Tanner Crab Assessment Report for the May 2018 CPT Meeting

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Executive Summary

This report summarizes the results of work since September 2017 to improve the Tanner crab stock assessment, as well as address CPT and SSC comments from previous meetings. Several alternative models to be evaluated for the Fall 2018 assessment are proposed for consideration by the CPT and SSC.

Responses to recent CPT/SSC comments

Jan. 2018 Modeling Workshop

Comment: The CPT recommends that the author further develop the analysis (regarding trawl sampling efficiency to account for station-level effects) and to identify research or data needs that would be informative.

Response: Time has not permitted any further work on this issue at this time.

Comment: The CPT recommends as a next step that assessment authors do the dynamic B0 calculation and come forward in May with results for comparison.

Response: The calculations necessary to compute dynamic B0 have been added to the TCSAM02 code. An example result is presented in this report.

Comment: There was concern from the CPT that classification error (e.g., mature crab incorrectly classified as immature [on the basis of CH:CW relationships]) for the maturity relationship established from the 2017 data was unknown and could not be incorporated into the model. A sensitivity analysis would need to be performed on the 2017 data analysis to determine the possible extent of classification error.

Response: Time has not permitted further work on this issue. It is unclear, however, how this analysis could proceed without histological verification of maturity to determine the classification error rate. Such data was not collected.

Comment: The CPT recommends that assessment authors conduct a retrospective analysis (for the terminal year for recruitment averaging) for the May 20218 CPT meeting.

Response: This issue is addressed in this report.

Comment: The CPT requested for the May 2018 meeting that assessment authors evaluate the impacts associated with discontinuing the collection of information on legal retention status by crab observers. The CPT also recommended that authors outline how legal not-retained information is used or addressed in stock assessments.

Response: Estimated total catch, based on at-sea crab observer sampling, is fit in the Tanner crab assessment model, as is landed (retained) catch. Legal retention status by crab observers is not used in the model.

Comment: The CPT recommended a further discussion on data weighting once the current methods used by the different authors are clear. The CPT recommended that authors use the Francis method first and then consider other approaches as necessary.
Response: Re-weighting algorithms based on the Francis and McAllister-Ianelli methods for size composition data have been implemented in TCSAM02. Preliminary results from applying these methods are discussed in this report. Briefly, though, the Francis method failed to converge in 5 iterations and substantially down-weighted the size composition data. The McAllister-Ianelli methods successfully converged in 5 iterations for most size composition data, but with the effect of up-weighting several datasets.

Oct. 2017 SSC Meeting
Comment: The SSC noted that several concerns remain (with the Tanner crab assessment), such as parameters hitting bounds and consistent overestimation of large male abundance. The SSC recommends a careful diagnosis of all parameters hitting bounds in this model with specific attention to whether those bounds are biologically meaningful, whether a reparameterization might help, whether there is prior information or auxiliary data that could be informative, and whether the parameter is even estimable given the data and model framework.

Response: Parameter specification in TCAM02 has been modified to incorporate parameter re-scaling using a control file, which will speed testing of some reparameterization schemes. Several of the parameters that hit their bounds are estimated on the logit-scale (e.g., those related to the size-specific probability of molt-to-maturity), with the arithmetic scale bounds corresponding to 0 or 1. One practical solution for these parameters would be to fix them rather than estimate them. Others are selectivity-related parameters. Several alternative selectivity functions have been added as options to TCSAM02, but there has not been time to explore their possible use yet.

Comment: Chronic overestimation of large males in the stock assessment was again discussed by the SSC. The SSC wonders whether retention could be related to temporal changes in size at maturity, as shell condition may affect marketability.

Response: Selectivity and retention in the directed fishery are currently modeled as the same for new shell and old shell males. However, legal new shell males are generally favored over old shell crab and the industry has some ability to avoid continuing to fish on aggregations of old shell crab. This would suggest that selectivity and retention should be estimated separately for new shell and old shell males. However, this possibility remains to be explored.

Comment: The SSC expressed some concern about the apparent poorer reproductive condition of female Tanner crab in the east compared to the west. The SSC would appreciate some analysis/discussion of the evidence for or against [several suggested] alternatives in next year's assessment.

Response: This issue has not yet been dealt with.

Sept. 2017 CPT Meeting
Comment: The CPT recommended that both the Francis and McAllister-Ianelli methods for re-weighting input sample sizes for size composition data should be evaluated.

Response: Model scenarios that used both methods to re-weight size composition data were included in this report. See the response to the comment from the Modeling Workshop above.

Comment: The CPT recommended that a full evaluation of fits to growth data needs to be undertaken with a range of likelihood weights to evaluate the impacts on model results.

Response: In the 2017 assessment, it was found that increasing the weight on fitting the growth data in the model by a factor of 20 led to convergence issues with the model. This report includes scenarios in *which the weight on the growth data in the likelihood was increased by a factor of 5, which did not lead to convergence issues. Results are discussed more fully in the report.*

Comment: The CPT recommended considering several approaches to dealing with parameters hitting their bounds, including reparameterization, adding priors to poorly-estimated parameters, or simply reducing the number of parameters being estimated.

Response: A flexible approach to reparameterization (via a control file) has been implemented in TCSAM02. Model scenarios in which several bounded parameters were transformed to logit scales for estimation were addressed, but this did not always eliminate the problem. Model scenarios in which several parameters at bounds were fixed rather than estimated were also considered. A new selectivity function option was implemented (a half-normal function), but scenarios that utilized it were not included in this report.

Comment: The CPT recommended that lognormal priors with the median equal to the prior value should be evaluated for natural mortality parameters.

Response: This has not yet been addressed.

Comment: The CPT recommends that addressing the issue that the model overpredicts the abundance of large males in the NMFS trawl survey should be a priority for future assessments.
Response: It was hoped that including male maturity ogive data in the model fitting process would resolve this issue, but it has not. CPT suggestions that the growth increment at terminal molt may be different from prior molts or that natural mortality of old males increases with age will be addressed in the future.

Comment: The CPT requested that the issue of whether or not to include recruitment estimated for the final year in the calculation of average recruitment for B_{MSY} should be addressed.

Response: A retrospective analysis of recruitment patterns and averaging time periods is included in this report.

Comment: A potential refinement to Model B2b would be to allow annual variation in retention during the 1991-1996 period only.

Response: This suggestion has not yet been addressed.

1. Introduction

Recent developments in the Tanner crab stock assessment model are discussed in Section 2. These developments included incorporating male maturity ogive data into the model fitting process, new growth parameterizations, new parameter scaling options, a new approach to "devs" vectors, a new likelihood component for recruitment, and the addition of dynamic B0 calculations. Other issues are discussed in Section 3, including a retrospective recruitment analysis to inform the time period over which to calculate average recruitment for use in status determination and OFL setting, results for a dynamic B0 calculation, bootstrapped effective sample sizes for NMFS size composition data, and NMFS survey catchability for males and females at small sizes. Results from a large set of potential model scenarios for the fall assessment are discussed in Section 4, while recommendations for a few scenarios to be carried over to the fall assessment are made in Section 5.

2. Assessment model development

2.1 Male maturity data

For *Chionoecetes* spp. males, the terminal molt typically involves a change in the allometric relationship between carapace width (CW) and chela height (CH), with terminally-molted ("mature") males typically exhibiting a much larger ratio of CH:CW than do "immature" males (i.e., those which have not undergone the terminal molt). For Tanner crab in Prince William Sound, Tamone et al. (2007) used additional data on sexual development to determine that a CH:CW ratio of 0.18 provided a good discriminant for maturity status across all sizes, with males exhibiting a ratio > 0.18 classified as "mature" and those exhibiting a ratio < 0.18 classified as "immature.". Rugolo and Turnock (2011) used this ratio and a set of special collections of male CH data to develop a size-specific maturity ogive (i.e., the expected fraction of mature males at a given size) for new shell males in NMFS trawl surveys (Fig. 2.2.1).

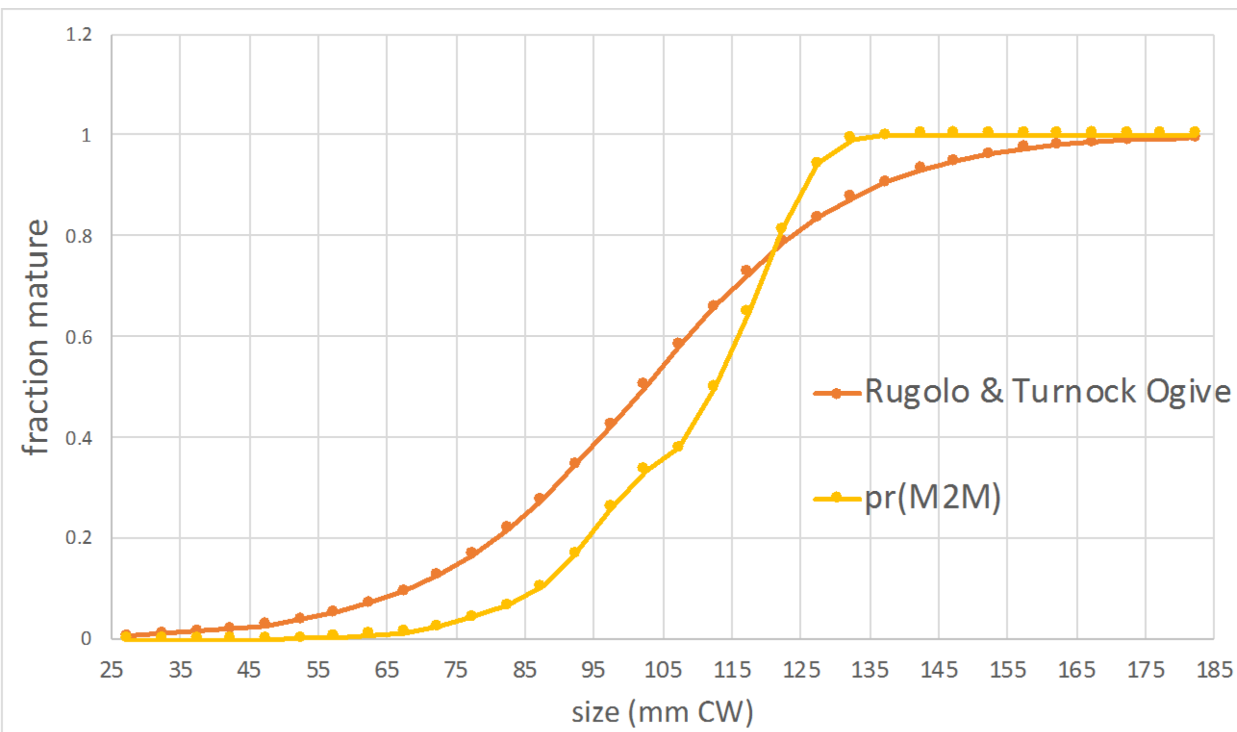


Fig. 2.1.1. Maturity ogive (Rugolo and Turnock, 2011) for new shell male crab used to characterize maturity state (immature, mature) by size. Also shown is the estimated probability of molt-to-maturity (pr(M2M)) estimated by the 2016 assessment model.

Since the Tier 3 assessment model for Tanner crab was adopted in 2012, the ogive in Fig. 2.2.1 has been used to determine abundance and biomass of new shell male crab by maturity state (i.e., immature, mature) in the NMFS surveys, while all old shell males are assumed to be post-terminal molt and thus "mature", regardless of size. This approach allows one to estimate time series of abundance and biomass, as well as size compositions, outside the model for immature and mature new shell males separately, but it relies on the implicit assumption that the ogive does not change with time. Given the episodic and highly variable nature of recruitment to the Tanner crab stock in the EBS, this assumption cannot be true and is an approximation, at best. However, the classification of male maturity outside the assessment model by a time-invariant maturity ogive creates a conflict with the assumptions behind growth in the assessment model because the model estimates and applies a size-specific probability of undergoing terminal molt, not a maturity ogive, to determine the predicted new shell mature male component of the stock from the previous year's immature male component as part of the overall population dynamics for Tanner crab.

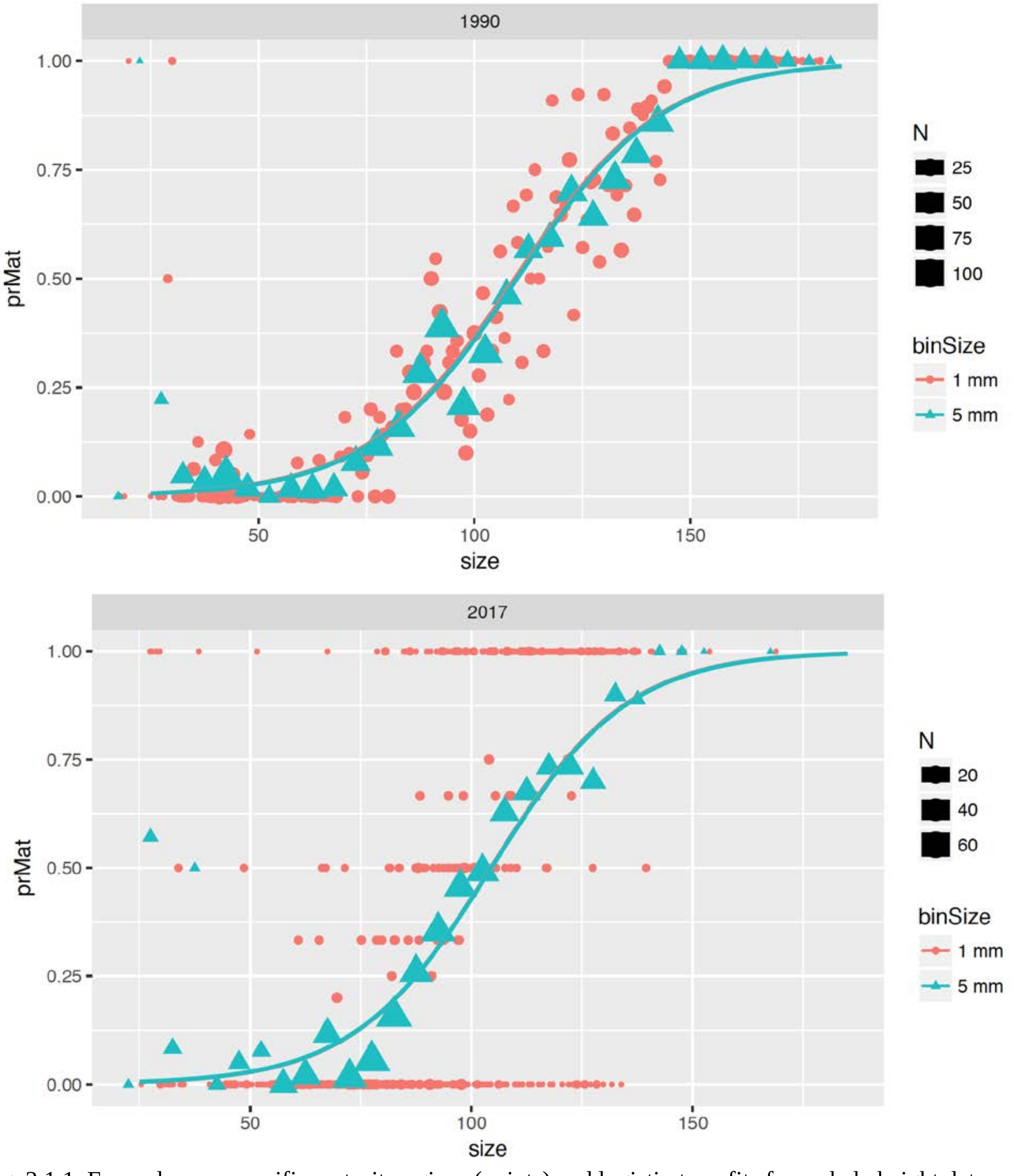


Fig. 2.1.1. Example year-specific maturity ogives (points) and logistic-type fits from chela height data collected in 1990 at 1 mm resolution (top plot) and 2017 at 0.1 mm resolution (bottom plot). Symbol sizes scale with relative sample size. Ogives are shown using two carapace width bin sizes, 1-mm and 5-mm.

An alternative approach would be to drop the immature/mature classification of survey data outside the model and use the male chela height data collected during NMFS surveys to estimate year-specific maturity ogives for new shell crab (see examples in Fig. 2.1.1) and to fit those in the assessment as part of the overall model optimization. Although chela height data is not collected every year, this would still provide data to inform the size-specific probability of undergoing terminal molt, which is time-invariant across some time block (only one time block, the entire model period, is used in the current assessment). To this end, a input data file format (Table 2.2.1) and a likelihood component for year-specific maturity ogives based on chela heights were developed for TCSAM02.

CHELAHEIGHT_DATA		#required keyword	
MATURITY_OGIVES		#dataset name	
NMFS_trawl_survey_(males_only)		#survey name	
BINOMIAL		#likelihood type	
0.0		#likelihood weight	
year	**size (mm CW)**	**sample size**	**Pr(mature|size)**
1990	32.5	42	0.04761905
1990	37.5	63	0.03174603
1990	42.5	106	0.04716981
1990	47.5	55	0.01818182
1990	52.5	28	0
1990	57.5	59	0.01694915
...	...	...	...

Table 2.1.1. Example format for a chela height/maturity ogive data file.

The likelihood component for chela height/maturity ogive data assumes the observed fraction of mature new shell males in size bin z is binomially-distributed, thus the negative log-likelihood is given by

$$-ln\mathcal{L} = \sum_{s} \left\{ -w_s \cdot \sum_{y,z} \left(n_{s,y,z} \cdot \{ p_{s,y,z} \cdot \ln(\tilde{p}_{s,y,z}) + (1 - p_{s,y,z}) \cdot \ln(1 - \tilde{p}_{s,y,z}) \} \right) \right\} \quad (2.1.1)$$

where $n_{s,y,z}$ is the sample size of chela heights taken in survey *s* during year *y* in size bin *z*, $p_{s,y,z}$ is the corresponding observed fraction of mature males, $\tilde{p}_{s,y,z}$ is the model-predicted value, and w_s is a user-specified weight for the survey-specific component. The model-predicted value, $\tilde{p}_{s,y,z}$, is simply the ratio of the abundance of mature new shell males to immature males predicted for survey *s* during year *y* in size bin *z*. For diagnostic purposes, Pearson's residuals are calculated for each observed value.

2.2 Growth parameterizations

Mean growth in TCSAM02 is described as linear on the log-scale using

$$\bar{Z}^{post} = exp[\alpha + \beta \cdot \ln(Z^{pre})] \quad (2.2.1)$$

where Z^{pre} is the pre-molt size, $\bar{Z}^{post}$ is the mean post-molt size, and α and β are estimable parameters, where α is the ln-scale intercept (i.e., $\alpha = \ln(\bar{Z}_{post})$ when $Z_{pre} = 1$) and β is the ln-scale slope.

An alternative parameterization (used in the 2017 assessment) is

$$\bar{Z}^{post} = \bar{Z}_L^{post} \cdot exp\left[\frac{ln\left(\frac{\bar{Z}_U^{post}}{\bar{Z}_L^{post}}\right)}{ln\left(\frac{z_U^{pre}}{z_L^{pre}}\right)} \cdot \ln(Z^{pre})\right]$$	(2.2.2)

where $\bar{Z}_L^{post}$ and $\bar{Z}_U^{post}$ are estimable parameters representing the mean post-molt sizes corresponding to the (user-specified) pre-molt sizes z_L^{pre} and z_U^{pre}, respectively. Parameter estimation using this formulation is thought to be more stable than that in Eq. 2.2.1 if the pre-molt sizes z_L^{pre} and z_U^{pre} corresponding to the parameters are chosen to be within the range of the data.

A second alternative parameterization has now been implemented that provides a hybrid of the two above. This hybrid parameterization is

$$\bar{Z}^{post} = \bar{Z}_L^{post} \cdot exp\left[\beta \cdot \ln(\frac{Z^{pre}}{z_L^{pre}})\right]$$	(2.2.3)

where $\bar{Z}_L^{post}$ and β are estimable parameters and z_L^{pre} is user-specified the pre-molt size corresponding to $\bar{Z}_L^{post}$. This parameterization has the advantage that the ln-scale slope of the growth relationship (β) can easily be constrained to be > 0 (which is the case for Tanner crab) while providing the assumed improved stability associated with estimating $\bar{Z}_L^{post}$ rather than α.

2.3 New parameter scaling options

Statistical inference when model parameters are estimated at their bounds, which has consistently occurred with the Tanner crab model for certain growth, selectivity and catchability parameters, is suspect (at best). One approach to addressing parameters that hit bounds is to change the scales on which those parameters are estimated to improve stability as, for example, estimating a parameter p which must be positive using a log-scale transformation (p^*=ln(p)) which allows the transformed parameter (p^*) to be estimated on $-\infty < p^* < \infty$. For parameters hitting an upper or lower bound, a logit or other transform that maps the "arithmetic scale" bounds $p_{lower} \le p^* \le p_{upper}$ to the "transformed scale" $-\infty < p^* < \infty$ might be appropriate. This capability to specify a transformed scale for a parameter has now been implemented in TCSAM02 using the "model parameters information" (MPI) file for all parameters. Potential transforms include the ln-scale, logit, and probit transforms. A possible advantage to specifying a parameter transformation in the MPI file is that a prior for a parameter is defined on the "arithmetic" scale while the parameter is estimated on the transformed scale.

2.4 A new approach to "devs" vectors

It is possible to define a set of related model parameters in ADMB as a "parameter vector" or, if the parameters represent deviations from some value, as a "devs" vector (the sum of which is zero). The phases in which estimation is "turned on" for the individual parameters that constitute a parameter vector or devs vector are all the same, as are the upper and lower bounds (if the parameters are bounded). ADMB also allows the user to define a vector of parameter vectors (e.g., in ADMB terminology, a param_init_vector_vector or a param_init_bounded_vector_vector), where the number of parameter vectors is arbitrary and each parameter vector can have its own estimation phase, bounds on possible values, and index values. This allows one to implement flexible model structures such as time blocks without having to pre-specify the number of time blocks or the size of individual time blocks. In the Tanner crab model, these vector of parameter vectors are used to implement parameters governing the probability of molting by size bin (a parameter vector) across potentially multiple time blocks. Unfortunately, at this point ADMB does not implement a similar structure for devs vectors—i.e., a vector of devs vectors. This is a serious drawback to developing a model in which the number of recruitment time blocks or fisheries, for example, is not specified *a priori* because recruitment deviations across one time period and catch rate deviations for one fleet are both typically defined using a devs vector.

Given this lack of a "vector of devs vectors", I developed two approaches to a "vector of devs vectors" for TCSAM02 based on ADMB's param_init_bounded_vector_vector object. In the approach used in the 2017 assessment, an *n*-element devs vector *d* was represented by an (*n*-1)-element bounded vector *v*, with the final the devs vector element, *d*(*n*), being given by $d(n) = -\sum_{i=1}^{n-1} v(i)$ such that $\sum_{i=1}^{n} d(i) = 0$ identically. One problem with this approach is that there is no guarantee that the value of *d*(*n*) respects the bounds imposed on the rest of the elements. In order to achieve this, a heavy penalty was placed on values of *d*(*n*) that approached either bound.

An alternative approach, now incorporated into TCSAM02, is to use an *n*-element bounded vector to represent an *n*-element devs vector—which assures that all elements will fall within the prescribed bounds. The requirement that the elements of a devs vector sum to 0 is then enforced by placing a heavy penalty on $(\sum d_i)^2$ in the objective function. While this approach assures that all elements of a devs vector will fall within the prescribed bounds (and is simpler to implement), it reduces the effective number of defined parameters by 1 for each devs vector—and thus the overall model dimensionality—by essentially introducing a linear constraint among the elements of each vector. While linear constraints among parameters can lead to problems with inverting the model's hessian matrix to estimate parameter uncertainties, this does not seem to be an issue with ADMB.

Tests using the 2017 assessment model configuration comparing the old and new approaches to devs vectors in TCSAM02 indicate both approaches result in the same parameter estimates.

2.5 A new likelihood component for recruitment

Previously, a likelihood component related to recruitment variability was incorporated into the model objective function as prior probability functions applied to the ln-scale deviations from ln-scale mean recruitment defined by time block using

$$-ln\mathcal{L}_R = -\sum_k w_k \cdot \sum_{i(k)} ln\left[P_k\left(\delta_{i(k)}\right)\right] \qquad (2.5.1)$$

where $-ln\mathcal{L}_R$ represents the total negative log-likelihood related to recruitment variability, w_k is a multiplier on the contribution from time block *k* to the total, $\delta_{i(k)}$ represents the ln-scale deviation in year *i* from ln-scale mean recruitment in time block *k*, and $P_k(\cdots)$ is the prior probability function assumed to apply to time block *k*. For example, in the current (2017) assessment model recruitment is estimated using two time blocks: the "historical" period (1948-1974; *k*=1) and the "current" period (1975+; *k*=2), with the prior probability function for the ln-scale deviations defined as a normally-distributed 1-lag random walk function (so $\delta_{(i+1)(k=1)} - \delta_{i(k=1)} \sim N(0, s_{k=1}^2)$) in the "historical" period and a normal distribution ($\delta_{i(k=2)} \sim N(0, s_{k=2}^2)$) in the "current" period (the s_k^2 are fixed.)

In addition to the likelihood contribution just described based on prior probabilities for the recruitment deviations, a second component has now been added in the form

$$-ln\mathcal{L}_R = \sum_k w_k \cdot \left\{ \sum_{i(k)} \left[-\ln(\sigma_k) + \frac{\delta_{i(k)}^2}{2 \cdot \sigma_k^2} \right] \right\} \qquad (2.5.2)$$

where σ_k^2 is represents the ln-scale recruitment variance in time block k. This likelihood is appropriate for normally-distributed random variables ($\delta_{i(k)}^2$) with unknown variance (σ_k^2). The σ_k^2 terms are parameterized using

$$\sigma_k^2 = ln\left(1 + p_k^2\right) \qquad (2.5.3)$$

where the (potentially-estimable) parameter p_k is the coefficient of variation of recruitment in time block k.

2.6 New selectivity functions

A new size selectivity function, based on a half-normal distribution function, was added to TCSAM02 as alternative to the asymptotic logistic selectivity functions previously available. The new function is

$$S(z) = \begin{cases} \exp\left[-\dfrac{(z - z_u)^2}{2 \cdot w^2}\right] & if\ z \le z_u \\ 1 & if\ z > z_u \end{cases} \qquad (2.6.1)$$

where z represents size (CW in mm) and z_u and w are estimable location and scale parameters, respectively. z_u represents the minimum fully-selected size whereas w influences the size range over which S decreases as z gets smaller.

2.7 Dynamic B0

A function to calculate dynamic B0 was added to TCSAM02. Following model convergence, the population time series is recalculated by setting all fishery capture rates to zero while keeping all other aspects the same—in particular the recruitment time series. This allows estimation of the population trajectory in the hypothetical absence of fishing mortality. Using the current value of dynamic B0 as a basis for the calculation of B_{MSY} may provide an alternative that is more robust to decadal-scale changes in recruitment than the current approach based on mean recruitment and SPR considerations. An example using the 2017 assessment is presented in Section 3.2

3. Other issues

3.1 Retrospective recruitment analysis

At the January 2018 Modeling Workshop, the CPT requested that authors conduct a retrospective analysis on recruitment to help identify an appropriate period over which to calculate mean recruitment for use in determining $B_{35\%}$ (i.e., the Tier 3 proxy for B_{MSY}). The time series of estimated recruitment from a retrospective analysis for Tanner crab using the "assessment years" 2011-2017 are shown in Fig. 3.1.1. Except for assessment year 2011, recruitment estimates for an assessment year tend to be higher in the final 2-3 years of the time series relative to those for the same year from later assessments with more data, suggesting the model tends to overestimate the most recent recruitment events.

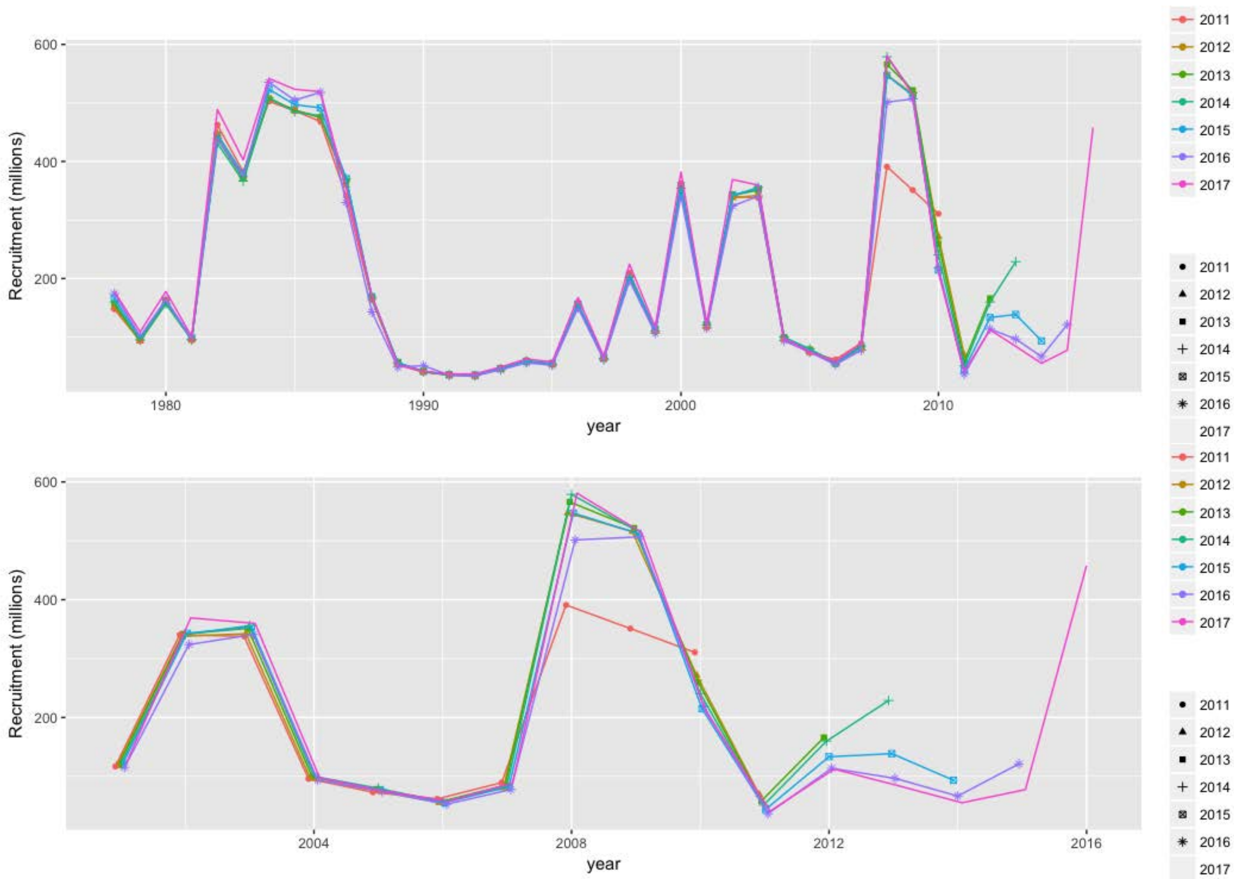


Fig. 3.1.1. Results for the estimated recruitment time series since 1978 (upper) and 2001 (lower) from retrospective model runs (2011-2017) using the 2017 assessment model configuration and data. Note that, as plotted here, recruits in year *y* enter the population in year *y*+1.

To evaluate the efficacy of alternative averaging periods, the mean recruitment for each retrospective model run was calculated for the period 1982 to (assessment model year – lag), where lags of 0-6 years were evaluated (Fig. 3.1.2.). The variability in mean recruitment across the retrospective model runs does not change appreciably with lag, which seems to indicate there is no “optimal” lag which minimizes the variance in mean recruitment across the retrospective model runs.

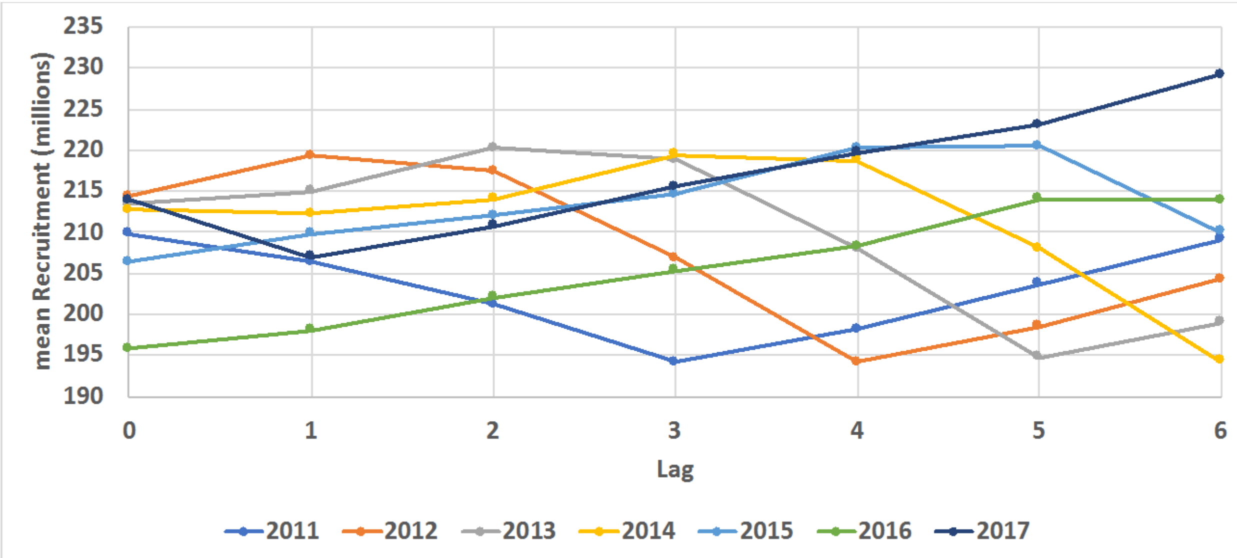


Fig. 3.1.2. Results for mean recruitment averaged over the period 1982 to (assessment year-lag) from retrospective model runs for assessment years 2011-2017 using the 2017 assessment model configuration and data.

