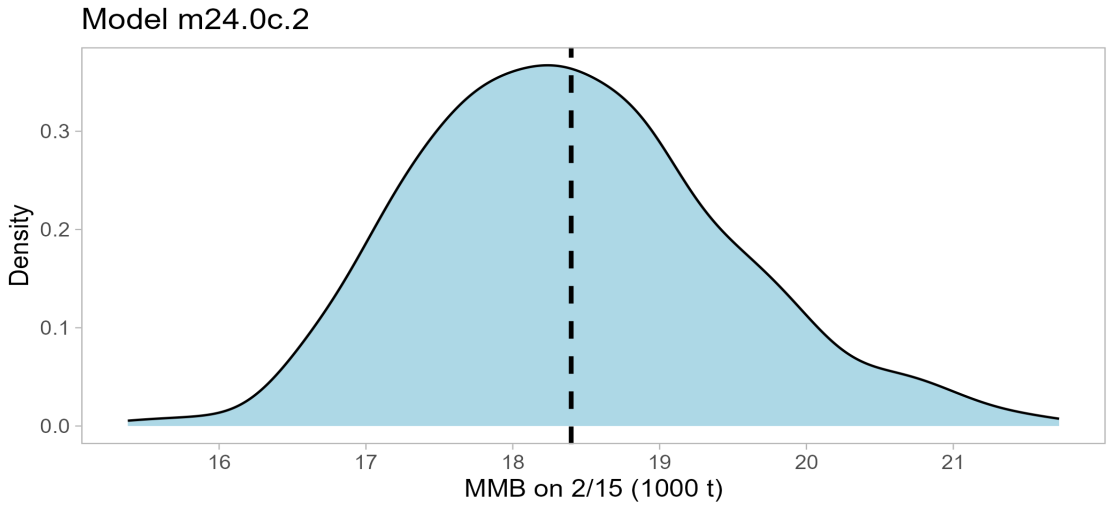

Figure 66: Histogram of estimated mature male biomass on Feb. 15, 2027, under model 24.0c.2 with the MCMC approach. The dashed line represents the MMB estimated from the MLE solution of model 24.0c.2

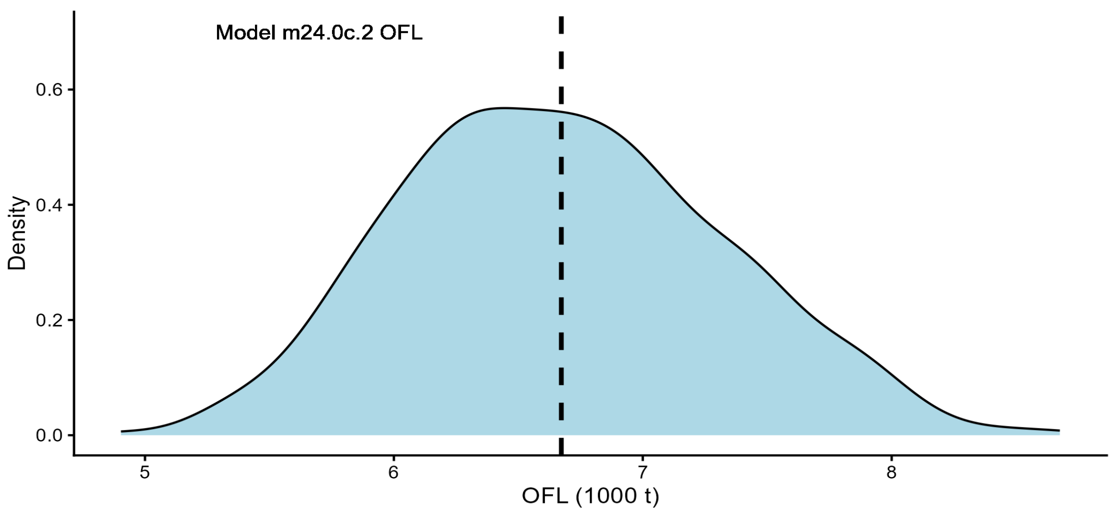

Figure 67: Histogram of the 2026/27 estimated OFL under model 24.0c.2 with the MCMC approach. The dashed line represents the OFL estimated from the MLE solution of model 24.0c.2