3.2 Dynamic B0

As noted previously, dynamic B0 calculations were incorporated into TCSAM02 earlier this year. Results from the base model 2018B0 (equivalent to the 2017 assessment model) are compared between the estimated dynamic B0 time series with no fishing mortality and the time series for MMB including fishing mortality in the Fig. 3.2.1.

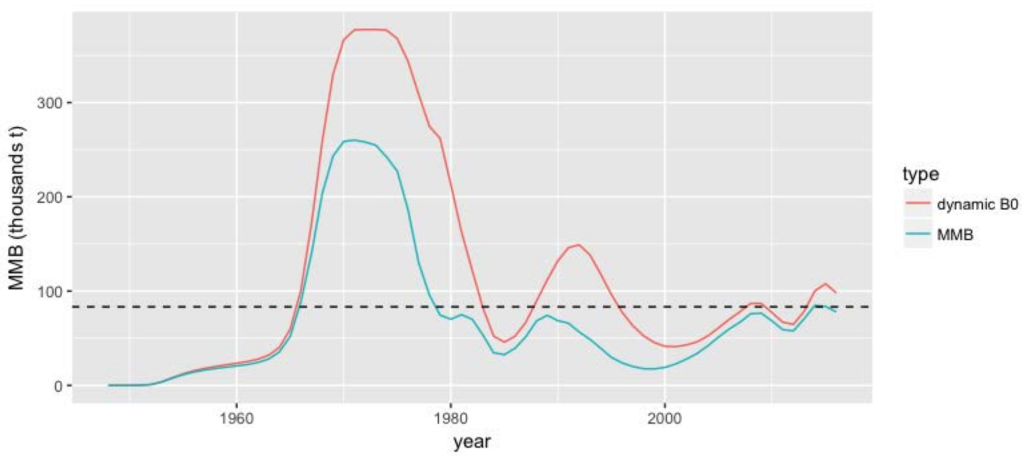


Fig. 3.2.1. Dynamic B0 (red line) and estimated MMB (green line) time series from 2018B0 (the 2017 assessment model).The dotted black line represents B_{100} (the mean unfished MMB) from the OFL calculation using mean recruitment.

In 2017, B_{MSY} ($B_{35\%}$) using the dynamic B0 approach would have been slightly larger than that based on the OFL calculation using mean recruitment.

3.3 Effective sample sizes for NMFS trawl survey size compositions

The NMFS trawl survey typically collect size composition data from several thousand Tanner crab at 100-150 stations each summer in the EBS. Because the crab at individual survey stations tend to be more similar to each other than those collected across the entire survey, the number of independent samples associated with the size compositions is much smaller than the actual number of crab measured. To account for this lack of independence, input sample sizes for Tanner crab size compositions from the NMFS survey are typically set to 100-200 in the assessment model to avoid over-fitting. However, this choice of effective sample size is somewhat arbitrary. Here, I used a resampling approach to estimate empirical effective sample sizes for survey size compositions during 1988-2017 to compare with the values used in the assessment.

For each survey year, observed crab were resampled using an area-stratified two-stage bootstrapping approach. For each survey stratum, a station *s* was randomly selected with replacement from those in the stratum. Then, n_s crabs were randomly selected with replacement from the n_s crab which had been measured at that station. This was repeated for the number of stations in the stratum and for each stratum to yield a "bootstrapped" version of the survey observations, after which an EBS-wide bootstrapped size composition was computed using area-swept, stratified survey calculations. This procedure was then repeated 100 times for each survey year to generate bootstrapped statistics for the size composition. Example results from the 2017 NMFS trawl survey are shown in Fig.

Effective sample sizes for each year were calculated from the bootstrapped size compositions using

$$n_{eff} = \frac{\sum_z \sigma_z^2}{\sum_z p_z \cdot (1 - p_z)} \qquad (3.3.1)$$

where n_{eff} is the effective sample size, σ_z^2 is the bootstrapped variance in size bin *z*, and p_z is the fraction of individuals in size bin *z* from the original size composition. Eq. 4.3.1 is derived from the standard formula for the variance of a multinomial distribution.

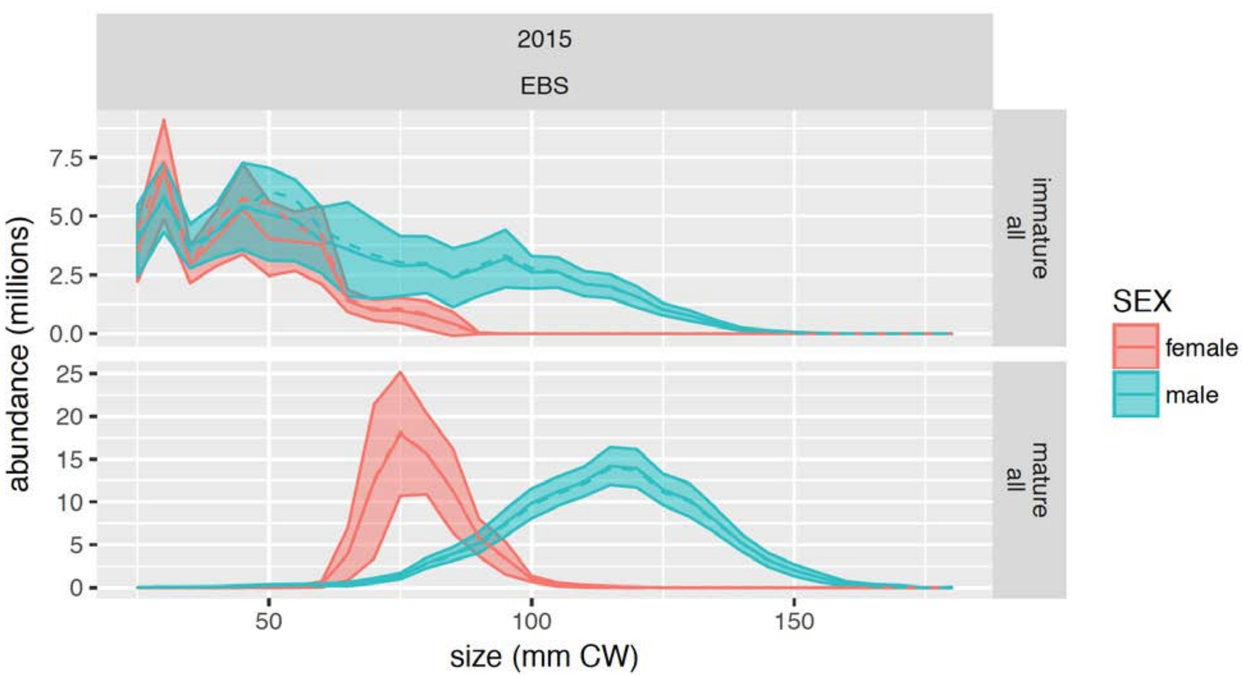


Fig. 3.3.1. Example bootstrapped Tanner crab size compositions, by sex and maturity state, from the 2017 NMFS trawl survey. The dashed line indicate the original size composition while the envelopes indicate the mean +/- one standard deviation in each size bin.

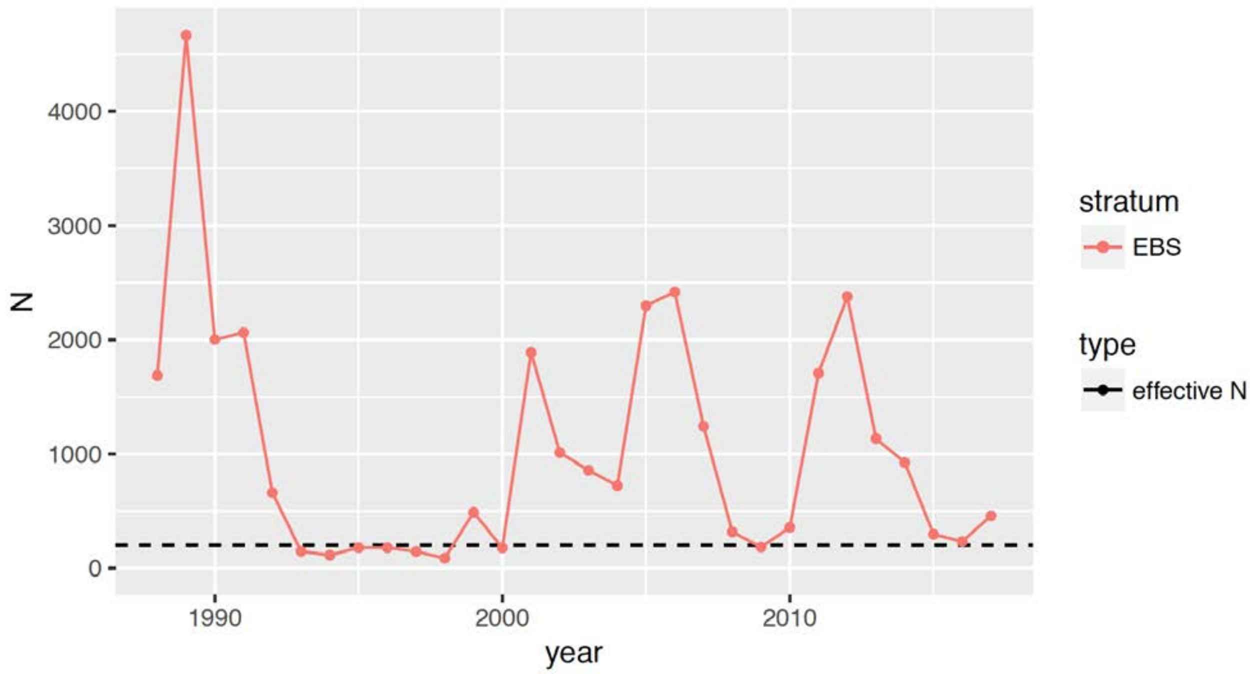


Fig. 3.3.2. Effective sample sizes (solid line) for Tanner crab size compositions from the NMFS trawl survey estimated from 200 bootstrapped size compositions. The input sample size to the assessment model is indicated by the dashed line.

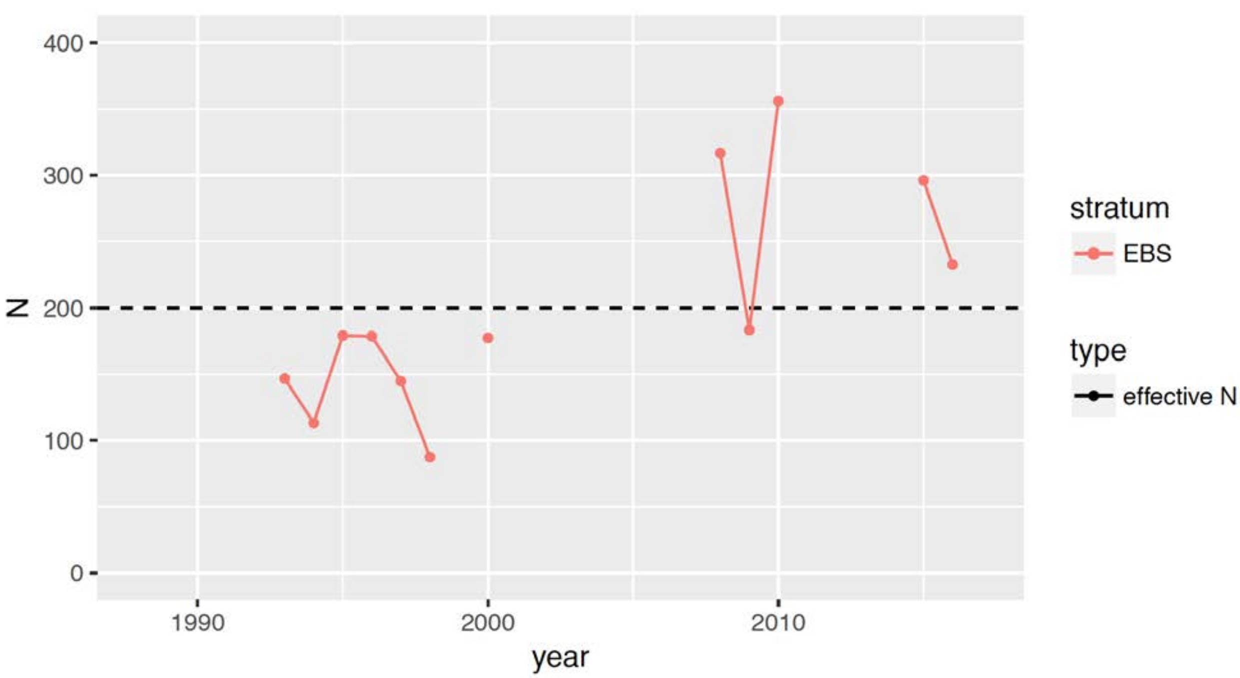


Fig. 3.3.3. Effective sample sizes for Tanner crab size compositions from the NMFS trawl survey estimated from 100 bootstrapped size compositions. The input sample size to the assessment model is indicated by the dashed line. Reduced scale to show details in the range 0-400.

As can be seen from Fig.s 3.3.2 and 3.3.3, the input sample size used in the assessment model (200) is smaller than the effective N calculated from the bootstrapping analysis in most years, except for those in the mid-1990s, 2000 and 2009. It will be worth exploring whether the input sample sizes for size compositions from these years should be decreased relative to the nominal sample size.

It may also be worth exploring whether or not this type of approach would be appropriate to use with observer sampling from the crab and groundfish fisheries.

3.4 NMFS survey selectivity/catchability at small crab sizes
Small (<45 mm CW) Tanner crab exhibit growth rates that are similar between the sexes. Assuming that natural mortality rates for small crab are not sex-specific (as in the current assessment model) and that the differential effect of fishing mortality on these crab is negligible, then the relative abundance of these small crab in the NMFS trawl survey should reflect both the sex ratio at recruitment and differences in survey capture probability.

A key assumption in the current assessment model configuration is that the female-to-male sex ratio at recruitment is 1:1. This determines the relative scale between males and females in the population and has implications with regard to survey catchability and selectivity functions. In particular, the observed sex ratio for small crab in the NMFS survey should be equal to the relative survey capture probabilities (i.e., the fully-selected catchability *x* selectivity-at-size) for females and males. The abundance of small (< 45 mm CW) female crab in the NMFS survey is plotted in Fig. 3.4.1 (lefthand plot) against that for males for all survey years, as is the sex ratio (females to males) by year (righthand plot).

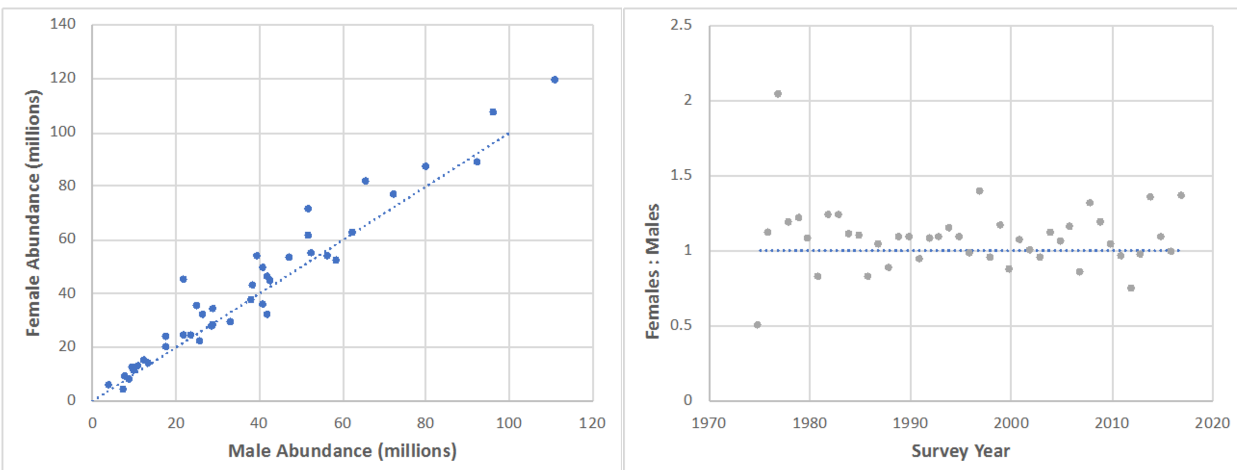


Fig. 3.4.1. Left: female abundance in the size range 25-45 mm CW from the NMFS survey plotted as a function of the corresponding male abundance. The dotted line indicates a 1:1 ratio. Right: The sex ratio for small crab (the ratio of abundance of small females to small males) by survey year.

The results from both plots in Fig. 3.4.1 suggest, given the assumptions of equal sex ratio at recruitment and equal natural mortality rates for small crab, that the capture probabilities for small crab should be equal for females and males (the mean ratio is 1.07). Currently, it is not possible to place a constraint of this type on the sex-specific capture probabilities estimated by the assessment model, although this could be implemented in the future. The righthand plot in Fig. 3.4.1 also suggests that the abundance estimates in 1975 and 1977 may be a matter for concern, given the highly-skewed nature of the sex ratios for those years.

3.5 BSFRF side-by-side survey integration
Natural Resources Consultants (NRC) have provided data from the joint Bering Sea Research Foundation (BSFRF)-NMFS "side-by-side" survey experiments conducted during the past several years. Integration with the assessment model is underway.

4. Potential model scenarios for Fall, 2018 assessment

4.1 Model datasets, model configurations and model scenarios

The model scenarios examined for this report were various combinations of six model datasets (Table 4.1.1) and ten model configuration options (Table 4.1.2). In all, 42 model scenarios were examined (Table 4.1.3).

The six model dataset configurations (Table 4.1.1) consisted of the dataset used in the 2017 assessment model (2018B here) and five alternatives that sequentially: 1) included fits to male maturity ogives based on chela height data in the parameter optimization (2018C); 2) changed how NMFS survey biomass and size composition data was fit (2018D); 3) included fits to the NMFS survey abundance time series, as well as the biomass time series (2018E); 4) increased the weight on fitting the molt increment and maturity ogive data by a factor of 5 (2018F); and 5) changed from fitting fishery catch biomass using normal likelihoods to using lognormal likelihoods (2018G). More details are provided in Appendix A.

The base model configuration ("0") was the configuration used for the 2017 assessment, in which the model is started in 1948 and the population is built up from zero using recruitment deviations ("rec devs") constrained on the ln-scale by random walk priors for 1948 to 1974 (the last year without survey data) while normal priors are applied on the ln-scale to subsequent rec devs during 1975-2017. Separate parameters describing ln-scale mean recruitment are estimated in each time period, and the rec devs sum to zero separately across each time period. Model configuration option "1" tested an alternative approach to initializing the model population: the model starts in 1900 and builds the population up from zero using rec devs with no priors imposed, only one parameter describing ln-scale mean recruitment is estimated, but separate recruitment CVs are assumed to apply to the two time periods. In model configuration option "a", the CV for recruitment was estimated in the 1975-2017 time period and used to calculate the value of the new recruitment likelihood component (described in Section 2.5). In addition, any priors on rec devs during this latter period were dropped. Configuration option "b" incorporated the options in "a" and also dropped the priors on ln-scale catch rate deviations used to constrain their size. Configuration option "c" incorporated the options from "b" and also eliminated the fits to the NMFS survey data during the 1975-1981 time period and extended the "historical" recruitment time period from 1974 to 1981.

In the base model, capture rates in the directed and bycatch fisheries in the time periods before data (catch data or effort data) were available to inform the model were applied using estimated ln-scale mean rates. Configuration option "d" eliminated the application of these rates to the population.

In the base model, the sex- and size-specific parameters governing the probabilities of the molt to maturity were estimated on the logit-scale for all size bins for males and for size bins up to 130 mm CW for females. However, the values for the parameters in the smallest and largest bins were very close to the lower or upper (respectively) bounds placed on them. The values were also highly uncertain on the logit-scale, but essentially 0 (for small sizes) or 1 (for large sizes) on the arithmetic scale. In the 2017 assessment, it was suggested that fixing the values of the parameters at these small or large sizes rather than estimating them might improve overall model stability. Configuration "e" eliminated the estimation of these parameters in the smallest (< 45 m CW) size bins for both sexes and the largest size bins for males (>170 mm CW).

As noted in Section 3.4, the sex ratios for Tanner crab in the NMFS survey data at small sizes indicate that the capture probabilities for small crab in the survey are probably the same for both sexes. As a first "cut" at addressing this concern, configuration "q" estimates a single survey catchability (Q) and selectivity function that applies to both males and females within each of the two survey time periods.

Finally, configuration options "-Fr" and "-McI" apply iterative re-weighting to size composition data using the Francis or McAllister-Ianelli approaches (as discussed in Punt, 2017), respectively.

Table 4.1.1. Model datasets.

Name	Description
2018B	TCSAM02 model run with the 2017 assessment data configuration.
2018C	2018B models but the parameter optimization now • includes fits to the male maturity ogive data
2018D	2018C models but the parameter optimization now • excludes fits to NMFS survey mature biomass by sex • excludes fits to NMFS survey size comp.s by sex/maturity state • includes fits to NMFS survey male biomass and size comp.s by shell condition • includes fits to the NMFS survey female biomass and size comp.s by maturity state/shell condition
2018E	2018D models but the parameter optimization now • includes fits to NMFS survey abundance time series, as well as biomass time series
2018F	2018E models but the parameter optimization now • includes increased weight (x 5) in likelihood on maturity ogive data and molt increment data
2018G	2018F models but the parameter optimization now • includes lognormal fits to fishery catch biomass

Table 4.1.2. Model configuration options.

Indicator	Description
0	2017 assessment model configuration: • model starts in 1948 • rec devs before 1975 have random walk priors • rec devs after 1974 have normal priors
1	0 +: • model starts in 1900 • no priors on rec devs • 1 mean ln-scale recruitment parameter, separate CVs are defined for pre-1975, post-1974 time blocks
a	+: • estimate recruitment CV in 1975+ time block • include new recruitment likelihood component in parameter optimization • drop priors on rec devs in 1975+ period
b	“a” + no prior on catch rate rec devs
c	“b” + • drop fits to survey data 1975-1981 • recruitment estimated in two time blocks: model start to 1981 and 1982 to 2017.
d	ln-scale mean fishery capture rates applied starting when effort or catch data are first available
e	probabilities of terminal molt are fixed at • 0 for smallest size classes • 1 for largest size classes
q	estimate single survey Q, selectivity function for males and females in each time block
-Fr	iteratively re-weight size comp.s using the Francis approach
-McI	iteratively re-weight size comp.s using the McAllister-Ianelli approach

The model naming convention adopted here for the 42 model scenarios is “dataset” + “model configuration indicators” + “iterative re-weighting options” (Table 4.1.3). Thus, scenario “2018G0bde-Fr” is based on dataset “2018G”, model configuration options “0bde”, and iterative re-weighting option “-Fr”. The “2018” in the scenario names will subsequently be dropped when identifying specific scenarios since it is common to all.

Table 4.1.3. Model scenarios examined for this report.

Name	Description
2018B0	2018B- data + "0" configuration (i.e., the 2017AM)
2018B0q	2018B0 + "q" configuration
2018B0-Fr	2018B0 + "-Fr" configuration
2018B0-McI	2018B0 + "-McI" configuration
2018B0a	2018B0 + "a" configuration
2018B0b	2018B0a + "b" configuration
2018B0c	2018B0b + "c" configuration
2018B1	2018B0 + "1" configuration
2018B1b	2018B1 + "b" configuration
2018B1c	2018B1b + "c" configuration
2018C0	2018C- data + "0" configuration
2018C0a	2018C0 + "a" configuration
2018C0b	2018C0a + "b" configuration
2018C0c	2018C0b + "c" configuration
2018C1	2018C0 + "1" configuration
2018C1b	2018C1 + "b" configuration
2018C1c	2018C1b + "c" configuration
2018D0	2018D- data + "0" configuration
2018D0a	2018D0 + "a" configuration
2018D0b	2018D0a + "b" configuration
2018D0c	2018D0b + "c" configuration
2018D1	2018D0 + "1" configuration
2018D1b	2018D1 + "b" configuration
2018D1c	2018D1b + "c" configuration

Name	Description
2018E0	2018E- data + "0" configuration
2018E0a	2018E0 + "a" configuration
2018E0b	2018E0a + "b" configuration
2018E0c	2018E0b + "c" configuration
20180	2018E0 + "1" configuration
2018E1b	2018E1 + "b" configuration
2018E1c	2018E1b + "c" configuration
2018F0	2018F- data + "0" configuration
2018F0a	2018F0 + "a" configuration
2018F0b	2018F0a + "b" configuration
2018F0c	2018F0b + "c" configuration
2018G0	2018F- data + "0" configuration
2018G0a	2018G0 + "a" configuration
2018G0b	2018G0a + "b" configuration
2018G0bd	2018G0b + "d" configuration
2018G0bde	2018G0bd + "e" configuration
2018G0bde-Fr	2018G0bde + "-Fr" config.
2018G0bde-McI	2018G0bde + "-McI" config.

4.2 Model results

Summary results from all model scenarios are shown in Table 4.2.1, including the "minimum" objective function value, the maximum gradient associated with the minimum, and a number of quantities related to quantities of management interest that are determined after the model has converged: average recruitment, unfished mature male biomass (B_{100}), B_{MSY} (i.e., $B_{35\%}$ for this Tier 3 stock), current MMB, F_{OFL}, F_{MSY}, OFL, MSY, and the projected MMB. These latter quantities are presented for model diagnostic purposes, not management decisions, because they integrate the estimated population and fishery processes in a synthetic fashion.

Given the large number of model scenarios addressed here, it was not possible to evaluate the models for convergence using parameter jittering due to time and processing constraints. Model scenarios that resulted in a large maximum gradient of the objective function at model "convergence" presumably did not convergence to that scenario's true minimum objective function value. Scenarios B0b, C1c, D0c, D1, E0, and E0c exhibited maximum gradients larger than 0.01, so results from these models will not be examined further.

Parameter estimates from all models are presented in Appendix B. Uncertainty estimates for the parameters were those reported in the model's "std" file, which are standard deviations derived using the assumption that the objective function in the vicinity of the minimum is adequately described as a multivariate normal distribution. Scenario B0 had no non-devs parameters whose CVs were larger than 1, while the closely-related scenario with Francis weighting, B0-Fr, had 17. The other scenarios fell within this range. Across the scenarios, the parameters pLgtRet[2] (logit-scale max retention in the directed fishery during 2005-2009), pLgtRet[3] (logit-scale max retention in the directed fishery during 2013-

2015), and pRCV[2] (the coefficient of variation for recruitment during the 1975-2017 period) tended to be consistently estimated with large uncertainty.

Parameters whose estimated values were near or at one of the bounds placed on the parameter are presented in Appendix C. Model B0 had 11 parameters estimated near or at their bounds, out of 351 total. Most of these parameter were related to selectivity functions for the various fisheries or survey. Only models F0 and F0a had fewer parameters at or near their bounds (10 each). The two models that incorporated iterative re-weighting of size compositions using the Francis method had the highest number of parameters at or near their bounds (18 for B0-Fr and 39 for G0bde-Fr). Across all the model scenarios, parameters that were most frequently estimated at or near their bounds included pLgtRet[1] (the logit-scale parameter for max retention in the pre-1997 time period; at its upper bound), pLgtPrM2M[1] at size index 32 (the logit-scale parameter for the male probability of terminal molt in the largest size bin; at its upper bound), pLgtPrM2M[2] at size index 1 (the logit-scale parameter for the female probability of terminal molt in the smallest size bin; at its lower bound), pGrBeta[1] (the shape factor for the growth probabilities; at its upper bound), pS1[20] (the size-at-50% selected for male bycatch in the groundfish fisheries during 1987-1996; at its lower bound), pS1[23], pS1[24] and pS1[27] (size-at-95 % selected parameters for crab bycatch in the BBRKC fishery), pS2[4] (the difference between the 95%- and 50%-selected sizes for females in the NMFS survey after 1981; at its upper bound), pS4[1] (the descending slope for male bycatch in the snow crab fishery before 1997; both upper and lower limits, depending on scenario), and pQ[1] and pQ[3] (ln-scale catchability for males and females, respectively, prior to 1982 in the NMFS survey).

Values of various components in the model objective function are compared for all scenarios in the tables given in Appendix D. Pertinent results are discussed on a case-by-case basis below.

Table 4.2.1. Summary of results for all model scenarios. Maximum gradient values > 0.01, indicating lack of model convergence, are highlighted in orange. OFL-related results are provided for diagnostic purposes only. Most objective function values are not directly comparable.

Model scenario	objective function value	max gradient	average recruitment (millions)	B100 (1000's t)	Bmsy (1000's t)	current MMB (1000's t)	Fofl	Fmsy	OFL (1000's t)	MSY (1000's t)	projected MMB (1000's t)
B0	2,905.84	0.00009	213.96	83.34	29.17	80.58	0.75	0.75	25.42	12.26	43.32
B0q	2,966.31	0.00053	279.95	108.58	38.00	117.29	0.75	0.75	37.03	14.85	64.30
B0-Fr	905.96	0.00019	600.22	82.98	29.04	58.52	9.43	14.77	32.65	10.25	19.60
B0-Mcl	3,834.97	0.00001	238.52	88.27	30.90	88.19	0.80	0.80	28.65	13.49	46.04
B0a	2,979.45	0.00290	197.68	83.47	29.21	80.68	0.72	0.72	25.08	12.08	43.94
B0b	2,514.74	0.08414	215.00	86.72	30.35	86.89	0.74	0.74	27.11	12.27	47.35
B0c	2,526.45	0.00041	212.60	86.47	30.26	86.17	0.74	0.74	26.84	12.21	47.03
B1	2,887.31	0.00011	278.80	95.81	33.53	102.99	0.91	0.91	35.18	14.61	52.08
B1b	2,462.07	0.00010	230.75	91.70	32.09	95.58	0.76	0.76	30.14	13.01	51.71
B1c	2,471.08	0.00081	233.37	91.92	32.17	96.20	0.76	0.76	30.37	13.08	51.98
C0	3,690.43	0.00062	381.10	101.51	35.53	115.02	1.79	1.79	48.77	17.60	46.37
C0a	3,712.09	0.00078	391.81	103.45	36.21	118.51	1.82	1.82	50.51	17.99	47.48
C0b	3,313.87	0.00111	361.71	100.81	35.28	116.05	1.77	1.77	48.74	16.74	47.67
C0c	3,357.47	0.00171	278.36	89.66	31.38	97.38	1.35	1.35	37.88	14.44	43.54
C1	3,660.46	0.00059	409.56	109.43	38.30	128.33	1.82	1.82	54.78	18.97	51.44
C1b	3,253.82	0.00022	407.81	111.50	39.02	134.59	1.90	1.90	57.61	18.51	54.17
C1c	3,301.45	58.02755	309.30	96.17	33.66	109.05	1.41	1.41	43.06	15.56	48.00
D0	5,412.73	0.00221	389.97	99.52	34.83	110.56	1.92	1.92	47.53	19.76	41.09
D0a	5,430.87	0.00163	388.70	99.68	34.89	111.14	1.92	1.92	47.74	19.78	41.36
D0b	5,072.15	0.00082	347.84	92.20	32.27	102.35	1.86	1.86	43.35	17.65	38.96
D0c	5,257.62	44.34706	239.37	79.79	27.93	84.37	1.40	1.40	33.23	14.77	35.15
D1	5,381.85	15.57300	389.17	102.15	35.75	114.76	1.88	1.88	49.16	20.16	43.00
D1b	5,018.05	0.00020	373.59	98.43	34.45	111.85	1.92	1.92	47.79	18.86	42.16
D1c	5,174.30	0.00210	301.25	88.05	30.82	96.97	1.57	1.57	39.47	16.62	38.77
E0	6,353.98	144.46094	343.12	82.93	29.02	97.97	1.57	1.57	40.27	18.14	36.10
E0a	6,372.73	0.00150	345.91	83.48	29.22	98.94	1.59	1.59	40.76	18.28	36.36
E0b	5,984.60	0.00195	337.59	82.49	28.87	98.56	1.57	1.57	40.49	17.83	36.40
E0c	6,260.70	0.09729	213.75	66.45	23.26	73.43	1.22	1.22	27.84	13.43	30.30
E1	6,317.20	0.00104	365.75	87.86	30.75	105.70	1.60	1.60	43.73	19.30	38.63
E1b	5,971.60	0.00326	317.74	79.79	27.92	94.61	1.59	1.59	38.70	16.89	35.34
E1c	6,174.64	0.00067	251.55	70.26	24.59	79.88	1.31	1.31	30.97	14.50	31.92
F0	9,901.13	0.00174	355.25	82.94	29.03	98.91	2.18	2.18	43.86	18.30	33.18
F0a	9,922.74	0.00250	354.53	82.93	29.02	98.99	2.18	2.18	43.88	18.30	33.22
F0c	9,952.32	0.00850	236.43	69.46	24.31	79.73	1.74	1.74	33.33	14.45	29.29
G0	10,417.65	0.00185	357.01	82.96	29.04	99.04	2.09	2.09	44.17	18.32	33.34
G0a	10,109.68	0.00176	587.81	90.27	31.59	107.16	2.15	2.15	47.87	23.41	32.43
G0b	9,737.90	0.00411	520.12	91.55	32.04	108.45	2.36	2.36	48.80	22.80	33.21
G0bd	9,828.30	0.00041	472.61	80.85	28.30	96.43	2.27	2.29	42.83	21.77	28.10
G0bde	9,428.14	0.00263	503.73	84.90	29.71	100.90	2.34	2.35	44.96	22.52	29.56
G0bde-Fr	5,161.97	0.00054	867.05	48.08	16.83	50.53	0.46	0.46	13.66	10.26	25.27
G0bde-Mcl	9,538.26	0.00020	573.22	91.58	32.05	114.29	2.70	2.70	52.66	24.12	32.09

4.2.1 B0 vs. B0q

This comparison examines what the impact on model results would be if catchability and selectivity for the NMFS survey were the same for males and females. This change had the effect that catchability for males was substantially smaller in B0q across all sizes in surveys after 1981 (Fig. 4.2.1.1) whereas little change occurred for females. Estimated recruitment was somewhat higher in B0q compared with B0, as was mature male biomass—although mature female biomass was not (Fig. 4.2.1.2). The difference in effect on male and female mature biomass can be traced to changes in the sex-specific rates of natural mortality estimated in the two scenarios for mature crab (Fig. 4.2.1.3).

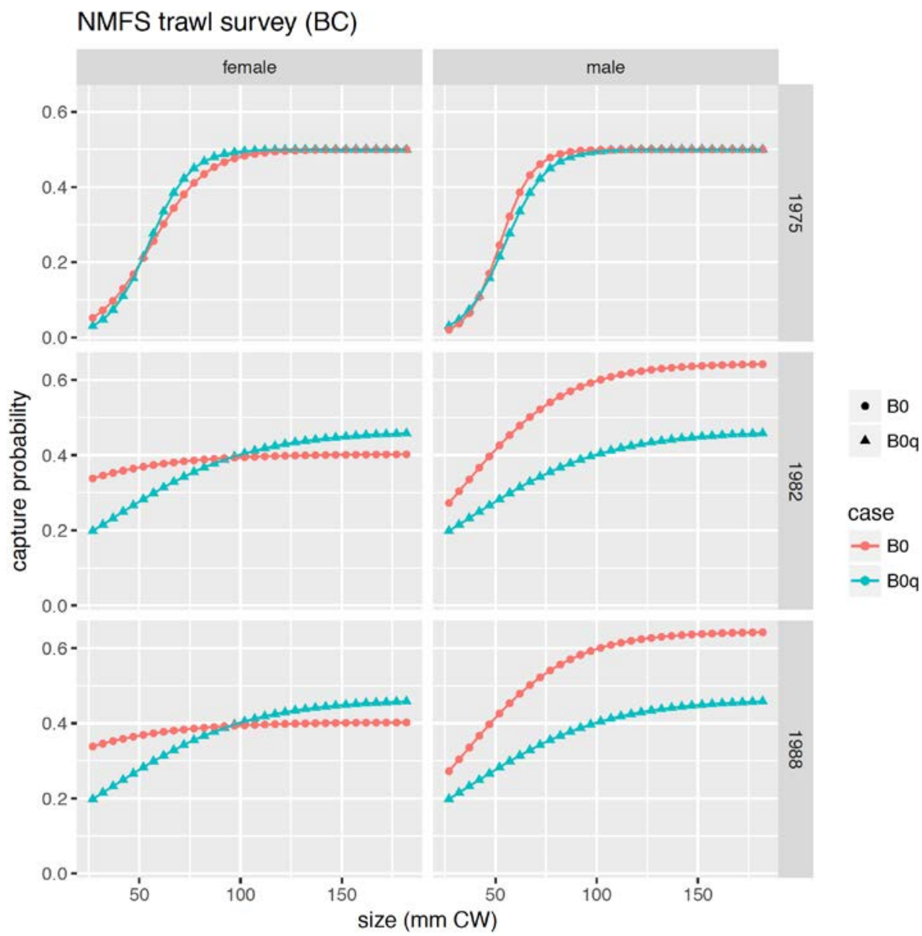
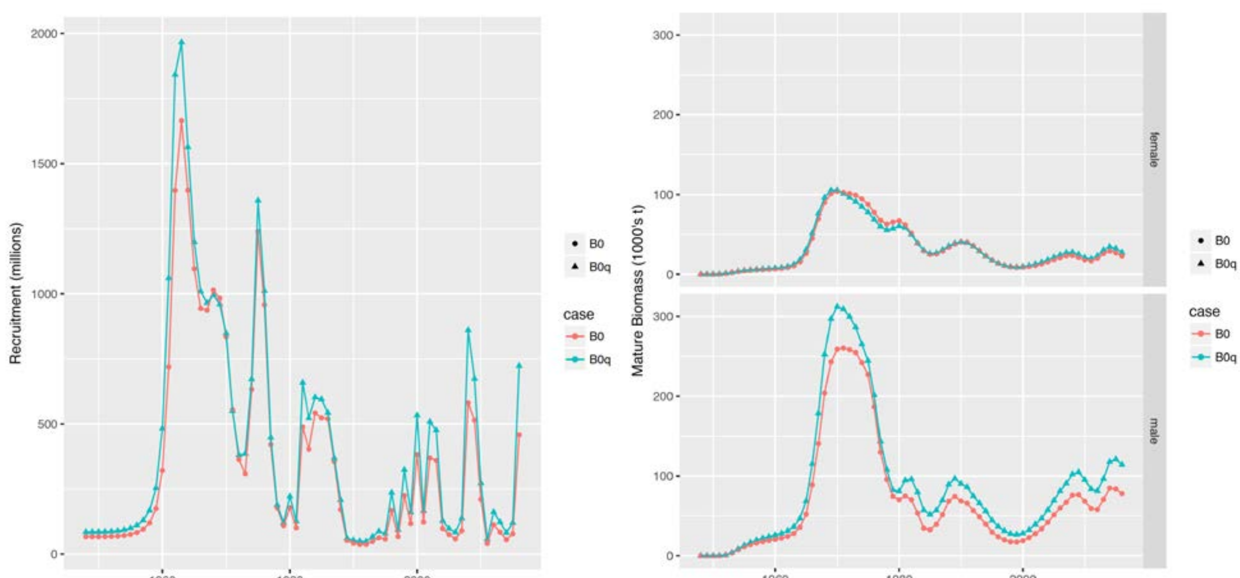


Fig. 4.2.1.1. NMFS survey capture probability functions as estimated in scenarios B0 and B0q.



4.2.1.2. Recruitment and mature biomass time series as estimated in scenarios B0 and B0q.

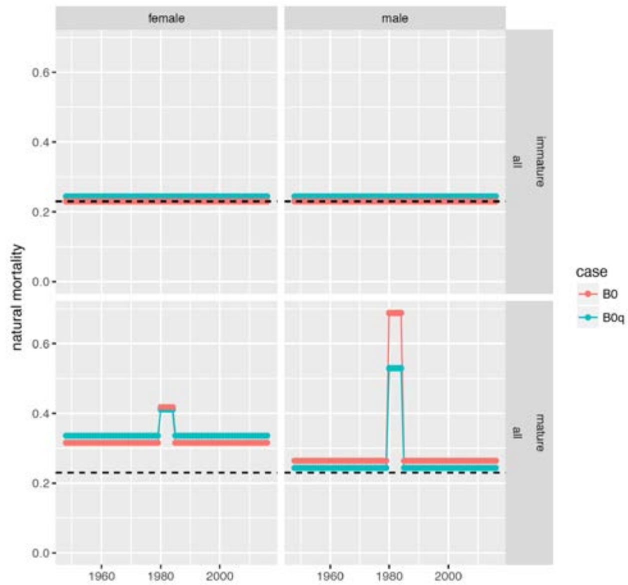


Fig. 4.2.1.3. Natural mortality rates as estimated in scenarios B0 and B0q.

The fit to survey mature biomass was degraded somewhat for both males (25 likelihood units) and females (6 units) in B0q compared with B0, while the fit to male survey size compositions was substantially degraded (162 units). In contrast, the fit to the female survey size compositions was substantially improved in B0q (143 units). Fits to growth data were also somewhat improved in B0q (13 units), as were fits to the bycatch size compositions in the groundfish fisheries (12 units). Otherwise, fits to data components that were included in the objective function were similar between the two scenarios.

These results reinforce the suggestion that forcing survey capture probabilities for males and females to be similar at small sizes, but allowing them to be different at large sizes, would improve overall model fit. However, these results also highlight the issue of why capture probabilities in the NMFS survey would be different between males and females at any in the first place, given that the survey (certainly since 1988) essentially covers the entire stock. One potential explanation is that the survey does not adequately cover mature females in deeper water near or beyond the continental shelf edge (thus resulting in lower capture probabilities for large females), although this idea is not strongly supported by first-look results from the NMFS EBS slope survey.

4.2.2. B0-B0a-B0b-B0c

The estimated CV for recruitment in the 1975+ time period in scenarios B0a, B0b and B0c was ~1.16, while the fixed value assumed in B0 was 0.5. Although the scenarios differed substantially in temporal trends for estimated recruitment and mature biomass prior to 1975, the temporal trends after 1975 were very similar for all four scenarios (Fig. 4.2.2.1). Average recruitment was somewhat smaller in B0a (198 millions) compared with the other scenarios (~214 million), but all other management quantities were quite similar (Table 4.2.1).

Removing priors on the ln-scale fully-selected fishery capture rate deviations in scenarios B0b and B0c led to several “spikes” in estimated capture rates in the directed fishery (“TCF”) and elevated bycatch rates in the BBRKC (“RKF”) fishery relative to the B0 scenario (Fig. 4.2.2.2). The spikes in the directed fishery appear to offset slightly prior spikes in recruitment in scenarios B0b and B0c, while the elevated rates in the BBRKC fishery accompany a right-shift in the estimated selectivity curves such that the size-specific capture rates are actually quite similar across the scenarios. Removing the priors had little effect on estimates of capture rates of selectivity curves for the snow crab fishery and groundfish fisheries.

Dropping fits to the pre-1982 NMFS survey data (scenario B0c) had very little effect on model results (relative to B0b) after 1982.

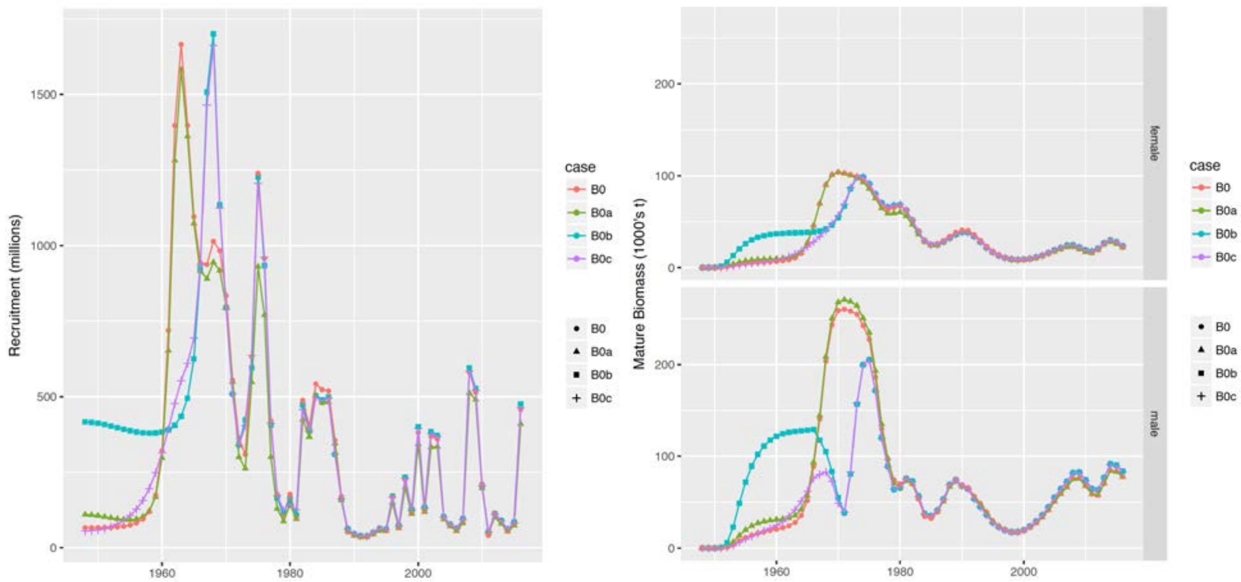


Fig. 4.2.2.1. Estimated recruitment and mature biomass time series from scenarios B0, B0a, B0b, and B0c.

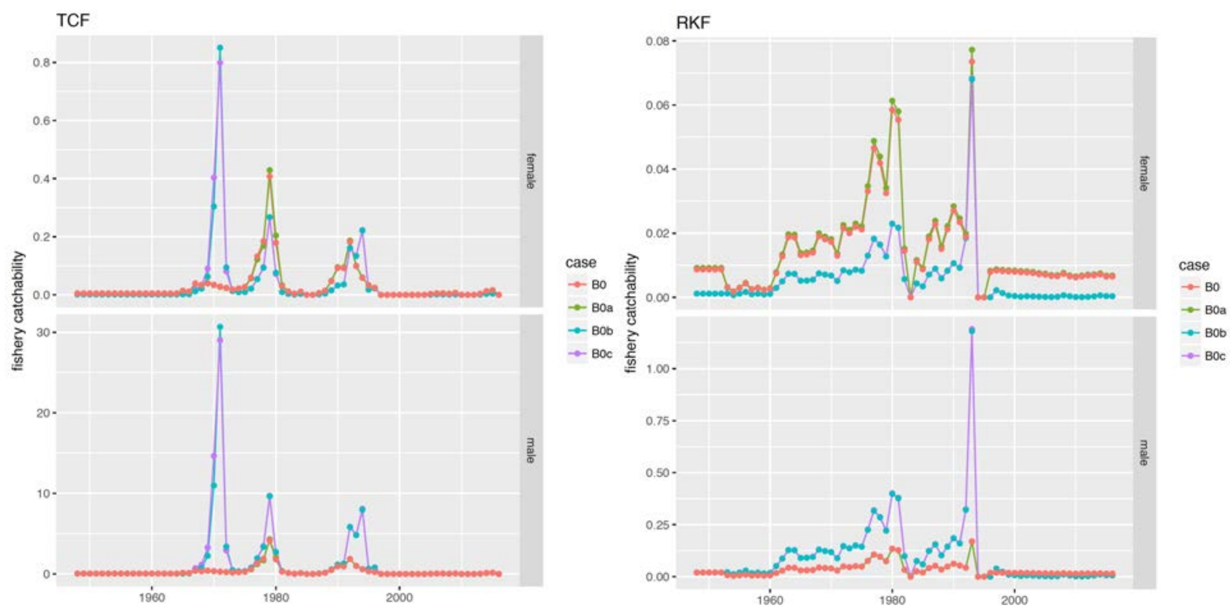


Fig. 4.2.2.2. Estimated fully-selected fishery catchability (capture) rates in the directed fishery (TCF) and the BBRKC ("RKF") fisheries, from scenarios B0, B0a, B0b, and B0c.

4.2.3 B0-B1-B1b-B1c

Starting the model in 1900 and using independently-distributed ln-scale recruitment deviations to "build up" the Tanner crab stock resulted in estimated recruitment time series for scenarios B1, B1b and B1c that were substantially different in character from B0 prior to 1975 (Fig. 4.2.3.1). Following 1975, the trends in all scenarios exhibited similar timing in fluctuations although mean recruitment in B0 was less than that in the B1 scenarios. Similar results hold for mature biomass (Fig. 4.2.3.2).

Removing priors on the ln-scale fishery capture rate deviations in B1b and B1c had similar effects to those in scenarios B0b and B0c. Similarly, starting the fits to the NMFS survey data in 1982 in scenario B1c led to almost no difference in the results from B1b.

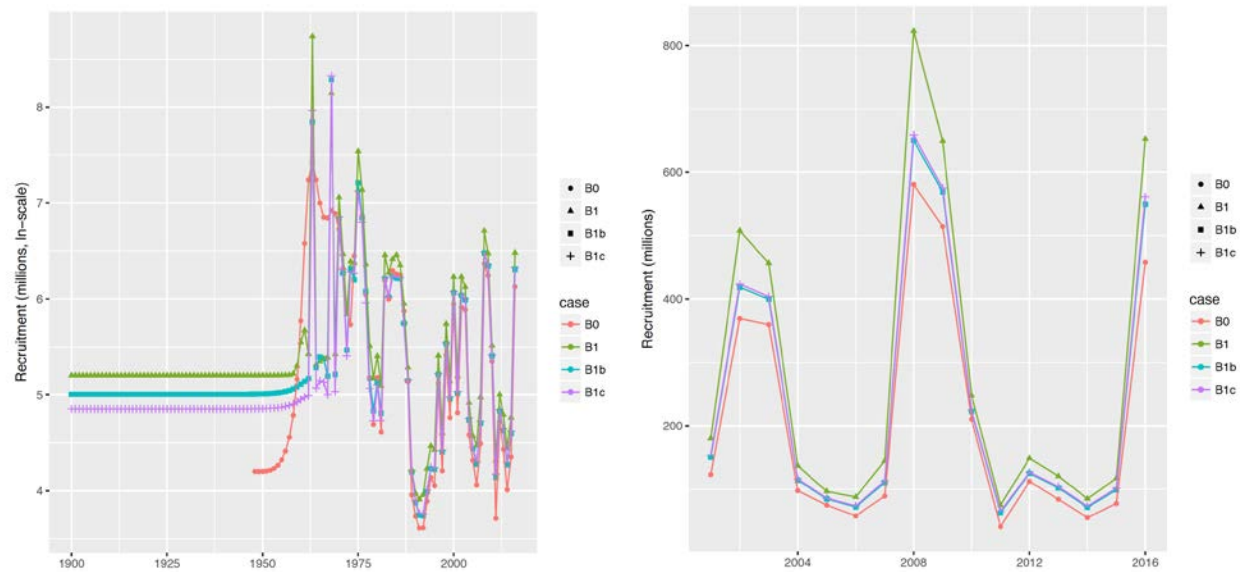


Fig. 4.2.3.1. Estimated recruitment time series for scenarios B0, B1, B1b and B1c. Lefthand plot is on the log-scale; righthand plot is on the arithmetic scale, but only for recent years.

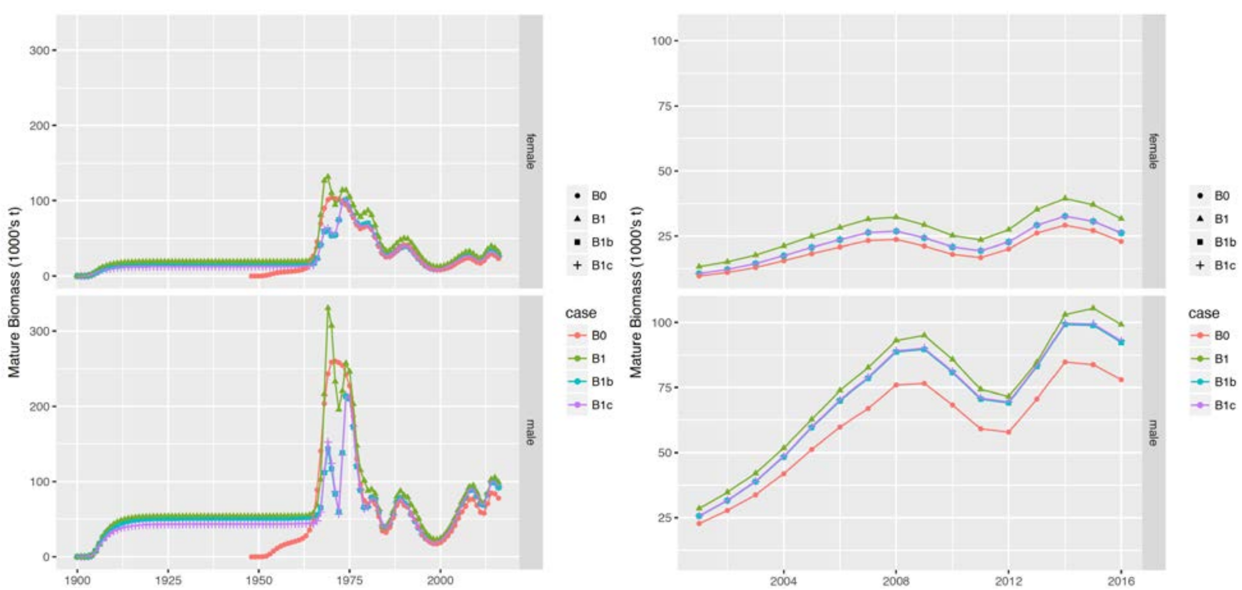


Fig. 4.2.3.2. Estimated mature biomass time series for scenarios B0, B1, B1b and B1c. The righthand plot shows recent years only.

4.2.4 B0-C0-D0

Including the maturity ogive data from the NMFS survey in the parameter optimization (scenario C0) had little effect on female population processes (Fig. 4.2.4.1) but did have effects on male population processes: the slope of the probability of male molt-to-maturity decreased somewhat in the range 75-150 mm CW relative to B0; male growth increments were slightly smaller, and natural mortality rates for mature males were larger. Changing the characteristics of the NMFS survey data fit in the parameter optimization (scenario D0) had little effect on the estimated probability of molt-to-maturity or growth, but did affect estimates of natural mortality, with those for mature crab somewhat higher still relative to C0. One consequence of the changes to the estimated probability of the molt to maturity for males was to increase F_{OFL} and F_{MSY} from 0.7 in B0 to 1.8 in C0 and E0 (Table 4.2.1).

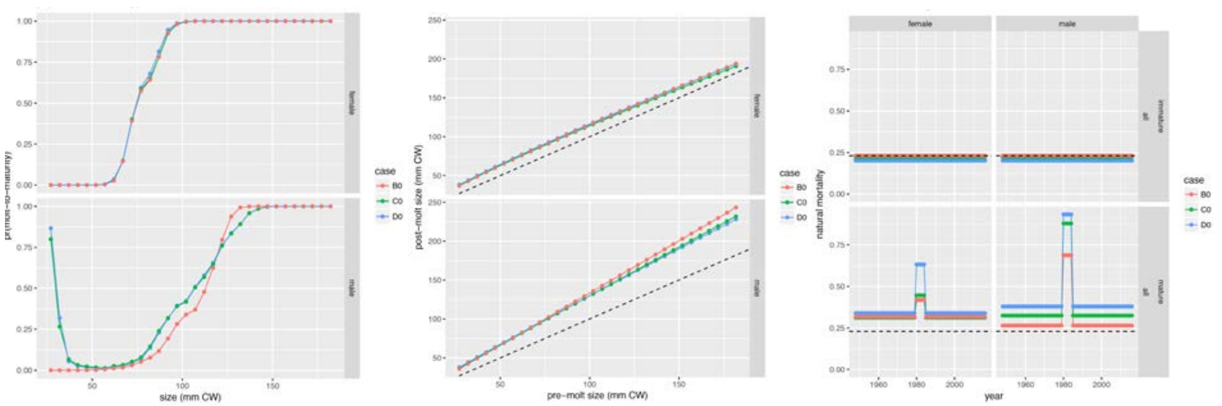


Fig. 4.2.4.1. The estimated probability of the molt to maturity (left), mean growth (center), and natural mortality rates (right) for scenarios B0, C0 and D0.

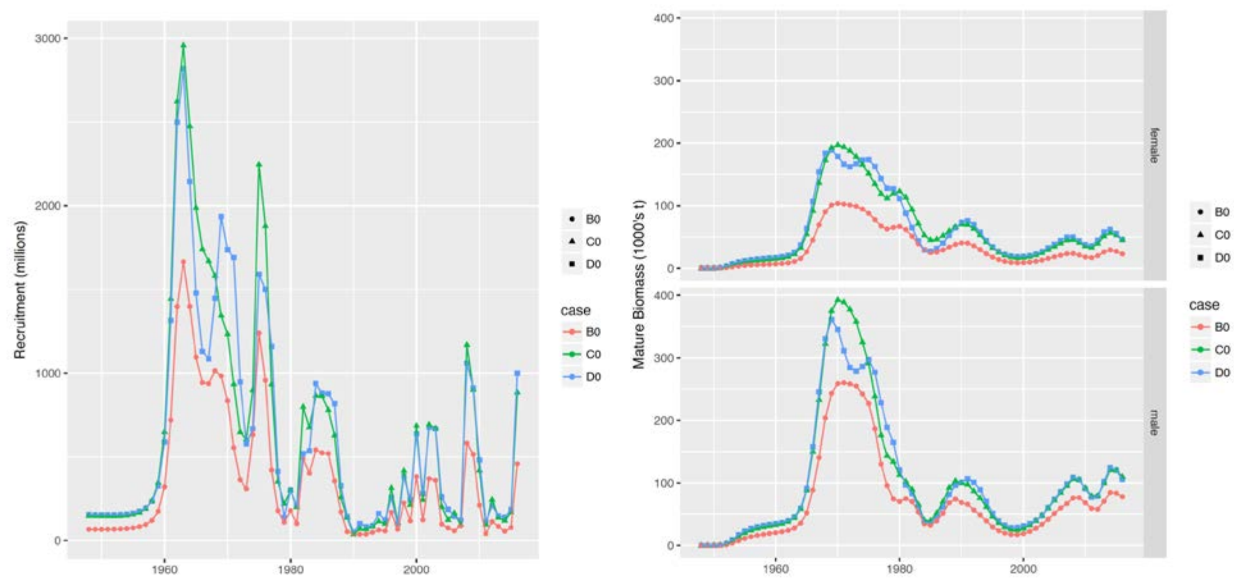


Fig. 4.2.4.2. Estimated time series for recruitment and mature biomass from scenarios B0, C0, and D0.

Including the male maturity ogive data in the parameter optimization also resulted in changes to the estimated survey capture probabilities, with capture probabilities generally smaller at all sizes for both males and females than those in scenario B0 (Fig. 4.2.4.3). This partly explains the differences in recruitment levels and mature biomass among the three scenarios. Fits to mature male survey size compositions improved by more than 170 likelihood units in scenarios C0 and D0 relative to B0, while fits to immature males degraded by 170. Both immature and mature female size compositions degraded by about 28 likelihood units.

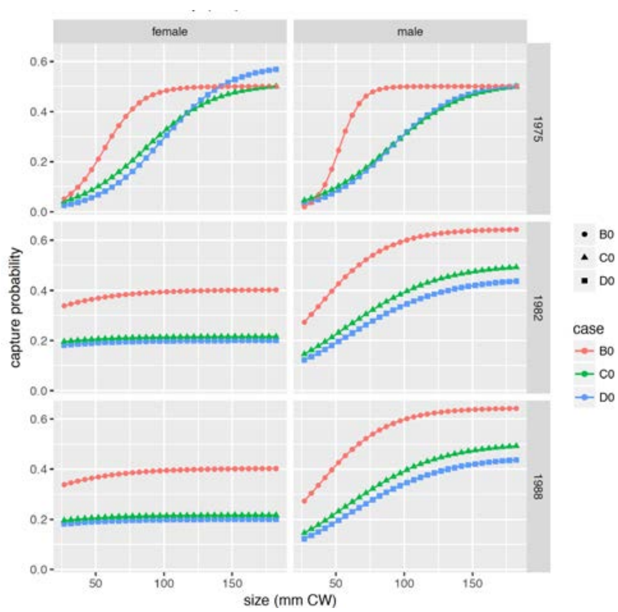


Fig. 4.2.3.3. Estimated capture probabilities in the NMFS trawl survey from scenarios B0, C0 and D0.

The actual fits to the maturity ogive data were not terribly impressive, although they did represent an improvement over not fitting the data.

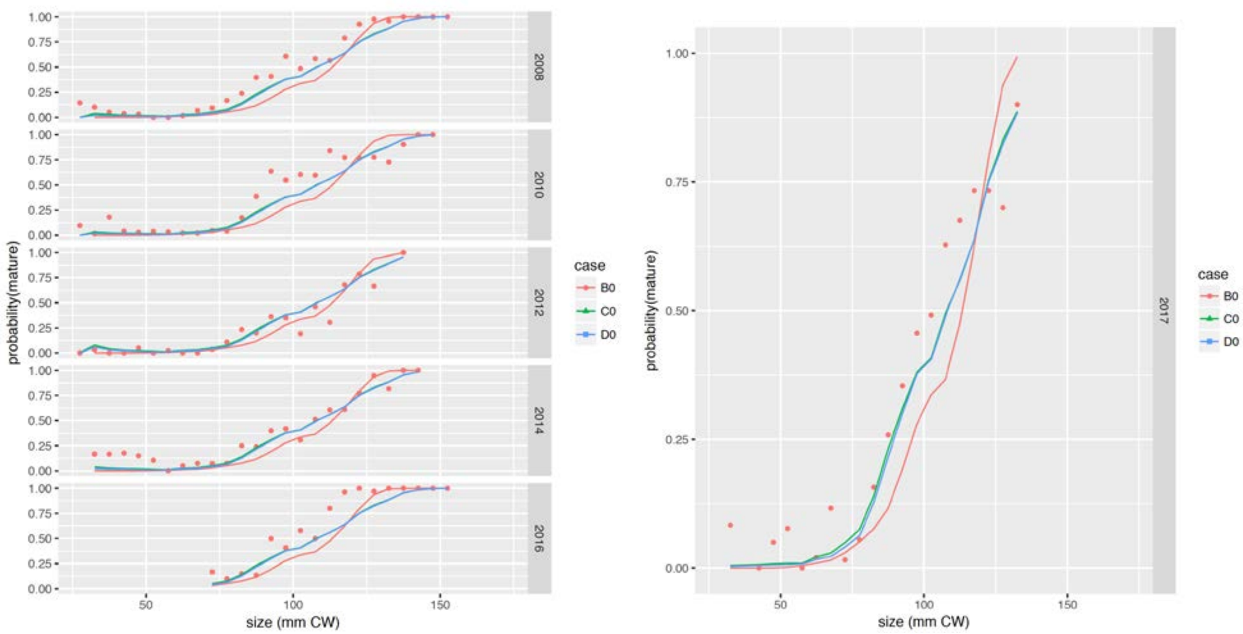


Fig. 4.2.4.4. Fits to recent male maturity ogives from NMFS survey data (data collected since 1990 is included in the parameter optimization).

4.2.5 D0-E0-F0

Fitting the time series of NMFS survey abundance in the model optimization reduced the scale of the estimated recruitment and mature biomass time series in scenarios E0 and F0 relative to D0 (Fig. 4.2.5.1), particularly early in the time series (the 1960s for recruitment, the 1970s for mature biomass). Estimated rates of natural mortality were slightly elevated in E0 and F0 (Fig. 4.2.5.2). Increasing the weight on fitting the growth data and male maturity ogive data in F0 resulted in slightly larger mean growth and slightly left-shifted probabilities of terminal molt (so that males between had a slightly higher chance of having undergone terminal molt) relative to D0 and E0, which were almost identical.

Including the NMFS survey abundance data in the model optimization also improved the fits to survey biomass data for both males and females in scenarios E0 and F0 relative to D0 (by 149 and 80 likelihood units, respectively) but degraded the fits to survey size compositions (by 115 units for males and 56 units for females; Tables D.2-3). Much of the improvement in the fits to survey biomass for scenarios E0 and F0 over D0 can be traced to better fits to the data for old shell crab in the late 1970s (Fig.s 4.2.5.3-4). There seems to be a distinct disconnect in the late 1970s between model dynamics and what is seen in the survey for new/old shell crab abundance and biomass, because the survey sees more new shell and fewer old shell crab than the model predicts. However, this does not seem to be because substantially different survey capture probabilities were estimated pre-1982 in the three scenarios (Fig. 4.2.5.5) The agreement between survey and model seems much better after 1981. In the scenarios considered in this report, the survey capture probabilities are independent of shell condition, which is probably appropriate if the stock is fully covered by the survey—as it is assumed to be for Tanner crab. One possible source for the disconnect prior to 1982, then, is the variable survey coverage during the 1975-1981 time period which could have led to different survey capture probabilities for new shell and old shell crab if these crab occupied different areas on the continental shelf. Survey coverage after 1981 is far more stable and covers the stock reasonably well, so that the assumption of equal capture probabilities for new shell and old shell Tanner crab in the NMFS survey after 1981 seems fairly reasonable.