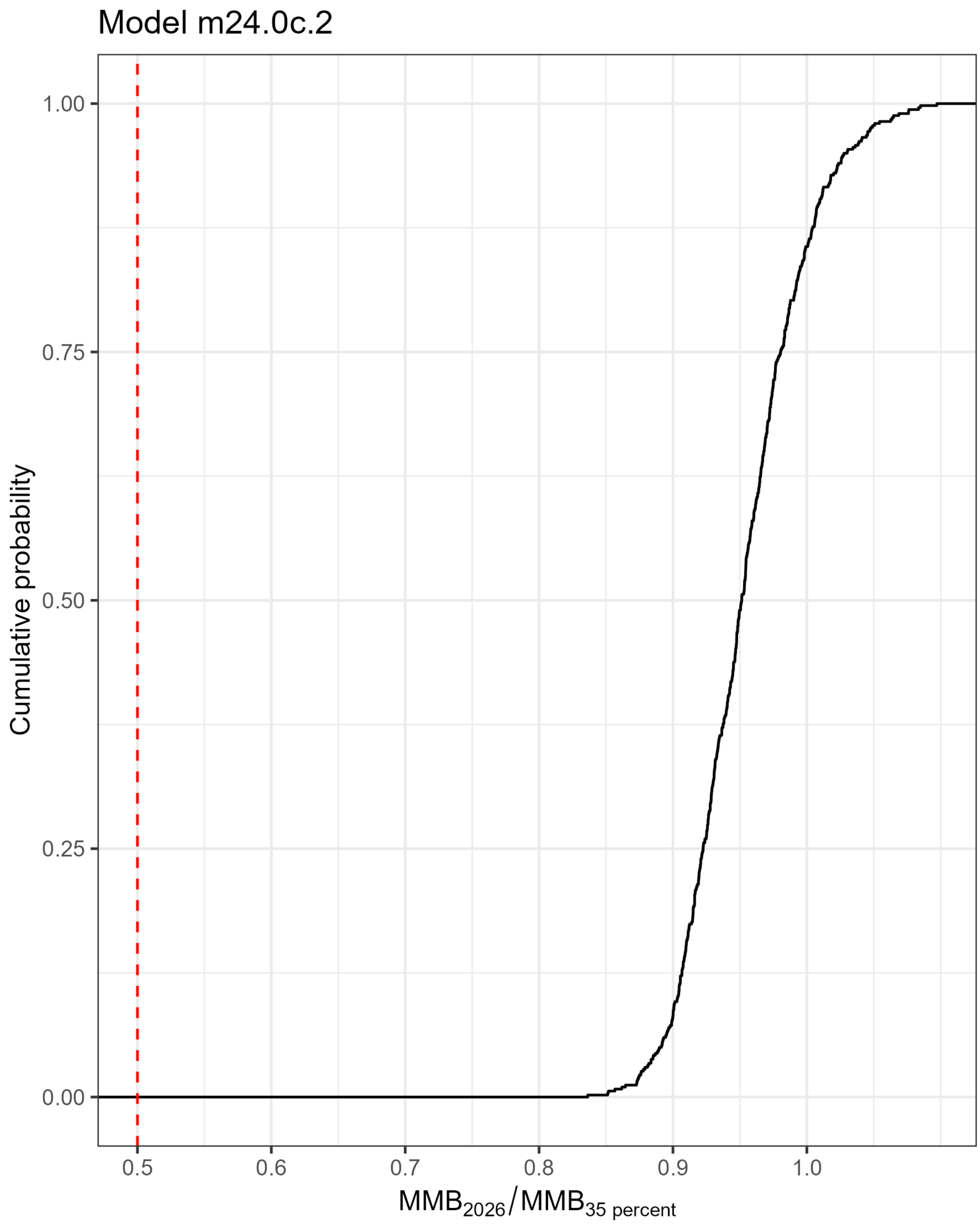

Figure 68: Cumulative probabilities of estimated ratios of MMB on Feb. 15, 2027, to corresponding estimated B35 values under model 24.0c.2 with the MCMC approach. Zero probability is below the estimated minimum thresholds.

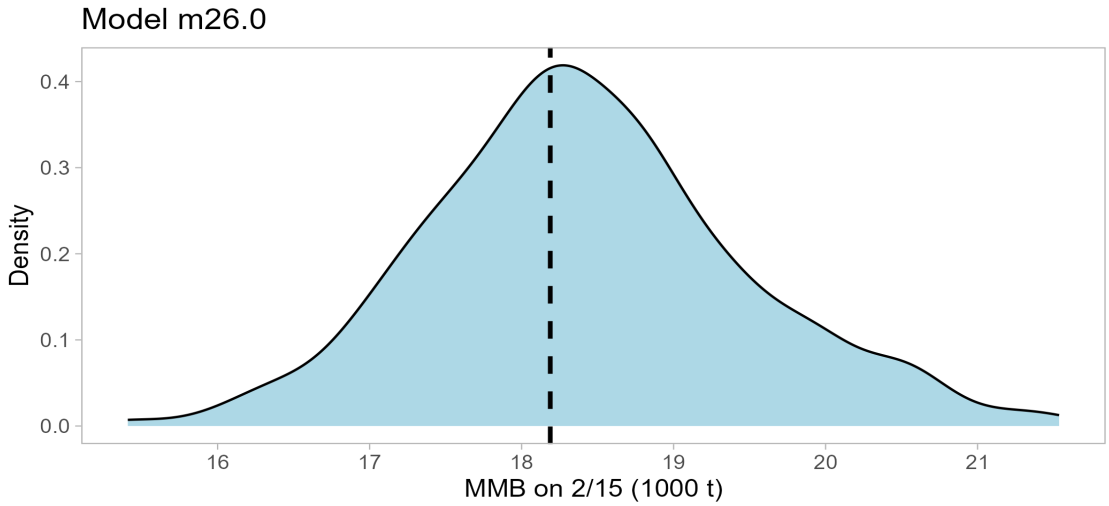

Figure 69: Histogram of estimated mature male biomass on Feb. 15, 2027, under model 26.0 with the MCMC approach. The dashed line represents the MMB estimated from the MLE solution of model 26.0

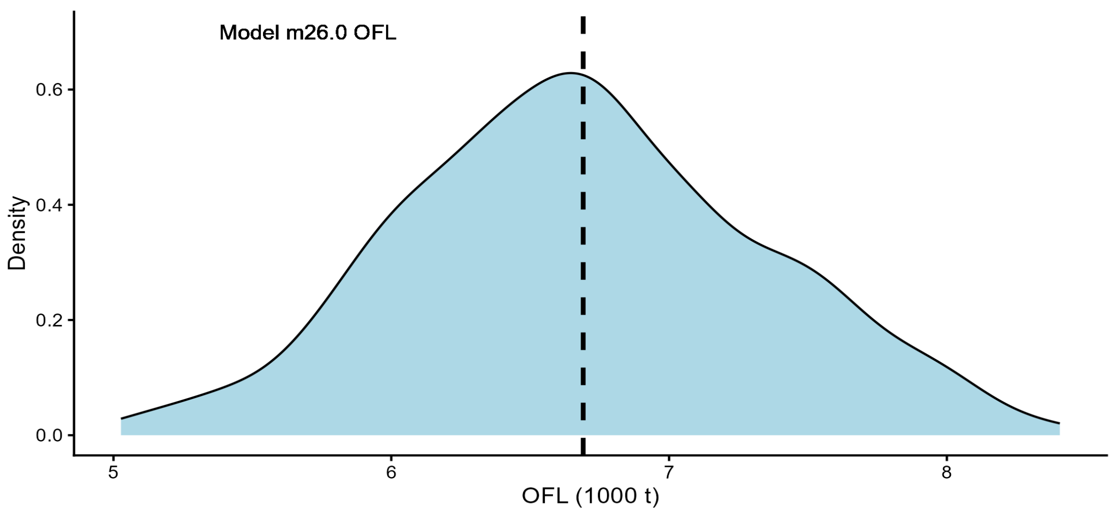

Figure 70: Histogram of the 2026/27 estimated OFL under model 26.0 with the MCMC approach. The dashed line represents the OFL estimated from the MLE solution of model 26.0