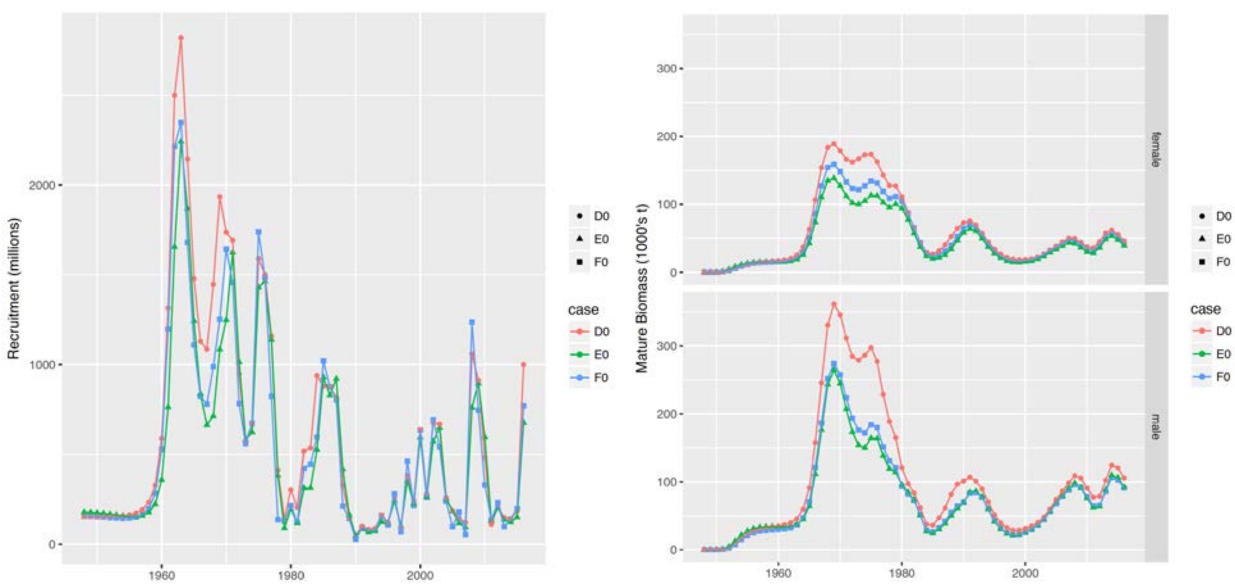


Fig. 4.2.5.1. Estimated time series of recruitment and mature biomass for scenarios D0, E0, and F0.

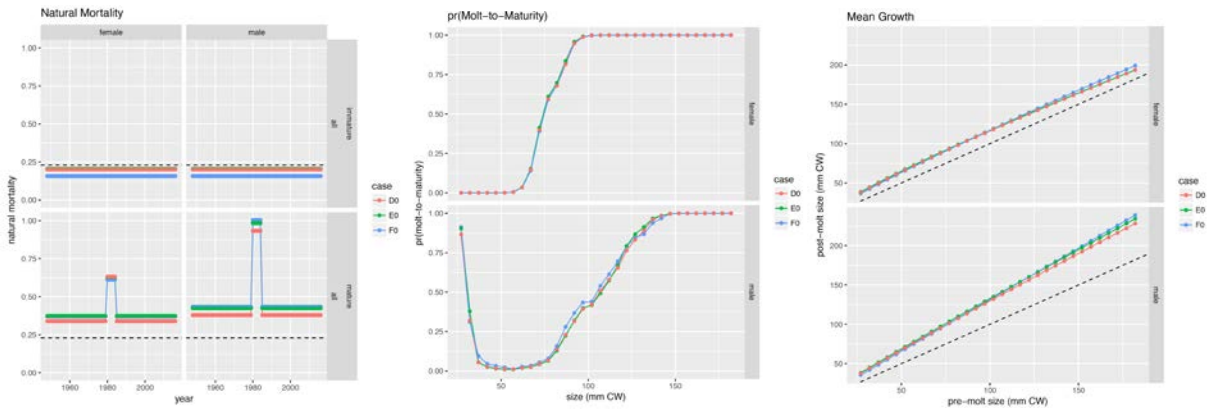


Fig. 4.2.5.2. Estimated natural mortality rates, probabilities of molt-to-maturity, and mean growth for scenarios D0, E0, and F0.

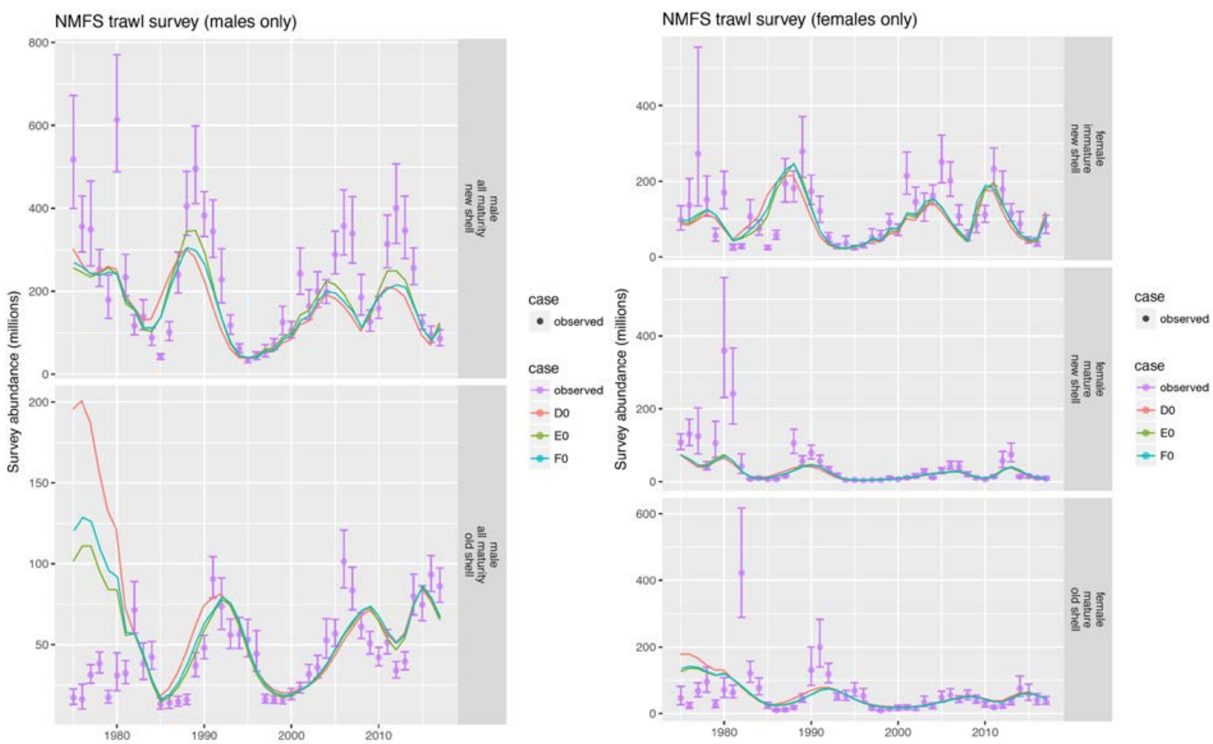


Fig. 4.2.5.3. Observed NMFS trawl survey abundance time series and corresponding estimates for scenarios D0, E0 and F0. Note that these data are not included in the objective function for D0.

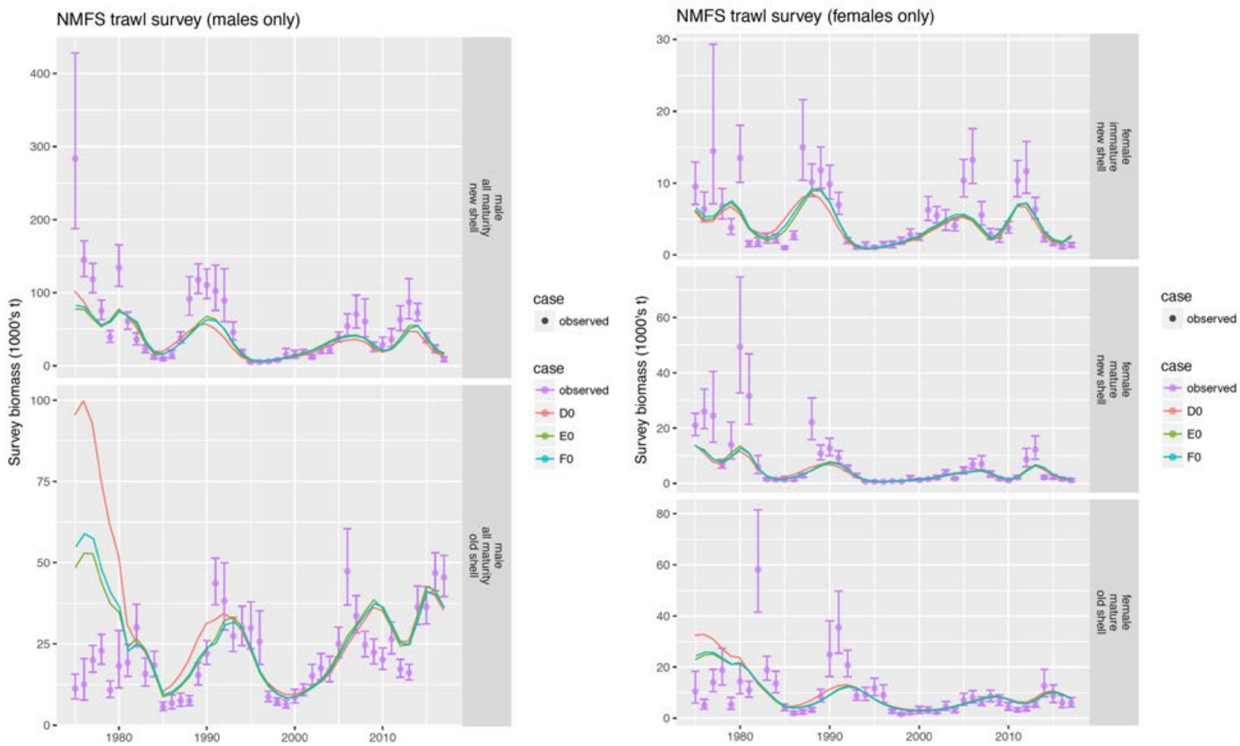


Fig. 4.2.5.4. Observed NMFS trawl survey biomass time series and corresponding fits for scenarios D0, E0 and F0.

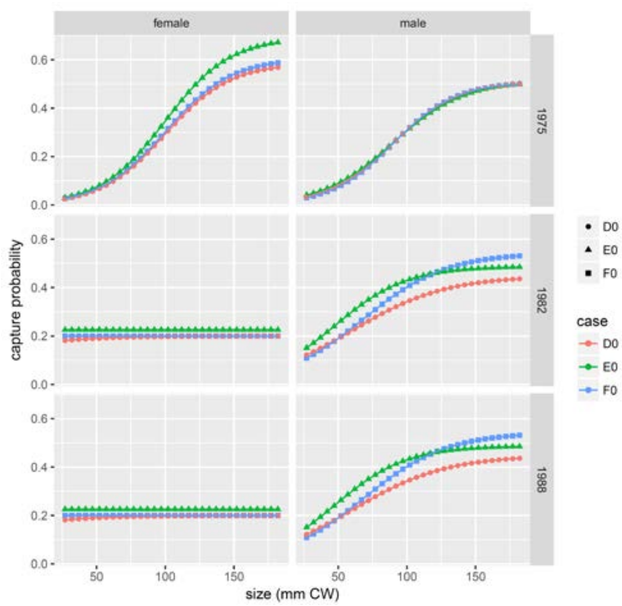


Fig. 4.2.5.5. Estimated NMFS survey capture probabilities for scenarios D0, E0 and F0.

4.2.6 F0-G0

Changing from normal likelihoods (scenario F0) to lognormal likelihoods (scenario G0) to express fits to fishery catch biomass had little impact on model results (Fig.s 4.2.7.1-3). For example, estimated time series for recruitment and mature biomass were nearly identical (Fig. 4.2.7.1). There were only small differences in estimated total catch biomass from the directed fishery for the two scenarios, as well as for fully-selected catchability (Fig. 4.2.7.2). Similarly, fits to survey biomass were also nearly identical (Fig,.

4.2.7.3). Not surprisingly, the management-related quantities for these two scenarios were very similar, as well (Table 4.2.1).

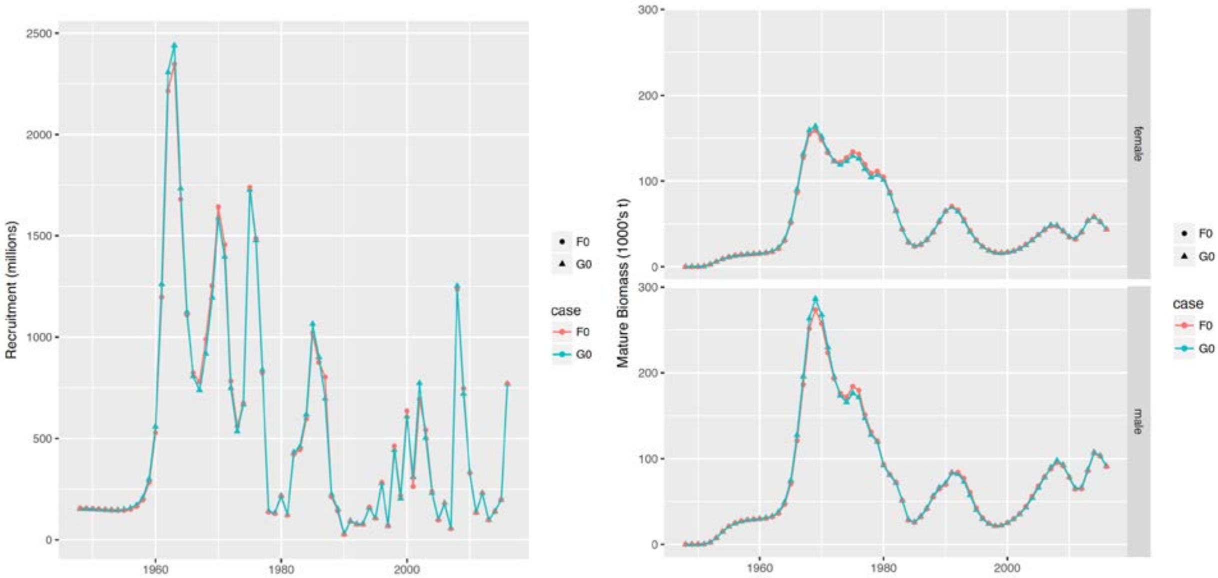


Fig. 4.2.6.1. Estimated recruitment and mature biomass time series from scenarios F0 and G0.

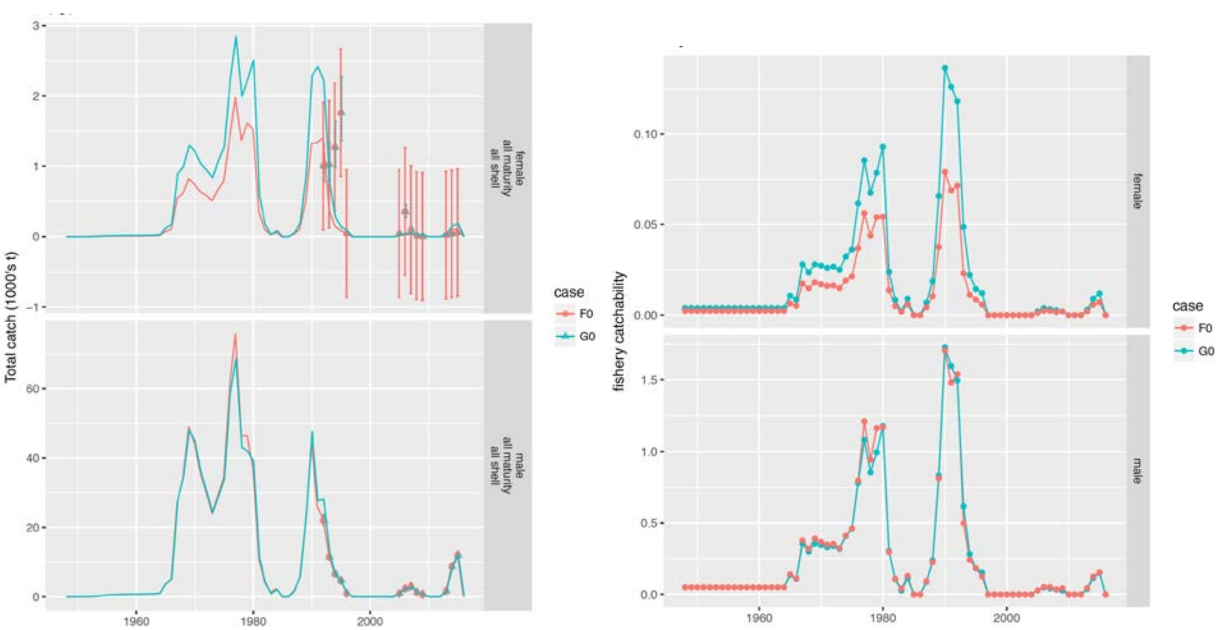


Fig. 4.2.6.2. Fits to total catch biomass (left) and estimates of fully-selected catch catchability (right) in the directed fishery for scenarios F0 and G0.

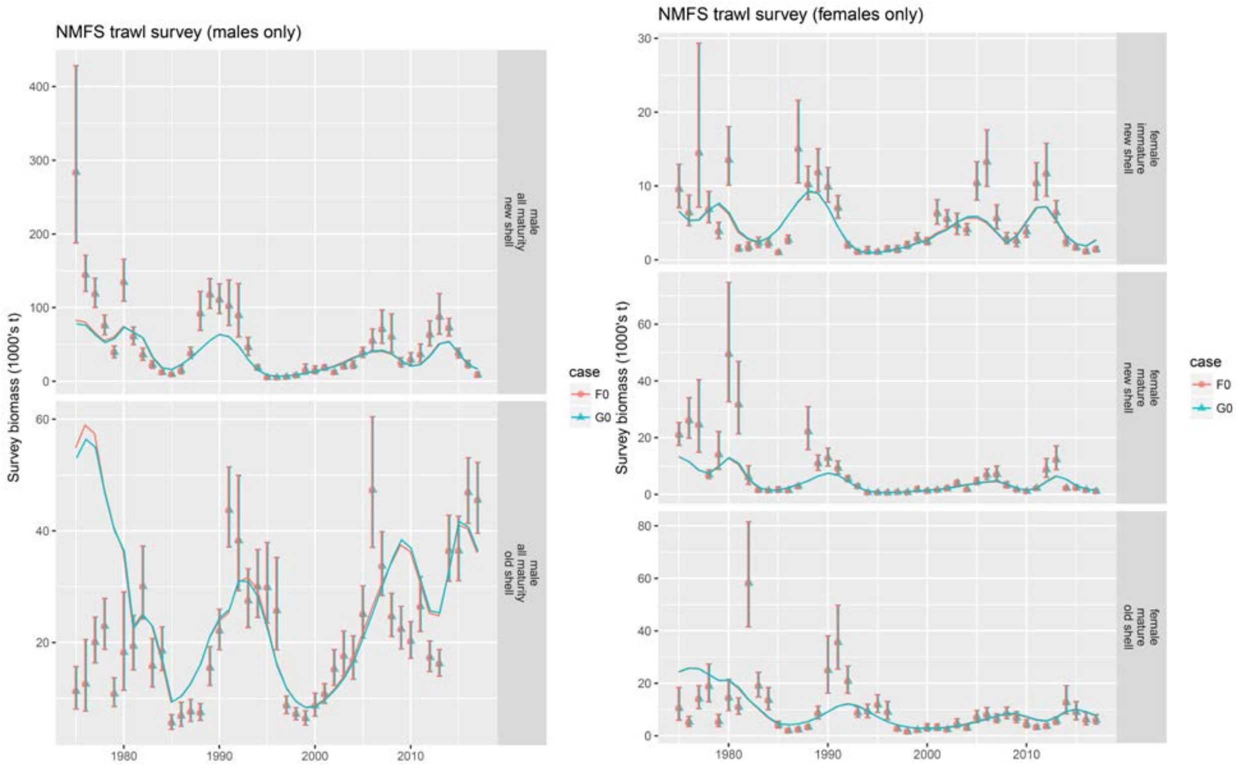


Fig. 4.2.6.3. Fits to NMFS survey biomass for scenarios F0 and G0.

4.2.7 G0-G0b-G0bd-G0bde

Dropping the priors on the ln-scale fishery capture rate "devs" (G0b) resulted in spikes in estimated recruitment in 1960 and 1970 that were similar in timing to spikes in scenario G0 but far exceed them in magnitude (Fig. 4.2.7.1). Applying mean fishery capture rates to the population dynamics only after effort or catch data are first available to the model (G0bd, G0bde) eliminated these early spikes in recruitment and made for a much smoother model startup from 1948 to 1970. Differences among the scenarios in timing and scale of the estimated recruitment time series were much reduced after 1975, as were differences in the estimated time series for mature biomass.

The estimated probabilities of terminal molt were practically identical for these scenarios, except that those for the G0bde scenario were fixed at 0 below 45 mm CW (Fig. 4.2.7.2). Estimated mean post-molt sizes were also quite similar, but estimated rates of natural mortality were somewhat elevated for mature crab in scenarios G0b, G0bd, and G0bde relative to those in G0.

Fits to retained catch biomass in all four scenarios were generally quite good, as were fits to total male catch biomass in the directed fishery (Fig. 4.2.7.3). Fits to total female catch biomass were less good, but this was not unexpected because fully-selected capture rates on females were assumed to be proportional to those on males (and this doesn't appear to be the case in the early 1990s, in particular).

It is worthwhile pointing out that average recruitment in scenarios G0b, G0bd and G0bde is ~500 million crab (Table 4.2.1), more than twice as much as for the baseline scenario, B0. However, virgin biomass for these scenarios is only about 10% larger than for B0 due to the higher rates of natural mortality estimated for males (fewer older crab) and left-shifted probabilities of terminal molt for males (fewer males reaching legal size) in these scenarios. These differences also help explain the much larger F_{MSY}'s (> 2 *x*) obtained for these scenarios relative to B0 (Table 4.2.1).

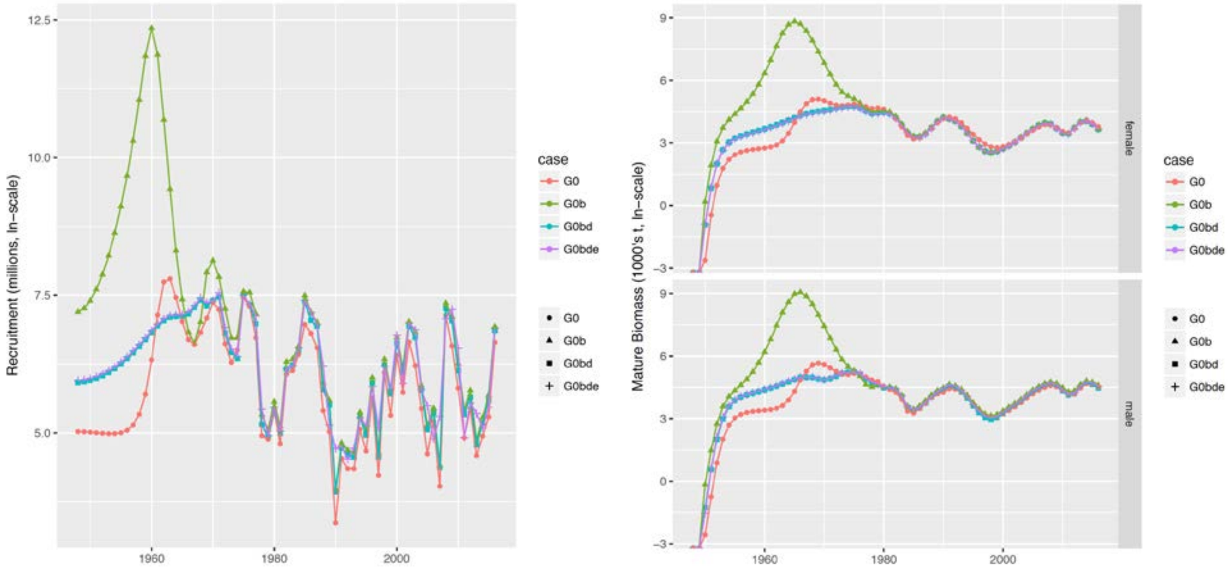


Fig. 4.2.7.1. Estimated time series for recruitment and mature biomass from scenarios G0, G0b, G0bd, and G0bde. Note that y-axes in both plots are log-scale to encompass the full range and show details.

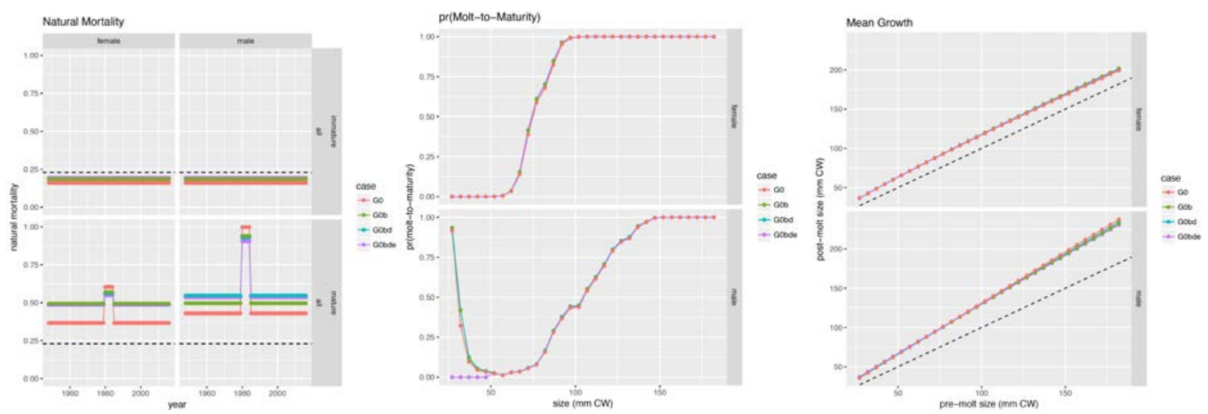


Fig. 4.2.7.2. Estimated rates of natural mortality (left), probability of terminal molt (center), and mean post-molt size (right) from scenarios G0, G0b, G0bd, and G0bde.

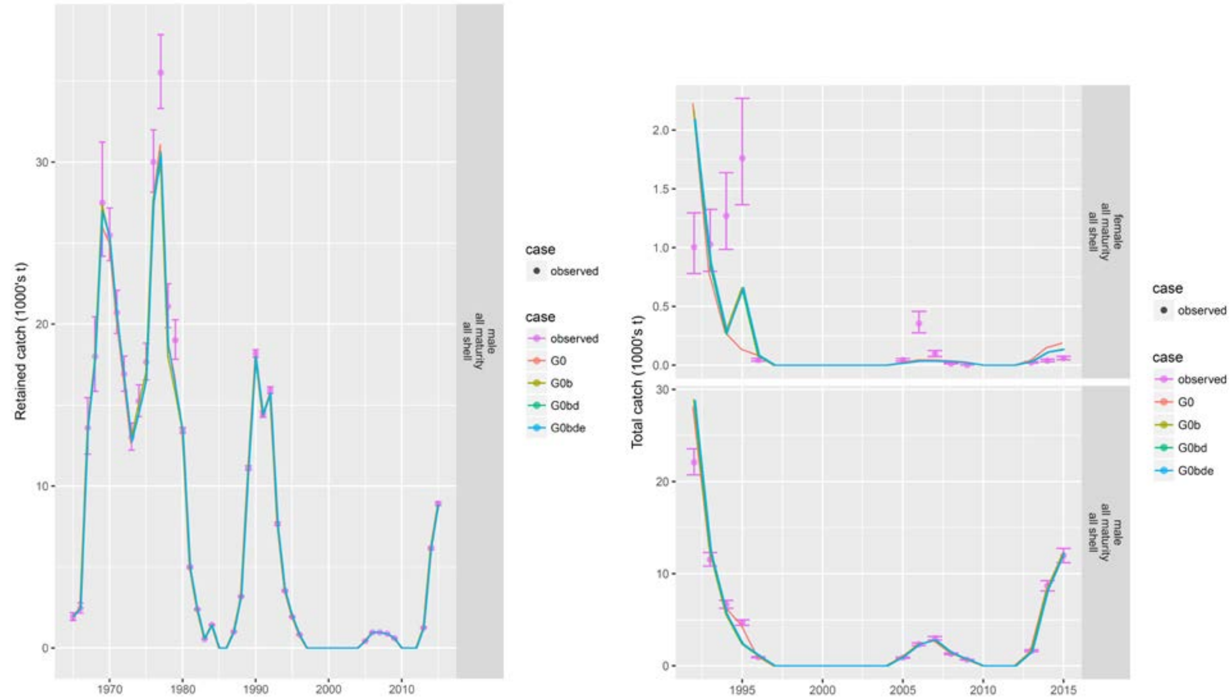


Fig. 4.2.7.3. Fits to retained catch and total catch in the directed fishery for scenarios G0, G0b, G0bd, and G0bde.

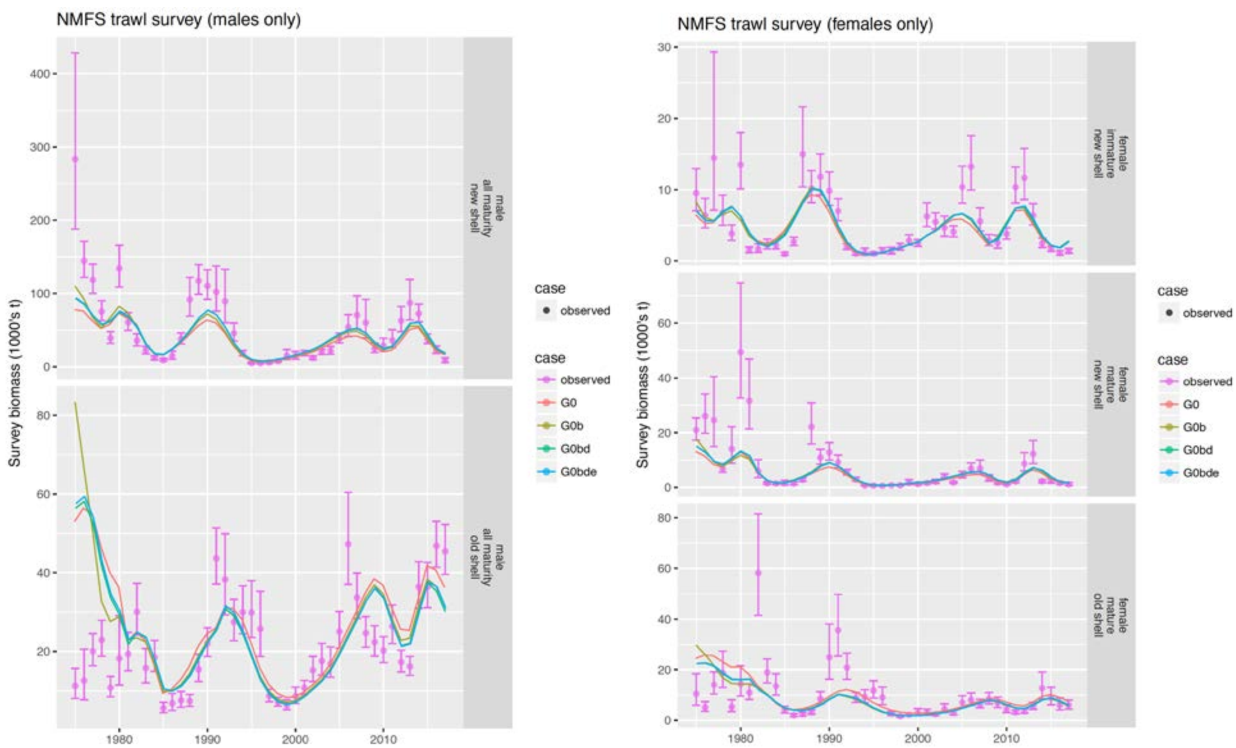


Fig. 4.2.7.4. Fits to NMFS survey biomass time series for scenarios G0, G0b, G0bd, and G0bde.

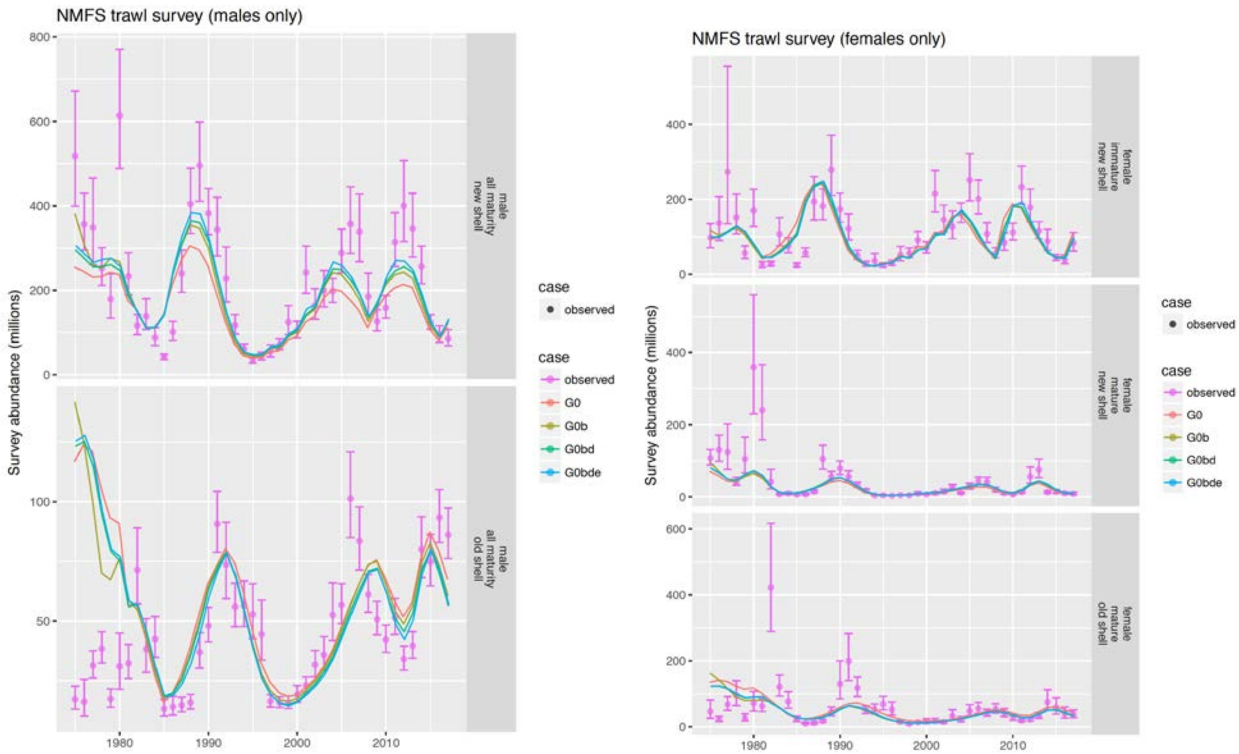


Fig. 4.2.7.5. Fits to NMFS survey abundance time series for scenarios G0, G0b, G0bd, and G0bde.

4.2.8 Use of iterative re-weighting for size composition data (B0-Fr, B0-McI, G0bde-Fr, G0bde-McI)

This set of scenarios provides an initial examination of the use of iterative re-weighting using either the Francis or McAllister-Ianelli approaches discussed in Punt (2017). For each iterative re-weighting scenario, the model was run for five additional phases after the final estimation phase (5) for the un-re-weighted scenario. The appropriate re-weighting scheme was applied to all size composition data prior to the start of each additional model estimation phase for a total of five iterations.

In both scenarios that used the Francis approach (B0-Fr and G0bde-Fr), the iterative re-weighting failed to converge for all of the size composition data within the five iterations allowed. As noted previously, the scenarios using the Francis approach resulted in the most parameters estimated at or near one of their bounds. Cumulative weights for the Francis approach after 5 iterations were all small (<0.05), with most extremely small (<0.0001), indicating that this approach was severely down-weighting all size composition data.

In both scenarios that used the McAllister-Ianelli approach (B0-McI and G0bde-McI), the iterative re-weighting converged for all fishery-related size compositions within the five iterations allowed. However, the resulting cumulative weighting was typically > 1 (in the range 1.5-10), indicating that this method was increasing the weight placed on the fishery size composition data in the objective function. As a consequence, negative log-likelihoods reflecting fits to fishery size compositions in B0-McI and G0bde-McI increased by several hundred units for each fishery relative to B0 and G0bde, respectively. The iterative re-weighting did not converge within the allotted five iterations for the survey-related size compositions, although it appeared that extending the number of re-weighting iterations would improve convergence. In contrast to the fishery size compositions, the iterative re-weighting on the survey data appeared to be decreasing the weight placed on this data in the objective function. As a consequence, the negative log-likelihoods reflecting fits to the size compositions in B0-McI and G0bde-McI were much smaller (50-100 likelihood units) smaller than those in B0 and G0bde.

5. Recommendations for Fall 2018 Alternative Model Scenarios

I recommend the following model configurations be evaluated for the Fall 2018 assessment:

- 2017AM: the 2017 assessment model configuration
- B0: the 2017 assessment model configuration with updated data for 2018
- B1: B0 + include the male maturity ogive data in the model optimization, with the probability of the molt-to-maturity fixed at 0 in size bins < 45 mm CW.
- B2: B1 + exclude NMFS survey data in the 2017AM configuration that included estimates of immature and mature male biomass determined outside the model using Rugolo' and Turnock's empirical maturity ogive include NMFS survey biomass and size composition data for males by shell condition and for females by maturity status and shell condition in the model optimization
- B3: B2 + include aggregated NMFS survey abundance estimates in the model optimization
- B4: B3 + use lognormal fits to fishery catch biomass in the objective function

In scenario B1, I recommend that the probability of the molt-to-maturity should be fixed at 0 for size bins < 45 mm CW in B1 and subsequent scenarios. It seems highly unlikely that males classified as "mature" on the basis of CH:CW ratios at sizes less than 45 mm CW are truly capable of mating with adult females in the wild. However, the model exhibits a tendency to estimate rather large probabilities of molt-to-maturity at very small sizes when left unconstrained. Thus, it seems prudent to fix these values to zero and let the model estimate probabilities in larger size bins.

In scenario B2, I recommend dropping the fits to the NMFS survey data used in the 2017 assessment. The Rugolo and Turnock empirical maturity ogive was used to apportion new shell male abundance and biomass by size bin as immature and mature outside the model. Keeping this data in the model fitting process introduces some circularity. Instead, I recommend fitting male biomass and size composition data by shell condition (without apportioning to immature/mature status outside the model) and fitting female biomass and size composition data by shell condition and maturity status (since the latter is unambiguous in the survey data).

In scenario B3, I recommend adding the time series of aggregated abundance estimates from the NMFS survey data to the model optimization. Fitting only the time series of aggregated biomass estimates from the NMFS survey data effectively up-weights the importance of large crab relative to small crab in the model optimization. Including the aggregated abundance time series in the model fitting process ameliorates this effect and may produce better estimates of recruitment. Although this undoubtedly leads to some amount of "double counting" in the model objective function, the bias this would introduce is probably rather small and certainly on the order of that introduced by selectively other components in the objective function.

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Tamone, S., S. Taggart, A. Andrews, J. Mondragon, and J. Nielsen. 2007. The relationship between circulating ecdysteroids and chela allometry in male Tanner crabs: evidence for a terminal molt in the genus Chionoecetes. J. Crust. Biol. 27: 635-642.

Accompanying Supplemental Material (available online)

The following files are provided online to provide more comprehensive results than can be presented in this report.

File name	Description
OFCs.DataComponents.xlsx	Excel spreadsheet with pivot tables for the data components to the objective function for each model scenario.
OFL.Rsults.xlsx	Excel spreadsheet with pivot tables for management-related quantities from the OFL calculations for each model scenario.
Params.Values.xlsx	Excel spreadsheet with pivot tables for the estimated parameter values and approximate standard errors for each model scenario.
Params.AtBounds.xlsx	Excel spreadsheet with pivot tables for the parameters that were estimated at or near one of their bounds for each model scenario.

Appendix A: Alternative model datasets

Table A.1. Dataset 2018B (the 2017 assessment model dataset).

Name	component	type	Distribution	Likelihood
2017AM, 2018B0	TCF: retained catch	abundance	--	--
		biomass	norm2	males only
		size comp.s	multinomial	males only
	TCF: total catch	abundance	--	--
		biomass	norm2	by sex
		size comp.s	multinomial	by sex
	SCF: total catch	abundance	--	--
		biomass	norm2	by sex
		size comp.s	multinomial	by sex
	RKF: total catch	abundance	--	--
		biomass	norm2	by sex
		size comp.s	multinomial	by sex
	GTF: total catch	abundance	--	--
		biomass	norm2	by sex
		size comp.s	multinomial	by sex
	NMFS survey	abundance	--	--
		biomass	lognormal	by sex for mature only
		size comp.s	multinomial	by sex/maturity
		chela height data	--	--
	growth data	EBS only	gamma	by sex

Table A.2 Dataset 2018C. Changes from 2018B are highlighted.

Name	component	type	Distribution	Likelihood
2018C	TCF: retained catch	abundance	--	--
		biomass	norm2	males only
		size comp.s	multinomial	males only
	TCF: total catch	abundance	--	--
		biomass	norm2	by sex
		size comp.s	multinomial	by sex
	SCF: total catch	abundance	--	--
		biomass	norm2	by sex
		size comp.s	multinomial	by sex
	RKF: total catch	abundance	--	--
		biomass	norm2	by sex
		size comp.s	multinomial	by sex
	GTF: total catch	abundance	--	--
		biomass	norm2	by sex
		size comp.s	multinomial	by sex
	NMFS survey	abundance	--	--
		biomass	lognormal	by sex for mature only
		size comp.s	multinomial	by sex/maturity
		chela height data	binomial	binomial
	growth data	EBS only	gamma	by sex

Table A.1. Dataset 2018D. Changes from 2018C are highlighted.

Name	component	type	Distribution	Likelihood
2018D	TCF: retained catch	abundance	--	--
		biomass	norm2	males only
		size comp.s	multinomial	males only
	TCF: total catch	abundance	--	--
		biomass	norm2	by sex
		size comp.s	multinomial	by sex
	SCF: total catch	abundance	--	--
		biomass	norm2	by sex
		size comp.s	multinomial	by sex
	RKF: total catch	abundance	--	--
		biomass	norm2	by sex
		size comp.s	multinomial	by sex
	GTF: total catch	abundance	--	--
		biomass	norm2	by sex
		size comp.s	multinomial	by sex
	NMFS survey	abundance	--	--
		biomass	lognormal	males: by shell condition
		size comp.s	multinomial	females: by maturity/shell condition
		chela height data	binomial	binomial
	growth data	EBS only	gamma	by sex

Table A.2 Dataset 2018E. Changes from 2018D are highlighted.

Name	component	type	Distribution	Likelihood
2018E	TCF: retained catch	abundance	--	--
		biomass	norm2	males only
		size comp.s	multinomial	males only
	TCF: total catch	abundance	--	--
		biomass	norm2	by sex
		size comp.s	multinomial	by sex
	SCF: total catch	abundance	--	--
		biomass	norm2	by sex
		size comp.s	multinomial	by sex
	RKF: total catch	abundance	--	--
		biomass	norm2	by sex
		size comp.s	multinomial	by sex
	GTF: total catch	abundance	--	--
		biomass	norm2	by sex
		size comp.s	multinomial	by sex
	NMFS survey	abundance	lognormal	males: by shell condition females: by maturity/shell condition
		biomass	lognormal	
		size comp.s	multinomial	
		chela height data	binomial	binomial
	growth data	EBS only	gamma	by sex

Table A.1. Dataset 2018F. Changes from 2018E are highlighted.

Name	component	type	Distribution	Likelihood components
2018F	TCF: retained catch	abundance	--	--
		biomass	norm2	males only
		size comp.s	multinomial	males only
	TCF: total catch	abundance	--	--
		biomass	norm2	by sex
		size comp.s	multinomial	by sex
	SCF: total catch	abundance	--	--
		biomass	norm2	by sex
		size comp.s	multinomial	by sex
	RKF: total catch	abundance	--	--
		biomass	norm2	by sex
		size comp.s	multinomial	by sex
	GTF: total catch	abundance	--	--
		biomass	norm2	by sex
		size comp.s	multinomial	by sex
	NMFS survey	abundance	lognormal	{ males: by shell condition females: by maturity/shell condition
		biomass	lognormal	
		size comp.s	multinomial	
		chela height data	binomial *x* 5	males only
	growth data	EBS only	gamma *x* 5	by sex

Table A.2 Dataset 2018G. Changes from 2018F are highlighted.

Name	component	type	Distribution	Likelihood components
2018G	TCF: retained catch	abundance	--	--
		biomass	lognormal	males only
		size comp.s	multinomial	males only
	TCF: total catch	abundance	--	--
		biomass	lognormal	by sex
		size comp.s	multinomial	by sex
	SCF: total catch	abundance	--	--
		biomass	lognormal	by sex
		size comp.s	multinomial	by sex
	RKF: total catch	abundance	--	--
		biomass	lognormal	by sex
		size comp.s	multinomial	by sex
	GTF: total catch	abundance	--	--
		biomass	lognormal	by sex
		size comp.s	multinomial	by sex
	NMFS survey	abundance	lognormal	{ males: by shell condition females: by maturity/shell condition
		biomass	lognormal	
		size comp.s	multinomial	
		chela height data	binomial *x* 5	males only
	growth data	EBS only	gamma *x* 5	by sex

Appendix B: All Model Parameter Values

This appendix includes tables of estimates for all model parameters, by model scenario. These tables are also provided as an Excel spreadsheet ("ParamValues.xlsx") in the supplementary online material.

Table B.1. Estimated model parameter values and standard deviations related to growth, maturity, natural mortality and recruitment for B model scenarios. Values for recruitment devs are not shown.

						Scenarios B0		B0-Fr		B0-McI		B0a		B0b		B0c		B0q		B1		B1b		B1c	
category	process	name	label	index	parameter scale	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.
population p	growth	pGrA[1]	males	1	ARITHMETIC	33.136	0.360	32.035	0.372	32.943	0.334	33.506	0.000	33.149	0.365	33.187	0.354	33.033	0.360	32.817	0.317	33.082	0.361	33.069	0.000
		pGrA[2]	females	1	ARITHMETIC	34.424	0.435	33.252	0.396	34.220	0.422	34.823	0.000	34.323	0.434	34.382	0.427	33.268	0.374	33.996	0.400	34.242	0.436	34.178	0.000
		pGrB[1]	males	1	ARITHMETIC	166.785	1.123	161.812	1.312	167.943	0.990	166.312	0.000	166.907	1.120	166.934	1.118	164.378	1.261	164.143	1.250	166.502	1.151	166.482	0.000
		pGrB[2]	females	1	ARITHMETIC	115.141	0.853	114.293	1.005	116.207	0.823	114.966	0.000	115.020	0.854	114.994	0.839	116.428	0.784	115.076	0.802	115.028	0.852	115.014	0.000
		pGrBeta[1]	both sexes	1	ARITHMETIC	0.820	0.129	0.500	0.000	0.869	0.120	0.882	0.000	0.820	0.132	0.828	0.132	0.670	0.115	0.598	0.100	0.781	0.128	0.774	0.000
	maturity	pLgtPrM2M[1]	males (entire model period)	1	ARITHMETIC	-12.087	7.441	4.719	3.175	-11.668	7.376	-12.500	0.000	-12.196	7.475	-12.197	7.475	-12.864	7.669	-12.138	7.405	-12.161	7.469	-12.210	0.000
				2	ARITHMETIC	-10.892	5.612	3.362	1.899	-10.515	5.556	-11.258	0.000	-10.992	5.642	-10.993	5.642	-11.570	5.807	-10.904	5.579	-10.959	5.637	-11.003	0.000
				3	ARITHMETIC	-9.697	4.014	2.005	1.009	-9.362	3.967	-10.015	0.000	-9.788	4.038	-9.788	4.038	-10.277	4.171	-9.669	3.984	-9.758	4.034	-9.796	0.000
				4	ARITHMETIC	-8.503	2.678	0.709	0.571	-8.210	2.642	-8.773	0.000	-8.585	2.697	-8.585	2.697	-8.983	2.795	-8.436	2.651	-8.557	2.694	-8.589	0.000
				5	ARITHMETIC	-7.321	1.624	-0.203	0.422	-7.070	1.595	-7.539	0.000	-7.392	1.639	-7.392	1.639	-7.698	1.709	-7.215	1.597	-7.368	1.636	-7.393	0.000
				6	ARITHMETIC	-6.162	0.909	-0.184	0.382	-5.954	0.896	-6.329	0.000	-6.224	0.919	-6.224	0.919	-6.434	0.970	-6.019	0.879	-6.202	0.916	-6.221	0.000
				7	ARITHMETIC	-5.104	0.541	-0.267	0.335	-4.935	0.555	-5.221	0.000	-5.155	0.546	-5.155	0.545	-5.270	0.587	-4.918	0.521	-5.135	0.546	-5.148	0.000
				8	ARITHMETIC	-4.477	0.364	-0.449	0.311	-4.372	0.388	-4.547	0.000	-4.515	0.366	-4.514	0.366	-4.571	0.386	-4.281	0.362	-4.501	0.367	-4.510	0.000
				9	ARITHMETIC	-4.090	0.290	-0.600	0.313	-4.087	0.307	-4.129	0.000	-4.124	0.291	-4.122	0.291	-4.193	0.297	-3.964	0.291	-4.117	0.292	-4.124	0.000
				10	ARITHMETIC	-3.448	0.224	-0.736	0.310	-3.437	0.237	-3.466	0.000	-3.489	0.225	-3.489	0.224	-3.522	0.227	-3.340	0.226	-3.480	0.225	-3.482	0.000
				11	ARITHMETIC	-2.913	0.175	-0.932	0.316	-2.873	0.183	-2.917	0.000	-2.950	0.175	-2.952	0.175	-2.895	0.170	-2.712	0.173	-2.933	0.175	-2.933	0.000
				12	ARITHMETIC	-2.487	0.144	-1.147	0.322	-2.485	0.149	-2.489	0.000	-2.506	0.144	-2.506	0.144	-2.461	0.140	-2.292	0.145	-2.493	0.144	-2.493	0.000
				13	ARITHMETIC	-2.021	0.125	-1.321	0.322	-2.085	0.125	-2.025	0.000	-2.029	0.124	-2.028	0.125	-2.057	0.120	-1.927	0.123	-2.026	0.125	-2.027	0.000
				14	ARITHMETIC	-1.430	0.109	-1.391	0.304	-1.477	0.101	-1.432	0.000	-1.448	0.108	-1.446	0.108	-1.522	0.109	-1.430	0.109	-1.454	0.109	-1.456	0.000
				15	ARITHMETIC	-0.937	0.095	-1.346	0.294	-0.947	0.085	-0.939	0.000	-0.967	0.094	-0.966	0.094	-1.008	0.102	-0.921	0.105	-0.968	0.095	-0.970	0.000
				16	ARITHMETIC	-0.668	0.092	-1.218	0.274	-0.659	0.080	-0.668	0.000	-0.693	0.091	-0.692	0.091	-0.649	0.088	-0.533	0.092	-0.685	0.091	-0.688	0.000
				17	ARITHMETIC	-0.536	0.089	-0.970	0.260	-0.522	0.076	-0.538	0.000	-0.528	0.089	-0.527	0.089	-0.507	0.086	-0.409	0.091	-0.527	0.088	-0.530	0.000
				18	ARITHMETIC	-0.093	0.100	-0.384	0.276	0.017	0.089	-0.115	0.000	-0.046	0.103	-0.043	0.103	-0.130	0.096	-0.060	0.097	-0.051	0.103	-0.055	0.000
				19	ARITHMETIC	0.512	0.130	0.472	0.315	0.692	0.118	0.479	0.000	0.588	0.134	0.591	0.135	0.400	0.119	0.451	0.117	0.571	0.133	0.566	0.000
				20	ARITHMETIC	1.362	0.202	1.332	0.378	1.627	0.173	1.310	0.000	1.455	0.206	1.461	0.206	1.101	0.174	1.119	0.164	1.412	0.206	1.405	0.000
				21	ARITHMETIC	2.708	0.366	2.494	0.578	2.934	0.287	2.604	0.000	2.850	0.370	2.859	0.369	2.076	0.389	2.033	0.370	2.769	0.385	2.758	0.000
				22	ARITHMETIC	4.957	0.591	4.003	0.909	5.359	0.512	4.853	0.000	5.114	0.600	5.121	0.600	4.326	0.628	4.226	0.642	5.049	0.602	5.041	0.000
				23	ARITHMETIC	7.096	1.048	5.551	1.379	7.608	0.994	7.008	0.000	7.248	1.068	7.252	1.069	6.588	0.982	6.479	0.977	7.209	1.055	7.203	0.000
				24	ARITHMETIC	8.917	1.667	6.994	1.962	9.489	1.637	8.845	0.000	9.056	1.696	9.058	1.697	8.532	1.540	8.428	1.514	9.038	1.678	9.034	0.000
				25	ARITHMETIC	10.412	2.305	8.303	2.554	11.001	2.290	10.355	0.000	10.536	2.338	10.536	2.339	10.129	2.161	10.034	2.127	10.533	2.320	10.531	0.000
				26	ARITHMETIC	11.615	2.838	9.491	3.042	12.186	2.832	11.571	0.000	11.722	2.871	11.721	2.872	11.413	2.702	11.328	2.667	11.730	2.854	11.728	0.000
				27	ARITHMETIC	12.566	3.175	10.572	3.336	13.088	3.173	12.532	0.000	12.655	3.204	12.654	3.205	12.426	3.058	12.352	3.028	12.668	3.190	12.668	0.000
				28	ARITHMETIC	13.306	3.248	11.564	3.369	13.753	3.249	13.280	0.000	13.378	3.272	13.376	3.272	13.212	3.156	13.152	3.132	13.393	3.261	13.392	0.000
				29	ARITHMETIC	13.877	3.007	12.485	3.091	14.230	3.008	13.859	0.000	13.931	3.024	13.930	3.025	13.818	2.941	13.772	2.924	13.945	3.017	13.945	0.000
				30	ARITHMETIC	14.321	2.412	13.353	2.463	14.566	2.413	14.310	0.000	14.358	2.423	14.357	2.423	14.287	2.371	14.256	2.360	14.368	2.418	14.368	0.000
				31	ARITHMETIC	14.682	1.434	14.185	1.456	14.806	1.434	14.676	0.000	14.700	1.439	14.699	1.439	14.666	1.416	14.651	1.411	14.706	1.436	14.706	0.000
				32	ARITHMETIC	15.000	0.004	15.000	0.010	15.000	0.004	15.000	0.000	15.000	0.004	15.000	0.004	15.000	0.004	15.000	0.004	15.000	0.004	15.000	0.000
		pLgtPrM2M[2]	females (entire model period)	1	ARITHMETIC	-15.000	0.002	4.478	2.836	-15.000	0.002	-15.000	0.000	-15.000	0.002	-15.000	0.002	-15.000	0.002	-15.000	0.002	-15.000	0.002	-15.000	0.000
				2	ARITHMETIC	-13.764	0.784	3.480	1.864	-13.675	0.784	-13.755	0.000	-13.763	0.783	-13.763	0.784	-13.728	0.785	-13.778	0.784	-13.765	0.784	-13.761	0.000
				3	ARITHMETIC	-12.475	1.186	2.482	1.139	-12.303	1.187	-12.458	0.000	-12.472	1.185	-12.473	1.185	-12.406	1.188	-12.500	1.186	-12.477	1.185	-12.469	0.000
				4	ARITHMETIC	-11.077	1.288	1.511	0.695	-10.840	1.290	-11.054	0.000	-11.073	1.287	-11.075	1.287	-10.984	1.291	-11.112	1.288	-11.080	1.287	-11.069	0.000
				5	ARITHMETIC	-9.518	1.152	0.731	0.461	-9.239	1.156	-9.491	0.000	-9.513	1.150	-9.516	1.151	-9.412	1.155	-9.559	1.153	-9.522	1.151	-9.508	0.000
				6	ARITHMETIC	-7.748	0.863	0.382	0.349	-7.459	0.869	-7.721	0.000	-7.743	0.861	-7.746	0.862	-7.643	0.865	-7.790	0.864	-7.753	0.862	-7.737	0.000
				7	ARITHMETIC	-5.743	0.525	0.250	0.302	-5.483	0.533	-5.722	0.000	-5.739	0.525	-5.741	0.525	-5.657	0.525	-5.780	0.527	-5.748	0.525	-5.733	0.000
				8	ARITHMETIC	-3.584	0.243	0.033	0.293	-3.402	0.250	-3.579	0.000	-3.583	0.243	-3.584	0.243	-3.535	0.239	-3.609	0.245	-3.590	0.243	-3.580	0.000
				9	ARITHMETIC	-1.780	0.110	-0.025	0.315	-1.673	0.110	-1.784	0.000	-1.787	0.110	-1.784	0.110	-1.753	0.110	-1.789	0.110	-1.791	0.110	-1.793	0.000
				10	ARITHMETIC	-0.433	0.087	0.154	0.322	-0.385	0.086	-0.430	0.000	-0.444	0.087	-0.440	0.087	-0.406	0.087	-0.446	0.086	-0.449	0.087	-0.455	0.000
				11	ARITHMETIC	0.302	0.092	0.463	0.319	0.306	0.083	0.312	0.000	0.290	0.092	0.294	0.092	0.317	0.090	0.276	0.090	0.283	0.092	0.276	0.000
				12	ARITHMETIC	0.586	0.103	0.670	0.319	0.812	0.093	0.591	0.000	0.576	0.103	0.578	0.103	0.624	0.101	0.585	0.101	0.573	0.103	0.566	0.000
				13	ARITHMETIC	1.274	0.165	1.025	0.335	1.741	0.203	1.280	0.000	1.254	0.164	1.257	0.163	1.356	0.167	1.240	0.154	1.247	0.162	1.236	0.000
				14	ARITHMETIC	2.575	0.347	1.629	0.427	3.088	0.276	2.604	0.000	2.531	0.342	2.536	0.341	2.734	0.349	2.391	0.300	2.497	0.335	2.477	0.000
				15	ARITHMETIC	4.025	0.670	2.403	0.716	3.755	0.310	4.082	0.000	3.958	0.655	3.967	0.655	4.260	0.676	3.662	0.534	3.893	0.632	3.865	0.000
				16	ARITHMETIC	5.512	1.280	3.227	1.313	4.080	0.480	5.596	0.000	5.425	1.252	5.436	1.255	5.822	1.294	4.983	1.045	5.330	1.213	5.296	0.000
	natural mort	pDM1[1]	multiplier for immature crab	1	ARITHMETIC	1.000	0.051	0.995	0.050	1.004	0.050	0.951	0.000	1.010	0.051	1.006	0.049	1.062	0.052	1.000	0.051	1.010	0.051	1.016	0.000
		pDM1[2]	multiplier for mature males	1	ARITHMETIC	1.150	0.040	1.030	0.044	1.197	0.038	1.130	0.000	1.106	0.040	1.104	0.039	1.059	0.039	1.202	0.042	1.110	0.040	1.113	0.000
		pDM1[3]	multiplier for mature females	1	ARITHMETIC	1.374	0.036	1.081	0.044	1.366	0.036	1.397	0.000	1.362	0.036	1.363	0.035	1.460	0.033	1.327	0.038	1.349	0.037	1.353	0.000
		pDM2[1]	1980-1984 multiplier for mature males	1	ARITHMETIC	2.601	0.243	6.089	0.840	2.766	0.231	2.178	0.000	2.507	0.234	2.573	0.225	2.174	0.232	2.824	0.259	2.505	0.234	2.312	0.000
		pDM2[2]	1980-1984 multiplier for mature females	1	ARITHMETIC	1.323	0.101	3.024	0.282	1.694	0.111	1.170	0.000	1.334	0.099	1.356	0.096	1.225	0.102	1.424	0.108	1.337	0.100	1.270	0.000
		pM[1]	base ln-scale M	1	LOG	-1.470	0.000	-1.470	0.000	-1.470	0.000	-1.470	0.000	-1.470	0.000	-1.470	0.000	-1.470	0.000	-1.470	0.000	-1.470	0.000	-1.470	0.000
	recruitment	pLnR[1]	historical recruitment period	1	ARITHMETIC	5.622	0.400	6.492	0.492	5.764	0.392	5.733	0.000	6.230	0.418	5.632	0.456	5.817	0.388	5.397	0.083	5.196	0.075	5.105	0.000
		pLnR[2]	current recruitment period	1	ARITHMETIC	5.115	0.072	4.363	1.230	5.271	0.072	4.996	0.000	5.112	0.071	4.991	0.072	5.371	0.086						
		pRa[1]	fixed value	1	LOG	2.442	0.000	2.442	0.000	2.442	0.000							2.442	0.000						
			ln-scale gamma distribution location parameter for	1	LOGIT							-0.251	0.000	-0.251	0.000	-0.251	0.000			-0.251	0.000	-0.251	0.000	-0.251	0.000
		pRb[1]	fixed value	1	LOG	1.386	0.000	1.386	0.000	1.386	0.000							1.386	0.000						
			ln-scale gamma distribution scale parameter for	1	LOGIT							-0.431	0.000	-0.431	0.000	-0.431	0.000			-0.431	0.000	-0.431	0.000	-0.431	0.000
		pRCV[1]	full model period	1	LOG	-0.693	0.000	-0.693	0.000	-0.693	0.000							-0.693	0.000						
			historical recruitment cv	1	LOG							-0.693	0.000	-0.693	0.000	-0.693	0.000			-0.416	0.105	-0.466	0.102	-0.270	0.000
		pRCV[2]	current recruitment cv	1	LOG							0.159	0.000	0.165	0.168	0.103	0.178			0.166	0.169	0.135	0.166	0.068	0.000
		pRX[1]	fraction of males at recruitment	1	LOGIT							0.000	0.000	0.000	0.000	0.000	0.000			0.000	0.000	0.000	0.000	0.000	0.000
			full model period	1	LOGIT	0.000	0.000	0.000	0.000	0.000	0.000							0.000	0.000						

Table B.2. Estimated model parameter values and standard deviations related to growth, maturity, natural mortality and recruitment for B0 and the C model scenarios. Values for recruitment devs are not shown.