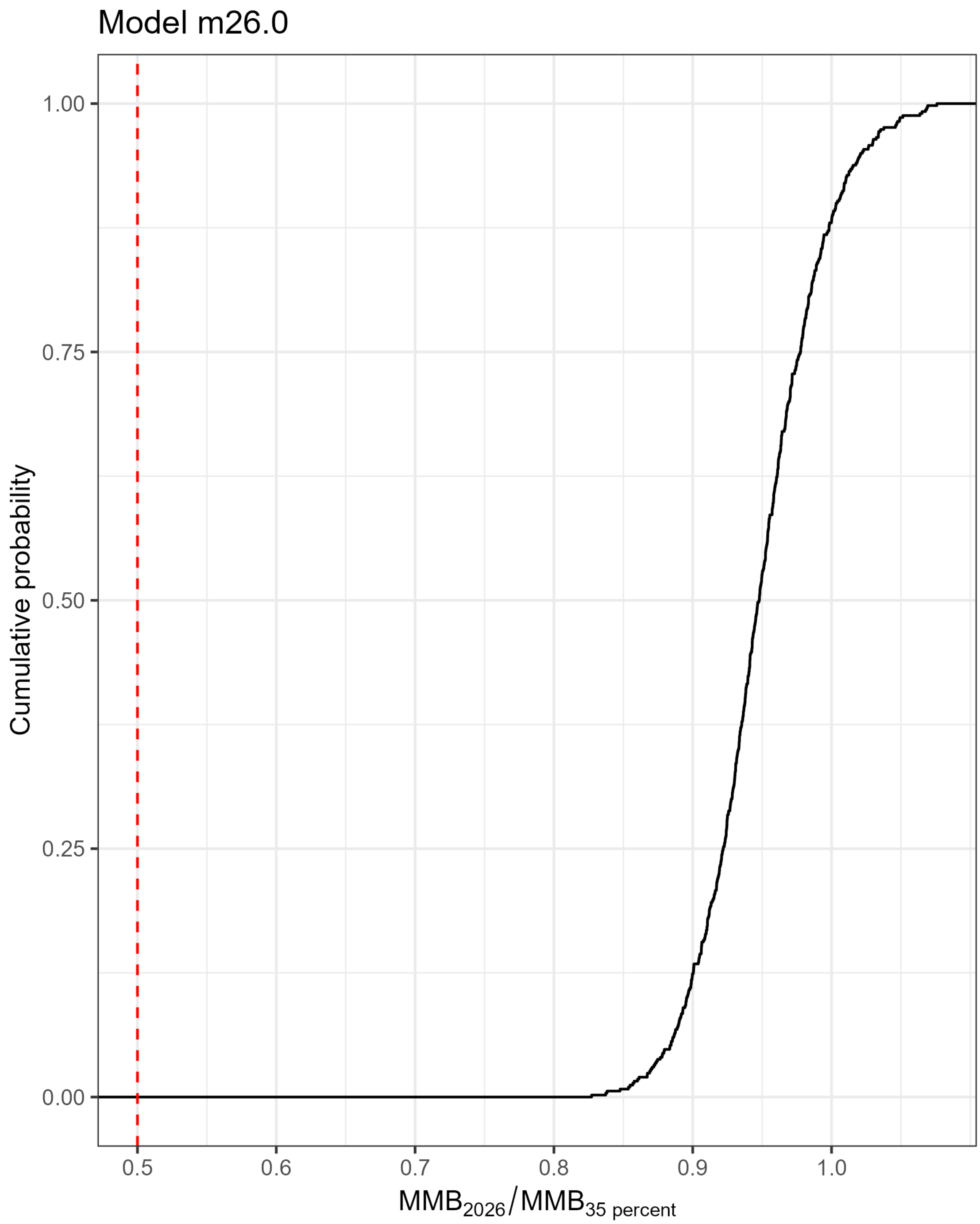

Figure 71: Cumulative probabilities of estimated ratios of MMB on Feb. 15, 2027, to corresponding estimated B35 values under model 26.0 with the MCMC approach. Zero probability is below the estimated minimum thresholds.

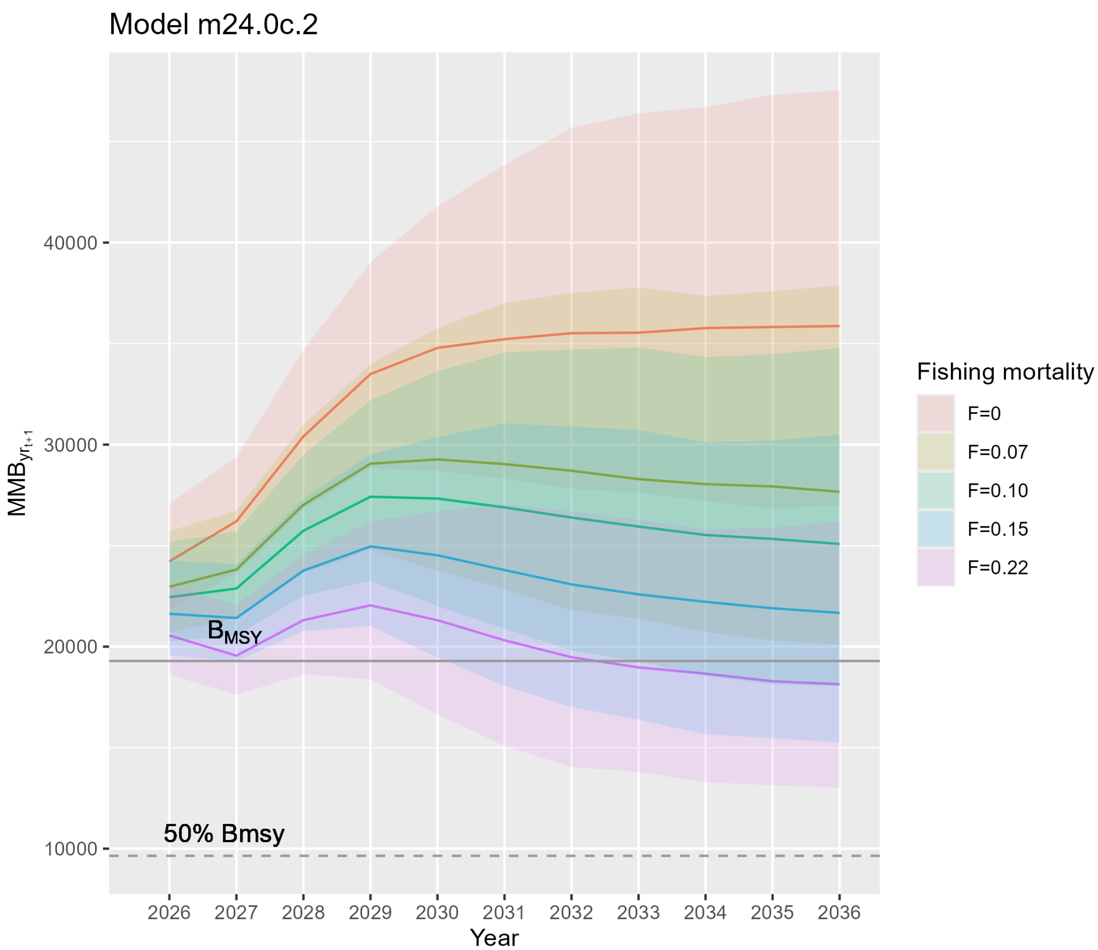

Figure 72: Projected mature male biomass (MMB) on Feb. 15 with four fishing mortalities in the directed fishery: F = 0, F = 0.07, F = 0.10, F = 0.15 and F = 0.22, during 2026-2036. Input parameter estimates are based on model 24.0c.2, and future recruitment is a random selection from estimated recruitments during 2015-2025. Crab year "2026" represents Feb. 15, 2027. Shaded areas represent the 0.05 to 0.95 limits.