category	process	name	label	index	parameter scale	Scenarios B0		C0		C0a		C0b		C0c		C1		C1b		C1c	
						param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.
population p	growth	pGrA[1]	males	1	ARITHMETIC	33.136	0.360	33.910	0.314	33.886	0.447	34.096	0.322	34.349	0.000	33.973	0.402	33.955	0.416	34.285	0.323
		pGrA[2]	females	1	ARITHMETIC	34.424	0.435	34.778	0.363	34.761	0.444	34.655	0.362	34.792	0.000	34.826	0.427	34.505	0.425	34.635	0.384
		pGrB[1]	males	1	ARITHMETIC	166.785	1.123	161.131	0.761	160.997	0.752	160.595	0.738	162.904	0.000	160.858	0.715	160.012	0.684	162.533	0.809
		pGrB[2]	females	1	ARITHMETIC	115.141	0.853	114.094	0.822	114.035	0.846	114.080	0.820	114.498	0.000	113.975	0.850	114.144	0.849	114.452	0.829
		pGrBeta[1]	both sexes	1	ARITHMETIC	0.820	0.129	1.000	0.005	0.968	0.171	1.000	0.030	1.000	0.000	0.987	0.156	0.906	0.147	1.000	0.000
	maturity	pLgtPrM2M[1]	males (entire model period)	1	ARITHMETIC	-12.087	7.441	1.387	0.854	1.438	0.861	1.490	0.869	1.603	0.000	1.482	0.867	1.518	0.872	1.599	0.887
				2	ARITHMETIC	-10.892	5.612	-1.018	0.278	-0.971	0.283	-0.933	0.287	-0.840	0.000	-0.928	0.285	-0.909	0.292	-0.840	0.300
				3	ARITHMETIC	-9.697	4.014	-2.646	0.215	-2.629	0.215	-2.636	0.215	-2.624	0.000	-2.614	0.215	-2.627	0.215	-2.616	0.215
				4	ARITHMETIC	-8.503	2.678	-3.414	0.187	-3.411	0.188	-3.426	0.187	-3.449	0.000	-3.407	0.188	-3.424	0.188	-3.440	0.187
				5	ARITHMETIC	-7.321	1.624	-3.753	0.210	-3.751	0.210	-3.769	0.210	-3.819	0.000	-3.749	0.210	-3.761	0.210	-3.809	0.210
				6	ARITHMETIC	-6.162	0.909	-4.040	0.238	-4.039	0.238	-4.053	0.237	-4.112	0.000	-4.038	0.237	-4.047	0.237	-4.106	0.237
				7	ARITHMETIC	-5.104	0.541	-4.323	0.246	-4.322	0.246	-4.332	0.245	-4.394	0.000	-4.323	0.246	-4.327	0.245	-4.389	0.245
				8	ARITHMETIC	-4.477	0.364	-3.632	0.178	-3.630	0.178	-3.642	0.177	-3.719	0.000	-3.631	0.178	-3.633	0.177	-3.714	0.177
				9	ARITHMETIC	-4.090	0.290	-3.398	0.162	-3.398	0.162	-3.407	0.162	-3.473	0.000	-3.397	0.162	-3.402	0.162	-3.471	0.161
				10	ARITHMETIC	-3.448	0.224	-2.899	0.120	-2.901	0.121	-2.908	0.120	-2.950	0.000	-2.900	0.121	-2.909	0.120	-2.949	0.120
				11	ARITHMETIC	-2.913	0.175	-2.467	0.094	-2.466	0.094	-2.478	0.094	-2.527	0.000	-2.467	0.094	-2.473	0.094	-2.525	0.094
				12	ARITHMETIC	-2.487	0.144	-1.775	0.071	-1.772	0.071	-1.785	0.070	-1.846	0.000	-1.772	0.071	-1.777	0.070	-1.844	0.070
				13	ARITHMETIC	-2.021	0.125	-1.157	0.059	-1.157	0.059	-1.165	0.059	-1.211	0.000	-1.155	0.059	-1.163	0.058	-1.210	0.058
				14	ARITHMETIC	-1.430	0.109	-0.762	0.052	-0.764	0.053	-0.769	0.052	-0.781	0.000	-0.762	0.053	-0.776	0.052	-0.785	0.052
				15	ARITHMETIC	-0.937	0.095	-0.448	0.052	-0.450	0.052	-0.461	0.051	-0.464	0.000	-0.451	0.052	-0.466	0.051	-0.468	0.051
				16	ARITHMETIC	-0.668	0.092	-0.334	0.052	-0.333	0.052	-0.349	0.051	-0.374	0.000	-0.334	0.052	-0.345	0.052	-0.377	0.051
				17	ARITHMETIC	-0.536	0.089	0.020	0.057	0.023	0.057	0.005	0.056	-0.055	0.000	0.023	0.056	0.013	0.056	-0.055	0.056
				18	ARITHMETIC	-0.093	0.100	0.274	0.057	0.276	0.058	0.270	0.057	0.233	0.000	0.277	0.058	0.265	0.057	0.232	0.057
				19	ARITHMETIC	0.512	0.130	0.608	0.065	0.606	0.065	0.618	0.065	0.630	0.000	0.608	0.065	0.607	0.064	0.627	0.067
				20	ARITHMETIC	1.362	0.202	1.153	0.080	1.146	0.081	1.170	0.079	1.235	0.000	1.147	0.080	1.153	0.078	1.227	0.083
				21	ARITHMETIC	2.708	0.366	1.632	0.105	1.622	0.105	1.651	0.103	1.763	0.000	1.620	0.104	1.629	0.101	1.752	0.106
				22	ARITHMETIC	4.957	0.591	2.100	0.119	2.092	0.119	2.124	0.118	2.229	0.000	2.088	0.118	2.111	0.117	2.224	0.117
				23	ARITHMETIC	7.096	1.048	3.131	0.168	3.127	0.168	3.167	0.168	3.231	0.000	3.128	0.168	3.182	0.168	3.240	0.167
				24	ARITHMETIC	8.917	1.667	4.166	0.262	4.165	0.262	4.191	0.262	4.200	0.000	4.172	0.262	4.221	0.262	4.215	0.262
				25	ARITHMETIC	10.412	2.305	5.924	0.568	5.925	0.568	5.921	0.571	5.902	0.000	5.934	0.568	5.958	0.571	5.918	0.570
				26	ARITHMETIC	11.615	2.838	7.674	1.058	7.675	1.058	7.646	1.065	7.613	0.000	7.687	1.058	7.684	1.067	7.628	1.063
				27	ARITHMETIC	12.566	3.175	9.236	1.580	9.238	1.580	9.193	1.590	9.155	0.000	9.249	1.580	9.229	1.592	9.168	1.586
				28	ARITHMETIC	13.306	3.248	10.615	1.964	10.616	1.964	10.568	1.974	10.530	0.000	10.627	1.964	10.599	1.976	10.541	1.970
				29	ARITHMETIC	13.877	3.007	11.843	2.081	11.845	2.081	11.801	2.089	11.768	0.000	11.854	2.081	11.826	2.091	11.776	2.085
				30	ARITHMETIC	14.321	2.412	12.959	1.841	12.960	1.841	12.927	1.846	12.903	0.000	12.966	1.841	12.944	1.847	12.908	1.844
				31	ARITHMETIC	14.682	1.434	13.998	1.181	13.999	1.181	13.981	1.183	13.969	0.000	14.002	1.181	13.990	1.184	13.972	1.183
				32	ARITHMETIC	15.000	0.004	15.000	0.005	15.000	0.005	15.000	0.005	15.000	0.000	15.000	0.005	15.000	0.005	15.000	0.031
		pLgtPrM2M[2]	females (entire model period)	1	ARITHMETIC	-15.000	0.002	-15.000	0.002	-15.000	0.002	-15.000	0.002	-15.000	0.000	-15.000	0.002	-15.000	0.002	-15.000	0.002
				2	ARITHMETIC	-13.764	0.784	-13.769	0.784	-13.770	0.784	-13.770	0.784	-13.752	0.000	-13.770	0.784	-13.774	0.784	-13.750	0.784
				3	ARITHMETIC	-12.475	1.186	-12.483	1.187	-12.484	1.186	-12.485	1.187	-12.452	0.000	-12.485	1.187	-12.493	1.186	-12.448	1.186
				4	ARITHMETIC	-11.077	1.288	-11.088	1.290	-11.089	1.289	-11.091	1.290	-11.045	0.000	-11.091	1.290	-11.102	1.289	-11.039	1.289
				5	ARITHMETIC	-9.518	1.152	-9.529	1.155	-9.531	1.154	-9.533	1.154	-9.479	0.000	-9.532	1.154	-9.546	1.153	-9.472	1.153
				6	ARITHMETIC	-7.748	0.863	-7.756	0.865	-7.757	0.865	-7.761	0.865	-7.705	0.000	-7.759	0.865	-7.774	0.865	-7.697	0.863
				7	ARITHMETIC	-5.743	0.525	-5.743	0.527	-5.744	0.527	-5.749	0.528	-5.699	0.000	-5.746	0.527	-5.761	0.528	-5.691	0.525
				8	ARITHMETIC	-3.584	0.243	-3.567	0.246	-3.570	0.246	-3.576	0.246	-3.540	0.000	-3.570	0.246	-3.586	0.246	-3.535	0.243
				9	ARITHMETIC	-1.780	0.110	-1.750	0.111	-1.755	0.111	-1.760	0.111	-1.733	0.000	-1.753	0.110	-1.769	0.110	-1.739	0.110
				10	ARITHMETIC	-0.433	0.087	-0.400	0.089	-0.408	0.089	-0.411	0.088	-0.382	0.000	-0.406	0.087	-0.422	0.087	-0.395	0.088
				11	ARITHMETIC	0.302	0.092	0.338	0.095	0.329	0.096	0.328	0.094	0.353	0.000	0.329	0.094	0.311	0.093	0.339	0.094
				12	ARITHMETIC	0.586	0.103	0.615	0.106	0.607	0.106	0.607	0.106	0.626	0.000	0.605	0.106	0.594	0.105	0.613	0.106
				13	ARITHMETIC	1.274	0.165	1.276	0.166	1.262	0.164	1.266	0.165	1.311	0.000	1.258	0.163	1.243	0.160	1.289	0.168
				14	ARITHMETIC	2.575	0.347	2.530	0.349	2.486	0.347	2.510	0.346	2.634	0.000	2.484	0.343	2.435	0.329	2.594	0.358
				15	ARITHMETIC	4.025	0.670	3.960	0.666	3.880	0.664	3.933	0.659	4.131	0.000	3.884	0.659	3.789	0.618	4.079	0.693
				16	ARITHMETIC	5.512	1.280	5.431	1.271	5.317	1.262	5.399	1.259	5.664	0.000	5.327	1.257	5.188	1.189	5.601	1.317
	natural mort	pDM1[1]	multiplier for immature crab	1	ARITHMETIC	1.000	0.051	0.968	0.044	0.967	0.044	0.967	0.044	0.931	0.000	0.963	0.043	0.961	0.043	0.950	0.050
		pDM1[2]	multiplier for mature males	1	ARITHMETIC	1.150	0.040	1.411	0.038	1.416	0.038	1.360	0.037	1.307	0.000	1.409	0.036	1.363	0.036	1.316	0.035
		pDM1[3]	multiplier for mature females	1	ARITHMETIC	1.374	0.036	1.356	0.035	1.351	0.037	1.342	0.035	1.403	0.000	1.345	0.032	1.318	0.031	1.392	0.035
		pDM2[1]	1980-1984 multiplier for mature males	1	ARITHMETIC	2.601	0.243	2.707	0.234	2.612	0.219	2.705	0.226	2.497	0.000	2.618	0.216	2.688	0.225	2.329	0.190
		pDM2[2]	1980-1984 multiplier for mature females	1	ARITHMETIC	1.323	0.101	1.432	0.106	1.398	0.100	1.469	0.104	1.361	0.000	1.400	0.100	1.462	0.105	1.299	0.093
		pM[1]	base ln-scale M	1	LOG	-1.470	0.000	-1.470	0.000	-1.470	0.000	-1.470	0.000	-1.470	0.000	-1.470	0.000	-1.470	0.000	-1.470	0.000
	recruitment	pLnR[1]	historical recruitment period	1	ARITHMETIC	5.622	0.400	6.266	0.403	6.377	0.377	6.761	0.516	5.903	0.000	5.779	0.039	5.787	0.040	5.388	0.077
		pLnR[2]	current recruitment period	1	ARITHMETIC	5.115	0.072	5.707	0.077	5.723	0.085	5.655	0.074	5.263	0.000						
		pRa[1]	fixed value	1	LOG	2.442	0.000	2.442	0.000												
			ln-scale gamma distribution location parameter for	1	LOGIT					-0.251	0.000	-0.251	0.000	-0.251	0.000	-0.251	0.000	-0.251	0.000	-0.251	0.000
		pRb[1]	fixed value	1	LOG	1.386	0.000	1.386	0.000												
			ln-scale gamma distribution scale parameter for	1	LOGIT					-0.431	0.000	-0.431	0.000	-0.431	0.000	-0.431	0.000	-0.431	0.000	-0.431	0.000
		pRCV[1]	full model period	1	LOG	-0.693	0.000	-0.693	0.000												
			historical recruitment cv	1	LOG					-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.465	0.104	-0.575	0.099	-0.285	0.104
		pRCV[2]	current recruitment cv	1	LOG					0.195	0.172	0.193	0.171	0.113	0.000	0.167	0.168	0.152	0.167	0.078	0.176
		pRX[1]	fraction of males at recruitment	1	LOGIT					0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			full model period	1	LOGIT	0.000	0.000	0.000	0.000												

Table B.3. Estimated model parameter values and standard deviations related to growth, maturity, natural mortality and recruitment for B0 and the D model scenarios. Values for recruitment devs are not shown.

category	process	name	label	index	parameter scale	Scenarios B0 param. value	B0 std. dev.	D0 param. value	D0 std. dev.	D0a param. value	D0a std. dev.	D0b param. value	D0b std. dev.	D0c param. value	D0c std. dev.	D1 param. value	D1 std. dev.	D1b param. value	D1b std. dev.	D1c param. value	D1c std. dev.
population p	growth	pGrA[1]	males	1	ARITHMETIC	33.136	0.360	35.138	0.293	35.176	0.293	35.320	0.299	35.783	0.000	35.153	0.301	35.223	0.293	35.483	0.310
		pGrA[2]	females	1	ARITHMETIC	34.424	0.435	35.639	0.344	35.670	0.345	35.536	0.343	35.860	0.000	35.646	0.345	35.467	0.338	35.358	0.335
		pGrB[1]	males	1	ARITHMETIC	166.785	1.123	160.073	0.633	160.027	0.632	159.749	0.651	161.201	0.000	160.045	0.638	159.390	0.649	160.727	0.688
		pGrB[2]	females	1	ARITHMETIC	115.141	0.853	116.206	0.592	116.143	0.591	116.133	0.598	116.673	0.000	116.180	0.591	116.061	0.597	116.810	0.597
		pGrBeta[1]	both sexes	1	ARITHMETIC	0.820	0.129	1.000	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000	0.000
	maturity	pLgtPrM2M[1]	males (entire model period)	1	ARITHMETIC	-12.087	7.441	1.869	0.921	1.914	0.929	2.001	0.947	2.293	0.000	1.890	0.926	1.940	0.934	2.104	0.969
				2	ARITHMETIC	-10.892	5.612	-0.759	0.309	-0.720	0.313	-0.652	0.324	-0.453	0.000	-0.744	0.313	-0.700	0.315	-0.579	0.340
				3	ARITHMETIC	-9.697	4.014	-2.850	0.203	-2.838	0.203	-2.827	0.203	-2.831	0.000	-2.851	0.203	-2.836	0.203	-2.827	0.204
				4	ARITHMETIC	-8.503	2.678	-3.595	0.176	-3.591	0.176	-3.593	0.176	-3.642	0.000	-3.599	0.176	-3.592	0.176	-3.608	0.176
				5	ARITHMETIC	-7.321	1.624	-4.091	0.198	-4.090	0.198	-4.098	0.199	-4.184	0.000	-4.096	0.198	-4.092	0.199	-4.133	0.199
				6	ARITHMETIC	-6.162	0.909	-4.432	0.221	-4.431	0.221	-4.437	0.221	-4.538	0.000	-4.437	0.221	-4.432	0.221	-4.486	0.221
				7	ARITHMETIC	-5.104	0.541	-4.469	0.214	-4.469	0.214	-4.475	0.214	-4.575	0.000	-4.474	0.214	-4.471	0.214	-4.532	0.214
				8	ARITHMETIC	-4.477	0.364	-3.854	0.161	-3.854	0.161	-3.865	0.161	-3.978	0.000	-3.858	0.161	-3.860	0.161	-3.941	0.161
				9	ARITHMETIC	-4.090	0.290	-3.619	0.147	-3.619	0.147	-3.628	0.147	-3.732	0.000	-3.623	0.147	-3.624	0.147	-3.705	0.146
				10	ARITHMETIC	-3.448	0.224	-3.061	0.109	-3.061	0.109	-3.067	0.109	-3.150	0.000	-3.064	0.109	-3.066	0.109	-3.135	0.109
				11	ARITHMETIC	-2.913	0.175	-2.617	0.087	-2.617	0.087	-2.627	0.087	-2.704	0.000	-2.620	0.087	-2.627	0.087	-2.692	0.087
				12	ARITHMETIC	-2.487	0.144	-1.848	0.065	-1.848	0.065	-1.865	0.065	-1.944	0.000	-1.851	0.065	-1.862	0.065	-1.930	0.065
				13	ARITHMETIC	-2.021	0.125	-1.213	0.054	-1.213	0.054	-1.228	0.054	-1.295	0.000	-1.216	0.054	-1.227	0.054	-1.285	0.054
				14	ARITHMETIC	-1.430	0.109	-0.774	0.048	-0.774	0.048	-0.781	0.048	-0.813	0.000	-0.777	0.048	-0.784	0.048	-0.814	0.049
				15	ARITHMETIC	-0.937	0.095	-0.431	0.048	-0.431	0.048	-0.435	0.048	-0.448	0.000	-0.434	0.048	-0.441	0.048	-0.455	0.048
				16	ARITHMETIC	-0.668	0.092	-0.314	0.048	-0.315	0.048	-0.325	0.048	-0.349	0.000	-0.318	0.048	-0.330	0.048	-0.351	0.048
				17	ARITHMETIC	-0.536	0.089	0.030	0.053	0.030	0.053	0.004	0.053	-0.054	0.000	0.025	0.053	0.002	0.053	-0.042	0.052
				18	ARITHMETIC	-0.093	0.100	0.318	0.055	0.317	0.055	0.289	0.055	0.234	0.000	0.313	0.055	0.290	0.055	0.250	0.054
				19	ARITHMETIC	0.512	0.130	0.642	0.062	0.640	0.062	0.634	0.063	0.604	0.000	0.637	0.062	0.631	0.062	0.617	0.064
				20	ARITHMETIC	1.362	0.202	1.171	0.077	1.169	0.077	1.190	0.078	1.197	0.000	1.167	0.077	1.182	0.077	1.202	0.080
				21	ARITHMETIC	2.708	0.366	1.608	0.102	1.604	0.102	1.651	0.103	1.687	0.000	1.603	0.102	1.636	0.102	1.688	0.105
				22	ARITHMETIC	4.957	0.591	2.105	0.119	2.099	0.119	2.163	0.118	2.195	0.000	2.099	0.119	2.150	0.118	2.202	0.119
				23	ARITHMETIC	7.096	1.048	3.160	0.169	3.155	0.169	3.236	0.169	3.255	0.000	3.159	0.169	3.235	0.169	3.272	0.168
				24	ARITHMETIC	8.917	1.667	4.216	0.262	4.213	0.262	4.283	0.262	4.266	0.000	4.217	0.262	4.293	0.262	4.291	0.262
				25	ARITHMETIC	10.412	2.305	5.997	0.566	5.995	0.566	6.040	0.568	6.000	0.000	5.999	0.566	6.057	0.568	6.028	0.569
				26	ARITHMETIC	11.615	2.838	7.759	1.056	7.758	1.056	7.778	1.062	7.724	0.000	7.761	1.056	7.799	1.062	7.755	1.062
				27	ARITHMETIC	12.566	3.175	9.322	1.578	9.322	1.578	9.324	1.588	9.264	0.000	9.325	1.578	9.346	1.588	9.296	1.587
				28	ARITHMETIC	13.306	3.248	10.694	1.963	10.694	1.963	10.686	1.972	10.626	0.000	10.696	1.963	10.706	1.973	10.658	1.971
				29	ARITHMETIC	13.877	3.007	11.909	2.080	11.909	2.080	11.897	2.088	11.843	0.000	11.911	2.080	11.914	2.088	11.873	2.087
				30	ARITHMETIC	14.321	2.412	13.005	1.841	13.005	1.841	12.995	1.846	12.954	0.000	13.006	1.841	13.007	1.846	12.977	1.845
				31	ARITHMETIC	14.682	1.434	14.022	1.181	14.022	1.181	14.016	1.183	13.998	0.000	14.023	1.181	14.023	1.183	14.007	1.183
				32	ARITHMETIC	15.000	0.004	15.000	0.005	15.000	0.005	15.000	0.005	15.000	0.000	15.000	0.003	15.000	0.005	15.000	0.005
		pLgtPrM2M[2]	females (entire model period)	1	ARITHMETIC	-15.000	0.002	-15.000	0.002	-15.000	0.002	-15.000	0.002	-15.000	0.000	-15.000	0.015	-15.000	0.002	-15.000	0.002
				2	ARITHMETIC	-13.764	0.784	-13.661	0.724	-13.660	0.724	-13.660	0.723	-13.633	0.000	-13.657	0.724	-13.661	0.723	-13.655	0.724
				3	ARITHMETIC	-12.475	1.186	-12.269	1.049	-12.266	1.049	-12.267	1.048	-12.214	0.000	-12.261	1.049	-12.269	1.048	-12.257	1.048
				4	ARITHMETIC	-11.077	1.288	-10.770	1.077	-10.766	1.077	-10.767	1.075	-10.693	0.000	-10.759	1.077	-10.770	1.074	-10.752	1.075
				5	ARITHMETIC	-9.518	1.152	-9.113	0.892	-9.108	0.891	-9.110	0.889	-9.024	0.000	-9.100	0.892	-9.113	0.889	-9.090	0.890
				6	ARITHMETIC	-7.748	0.863	-7.267	0.603	-7.262	0.603	-7.264	0.601	-7.178	0.000	-7.254	0.602	-7.267	0.600	-7.238	0.601
				7	ARITHMETIC	-5.743	0.525	-5.310	0.295	-5.306	0.294	-5.310	0.294	-5.239	0.000	-5.299	0.294	-5.314	0.293	-5.277	0.294
				8	ARITHMETIC	-3.584	0.243	-3.317	0.117	-3.315	0.117	-3.323	0.117	-3.274	0.000	-3.310	0.117	-3.328	0.117	-3.284	0.117
				9	ARITHMETIC	-1.780	0.110	-1.761	0.069	-1.760	0.069	-1.771	0.070	-1.721	0.000	-1.755	0.069	-1.778	0.070	-1.727	0.069
				10	ARITHMETIC	-0.433	0.087	-0.409	0.059	-0.409	0.059	-0.421	0.060	-0.370	0.000	-0.404	0.059	-0.430	0.060	-0.374	0.059
				11	ARITHMETIC	0.302	0.092	0.387	0.063	0.386	0.063	0.375	0.063	0.419	0.000	0.391	0.063	0.365	0.063	0.416	0.063
				12	ARITHMETIC	0.586	0.103	0.749	0.075	0.747	0.075	0.735	0.076	0.784	0.000	0.752	0.075	0.724	0.076	0.782	0.076
				13	ARITHMETIC	1.274	0.165	1.484	0.119	1.477	0.119	1.462	0.120	1.542	0.000	1.484	0.119	1.445	0.119	1.543	0.122
				14	ARITHMETIC	2.575	0.347	2.873	0.235	2.860	0.233	2.838	0.234	3.000	0.000	2.871	0.234	2.810	0.232	2.987	0.245
				15	ARITHMETIC	4.025	0.670	4.351	0.545	4.327	0.541	4.293	0.537	4.615	0.000	4.347	0.544	4.249	0.530	4.567	0.578
				16	ARITHMETIC	5.512	1.280	5.922	1.126	5.886	1.119	5.844	1.110	6.311	0.000	5.916	1.123	5.786	1.097	6.234	1.181
	natural mort	pDM1[1]	multiplier for immature crab	1	ARITHMETIC	1.000	0.051	0.875	0.043	0.871	0.043	0.875	0.044	0.736	0.000	0.854	0.043	0.868	0.044	0.828	0.044
		pDM1[2]	multiplier for mature males	1	ARITHMETIC	1.150	0.040	1.649	0.032	1.648	0.032	1.602	0.033	1.538	0.000	1.637	0.032	1.603	0.034	1.574	0.033
		pDM1[3]	multiplier for mature females	1	ARITHMETIC	1.374	0.036	1.476	0.032	1.477	0.032	1.471	0.033	1.539	0.000	1.478	0.033	1.463	0.033	1.498	0.033
		pDM2[1]	1980-1984 multiplier for mature males	1	ARITHMETIC	2.601	0.243	2.461	0.130	2.437	0.129	2.544	0.140	2.243	0.000	2.449	0.130	2.506	0.140	2.308	0.133
		pDM2[2]	1980-1984 multiplier for mature females	1	ARITHMETIC	1.323	0.101	1.861	0.107	1.848	0.107	1.923	0.110	1.725	0.000	1.850	0.107	1.899	0.111	1.775	0.106
		pM[1]	base ln-scale M	1	LOG	-1.470	0.000	-1.470	0.000	-1.470	0.000	-1.470	0.000	-1.470	0.000	-1.470	0.000	-1.470	0.000	-1.470	0.000
	recruitment	pLnR[1]	historical recruitment period	1	ARITHMETIC	5.622	0.400	6.280	0.413	6.317	0.394	6.595	0.485	5.716	0.000	5.743	0.033	5.716	0.067	5.395	0.063
		pLnR[2]	current recruitment period	1	ARITHMETIC	5.115	0.072	5.749	0.034	5.737	0.033	5.640	0.063	5.153	0.000						
		pRa[1]	fixed value	1	LOG	2.442	0.000	2.442	0.000												
			ln-scale gamma distribution location parameter for	1	LOGIT					-0.251	0.000	-0.251	0.000	-0.251	0.000	-0.251	0.000	-0.251	0.000	-0.251	0.000
		pRb[1]	fixed value	1	LOG	1.386	0.000	1.386	0.000												
			ln-scale gamma distribution scale parameter for	1	LOGIT					-0.431	0.000	-0.431	0.000	-0.431	0.000	-0.431	0.000	-0.431	0.000	-0.431	0.000
		pRCV[1]	full model period	1	LOG	-0.693	0.000	-0.693	0.000												
			historical recruitment cv	1	LOG					-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.411	0.106	-0.468	0.103	-0.270	0.103
		pRCV[2]	current recruitment cv	1	LOG					0.088	0.161	0.091	0.161	0.019	0.000	0.073	0.159	0.064	0.159	-0.004	0.169
		pRX[1]	fraction of males at recruitment	1	LOGIT					0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			full model period	1	LOGIT	0.000	0.000	0.000	0.000												

Table B.4. Estimated model parameter values and standard deviations related to growth, maturity, natural mortality and recruitment for B0 and the E scenarios. Values for recruitment devs are not shown.

						Scenarios B0		E0		E0a		E0b		E0c		E1		E1b		E1c	
category	process	name	label	index	parameter scale	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.
population p	growth	pGrA[1]	males	1	ARITHMETIC	33.136	0.360	35.656	0.000	35.687	0.298	35.701	0.000	36.348	0.316	35.687	0.296	36.097	0.297	36.194	0.320
		pGrA[2]	females	1	ARITHMETIC	34.424	0.435	36.313	0.000	36.341	0.321	36.332	0.000	36.537	0.328	36.376	0.322	36.351	0.325	36.335	0.328
		pGrB[1]	males	1	ARITHMETIC	166.785	1.123	163.989	0.000	163.896	0.732	163.711	0.000	165.288	0.737	163.731	0.731	162.727	0.692	164.998	0.740
		pGrB[2]	females	1	ARITHMETIC	115.141	0.853	116.859	0.000	116.792	0.589	116.781	0.000	117.268	0.600	116.747	0.589	116.699	0.590	117.262	0.598
		pGrBeta[1]	both sexes	1	ARITHMETIC	0.820	0.129	1.000	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000	0.000
	maturity	pLgtPrM2M[1]	males (entire model period)	1	ARITHMETIC	-12.087	7.441	2.239	0.000	2.284	1.001	2.282	0.000	2.913	1.141	2.299	1.003	2.682	1.085	2.858	1.132
				2	ARITHMETIC	-10.892	5.612	-0.496	0.000	-0.460	0.350	-0.465	0.000	-0.050	0.430	-0.445	0.350	-0.174	0.395	-0.057	0.427
				3	ARITHMETIC	-9.697	4.014	-2.844	0.000	-2.833	0.202	-2.841	0.000	-2.806	0.205	-2.825	0.202	-2.774	0.203	-2.755	0.205
				4	ARITHMETIC	-8.503	2.678	-3.652	0.000	-3.647	0.176	-3.655	0.000	-3.701	0.178	-3.642	0.176	-3.638	0.177	-3.645	0.178
				5	ARITHMETIC	-7.321	1.624	-4.185	0.000	-4.183	0.198	-4.192	0.000	-4.298	0.198	-4.178	0.198	-4.194	0.198	-4.230	0.199
				6	ARITHMETIC	-6.162	0.909	-4.539	0.000	-4.537	0.221	-4.546	0.000	-4.698	0.221	-4.532	0.221	-4.551	0.222	-4.629	0.221
				7	ARITHMETIC	-5.104	0.541	-4.574	0.000	-4.572	0.215	-4.579	0.000	-4.733	0.215	-4.568	0.215	-4.586	0.215	-4.680	0.215
				8	ARITHMETIC	-4.477	0.364	-3.951	0.000	-3.949	0.161	-3.956	0.000	-4.101	0.160	-3.947	0.161	-3.963	0.161	-4.062	0.161
				9	ARITHMETIC	-4.090	0.290	-3.691	0.000	-3.689	0.147	-3.697	0.000	-3.837	0.145	-3.687	0.147	-3.700	0.146	-3.807	0.146
				10	ARITHMETIC	-3.448	0.224	-3.114	0.000	-3.112	0.109	-3.121	0.000	-3.263	0.109	-3.111	0.109	-3.125	0.109	-3.240	0.109
				11	ARITHMETIC	-2.913	0.175	-2.678	0.000	-2.677	0.088	-2.684	0.000	-2.820	0.087	-2.675	0.088	-2.694	0.088	-2.803	0.088
				12	ARITHMETIC	-2.487	0.144	-1.910	0.000	-1.909	0.065	-1.915	0.000	-2.028	0.065	-1.907	0.065	-1.927	0.065	-2.015	0.065
				13	ARITHMETIC	-2.021	0.125	-1.242	0.000	-1.242	0.055	-1.250	0.000	-1.319	0.055	-1.241	0.055	-1.255	0.055	-1.313	0.055
				14	ARITHMETIC	-1.430	0.109	-0.758	0.000	-0.758	0.049	-0.769	0.000	-0.801	0.049	-0.759	0.049	-0.767	0.049	-0.801	0.049
				15	ARITHMETIC	-0.937	0.095	-0.407	0.000	-0.407	0.048	-0.419	0.000	-0.462	0.047	-0.409	0.048	-0.419	0.048	-0.460	0.047
				16	ARITHMETIC	-0.668	0.092	-0.332	0.000	-0.331	0.048	-0.341	0.000	-0.418	0.047	-0.333	0.048	-0.351	0.048	-0.411	0.047
				17	ARITHMETIC	-0.536	0.089	-0.030	0.000	-0.029	0.053	-0.033	0.000	-0.143	0.052	-0.029	0.053	-0.063	0.052	-0.130	0.052
				18	ARITHMETIC	-0.093	0.100	0.297	0.000	0.297	0.056	0.298	0.000	0.231	0.057	0.296	0.056	0.266	0.056	0.244	0.057
				19	ARITHMETIC	0.512	0.130	0.708	0.000	0.705	0.067	0.708	0.000	0.709	0.070	0.701	0.067	0.694	0.067	0.721	0.070
				20	ARITHMETIC	1.362	0.202	1.339	0.000	1.334	0.084	1.335	0.000	1.400	0.086	1.327	0.084	1.341	0.084	1.411	0.086
				21	ARITHMETIC	2.708	0.366	1.876	0.000	1.869	0.106	1.869	0.000	1.968	0.104	1.860	0.106	1.898	0.106	1.984	0.105
				22	ARITHMETIC	4.957	0.591	2.358	0.000	2.352	0.116	2.355	0.000	2.459	0.113	2.346	0.116	2.418	0.116	2.481	0.114
				23	ARITHMETIC	7.096	1.048	3.347	0.000	3.343	0.166	3.345	0.000	3.447	0.165	3.345	0.166	3.464	0.166	3.475	0.165
				24	ARITHMETIC	8.917	1.667	4.286	0.000	4.285	0.263	4.279	0.000	4.332	0.263	4.291	0.263	4.413	0.263	4.366	0.264
				25	ARITHMETIC	10.412	2.305	6.002	0.000	6.002	0.565	5.989	0.000	6.002	0.566	6.010	0.565	6.114	0.567	6.039	0.566
				26	ARITHMETIC	11.615	2.838	7.728	0.000	7.729	1.049	7.711	0.000	7.695	1.053	7.738	1.049	7.819	1.056	7.732	1.053
				27	ARITHMETIC	12.566	3.175	9.274	0.000	9.275	1.569	9.254	0.000	9.222	1.574	9.284	1.569	9.343	1.579	9.255	1.575
				28	ARITHMETIC	13.306	3.248	10.641	0.000	10.642	1.953	10.622	0.000	10.583	1.959	10.650	1.954	10.692	1.964	10.612	1.959
				29	ARITHMETIC	13.877	3.007	11.861	0.000	11.861	2.073	11.844	0.000	11.807	2.077	11.868	2.073	11.896	2.081	11.830	2.078
				30	ARITHMETIC	14.321	2.412	12.969	0.000	12.969	1.836	12.957	0.000	12.929	1.839	12.974	1.836	12.991	1.841	12.945	1.839
				31	ARITHMETIC	14.682	1.434	14.003	0.000	14.003	1.179	13.997	0.000	13.982	1.180	14.006	1.179	14.014	1.181	13.990	1.180
				32	ARITHMETIC	15.000	0.004	15.000	0.000	15.000	0.005	15.000	0.000	15.000	0.005	15.000	0.005	15.000	0.005	15.000	0.005
		pLgtPrM2M[2]	females (entire model period)	1	ARITHMETIC	-15.000	0.002	-15.000	0.000	-15.000	0.002	-15.000	0.000	-15.000	0.002	-15.000	0.002	-15.000	0.002	-15.000	0.002
				2	ARITHMETIC	-13.764	0.784	-13.684	0.000	-13.683	0.726	-13.683	0.000	-13.651	0.726	-13.682	0.726	-13.680	0.726	-13.673	0.726
				3	ARITHMETIC	-12.475	1.186	-12.312	0.000	-12.310	1.054	-12.309	0.000	-12.249	1.053	-12.309	1.054	-12.304	1.053	-12.291	1.054
				4	ARITHMETIC	-11.077	1.288	-10.827	0.000	-10.825	1.083	-10.824	0.000	-10.742	1.082	-10.823	1.084	-10.817	1.082	-10.798	1.083
				5	ARITHMETIC	-9.518	1.152	-9.176	0.000	-9.173	0.899	-9.172	0.000	-9.079	0.896	-9.171	0.899	-9.164	0.898	-9.140	0.898
				6	ARITHMETIC	-7.748	0.863	-7.322	0.000	-7.319	0.609	-7.318	0.000	-7.226	0.606	-7.318	0.609	-7.310	0.608	-7.283	0.608
				7	ARITHMETIC	-5.743	0.525	-5.337	0.000	-5.335	0.299	-5.334	0.000	-5.261	0.295	-5.334	0.299	-5.328	0.298	-5.298	0.298
				8	ARITHMETIC	-3.584	0.243	-3.312	0.000	-3.311	0.117	-3.311	0.000	-3.268	0.116	-3.311	0.117	-3.311	0.117	-3.281	0.117
				9	ARITHMETIC	-1.780	0.110	-1.724	0.000	-1.725	0.068	-1.726	0.000	-1.688	0.068	-1.726	0.068	-1.727	0.068	-1.695	0.068
				10	ARITHMETIC	-0.433	0.087	-0.353	0.000	-0.355	0.058	-0.355	0.000	-0.322	0.058	-0.356	0.058	-0.357	0.058	-0.328	0.058
				11	ARITHMETIC	0.302	0.092	0.450	0.000	0.448	0.063	0.447	0.000	0.474	0.063	0.447	0.063	0.445	0.063	0.468	0.063
				12	ARITHMETIC	0.586	0.103	0.833	0.000	0.829	0.077	0.828	0.000	0.857	0.078	0.826	0.077	0.824	0.077	0.850	0.077
				13	ARITHMETIC	1.274	0.165	1.630	0.000	1.620	0.126	1.618	0.000	1.672	0.129	1.613	0.126	1.608	0.125	1.659	0.128
				14	ARITHMETIC	2.575	0.347	3.115	0.000	3.099	0.252	3.094	0.000	3.217	0.267	3.086	0.251	3.070	0.250	3.181	0.261
				15	ARITHMETIC	4.025	0.670	4.734	0.000	4.706	0.603	4.699	0.000	4.947	0.648	4.689	0.602	4.653	0.595	4.868	0.631
				16	ARITHMETIC	5.512	1.280	6.427	0.000	6.388	1.227	6.379	0.000	6.742	1.300	6.367	1.225	6.313	1.214	6.623	1.272
	natural mort	pDM1[1]	multiplier for immature crab	1	ARITHMETIC	1.000	0.051	0.889	0.000	0.889	0.042	0.887	0.000	0.783	0.041	0.888	0.042	0.883	0.042	0.860	0.043
		pDM1[2]	multiplier for mature males	1	ARITHMETIC	1.150	0.040	1.846	0.000	1.848	0.031	1.830	0.000	1.701	0.029	1.852	0.031	1.796	0.031	1.743	0.030
		pDM1[3]	multiplier for mature females	1	ARITHMETIC	1.374	0.036	1.625	0.000	1.625	0.030	1.622	0.000	1.681	0.029	1.621	0.030	1.615	0.030	1.644	0.030
		pDM2[1]	1980-1984 multiplier for mature males	1	ARITHMETIC	2.601	0.243	2.318	0.000	2.301	0.091	2.325	0.000	2.233	0.089	2.277	0.091	2.401	0.094	2.291	0.092
		pDM2[2]	1980-1984 multiplier for mature females	1	ARITHMETIC	1.323	0.101	1.680	0.000	1.670	0.075	1.685	0.000	1.587	0.069	1.651	0.075	1.734	0.076	1.642	0.073
		pM[1]	base ln-scale M	1	LOG	-1.470	0.000	-1.470	0.000	-1.470	0.000	-1.470	0.000	-1.470	0.000	-1.470	0.000	-1.470	0.000	-1.470	0.000
	recruitment	pLnR[1]	historical recruitment period	1	ARITHMETIC	5.622	0.400	6.097	0.000	6.119	0.406	6.518	0.000	5.365	0.485	5.675	0.059	5.552	0.055	5.227	0.051
		pLnR[2]	current recruitment period	1	ARITHMETIC	5.115	0.072	5.618	0.000	5.615	0.056	5.596	0.000	5.055	0.044						
		pRa[1]	fixed value	1	LOG	2.442	0.000	2.442	0.000												
			ln-scale gamma distribution location parameter for	1	LOGIT					-0.251	0.000	-0.251	0.000	-0.251	0.000	-0.251	0.000	-0.251	0.000	-0.251	0.000
		pRb[1]	fixed value	1	LOG	1.386	0.000	1.386	0.000												
			ln-scale gamma distribution scale parameter for	1	LOGIT					-0.431	0.000	-0.431	0.000	-0.431	0.000	-0.431	0.000	-0.431	0.000	-0.431	0.000
		pRCV[1]	full model period	1	LOG	-0.693	0.000	-0.693	0.000												
			historical recruitment cv	1	LOG					-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.505	0.104	-0.509	0.104	-0.250	0.106
		pRCV[2]	current recruitment cv	1	LOG					0.115	0.162	0.114	0.000	-0.006	0.168	0.095	0.161	0.098	0.161	-0.021	0.167
		pRX[1]	fraction of males at recruitment	1	LOGIT					0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			full model period	1	LOGIT	0.000	0.000	0.000	0.000												

Table B.5. Estimated model parameter values and standard deviations related to growth, maturity, natural mortality and recruitment for B0 and the F and G model scenarios. Values for recruitment devs are not shown.

						Scenarios B0		F0		F0a		F0c		G0		G0a		G0b		G0bd		G0bde		G0bde-Fr		G0bde-McI	
category	process	name	label	index	parameter scale	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.
population p	growth	pGrA[1]	males	1	ARITHMETIC	33.136	0.360	32.926	0.169	32.945	0.170	33.118	0.175	33.071	0.168	33.226	0.177	33.667	0.175	33.488	0.174	34.502	0.188	32.219	0.163	33.856	0.285
		pGrA[2]	females	1	ARITHMETIC	34.424	0.435	34.172	0.203	34.199	0.203	34.174	0.203	34.164	0.203	34.026	0.211	34.096	0.212	34.107	0.212	34.408	0.214	33.595	0.178	33.815	0.239
		pGrB[1]	males	1	ARITHMETIC	166.785	1.123	164.139	0.525	164.110	0.525	165.333	0.568	163.630	0.494	163.747	0.552	161.116	0.497	162.122	0.499	160.994	0.435	160.090	0.619	160.434	0.440
		pGrB[2]	females	1	ARITHMETIC	115.141	0.853	117.053	0.453	117.004	0.452	117.295	0.458	116.990	0.452	117.915	0.458	118.018	0.459	117.988	0.457	117.769	0.457	114.235	0.457	117.377	0.453
		pGrBeta[1]	both sexes	1	ARITHMETIC	0.820	0.129	1.000	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000	0.000	1.000	0.000	0.500	0.000	0.750	0.092
	maturity	pLgtPrM2M[1]	males (entire model period)	1	ARITHMETIC	-12.087	7.441	2.346	0.638	2.382	0.643	2.386	0.643	2.384	0.643	2.527	0.668	2.658	0.691	2.632	0.687	-3.625	0.127	-3.314	0.135	-3.567	0.128
				2	ARITHMETIC	-10.892	5.612	-0.799	0.150	-0.749	0.151	-0.764	0.153	-0.746	0.155	-0.479	0.169	-0.325	0.185	-0.324	0.183	-4.393	0.144	-4.452	0.160	-4.398	0.147
				3	ARITHMETIC	-9.697	4.014	-2.255	0.113	-2.240	0.113	-2.271	0.113	-2.234	0.113	-2.028	0.116	-2.010	0.116	-1.953	0.117	-3.478	0.090	-3.445	0.097	-3.446	0.092
				4	ARITHMETIC	-8.503	2.678	-3.061	0.093	-3.057	0.093	-3.093	0.093	-3.057	0.093	-2.901	0.095	-2.902	0.095	-2.849	0.095	-3.302	0.086	-3.280	0.093	-3.283	0.087
				5	ARITHMETIC	-7.321	1.624	-3.382	0.107	-3.380	0.107	-3.434	0.107	-3.380	0.107	-3.258	0.108	-3.265	0.108	-3.200	0.108	-2.809	0.061	-2.843	0.066	-2.813	0.062
				6	ARITHMETIC	-6.162	0.909	-3.754	0.123	-3.753	0.123	-3.817	0.123	-3.754	0.123	-3.672	0.123	-3.681	0.123	-3.606	0.123	-2.436	0.048	-2.492	0.052	-2.430	0.049
				7	ARITHMETIC	-5.104	0.541	-4.471	0.143	-4.470	0.143	-4.529	0.143	-4.473	0.143	-4.414	0.143	-4.420	0.143	-4.364	0.143	-1.640	0.035	-1.690	0.038	-1.622	0.036
				8	ARITHMETIC	-4.477	0.364	-3.536	0.090	-3.536	0.090	-3.601	0.090	-3.537	0.090	-3.506	0.090	-3.512	0.091	-3.452	0.090	-0.915	0.030	-0.938	0.032	-0.906	0.030
				9	ARITHMETIC	-4.090	0.290	-3.349	0.086	-3.349	0.086	-3.406	0.085	-3.349	0.086	-3.341	0.086	-3.346	0.086	-3.277	0.086	-0.520	0.026	-0.569	0.029	-0.536	0.027
				10	ARITHMETIC	-3.448	0.224	-2.841	0.061	-2.841	0.061	-2.886	0.061	-2.845	0.061	-2.851	0.062	-2.851	0.062	-2.787	0.062	-0.247	0.026	-0.325	0.029	-0.268	0.026
				11	ARITHMETIC	-2.913	0.175	-2.462	0.048	-2.462	0.048	-2.506	0.048	-2.466	0.048	-2.472	0.049	-2.466	0.049	-2.415	0.049	-0.224	0.027	-0.322	0.029	-0.232	0.027
				12	ARITHMETIC	-2.487	0.144	-1.670	0.035	-1.669	0.035	-1.709	0.035	-1.670	0.035	-1.667	0.036	-1.658	0.036	-1.621	0.036	0.195	0.030	0.139	0.033	0.195	0.030
				13	ARITHMETIC	-2.021	0.125	-0.946	0.029	-0.946	0.029	-0.972	0.029	-0.946	0.029	-0.928	0.030	-0.927	0.030	-0.897	0.030	0.501	0.031	0.448	0.034	0.502	0.031
				14	ARITHMETIC	-1.430	0.109	-0.543	0.026	-0.543	0.026	-0.552	0.026	-0.547	0.026	-0.528	0.027	-0.530	0.027	-0.502	0.027	0.851	0.034	0.789	0.037	0.847	0.034
				15	ARITHMETIC	-0.937	0.095	-0.263	0.025	-0.263	0.025	-0.273	0.025	-0.270	0.025	-0.253	0.027	-0.254	0.027	-0.228	0.027	1.343	0.039	1.226	0.042	1.325	0.039
				16	ARITHMETIC	-0.668	0.092	-0.242	0.026	-0.242	0.026	-0.266	0.026	-0.248	0.026	-0.227	0.027	-0.223	0.027	-0.206	0.027	1.707	0.048	1.498	0.049	1.670	0.047
				17	ARITHMETIC	-0.536	0.089	0.161	0.029	0.161	0.029	0.122	0.029	0.163	0.029	0.202	0.030	0.204	0.030	0.211	0.031	1.915	0.053	1.550	0.054	1.889	0.053
				18	ARITHMETIC	-0.093	0.100	0.462	0.030	0.462	0.030	0.441	0.030	0.469	0.030	0.518	0.031	0.511	0.031	0.518	0.031	2.798	0.081	2.292	0.082	2.797	0.081
				19	ARITHMETIC	0.512	0.130	0.823	0.034	0.823	0.034	0.828	0.035	0.827	0.034	0.877	0.035	0.861	0.035	0.875	0.035	3.526	0.125	2.978	0.126	3.548	0.125
				20	ARITHMETIC	1.362	0.202	1.332	0.040	1.331	0.040	1.355	0.040	1.330	0.039	1.371	0.040	1.351	0.040	1.377	0.040	5.635	0.354	5.088	0.356	5.665	0.354
				21	ARITHMETIC	2.708	0.366	1.698	0.048	1.697	0.048	1.732	0.047	1.696	0.047	1.732	0.048	1.716	0.048	1.754	0.048	8.040	0.747	7.553	0.754	8.070	0.747
				22	ARITHMETIC	4.957	0.591	1.883	0.052	1.883	0.052	1.922	0.052	1.884	0.052	1.912	0.053	1.925	0.053	1.967	0.053	10.399	0.986	10.037	0.993	10.423	0.986
				23	ARITHMETIC	7.096	1.048	2.721	0.080	2.721	0.080	2.764	0.080	2.726	0.080	2.744	0.081	2.804	0.081	2.840	0.081	12.712	0.811	12.519	0.818	12.725	0.811
				24	ARITHMETIC	8.917	1.667	3.434	0.125	3.434	0.125	3.449	0.125	3.429	0.125	3.443	0.125	3.532	0.125	3.553	0.125	15.000	0.007	15.000	0.118	15.000	0.007
				25	ARITHMETIC	10.412	2.305	5.516	0.351	5.516	0.351	5.509	0.351	5.507	0.351	5.520	0.351	5.617	0.351	5.631	0.351						
				26	ARITHMETIC	11.615	2.838	7.692	0.802	7.692	0.802	7.668	0.803	7.682	0.801	7.695	0.801	7.787	0.803	7.799	0.802						
				27	ARITHMETIC	12.566	3.175	9.529	1.334	9.529	1.334	9.496	1.336	9.520	1.333	9.532	1.333	9.614	1.336	9.624	1.334						
				28	ARITHMETIC	13.306	3.248	11.034	1.759	11.034	1.759	10.999	1.761	11.026	1.758	11.036	1.758	11.106	1.761	11.114	1.759						
				29	ARITHMETIC	13.877	3.007	12.267	1.931	12.267	1.931	12.235	1.933	12.260	1.931	12.268	1.930	12.322	1.933	12.329	1.931						
				30	ARITHMETIC	14.321	2.412	13.293	1.749	13.293	1.749	13.269	1.750	13.288	1.748	13.294	1.748	13.331	1.750	13.335	1.749						
				31	ARITHMETIC	14.682	1.434	14.181	1.141	14.181	1.141	14.168	1.141	14.178	1.141	14.181	1.141	14.200	1.141	14.202	1.141						
				32	ARITHMETIC	15.000	0.004	15.000	0.003	15.000	0.003	15.000	0.003	15.000	0.003	15.000	0.003	15.000	0.003	15.000	0.003						
		pLgtPrM2M[2]	females (entire model period)	1	ARITHMETIC	-15.000	0.002	-15.000	0.002	-15.000	0.002	-15.000	0.002	-15.000	0.002	-15.000	0.002	-15.000	0.002	-15.000	0.002	-11.756	2.323	-10.394	4.803	-11.715	2.515
				2	ARITHMETIC	-13.764	0.784	-13.709	0.723	-13.707	0.723	-13.674	0.722	-13.713	0.723	-13.630	0.727	-13.632	0.727	-13.626	0.727	-9.567	1.425	-8.699	3.569	-9.566	1.574
				3	ARITHMETIC	-12.475	1.186	-12.358	1.047	-12.355	1.047	-12.293	1.045	-12.367	1.047	-12.210	1.057	-12.215	1.057	-12.202	1.056	-7.384	0.758	-7.004	2.503	-7.422	0.857
				4	ARITHMETIC	-11.077	1.288	-10.889	1.074	-10.885	1.074	-10.800	1.070	-10.902	1.074	-10.692	1.088	-10.699	1.088	-10.680	1.086	-5.274	0.310	-5.312	1.626	-5.326	0.369
				5	ARITHMETIC	-9.518	1.152	-9.245	0.890	-9.241	0.890	-9.143	0.886	-9.261	0.890	-9.029	0.904	-9.036	0.904	-9.012	0.902	-3.274	0.117	-3.637	0.949	-3.324	0.143
				6	ARITHMETIC	-7.748	0.863	-7.392	0.603	-7.388	0.603	-7.290	0.598	-7.409	0.603	-7.192	0.611	-7.198	0.611	-7.171	0.609	-1.719	0.068	-2.014	0.482	-1.772	0.080
				7	ARITHMETIC	-5.743	0.525	-5.405	0.297	-5.402	0.297	-5.324	0.293	-5.421	0.297	-5.252	0.297	-5.257	0.298	-5.229	0.297	-0.355	0.057	-0.493	0.287	-0.426	0.064
				8	ARITHMETIC	-3.584	0.243	-3.377	0.116	-3.376	0.116	-3.333	0.116	-3.394	0.116	-3.279	0.117	-3.284	0.117	-3.259	0.117	0.440	0.061	0.754	0.277	0.365	0.065
				9	ARITHMETIC	-1.780	0.110	-1.810	0.067	-1.809	0.067	-1.779	0.067	-1.827	0.067	-1.723	0.068	-1.721	0.068	-1.703	0.068	0.839	0.074	1.624	0.312	0.867	0.074
				10	ARITHMETIC	-0.433	0.087	-0.441	0.055	-0.441	0.055	-0.419	0.055	-0.459	0.055	-0.356	0.057	-0.353	0.057	-0.337	0.057	1.688	0.121	2.420	0.440	1.850	0.141
				11	ARITHMETIC	0.302	0.092	0.371	0.059	0.371	0.059	0.382	0.059	0.355	0.059	0.438	0.061	0.438	0.061	0.455	0.061	3.259	0.253	3.317	0.801	3.126	0.212
				12	ARITHMETIC	0.586	0.103	0.763	0.071	0.761	0.071	0.769	0.071	0.748	0.071	0.841	0.074	0.841	0.074	0.859	0.074	5.040	0.624	4.284	1.413	3.835	0.280
				13	ARITHMETIC	1.274	0.165	1.557	0.114	1.552	0.114	1.566	0.115	1.536	0.113	1.696	0.121	1.705	0.122	1.726	0.122	6.895	1.267	5.266	2.265	4.405	0.500
				14	ARITHMETIC	2.575	0.347	3.030	0.230	3.019	0.229	3.072	0.238	3.008	0.229	3.272	0.253	3.296	0.255	3.310	0.255						
				15	ARITHMETIC	4.025	0.670	4.665	0.560	4.646	0.557	4.782	0.587	4.649	0.558	5.069	0.622	5.108	0.629	5.116	0.628						
				16	ARITHMETIC	5.512	1.280	6.392	1.161	6.367	1.156	6.577	1.206	6.384	1.157	6.941	1.263	6.992	1.274	6.996	1.273						
	natural mort	pDM1[1]	multiplier for immature crab	1	ARITHMETIC	1.000	0.051	0.684	0.039	0.681	0.039	0.549	0.038	0.700	0.038	0.394	0.035	0.340	0.036	0.295	0.036	0.353	0.023	0.870	0.047	0.363	0.034
		pDM1[2]	multiplier for mature males	1	ARITHMETIC	1.150	0.040	1.887	0.027	1.888	0.027	1.788	0.028	1.869	0.027	0.942	0.017	0.906	0.017	0.997	0.017	0.977	0.016	0.855	0.022	0.967	0.017
		pDM1[3]	multiplier for mature females	1	ARITHMETIC	1.374	0.036	1.608	0.029	1.609	0.029	1.656	0.029	1.595	0.028	0.897	0.017	0.901	0.017	0.898	0.018	0.888	0.018	0.951	0.020	0.877	0.018
		pDM2[1]	1980-1984 multiplier for mature males	1	ARITHMETIC	2.601	0.243	2.313	0.086	2.304	0.086	2.022	0.083	2.321	0.087	1.841	0.077	1.894	0.080	1.701	0.072	1.691	0.071	1.967	0.093	1.668	0.073
		pDM2[2]	1980-1984 multiplier for mature females	1	ARITHMETIC	1.323	0.101	1.653	0.075	1.647	0.074	1.457	0.068	1.647	0.075	1.146	0.059	1.153	0.059	1.138	0.060	1.130	0.060	1.109	0.059	1.192	0.061
		pM[1]	base ln-scale M	1	LOG	-1.470	0.000	-1.470	0.000	-1.470	0.000	-1.470	0.000	-1.470	0.000	-0.602	0.000	-0.602	0.000	-0.602	0.000	-0.602	0.000	-0.602	0.000	-0.602	0.000
	recruitment	pLnR[1]	historical recruitment period	1	ARITHMETIC	5.622	0.400	6.133	0.410	6.179	0.391	5.476	0.464	6.133	0.411	7.199	0.490	8.567	0.512	6.675	0.569	6.710	0.564	7.093	0.660	6.804	0.562
		pLnR[2]	current recruitment period	1	ARITHMETIC	5.115	0.072	5.586	0.031	5.575	0.030	5.110	0.047	5.597	0.031	6.052	0.086	5.938	0.085	5.837	0.084	5.926	0.055	6.168	0.109	6.055	0.080
		pRa[1]	fixed value	1	LOG	2.442	0.000	2.442	0.000					2.442	0.000												
			ln-scale gamma distribution location parameter for	1	LOGIT					-0.251	0.000	-0.251	0.000			0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		pRb[1]	fixed value	1	LOG	1.386	0.000	1.386	0.000					1.386	0.000												
			ln-scale gamma distribution scale parameter for	1	LOGIT					-0.431	0.000	-0.431	0.000			0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		pRCV[1]	full model period	1	LOG	-0.693	0.000	-0.693	0.000					-0.693	0.000												
			historical recruitment cv	1	LOG					-0.693	0.000	-0.693	0.000			-0.805	0.000	-0.805	0.000	-0.805	0.000	-0.805	0.000	-0.805	0.000	-0.805	0.000
		pRCV[2]	current recruitment cv	1	LOG					0.208	0.171	0.116	0.180			0.211	0.171	0.197	0.170	0.182	0.168	0.100	0.161	0.530	0.222	0.086	0.160
		pRX[1]	fraction of males at recruitment	1	LOGIT					0.000	0.000	0.000	0.000			0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			full model period	1	LOGIT	0.000	0.000	0.000	0.000					0.000	0.000												

Table B.6. Estimated model parameter values and standard deviations related to selectivity and retention functions for the B model scenarios.

						Scenarios B0		B0-Fr		B0-McI		B0a		B0b		B0c		B0q		B1		B1b		B1c	
category	process	name	label	index	parameter scale	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.
selectivity	selectivity	pDevsS1[1]	ln(z50 devs) for TCF selectivity (males, 1991+)	1	ARITHMETIC	0.029	0.018	0.002	0.050	0.036	0.015	0.030	0.000	0.031	0.021	0.031	0.021	0.027	0.018	0.030	0.017	0.031	0.021	0.032	0.000
				2	ARITHMETIC	0.116	0.012	-0.030	0.024	0.119	0.011	0.116	0.000	0.167	0.025	0.167	0.025	0.118	0.013	0.116	0.012	0.173	0.027	0.172	0.000
				3	ARITHMETIC	0.097	0.014	-0.058	0.026	0.100	0.012	0.097	0.000	0.181	0.031	0.181	0.031	0.100	0.014	0.096	0.014	0.190	0.035	0.188	0.000
				4	ARITHMETIC	0.077	0.021	-0.048	0.029	0.088	0.017	0.077	0.000	0.252	0.044	0.252	0.044	0.075	0.021	0.071	0.020	0.267	0.054	0.265	0.000
				5	ARITHMETIC	-0.010	0.027	-0.003	0.029	-0.012	0.025	-0.009	0.000	0.021	0.037	0.022	0.037	-0.024	0.029	-0.023	0.027	0.013	0.037	0.012	0.000
				6	ARITHMETIC	0.120	0.040	-0.030	0.059	0.124	0.034	0.120	0.000	0.173	0.057	0.174	0.057	0.122	0.043	0.119	0.039	0.179	0.061	0.177	0.000
				7	ARITHMETIC	-0.086	0.017	0.021	0.065	-0.090	0.014	-0.087	0.000	-0.136	0.020	-0.136	0.020	-0.085	0.017	-0.083	0.017	-0.139	0.021	-0.138	0.000
				8	ARITHMETIC	-0.095	0.018	0.018	0.055	-0.095	0.014	-0.095	0.000	-0.144	0.020	-0.144	0.020	-0.093	0.018	-0.089	0.017	-0.147	0.021	-0.146	0.000
				9	ARITHMETIC	-0.131	0.016	-0.062	0.059	-0.136	0.013	-0.131	0.000	-0.182	0.019	-0.182	0.019	-0.132	0.016	-0.129	0.016	-0.185	0.020	-0.185	0.000
				10	ARITHMETIC	0.010	0.014	0.122	0.056	0.004	0.011	0.010	0.000	-0.039	0.017	-0.039	0.017	0.012	0.014	0.011	0.014	-0.042	0.018	-0.042	0.000
				11	ARITHMETIC	0.180	0.016	0.240	0.045	0.176	0.013	0.180	0.000	0.130	0.019	0.130	0.019	0.183	0.016	0.179	0.016	0.128	0.020	0.128	0.000
				12	ARITHMETIC	-0.048	0.017	0.054	0.064	-0.049	0.013	-0.048	0.000	-0.099	0.019	-0.099	0.019	-0.048	0.017	-0.048	0.016	-0.103	0.020	-0.102	0.000
				13	ARITHMETIC	-0.109	0.014	-0.096	0.041	-0.109	0.012	-0.109	0.000	-0.158	0.017	-0.159	0.017	-0.108	0.014	-0.105	0.014	-0.162	0.018	-0.161	0.000
				14	ARITHMETIC	-0.149	0.016	-0.130	0.054	-0.156	0.013	-0.150	0.000	-0.198	0.019	-0.198	0.019	-0.149	0.016	-0.144	0.015	-0.201	0.019	-0.201	0.000
		pS1[1]	z50 for NMFS survey selectivity (males, pre-1982)	1	ARITHMETIC	52.306	2.115	90.000	0.001	56.036	2.690	46.850	0.000	52.689	2.192	52.689	0.000	54.849	2.431	90.000	0.008	53.339	2.292	52.672	0.000
		pS1[10]	ascending z50 for SCF selectivity (males, pre-1997)	1	ARITHMETIC	87.704	1.564	115.431	4.152	87.317	1.004	87.766	0.000	87.282	1.635	87.273	1.631	87.531	1.809	87.770	1.789	87.097	1.692	87.144	0.000
		pS1[11]	ascending z50 for SCF selectivity (males, 1997-2004)	1	ARITHMETIC	95.698	3.754	103.645	10.097	94.758	1.968	95.530	0.000	93.705	3.092	93.682	3.092	96.817	4.653	97.097	4.405	93.887	3.170	93.878	0.000
		pS1[12]	ascending z50 for SCF selectivity (males, 2005+)	1	ARITHMETIC	105.606	1.419	140.000	0.010	105.529	0.833	105.523	0.000	105.109	1.413	105.088	1.413	106.206	1.518	107.069	1.516	105.305	1.441	105.301	0.000
		pS1[13]	ascending z50 for SCF selectivity (females, pre-1997)	1	ARITHMETIC	70.265	5.030	68.571	6.315	72.128	1.506	70.098	0.000	70.798	4.770	70.739	4.792	71.678	4.497	70.973	4.693	71.027	4.658	71.131	0.000
		pS1[14]	ascending z50 for SCF selectivity (females, 1997-	1	ARITHMETIC	76.295	4.524	84.463	10.268	76.815	1.484	76.093	0.000	76.339	4.512	76.323	4.517	76.763	4.377	76.664	4.513	76.390	4.504	76.415	0.000
		pS1[15]	ascending z50 for SCF selectivity (females, 2005+)	1	ARITHMETIC	85.218	5.644	110.624	49.922	81.547	1.483	85.025	0.000	84.925	5.486	84.900	5.489	86.166	5.601	86.884	6.274	85.210	5.595	85.212	0.000
		pS1[16]	z50 for GF.AllGear selectivity (males, pre-1987)	1	ARITHMETIC	55.023	1.859	81.203	4.027	56.466	1.688	52.169	0.000	54.243	1.862	54.345	1.776	53.361	1.801	57.928	2.166	54.510	1.902	53.891	0.000
		pS1[17]	z50 for GF.AllGear selectivity (males, 1987-1996)	1	ARITHMETIC	59.073	4.849	107.557	6.668	55.689	3.103	56.265	0.000	56.841	4.955	56.775	4.888	49.949	3.353	63.320	5.935	56.094	4.886	56.140	0.000
		pS1[18]	z50 for GF.AllGear selectivity (males, 1997+)	1	ARITHMETIC	80.841	2.175	94.019	3.112	79.834	1.773	79.706	0.000	79.834	2.189	79.698	2.167	80.612	2.281	85.645	2.465	80.229	2.205	80.333	0.000
		pS1[19]	z50 for GF.AllGear selectivity (males, pre-1987)	1	ARITHMETIC	41.200	1.660	75.983	7.230	43.196	1.594	40.000	0.000	40.942	1.683	40.957	1.647	44.806	1.877	41.765	1.810	41.150	1.722	40.828	0.000
		pS1[2]	z50 for NMFS survey selectivity (males, 1982+)	1	ARITHMETIC	34.918	4.148	57.479	289.460	35.078	4.253	30.348	0.000	34.041	4.079	33.572	3.933	36.993	6.403	42.853	5.963	34.977	4.191	35.479	0.000
		pS1[20]	z50 for GF.AllGear selectivity (males, 1987-1996)	1	ARITHMETIC	40.000	0.000	86.202	7.663	40.000	0.000	40.000	0.000	40.000	0.000	40.000	0.000	40.000	0.000	40.000	0.000	40.000	0.000	40.000	0.000
		pS1[21]	z50 for GF.AllGear selectivity (males, 1997+)	1	ARITHMETIC	76.113	2.531	84.826	5.073	78.398	2.008	76.623	0.000	75.556	2.500	75.454	2.512	78.574	2.281	78.025	2.679	76.056	2.509	76.164	0.000
		pS1[22]	z95 for RKF selectivity (males, pre-1997)	1	ARITHMETIC	158.210	6.552	95.000	0.022	178.773	4.065	157.925	0.000	180.000	0.000	180.000	0.000	158.461	6.635	158.616	6.234	180.000	0.000	180.000	0.000
		pS1[23]	z95 for RKF selectivity (males, 1997-2004)	1	ARITHMETIC	180.000	0.005	180.000	0.164	180.000	0.002	180.000	0.000	180.000	0.027	180.000	0.025	180.000	0.003	180.000	0.004	180.000	0.023	180.000	0.000
		pS1[24]	z95 for RKF selectivity (males, 2005+)	1	ARITHMETIC	180.000	0.000	180.000	0.092	180.000	0.000	180.000	0.000	180.000	0.002	180.000	0.002	180.000	0.000	180.000	0.000	180.000	0.001	180.000	0.000
		pS1[25]	z95 for RKF selectivity (females, pre-1997)	1	ARITHMETIC	121.572	37.669	136.544	17.081	118.643	3.303	121.671	0.000	120.230	29.441	120.263	29.526	123.435	57.865	121.594	34.493	120.286	29.426	120.193	0.000
		pS1[26]	z95 for RKF selectivity (females, 1997-2004)	1	ARITHMETIC	121.215	53.480	133.714	23.419	125.869	7.936	120.409	0.000	127.875	84.613	127.935	85.011	118.316	44.733	123.036	57.607	128.118	85.594	127.950	0.000
		pS1[27]	z95 for RKF selectivity (females, 2005+)	1	ARITHMETIC	140.000	0.034	140.000	0.063	140.000	0.050	140.000	0.000	140.000	0.031	140.000	0.031	140.000	0.043	140.000	0.034	140.000	0.031	140.000	0.000
		pS1[28]	z50 for TCF retention (2005-2009)	1	ARITHMETIC	138.717	1.632	141.980	2.859	138.621	1.230	138.711	0.000	138.879	1.523	138.877	1.525	138.868	1.523	138.887	1.514	138.913	1.502	138.913	0.000
		pS1[29]	z50 for TCF retention (2013-2015)	1	ARITHMETIC	125.037	0.758	124.304	2.499	125.091	0.543	125.006	0.000	125.075	0.755	125.075	0.755	124.996	0.763	125.086	0.762	125.051	0.757	125.050	0.000
		pS1[3]	z50 for NMFS survey selectivity (females, pre-1982)	1	ARITHMETIC	56.293	2.856	81.254	2.770	60.541	2.954	42.022	0.000	57.880	3.007	57.880	0.000	56.293	0.000	76.612	3.076	58.454	3.027	57.667	0.000
		pS1[4]	z50 for NMFS survey selectivity (females, 1982+)	1	ARITHMETIC	-29.135	26.960	68.739	3513.500	-14.332	20.460	-49.015	0.000	-20.057	22.193	-22.677	22.912	-29.135	0.000	-24.411	25.478	-16.566	20.863	-12.205	0.000
		pS1[5]	z50 for TCF retention (pre-1991)	1	ARITHMETIC	137.986	0.416	85.000	0.093	138.428	0.342	137.996	0.000	137.903	0.430	137.901	0.429	138.159	0.430	138.246	0.436	137.724	0.425	137.755	0.000
		pS1[6]	z50 for TCF retention (1991-1996)	1	ARITHMETIC	137.498	0.249	128.194	1.592	137.871	0.195	137.487	0.000	137.453	0.253	137.449	0.253	137.640	0.244	137.598	0.243	137.503	0.250	137.501	0.000
		pS1[7]	DUMMY VALUE	1	ARITHMETIC	4.884	0.000	4.884	0.000	4.884	0.000	4.884	0.000	4.884	0.000	4.884	0.000	4.884	0.000	4.884	0.000	4.884	0.000	4.884	0.000
		pS1[8]	ln(z50) for TCF selectivity (males)	1	ARITHMETIC	4.865	0.008	4.876	0.028	4.870	0.007	4.864	0.000	4.913	0.013	4.914	0.013	4.866	0.009	4.872	0.008	4.919	0.014	4.918	0.000
		pS1[9]	z50 for TCF selectivity (females)	1	ARITHMETIC	96.581	2.622	91.987	6.804	97.880	1.244	96.457	0.000	96.609	2.628	96.615	2.631	96.294	2.484	96.930	2.702	96.628	2.636	96.622	0.000
		pS2[1]	z95-z50 for NMFS survey selectivity (males, pre-	1	ARITHMETIC	23.496	3.492	3.655	8.089	26.262	4.489	19.513	0.000	24.042	3.637	24.042	0.000	29.789	3.663	86.660	7.172	24.554	3.768	24.554	0.000
		pS2[10]	ascending slope for SCF selectivity (males, pre-1997)	1	ARITHMETIC	0.374	0.129	0.488	0.459	0.355	0.067	0.370	0.000	0.375	0.134	0.377	0.134	0.325	0.111	0.317	0.104	0.367	0.132	0.366	0.000
		pS2[11]	ascending slope for SCF selectivity (males, 1997-	1	ARITHMETIC	0.208	0.063	0.100	0.002	0.223	0.036	0.209	0.000	0.237	0.075	0.237	0.076	0.194	0.059	0.194	0.058	0.234	0.074	0.234	0.000
		pS2[12]	ascending slope for SCF selectivity (males, 2005+)	1	ARITHMETIC	0.175	0.015	0.168	0.160	0.173	0.008	0.175	0.000	0.176	0.015	0.176	0.015	0.170	0.014	0.168	0.013	0.175	0.015	0.175	0.000
		pS2[13]	slope for SCF selectivity (females, pre-1997)	1	ARITHMETIC	0.220	0.128	0.500	0.004	0.214	0.035	0.222	0.000	0.224	0.124	0.224	0.125	0.222	0.112	0.225	0.121	0.225	0.122	0.225	0.000
		pS2[14]	slope for SCF selectivity (females, 1997-2004)	1	ARITHMETIC	0.264	0.129	0.483	2.797	0.255	0.039	0.265	0.000	0.265	0.129	0.265	0.129	0.268	0.124	0.260	0.125	0.265	0.128	0.265	0.000
		pS2[15]	slope for SCF selectivity (females, 2005+)	1	ARITHMETIC	0.156	0.049	0.125	0.316	0.184	0.018	0.155	0.000	0.158	0.050	0.158	0.050	0.156	0.047	0.147	0.046	0.156	0.049	0.157	0.000
		pS2[16]	slope for GF.AllGear selectivity (males, pre-1987)	1	ARITHMETIC	0.104	0.010	0.093	0.010	0.097	0.007	0.113	0.000	0.105	0.010	0.105	0.010	0.109	0.010	0.094	0.009	0.104	0.010	0.106	0.000
		pS2[17]	slope for GF.AllGear selectivity (males, 1987-1996)	1	ARITHMETIC	0.057	0.012	0.070	0.008	0.071	0.011	0.061	0.000	0.061	0.015	0.061	0.015	0.085	0.021	0.048	0.010	0.063	0.016	0.063	0.000
		pS2[18]	slope for GF.AllGear selectivity (males, 1997+)	1	ARITHMETIC	0.074	0.004	0.103	0.009	0.076	0.003	0.074	0.000	0.075	0.004	0.075	0.004	0.074	0.004	0.069	0.004	0.075	0.004	0.075	0.000
		pS2[19]	slope for GF.AllGear selectivity (females, pre-1987)	1	ARITHMETIC	0.137	0.022	0.106	0.016	0.119	0.015	0.146	0.000	0.136	0.023	0.135	0.022	0.117	0.018	0.129	0.021	0.133	0.022	0.137	0.000
		pS2[2]	z95-z50 for NMFS survey selectivity (males, 1982+)	1	ARITHMETIC	75.073	10.254	0.795	480.400	74.487	11.152	72.790	0.000	72.852	10.035	72.543	10.029	100.000	0.000	95.133	15.442	74.435	10.306	74.357	0.000
		pS2[20]	slope for GF.AllGear selectivity (females, 1987-1996)	1	ARITHMETIC	0.185	0.038	0.101	0.013	0.183	0.028	0.186	0.000	0.188	0.038	0.188	0.038	0.177	0.037	0.183	0.038	0.189	0.038	0.188	0.000
		pS2[21]	slope for GF.AllGear selectivity (females, 1997+)	1	ARITHMETIC	0.072	0.006	0.132	0.013	0.069	0.004	0.070	0.000	0.074	0.006	0.074	0.006	0.076	0.005	0.071	0.005	0.073	0.006	0.074	0.000
		pS2[22]	ln(z95-z50) for RKF selectivity (males, pre-1997)	1	ARITHMETIC	3.077	0.162	2.667	1.946	3.260	0.064	3.076	0.000	3.113	0.064	3.113	0.064	3.094	0.163	3.064	0.156	3.110	0.065	3.111	0.000
		pS2[23]	ln(z95-z50) for RKF selectivity (males, 1997-2004)	1	ARITHMETIC	3.552	0.085	3.241	0.662	3.570	0.042	3.556	0.000	3.547	0.091	3.547	0.091	3.549	0.086	3.532	0.083	3.548	0.091	3.548	0.000
		pS2[24]	ln(z95-z50) for RKF selectivity (males, 2005+)	1	ARITHMETIC	3.487	0.044	3.116	0.247	3.520	0.022	3.492	0.000	3.535	0.047	3.536	0.047	3.474	0.044	3.457	0.043	3.532	0.046	3.532	0.000
		pS2[25]	ln(z95-z50) for RKF selectivity (males, pre-1997)	1	ARITHMETIC	2.785	0.684	2.500	0.007	2.698	0.070	2.793	0.000	2.759	0.587	2.760	0.588	2.805	0.910	2.777	0.627	2.759	0.585	2.757	0.000
		pS2[26]	ln(z95-z50) for RKF selectivity (males, 1997-2004)	1	ARITHMETIC	2.849	0.903	2.500	0.017	2.888	0.110	2.842	0.000	2.923	0.961	2.924	0.963	2.792	0.869	2.865	0.881	2.924	0.957	2.922	0.000
		pS2[27]	ln(z95-z50) for RKF selectivity (males, 2005+)	1	ARITHMETIC	2.991	0.220	2.500	0.007	2.994	0.034	2.999	0.000	2.987	0.219	2.987	0.219	2.981	0.218	2.976	0.219	2.985	0.219	2.984	0.000
		pS2[28]	slope for TCF retention (2005-2009)	1	ARITHMETIC	0.894	0.725	0.514	1.075	0.929	0.613	0.897	0.000	0.839	0.561	0.839	0.563	0.843	0.569	0.836	0.553	0.827	0.533	0.827	0.000
		pS2[29]	slope for TCF retention (2013-2015)	1	ARITHMETIC	0.576	0.126	0.765	1.883	0.577	0.090	0.579	0.000	0.572	0.124	0.572	0.124	0.575	0.127	0.568	0.123	0.572	0.125	0.572	0.000
		pS2[3]	z95-z50 for NMFS survey selectivity (females, pre-	1	ARITHMETIC	39.982	5.871	4.022	13.794	40.950	5.367	0.112	0.000	43.747	6.427	43.747	0.000	39.982	0.000	59.814	6.253	43.444	6.252	43.444	0.000
		pS2[4]	z95-z50 for NMFS survey selectivity (females, 1982+)	1	ARITHMETIC	100.000	0.002	0.222	604.190	100.000	0.001	100.000	0.000	100.000	0.001	100.000	0.001	100.000	0.000	100.000	0.001	100.000	0.001	100.000	0.000
		pS2[5]	slope for TCF retention (pre-1991)	1	ARITHMETIC	0.690	0.126	0.999	0.635	0.660	0.087	0.697	0.000	0.657	0.123	0.654	0.122	0.685	0.124	0.702	0.127	0.649	0.121	0.649	0.000
		pS2[6]	slope for TCF retention (1997+)	1	ARITHMETIC	0.956	0.192	2.000	0.170	0.986	0.173	0.955	0.000	0.941	0.189	0.941	0.189	0.980	0.219	0.972	0.209	0.947	0.197	0.947	0.000
		pS2[7]	slope for TCF selectivity (males, pre-1997)	1	ARITHMETIC	0.118	0.006	0.146	0.031	0.112	0.005	0.118	0.000	0.103	0.005	0.104	0.005	0.112	0.006	0.118	0.006	0.102	0.005	0.102	0.000
		pS2[8]	slope for TCF selectivity (males, 1997+)	1	ARITHMETIC	0.155	0.008	0.119	0.020	0.153	0.006	0.155	0.000	0.155	0.009	0.155	0.009	0.155	0.008	0.155	0.008	0.155	0.008	0.155	0.000
		pS2[9]	slope for TCF selectivity (females)	1	ARITHMETIC	0.187	0.019	0.236	0.099	0.185	0.007	0.186	0.000	0.186	0.019	0.186	0.019	0.192	0.019	0.186	0.019	0.186	0.019	0.187	0.000
		pS3[1]	ln(dz50-az50) for SCF selectivity (males, pre-1997)	1	ARITHMETIC	3.956	0.040	3.674	0.338	3.781	0.071	3.955	0.000	3.965	0.042	3.965	0.042	3.967	0.049	3.965	0.046	3.971	0.044	3.970	0.000
		pS3[2]	ln(dz50-az50) for SCF selectivity (males, 1997-2004)	1	ARITHMETIC	3.730	0.210	2.000	0.014	3.722	0.126	3.732	0.000	3.855	0.156	3.855	0.156	3.617	0.340	3.675	0.273	3.840	0.162	3.841	0.000
		pS3[3]	ln(dz50-az50) for SCF selectivity (males, 2005+)	1	ARITHMETIC	3.446	0.082	2.476	1.096	3.449	0.046	3.445	0.000	3.468	0.079	3.469	0.079	3.412	0.092	3.399	0.092	3.458	0.082	3.459	0.000
		pS4[1]	descending slope for SCF selectivity (males, pre-	1	ARITHMETIC	0.500	0.001	0.500	0.028	0.100	0.000	0.500	0.000	0.500	0.001	0.500	0.001	0.468	0.414	0.500	0.006	0.500	0.003	0.500	0.000
		pS4[2]	descending slope for SCF selectivity (males, 1997-	1	ARITHMETIC	0.130	0.081	0.500	0.008	0.121	0.037	0.131	0.000	0.155	0.097	0.155	0.097	0.105	0.072	0.120	0.084	0.151	0.093	0.152	0.000
		pS4[3]	descending slope for SCF selectivity (males, 2005+)	1	ARITHMETIC	0.185	0.024	0.179	0.654	0.185	0.013	0.184	0.000	0.186	0.025	0.186	0.025	0.179	0.024	0.182	0.025	0.184	0.025	0.184	0.000