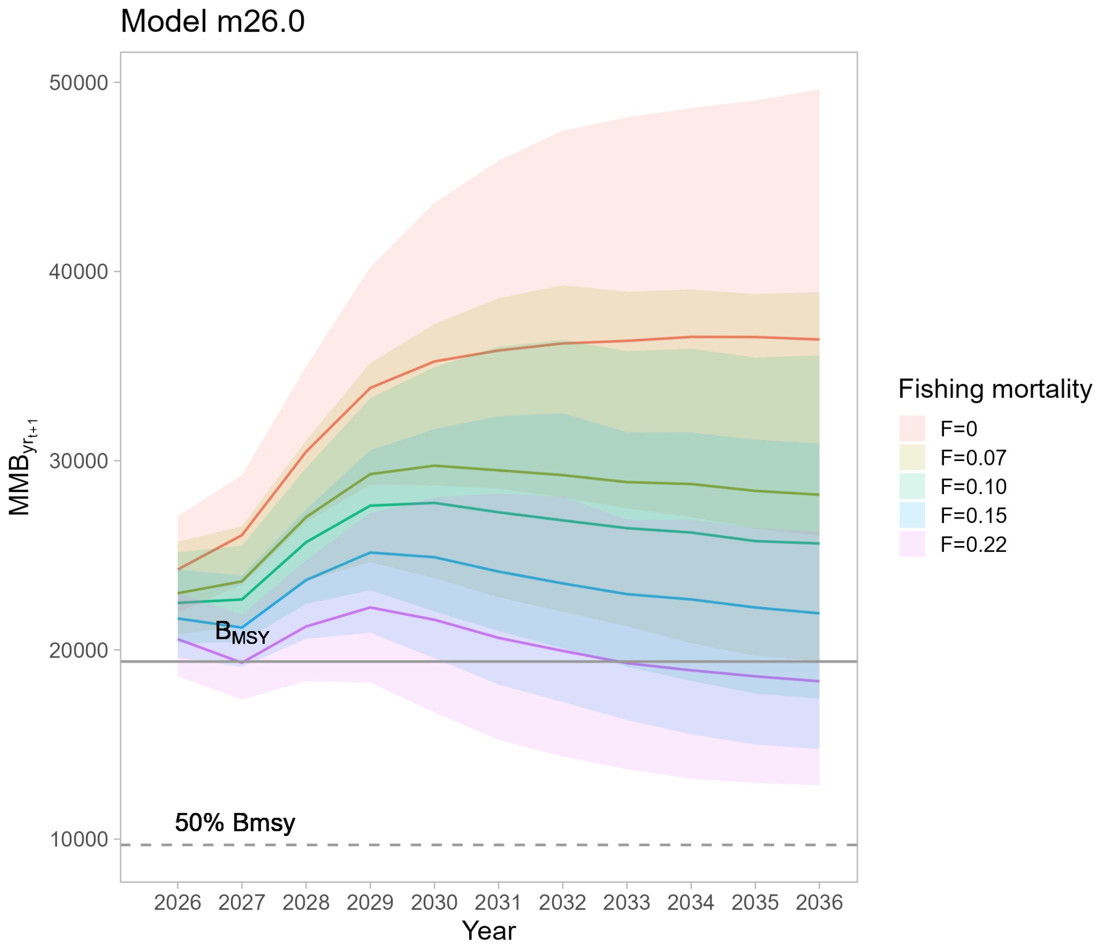

Figure 73: Projected mature male biomass (MMB) on Feb. 15 with four fishing mortalities in the directed fishery: F = 0, F = 0.07, F = 0.10, F = 0.15 and F = 0.22, during 2026-2036. Input parameter estimates are based on model 26.0, and future recruitment is a random selection from estimated recruitments during 2015-2025. Crab year "2026" represents Feb. 15, 2027. Shaded areas represent the 0.05 to 0.95 limits.

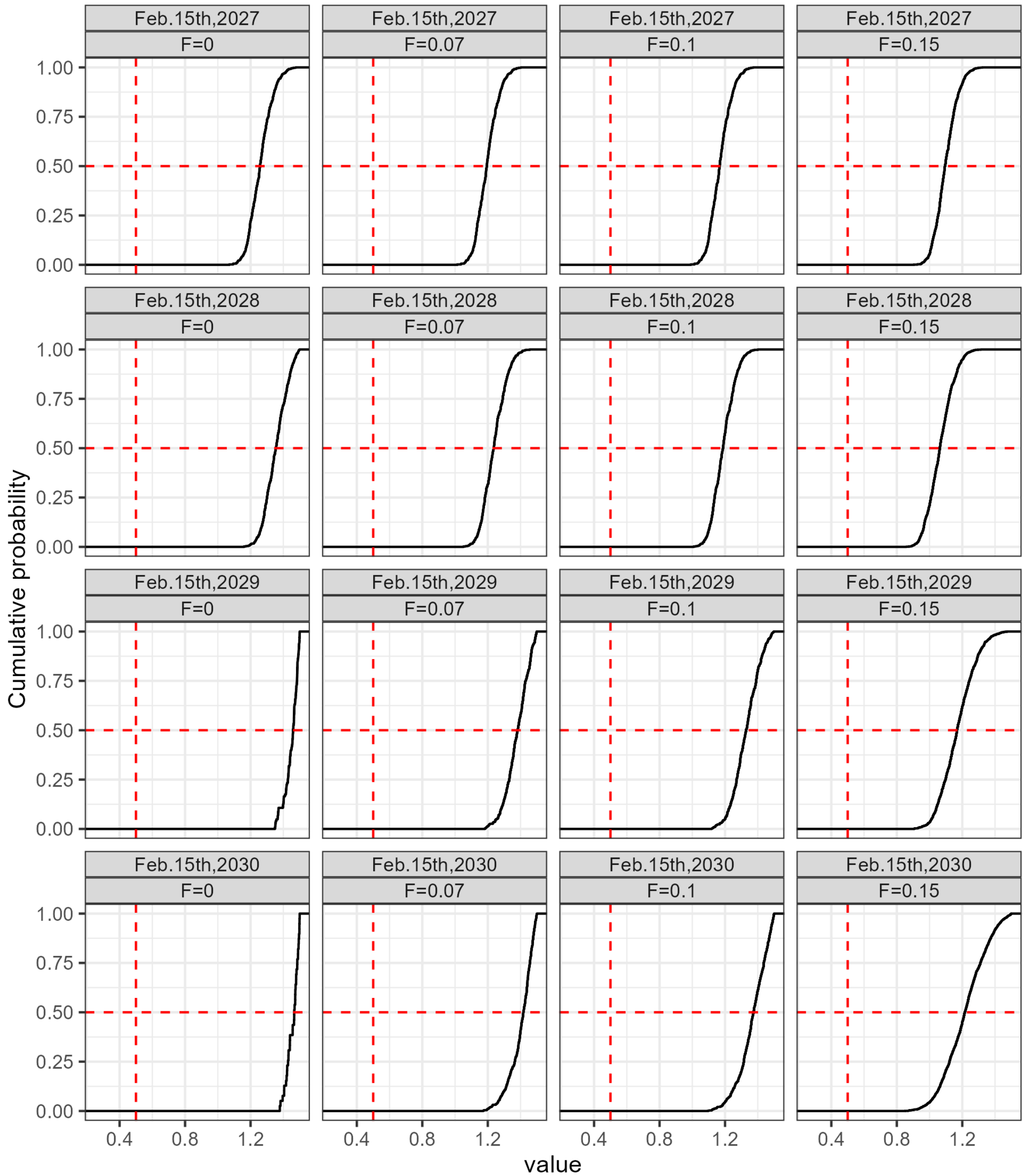

Figure 74: Cumulative probabilities of estimated ratios of MMB during 2026-2029 as represented by projected biomass on Feb.15th in year t+1, to corresponding estimated B35 values under model 24.0c.2 with the MCMC approach and four fishing mortality values. Feb. 15, 2027 represents crab year "2026".

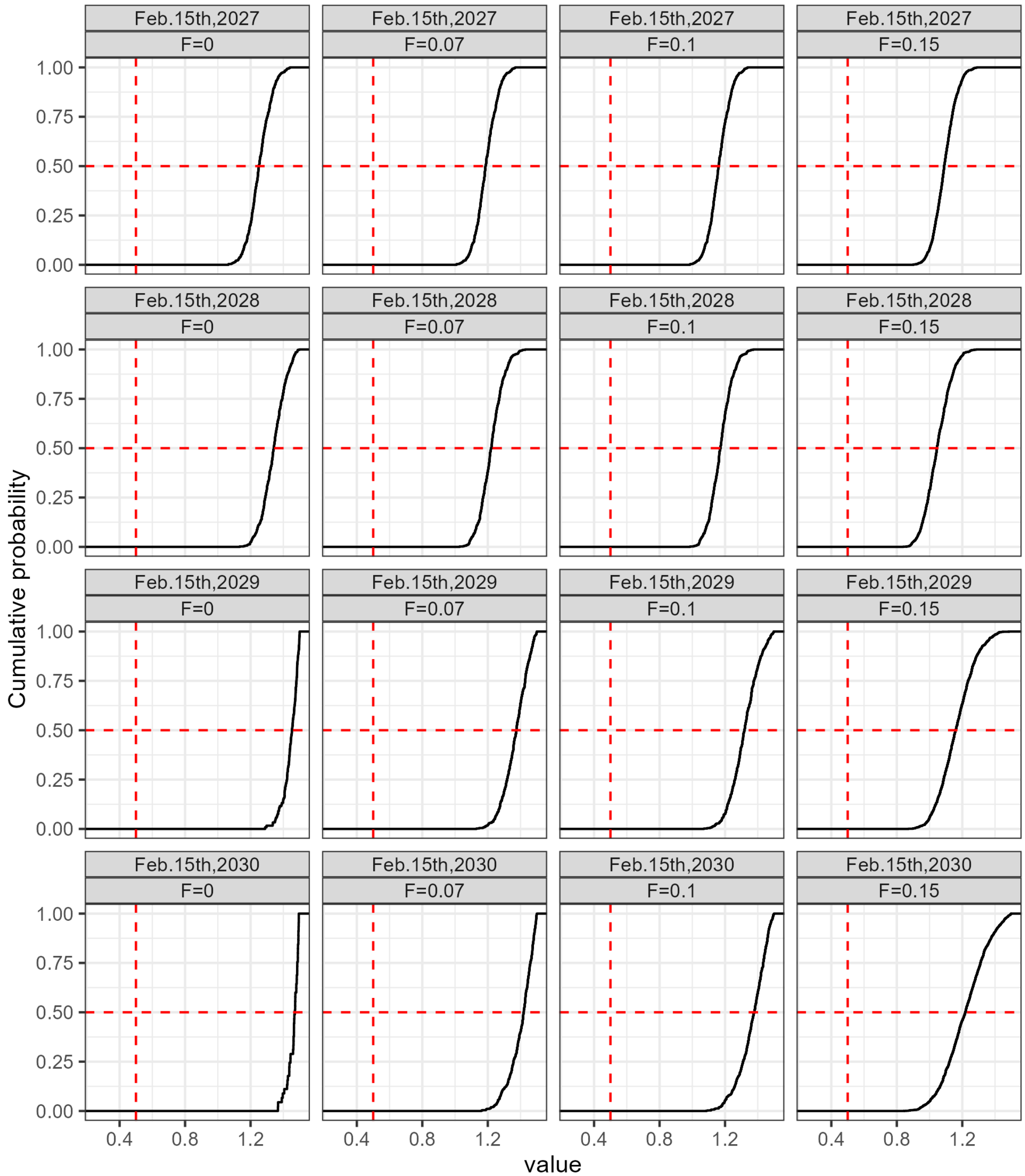

Figure 75: Cumulative probabilities of estimated ratios of MMB during 2026-2029 as represented by projected biomass on Feb.15th in year t+1, to corresponding estimated B35 values under model 26.0 with the MCMC approach and four fishing mortality values. Feb. 15, 2027 represents crab year “2026”.

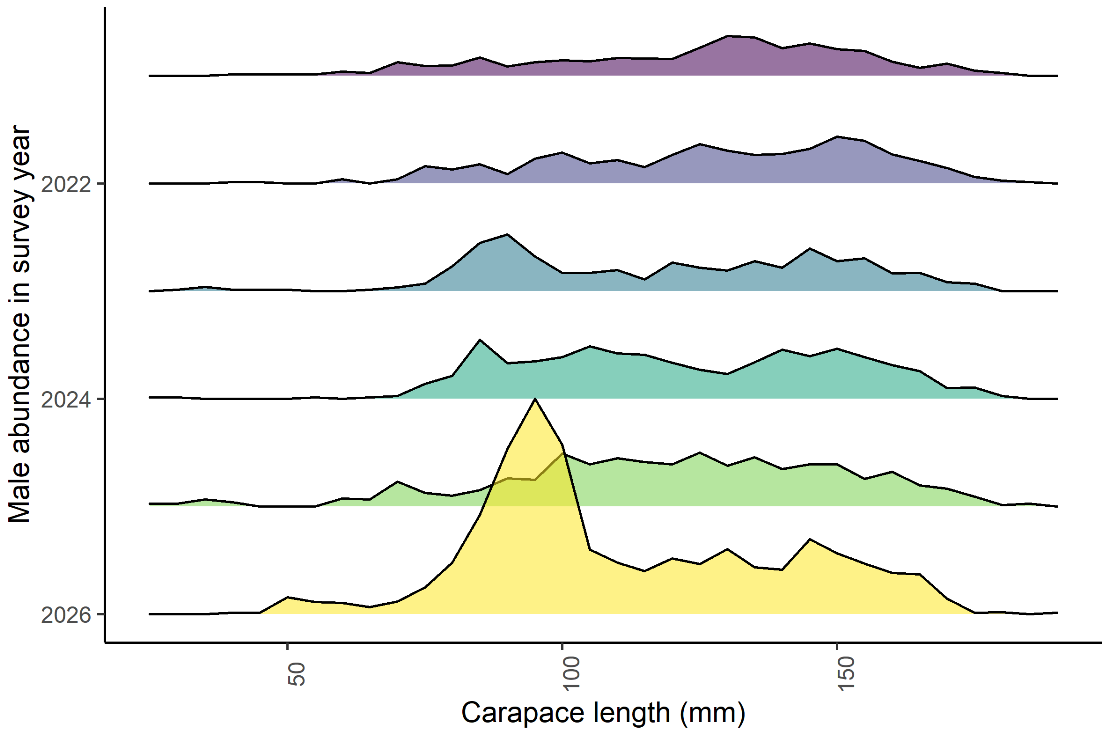

Figure 76: Length frequency distributions of male red king crab in Bristol Bay from NMFS trawl surveys during 2019-2025. For purposes of these graphs, abundance estimates are based on area-swept methods.

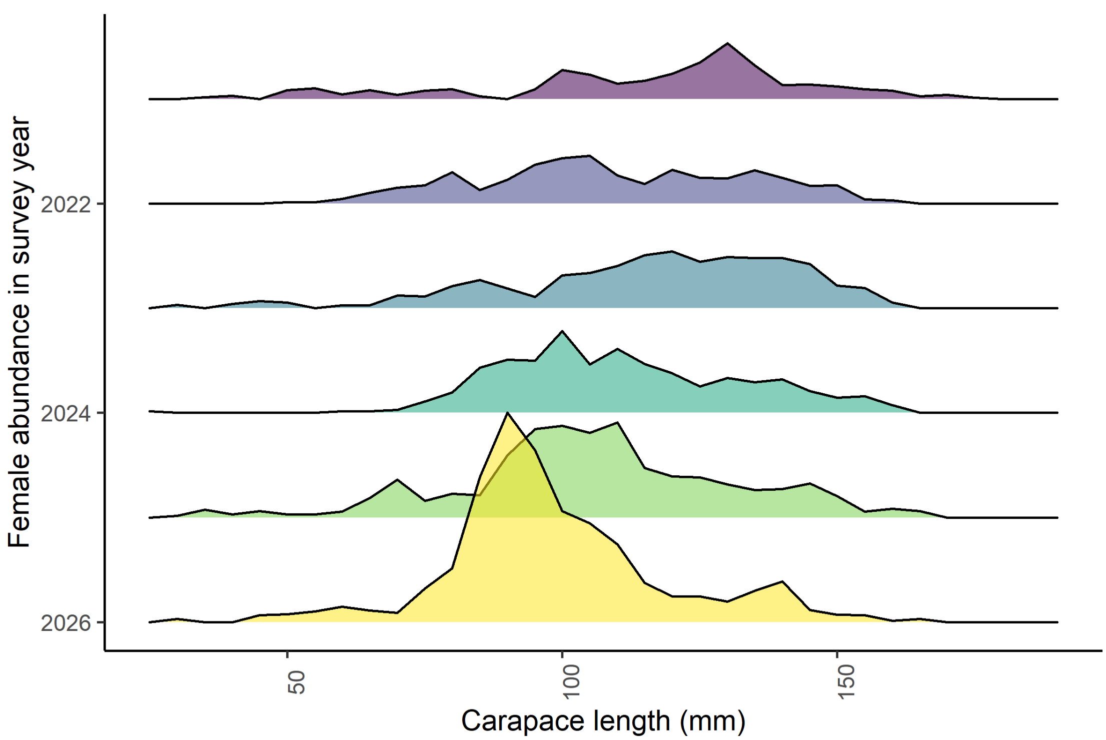

Figure 77: Length frequency distributions of female red king crab in Bristol Bay from NMFS trawl surveys during 2019-2025. For purposes of these graphs, abundance estimates are based on area-swept methods.

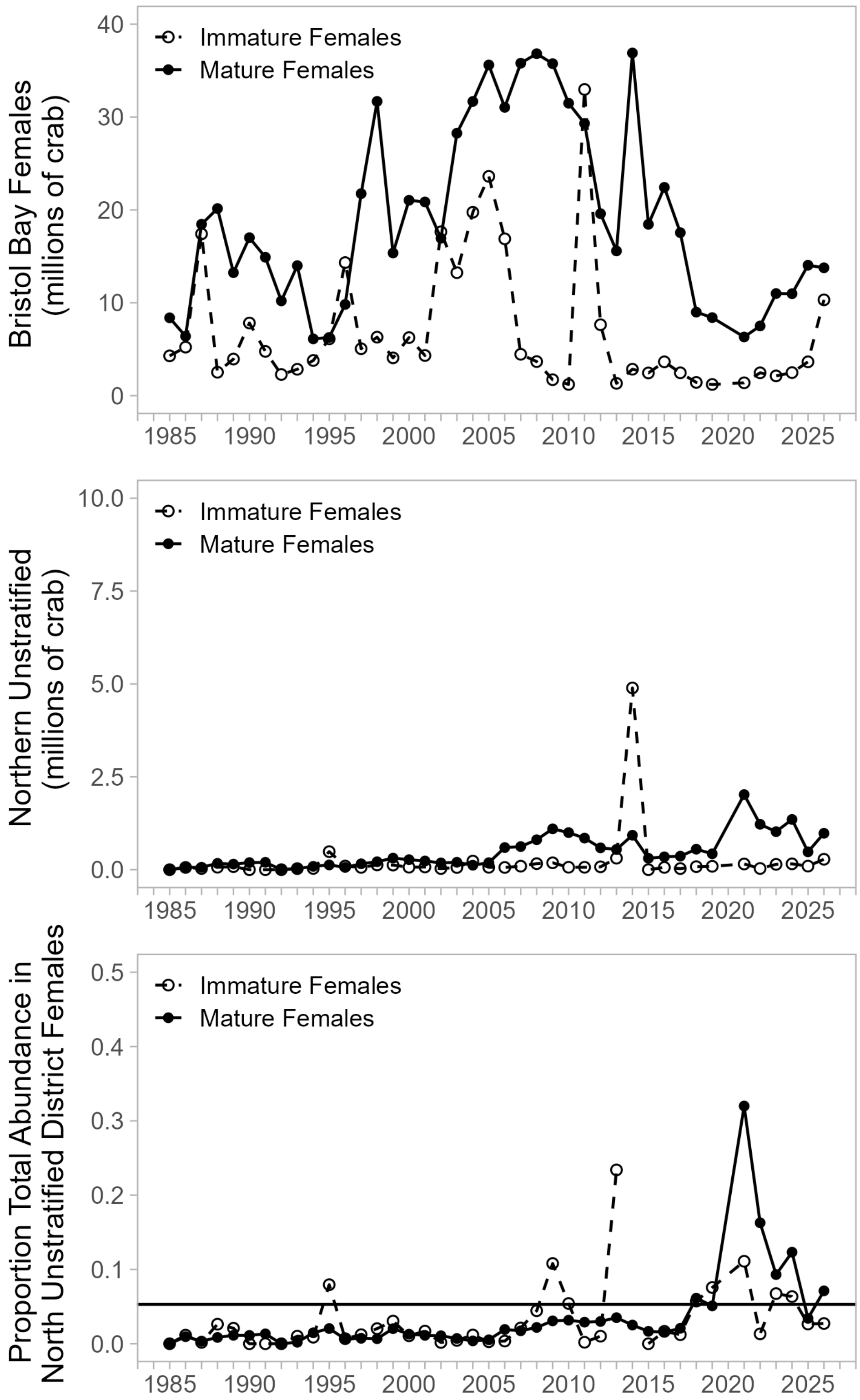

Figure 78: Comparisons of NMFS survey area-swept estimates of immature and mature (visual maturity definition) female crab abundance in Bristol Bay area (BB) and north of Bristol Bay area (North) during 1985-2026. NOTE the large scale differences between panels 1 and 2. The horizontal line in panel 3 represents the average proportion of mature crab over the entire time series.

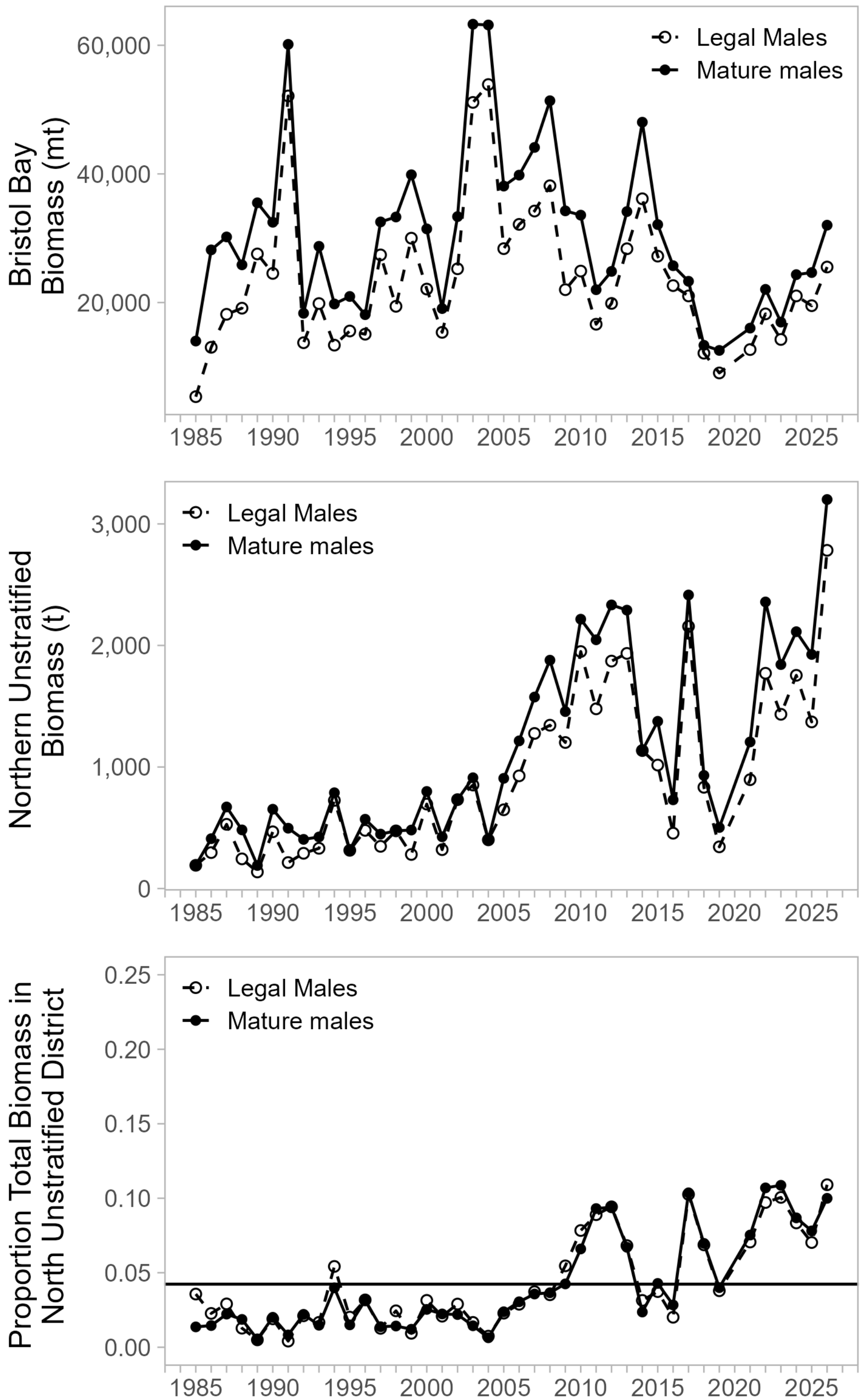

Figure 79: Comparisons of NMFS survey area-swept estimates of mature and legal male abundances in Bristol Bay area (BB) and north of Bristol Bay area (North) during 1985-2026. NOTE the large scale differences between panels 1 and 2. The horizontal line in panel 3 represents the average proportion of mature crab over the entire time series.

Appendices

Appendix A, B, D, and E can be found on the e-agenda as separate attachments.

Appendix A: Description of GMACS with Bristol Bay Red King Crab Options (**Appendix A link**)

Appendix B: Data files for model 24.0c.2 (more readable versions can be requested from the author - katie.palof@alaska.gov); (**Appendix B link**)

Appendix C: Tier 4 fallback REMA exploration

Appendix D: BBRKC ESP

Appendix E: History of ABC buffer decisions and Draft Risk Table for BBRKC 2026; (**Appendix E link**)

Appendix C. Tier 4 fallback REMA exploration

At the March 2023 simpler model working group meeting, a "fallback" option for model output was discussed to be used as an alternative option if the current assessment model is not usable. This option is detailed in the working group report under "Proposed Fallback model options".

This is a Tier 4 approach where:

- B or current year's biomass is equal to survey-estimated (ideally using the REMA R package) vulnerable male biomass. Vulnerable male biomass is male crabs likely to be susceptible to both the directed and incidental catch fisheries
- OFL = M (adjusted by the stock status as defined in the Crab FMP) * B
- ABC = buffer * OFL

REMA model for BBRKC

For BBRKC the male biomass that is determined to be vulnerable to the directed and incidental catch fisheries is the mature male biomass, crab > 119mm CL. Crab at this size are approximately one or more molt increments away from legal size and therefore are likely to be found with legal size male crab and be vulnerable to discard mortality. This modeling exercise applies two ABC buffers - one similar to the 2023 Tanner crab REMA model, where the ABC buffer is estimated to be the CV of the final year of the REMA output rounded to the nearest 5% (which for 2025 is 15%), and the Tier 3 20% buffer. The Tier 3 resulting ABC (using a buffer of 20%) is labeled ABC in the table below, and the alternative buffer calculation (using a buffer of 15%) is labeled ABC_2.

As defined by the Crab FMP, stock status is determined by the current years biomass (B) compared to the average biomass over a period of time. For consistencies with the current modeling approaches for BBRKC the time period used is 1984 to 2025, as this is the same time period that is used in the Tier 3 model for status determination.

Calculation of Reference Points

The Tier 4 OFL is calculated using the F_{OFL} control rule:

$$F_{OFL} = \begin{cases} 0 & \frac{MMB}{B_{MSY}} \leq 0.25 \\ \frac{M(\frac{MMB}{B_{MSY}} - \alpha)}{1-\alpha} & 0.25 < \frac{MMB}{B_{MSY}} < 1 \\ M & MMB > B_{MSY} \end{cases} \tag{2}$$

where MMB is quantified at the mean time of mating date (15 February), B_{MSY} is defined as the average MMB for a specified period, $M = 0.23$ yr^{-1}, and $\alpha = 0.1$. The Tier 4 OFL (Table 25) was calculated by applying a fishing mortality determined by the harvest control rule (above) to the mature male biomass at the time of mating (B_{proj} or Current B).

Table 25: Specificatoins using the REMA output on mature male NFMS trawl survey area-swept biomass (1,000 mt).

avgB	Current B	MMB/B_{MSY}	M	F_{OFL}	OFL	ABC	ABC 2
27.78	30.50	1.10	0.23	0.26	7.78	6.22	6.61

Figures

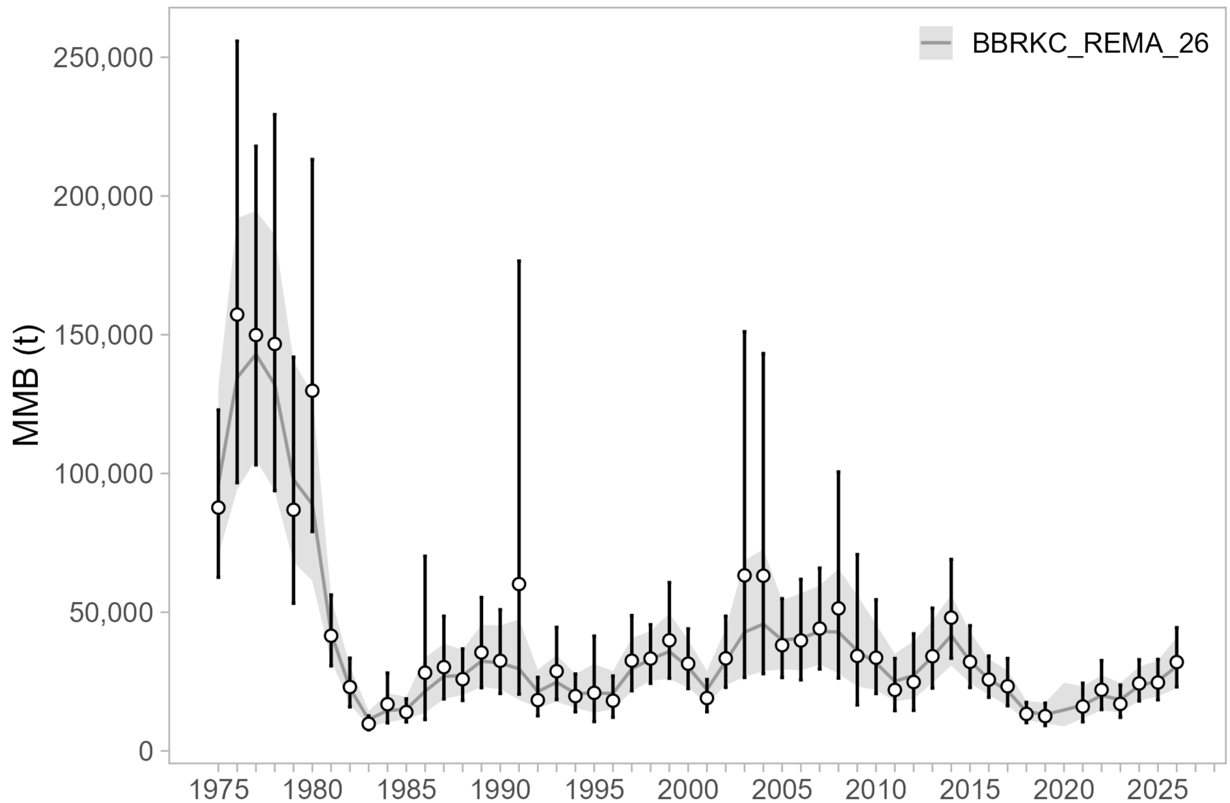

Figure 80: Comparisons of area-swept estimates of mature MALE NMFS survey biomass (males > 119 mm) and REMA model predicted fit.