Table B.7. Estimated model parameter values and standard deviations related to selectivity and retention functions for B0 and the C model scenarios.

category	process	name	label	index	parameter scale	Scenarios B0 param. value	B0 std. dev.	C0 param. value	C0 std. dev.	C0a param. value	C0a std. dev.	C0b param. value	C0b std. dev.	C0c param. value	C0c std. dev.	C1 param. value	C1 std. dev.	C1b param. value	C1b std. dev.	C1c param. value	C1c std. dev.
selectivity	selectivity	pDevsS1[1]	ln(z50 devs) for TCF selectivity (males, 1991+)	1	ARITHMETIC	0.029	0.018	0.039	0.016	0.039	0.016	0.041	0.019	0.040	0.000	0.037	0.016	0.034	0.030	0.039	0.019
				2	ARITHMETIC	0.116	0.012	0.114	0.012	0.114	0.011	0.173	0.025	0.166	0.000	0.112	0.011	0.193	0.017	0.177	0.035
				3	ARITHMETIC	0.097	0.014	0.086	0.012	0.085	0.012	0.190	0.035	0.179	0.000	0.084	0.012	0.223	0.027	0.194	0.047
				4	ARITHMETIC	0.077	0.021	0.050	0.017	0.049	0.017	0.266	0.053	0.249	0.000	0.048	0.017	0.382	0.296	0.273	0.076
				5	ARITHMETIC	-0.010	0.027	-0.028	0.023	-0.028	0.023	-0.009	0.029	0.012	0.000	-0.029	0.023	-0.028	0.041	0.004	0.033
				6	ARITHMETIC	0.120	0.040	0.091	0.037	0.091	0.037	0.113	0.041	0.127	0.000	0.095	0.036	0.107	0.051	0.127	0.043
				7	ARITHMETIC	-0.086	0.017	-0.072	0.015	-0.071	0.015	-0.125	0.018	-0.124	0.000	-0.071	0.015	-0.142	0.032	-0.129	0.021
				8	ARITHMETIC	-0.095	0.018	-0.076	0.015	-0.075	0.015	-0.129	0.018	-0.130	0.000	-0.075	0.015	-0.145	0.032	-0.135	0.021
				9	ARITHMETIC	-0.131	0.016	-0.112	0.014	-0.112	0.014	-0.165	0.017	-0.164	0.000	-0.111	0.014	-0.183	0.031	-0.170	0.021
				10	ARITHMETIC	0.010	0.014	0.013	0.012	0.014	0.012	-0.039	0.016	-0.040	0.000	0.014	0.012	-0.056	0.031	-0.044	0.020
				11	ARITHMETIC	0.180	0.016	0.150	0.013	0.150	0.013	0.098	0.016	0.099	0.000	0.151	0.013	0.082	0.031	0.094	0.020
				12	ARITHMETIC	-0.048	0.017	-0.035	0.014	-0.036	0.014	-0.090	0.018	-0.089	0.000	-0.035	0.014	-0.108	0.032	-0.094	0.021
				13	ARITHMETIC	-0.109	0.014	-0.093	0.011	-0.093	0.011	-0.146	0.015	-0.146	0.000	-0.093	0.011	-0.163	0.030	-0.151	0.019
				14	ARITHMETIC	-0.149	0.016	-0.127	0.012	-0.127	0.012	-0.178	0.015	-0.179	0.000	-0.127	0.012	-0.196	0.030	-0.184	0.020
		pS1[1]	z50 for NMFS survey selectivity (males, pre-1982)	1	ARITHMETIC	52.306	2.115	90.000	0.000	90.000	0.000	90.000	0.000	52.689	0.000	90.000	0.000	90.000	0.000	53.444	1.630
		pS1[10]	ascending z50 for SCF selectivity (males, pre-1997)	1	ARITHMETIC	87.704	1.564	88.052	1.898	88.104	1.920	87.958	1.922	87.725	0.000	87.926	1.946	91.052	2.895	87.599	1.798
		pS1[11]	ascending z50 for SCF selectivity (males, 1997-2004)	1	ARITHMETIC	95.698	3.754	99.675	4.112	99.754	4.151	97.309	3.177	96.577	0.000	100.150	4.470	97.736	3.451	96.796	3.158
		pS1[12]	ascending z50 for SCF selectivity (males, 2005+)	1	ARITHMETIC	105.606	1.419	109.869	1.476	109.901	1.480	109.545	1.464	108.851	0.000	109.993	1.514	110.016	1.575	109.012	1.456
		pS1[13]	ascending z50 for SCF selectivity (females, pre-1997)	1	ARITHMETIC	70.265	5.030	71.211	4.693	71.305	4.648	71.299	4.562	70.964	0.000	71.357	4.605	72.101	4.459	71.314	4.515
		pS1[14]	ascending z50 for SCF selectivity (females, 1997-	1	ARITHMETIC	76.295	4.524	76.907	4.559	76.922	4.560	76.744	4.533	76.534	0.000	76.963	4.573	76.557	4.542	76.632	4.501
		pS1[15]	ascending z50 for SCF selectivity (females, 2005+)	1	ARITHMETIC	85.218	5.644	90.231	7.785	90.353	7.840	89.094	7.239	87.581	0.000	90.618	7.994	84.897	5.576	87.960	6.685
		pS1[16]	z50 for GF.AllGear selectivity (males, pre-1987)	1	ARITHMETIC	55.023	1.859	63.053	3.042	62.708	3.112	62.376	3.161	57.830	0.000	62.787	3.054	63.411	3.474	57.653	2.365
		pS1[17]	z50 for GF.AllGear selectivity (males, 1987-1996)	1	ARITHMETIC	59.073	4.849	81.861	7.436	81.487	7.412	81.892	8.686	72.492	0.000	80.968	7.404	82.785	9.369	72.117	6.771
		pS1[18]	z50 for GF.AllGear selectivity (males, 1997+)	1	ARITHMETIC	80.841	2.175	100.129	2.626	100.352	2.737	100.370	2.733	95.076	0.000	100.116	2.601	101.111	2.696	95.637	2.536
		pS1[19]	z50 for GF.AllGear selectivity (females, pre-1987)	1	ARITHMETIC	41.200	1.660	40.087	1.562	40.000	0.002	40.001	1.492	40.000	0.000	40.000	0.003	40.032	1.597	40.000	0.003
		pS1[2]	z50 for NMFS survey selectivity (males, 1982+)	1	ARITHMETIC	34.918	4.148	57.723	4.609	58.316	5.012	55.762	4.692	47.574	0.000	57.463	4.221	57.112	4.244	50.254	5.017
		pS1[20]	z50 for GF.AllGear selectivity (males, 1987-1996)	1	ARITHMETIC	40.000	0.000	40.000	0.000	40.000	0.000	40.000	0.000	40.000	0.000	40.000	0.000	40.000	0.000	40.000	0.001
		pS1[21]	z50 for GF.AllGear selectivity (males, 1997+)	1	ARITHMETIC	76.113	2.531	83.487	3.143	83.909	3.113	83.672	3.230	81.985	0.000	83.787	3.108	84.020	3.316	82.436	2.885
		pS1[22]	z95 for RKF selectivity (males, pre-1997)	1	ARITHMETIC	158.210	6.552	159.627	5.911	159.627	5.901	180.000	0.000	180.000	0.000	159.643	5.903	180.000	0.000	180.000	0.003
		pS1[23]	z95 for RKF selectivity (males, 1997-2004)	1	ARITHMETIC	180.000	0.005	179.738	15.352	179.984	15.317	174.770	15.981	172.323	0.000	180.000	0.073	176.791	16.520	172.816	16.242
		pS1[24]	z95 for RKF selectivity (males, 2005+)	1	ARITHMETIC	180.000	0.000	180.000	0.000	180.000	0.000	177.494	8.586	174.720	0.000	180.000	0.000	178.859	8.718	175.474	8.872
		pS1[25]	z95 for RKF selectivity (females, pre-1997)	1	ARITHMETIC	121.572	37.669	122.060	34.042	122.143	34.182	120.964	29.537	120.531	0.000	122.075	33.856	120.953	29.594	120.360	28.736
		pS1[26]	z95 for RKF selectivity (females, 1997-2004)	1	ARITHMETIC	121.215	53.480	124.872	62.571	125.069	63.175	130.038	93.327	129.063	0.000	125.139	63.315	130.151	94.272	128.851	87.286
		pS1[27]	z95 for RKF selectivity (females, 2005+)	1	ARITHMETIC	140.000	0.034	140.000	0.033	140.000	0.033	140.000	0.031	140.000	0.000	140.000	0.033	140.000	0.031	140.000	0.032
		pS1[28]	z50 for TCF retention (2005-2009)	1	ARITHMETIC	138.717	1.632	138.935	1.485	138.943	1.480	139.144	1.384	138.891	0.000	138.942	1.478	139.216	1.352	139.245	1.290
		pS1[29]	z50 for TCF retention (2013-2015)	1	ARITHMETIC	125.037	0.758	125.259	0.575	125.259	0.574	125.261	0.573	125.125	0.000	125.254	0.574	125.261	0.571	125.127	0.775
		pS1[3]	z50 for NMFS survey selectivity (females, pre-1982)	1	ARITHMETIC	56.293	2.856	87.078	3.938	87.723	4.193	85.342	3.578	57.880	0.000	87.327	3.626	86.904	3.444	59.804	2.362
		pS1[4]	z50 for NMFS survey selectivity (females, 1982+)	1	ARITHMETIC	-29.135	26.960	-50.000	0.009	-50.000	0.010	-50.000	0.032	-42.951	0.000	-50.000	0.021	-50.000	0.078	-27.255	25.044
		pS1[5]	z50 for TCF retention (pre-1991)	1	ARITHMETIC	137.986	0.416	138.308	0.416	138.310	0.415	138.074	0.411	137.568	0.000	138.176	0.396	137.768	0.473	137.369	0.409
		pS1[6]	z50 for TCF retention (1991-1996)	1	ARITHMETIC	137.498	0.249	137.710	0.243	137.717	0.243	137.558	0.245	137.577	0.000	137.748	0.246	137.634	0.241	137.621	0.247
		pS1[7]	DUMMY VALUE	1	ARITHMETIC	4.884	0.000	4.884	0.000	4.884	0.000	4.884	0.000	4.884	0.000	4.884	0.000	4.884	0.000	4.884	0.000
		pS1[8]	ln(z50) for TCF selectivity (males)	1	ARITHMETIC	4.865	0.008	4.874	0.007	4.874	0.007	4.926	0.012	4.916	0.000	4.875	0.007	4.946	0.029	4.923	0.017
		pS1[9]	z50 for TCF selectivity (females)	1	ARITHMETIC	96.581	2.622	97.380	2.709	97.419	2.723	97.280	2.705	96.938	0.000	97.382	2.712	97.193	2.706	96.938	2.628
		pS2[1]	z95-z50 for NMFS survey selectivity (males, pre-	1	ARITHMETIC	23.496	3.492	79.688	5.710	80.362	5.920	79.351	5.730	24.042	0.000	79.368	5.554	76.550	5.351	24.554	0.000
		pS2[10]	ascending slope for SCF selectivity (males, pre-1997)	1	ARITHMETIC	0.374	0.129	0.304	0.099	0.302	0.098	0.307	0.101	0.339	0.000	0.304	0.100	0.237	0.078	0.334	0.113
		pS2[11]	ascending slope for SCF selectivity (males, 1997-	1	ARITHMETIC	0.208	0.063	0.178	0.045	0.177	0.045	0.201	0.052	0.207	0.000	0.174	0.044	0.198	0.052	0.205	0.054
		pS2[12]	ascending slope for SCF selectivity (males, 2005+)	1	ARITHMETIC	0.175	0.015	0.164	0.011	0.164	0.011	0.164	0.011	0.166	0.000	0.163	0.011	0.162	0.011	0.165	0.012
		pS2[13]	slope for SCF selectivity (females, pre-1997)	1	ARITHMETIC	0.220	0.128	0.222	0.118	0.223	0.117	0.227	0.120	0.228	0.000	0.224	0.117	0.217	0.109	0.229	0.120
		pS2[14]	slope for SCF selectivity (females, 1997-2004)	1	ARITHMETIC	0.264	0.129	0.254	0.122	0.254	0.122	0.259	0.124	0.262	0.000	0.253	0.121	0.263	0.127	0.262	0.125
		pS2[15]	slope for SCF selectivity (females, 2005+)	1	ARITHMETIC	0.156	0.049	0.131	0.040	0.131	0.040	0.136	0.042	0.143	0.000	0.129	0.040	0.161	0.051	0.142	0.044
		pS2[16]	slope for GF.AllGear selectivity (males, pre-1987)	1	ARITHMETIC	0.104	0.010	0.079	0.008	0.080	0.009	0.079	0.009	0.090	0.000	0.079	0.008	0.077	0.009	0.091	0.010
		pS2[17]	slope for GF.AllGear selectivity (males, 1987-1996)	1	ARITHMETIC	0.057	0.012	0.035	0.005	0.036	0.005	0.033	0.005	0.038	0.000	0.036	0.005	0.032	0.005	0.038	0.006
		pS2[18]	slope for GF.AllGear selectivity (males, 1997+)	1	ARITHMETIC	0.074	0.004	0.058	0.002	0.058	0.002	0.057	0.002	0.059	0.000	0.058	0.002	0.057	0.002	0.059	0.003
		pS2[19]	slope for GF.AllGear selectivity (females, pre-1987)	1	ARITHMETIC	0.137	0.022	0.144	0.023	0.145	0.022	0.144	0.023	0.145	0.000	0.144	0.021	0.141	0.023	0.146	0.022
		pS2[2]	z95-z50 for NMFS survey selectivity (males, 1982+)	1	ARITHMETIC	75.073	10.254	100.000	0.000	100.000	0.000	100.000	0.000	100.000	0.000	100.000	0.000	100.000	0.000	100.000	0.003
		pS2[20]	slope for GF.AllGear selectivity (females, 1987-1996)	1	ARITHMETIC	0.185	0.038	0.181	0.039	0.180	0.038	0.184	0.039	0.182	0.000	0.181	0.038	0.185	0.038	0.181	0.038
		pS2[21]	slope for GF.AllGear selectivity (females, 1997+)	1	ARITHMETIC	0.072	0.006	0.064	0.005	0.064	0.005	0.065	0.005	0.066	0.000	0.064	0.005	0.064	0.005	0.067	0.005
		pS2[22]	ln(z95-z50) for RKF selectivity (males, pre-1997)	1	ARITHMETIC	3.077	0.162	3.042	0.144	3.042	0.144	3.052	0.062	3.084	0.000	3.045	0.145	3.031	0.062	3.073	0.065
		pS2[23]	ln(z95-z50) for RKF selectivity (males, 1997-2004)	1	ARITHMETIC	3.552	0.085	3.494	0.183	3.497	0.182	3.430	0.194	3.428	0.000	3.499	0.076	3.449	0.191	3.432	0.205
		pS2[24]	ln(z95-z50) for RKF selectivity (males, 2005+)	1	ARITHMETIC	3.487	0.044	3.430	0.039	3.428	0.039	3.436	0.109	3.438	0.000	3.428	0.039	3.442	0.107	3.442	0.117
		pS2[25]	ln(z95-z50) for RKF selectivity (males, pre-1997)	1	ARITHMETIC	2.785	0.684	2.777	0.606	2.778	0.605	2.759	0.565	2.759	0.000	2.777	0.602	2.760	0.566	2.754	0.570
		pS2[26]	ln(z95-z50) for RKF selectivity (males, 1997-2004)	1	ARITHMETIC	2.849	0.903	2.883	0.871	2.885	0.870	2.930	0.928	2.928	0.000	2.886	0.870	2.932	0.929	2.924	0.937
		pS2[27]	ln(z95-z50) for RKF selectivity (males, 2005+)	1	ARITHMETIC	2.991	0.220	2.966	0.217	2.964	0.217	2.964	0.216	2.974	0.000	2.965	0.217	2.964	0.216	2.972	0.216
		pS2[28]	slope for TCF retention (2005-2009)	1	ARITHMETIC	0.894	0.725	0.838	0.533	0.835	0.528	0.783	0.408	0.847	0.000	0.835	0.527	0.766	0.374	0.752	0.344
		pS2[29]	slope for TCF retention (2013-2015)	1	ARITHMETIC	0.576	0.126	0.548	0.105	0.548	0.105	0.548	0.105	0.567	0.000	0.547	0.105	0.545	0.104	0.564	0.122
		pS2[3]	z95-z50 for NMFS survey selectivity (females, pre-	1	ARITHMETIC	39.982	5.871	73.601	7.947	75.359	8.199	70.339	7.267	43.747	0.000	73.812	7.666	70.650	7.225	43.444	0.000
		pS2[4]	z95-z50 for NMFS survey selectivity (females, 1982+)	1	ARITHMETIC	100.000	0.002	100.000	0.005	100.000	0.005	100.000	0.004	100.000	0.000	100.000	0.004	100.000	0.004	100.000	0.006
		pS2[5]	slope for TCF retention (pre-1991)	1	ARITHMETIC	0.690	0.126	0.717	0.126	0.719	0.126	0.708	0.128	0.687	0.000	0.728	0.128	0.714	0.129	0.673	0.122
		pS2[6]	slope for TCF retention (1997+)	1	ARITHMETIC	0.956	0.192	0.996	0.234	0.997	0.236	0.957	0.209	0.955	0.000	1.004	0.246	0.976	0.228	0.962	0.219
		pS2[7]	slope for TCF selectivity (males, pre-1997)	1	ARITHMETIC	0.118	0.006	0.126	0.006	0.126	0.006	0.110	0.005	0.109	0.000	0.125	0.006	0.106	0.004	0.107	0.005
		pS2[8]	slope for TCF selectivity (males, 1997+)	1	ARITHMETIC	0.155	0.008	0.164	0.008	0.163	0.008	0.164	0.008	0.166	0.000	0.163	0.008	0.162	0.008	0.165	0.008
		pS2[9]	slope for TCF selectivity (females)	1	ARITHMETIC	0.187	0.019	0.185	0.018	0.185	0.018	0.185	0.018	0.186	0.000	0.185	0.018	0.185	0.019	0.187	0.019
		pS3[1]	ln(dz50-az50) for SCF selectivity (males, pre-1997)	1	ARITHMETIC	3.956	0.040	3.965	0.049	3.965	0.050	3.963	0.050	3.961	0.000	3.970	0.055	3.577	0.222	3.967	0.047
		pS3[2]	ln(dz50-az50) for SCF selectivity (males, 1997-2004)	1	ARITHMETIC	3.730	0.210	3.701	0.225	3.696	0.229	3.856	0.165	3.862	0.000	3.663	0.264	3.813	0.188	3.848	0.159
		pS3[3]	ln(dz50-az50) for SCF selectivity (males, 2005+)	1	ARITHMETIC	3.446	0.082	3.331	0.101	3.330	0.101	3.350	0.098	3.362	0.000	3.322	0.106	3.320	0.111	3.353	0.096
		pS4[1]	descending slope for SCF selectivity (males, pre-	1	ARITHMETIC	0.500	0.001	0.500	0.006	0.500	0.015	0.500	0.004	0.500	0.000	0.443	0.368	0.100	0.000	0.500	0.003
		pS4[2]	descending slope for SCF selectivity (males, 1997-	1	ARITHMETIC	0.130	0.081	0.143	0.103	0.142	0.102	0.186	0.137	0.192	0.000	0.132	0.099	0.161	0.116	0.185	0.128
		pS4[3]	descending slope for SCF selectivity (males, 2005+)	1	ARITHMETIC	0.185	0.024	0.182	0.026	0.182	0.026	0.183	0.027	0.188	0.000	0.180	0.026	0.177	0.027	0.185	0.026

Table B.8. Estimated model parameter values and standard deviations related to selectivity and retention functions for B0 and the D model scenarios.

						Scenarios															
						B0		D0		D0a		D0b		D0c		D1		D1b		D1c	
category	process	name	label	index	parameter scale	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.
selectivity	selectivity	pDevsS1[1]	ln(z50 devs) for TCF selectivity (males, 1991+)	1	ARITHMETIC	0.029	0.018	0.054	0.017	0.054	0.017	0.062	0.032	0.061	0.000	0.052	0.017	0.059	0.024	0.058	0.024
				2	ARITHMETIC	0.116	0.012	0.119	0.012	0.119	0.012	0.183	0.025	0.186	0.000	0.118	0.012	0.180	0.017	0.183	0.017
				3	ARITHMETIC	0.097	0.014	0.076	0.012	0.076	0.012	0.202	0.040	0.206	0.000	0.076	0.012	0.198	0.036	0.203	0.037
				4	ARITHMETIC	0.077	0.021	0.032	0.017	0.032	0.017	0.467	0.302	0.490	0.000	0.032	0.017	0.500	0.001	0.500	0.000
				5	ARITHMETIC	-0.010	0.027	-0.046	0.025	-0.046	0.025	-0.061	0.039	-0.051	0.000	-0.045	0.025	-0.066	0.030	-0.055	0.031
				6	ARITHMETIC	0.120	0.040	0.101	0.036	0.102	0.036	0.112	0.058	0.127	0.000	0.104	0.036	0.113	0.050	0.126	0.053
				7	ARITHMETIC	-0.086	0.017	-0.069	0.015	-0.069	0.015	-0.149	0.028	-0.156	0.000	-0.069	0.015	-0.152	0.016	-0.155	0.016
				8	ARITHMETIC	-0.095	0.018	-0.073	0.015	-0.073	0.015	-0.153	0.028	-0.160	0.000	-0.073	0.015	-0.155	0.015	-0.159	0.016
				9	ARITHMETIC	-0.131	0.016	-0.108	0.014	-0.108	0.014	-0.188	0.027	-0.194	0.000	-0.108	0.014	-0.191	0.014	-0.194	0.015
				10	ARITHMETIC	0.010	0.014	0.015	0.012	0.015	0.012	-0.063	0.027	-0.070	0.000	0.015	0.012	-0.065	0.013	-0.070	0.014
				11	ARITHMETIC	0.180	0.016	0.154	0.013	0.154	0.013	0.077	0.027	0.071	0.000	0.155	0.013	0.075	0.014	0.072	0.014
				12	ARITHMETIC	-0.048	0.017	-0.029	0.014	-0.029	0.014	-0.110	0.028	-0.116	0.000	-0.030	0.014	-0.112	0.015	-0.116	0.015
				13	ARITHMETIC	-0.109	0.014	-0.095	0.011	-0.095	0.011	-0.172	0.026	-0.178	0.000	-0.095	0.012	-0.175	0.012	-0.179	0.013
				14	ARITHMETIC	-0.149	0.016	-0.131	0.012	-0.131	0.012	-0.207	0.026	-0.214	0.000	-0.131	0.013	-0.210	0.013	-0.214	0.014
		pS1[1]	z50 for NMFS survey selectivity (males, pre-1982)	1	ARITHMETIC	52.306	2.115	90.000	0.000	90.000	0.000	90.000	0.000	52.689	0.000	90.000	0.000	90.000	0.000	57.115	1.498
		pS1[10]	ascending z50 for SCF selectivity (males, pre-1997)	1	ARITHMETIC	87.704	1.564	89.481	2.632	89.527	2.638	91.243	3.973	90.907	0.000	89.415	2.652	90.745	3.641	90.392	3.385
		pS1[11]	ascending z50 for SCF selectivity (males, 1997-2004)	1	ARITHMETIC	95.698	3.754	100.799	5.385	100.810	5.393	97.311	3.340	96.323	0.000	101.270	5.559	97.499	3.430	96.868	3.290
		pS1[12]	ascending z50 for SCF selectivity (males, 2005+)	1	ARITHMETIC	105.606	1.419	109.910	1.507	109.898	1.506	109.740	1.538	109.002	0.000	109.933	1.532	109.833	1.553	109.327	1.527
		pS1[13]	ascending z50 for SCF selectivity (females, pre-1997)	1	ARITHMETIC	70.265	5.030	68.338	5.070	68.382	5.053	69.106	4.974	68.264	0.000	68.388	5.035	69.212	4.861	69.012	5.020
		pS1[14]	ascending z50 for SCF selectivity (females, 1997-	1	ARITHMETIC	76.295	4.524	75.579	4.670	75.574	4.670	75.473	4.663	75.231	0.000	75.624	4.674	75.500	4.650	75.494	4.645
		pS1[15]	ascending z50 for SCF selectivity (females, 2005+)	1	ARITHMETIC	85.218	5.644	84.115	5.791	84.090	5.779	82.054	4.979	80.778	0.000	84.184	5.828	82.474	5.144	81.774	4.747
		pS1[16]	z50 for GF.AllGear selectivity (males, pre-1987)	1	ARITHMETIC	55.023	1.859	59.263	2.356	58.967	2.331	58.236	2.306	52.871	0.000	59.065	2.353	58.755	2.374	55.383	1.964
		pS1[17]	z50 for GF.AllGear selectivity (males, 1987-1996)	1	ARITHMETIC	59.073	4.849	73.951	5.272	73.672	5.254	72.006	5.721	64.120	0.000	73.183	5.302	72.464	5.877	67.487	5.262
		pS1[18]	z50 for GF.AllGear selectivity (males, 1997+)	1	ARITHMETIC	80.841	2.175	99.183	2.557	99.137	2.561	99.163	2.692	93.517	0.000	98.769	2.564	99.592	2.707	95.669	2.559
		pS1[19]	z50 for GF.AllGear selectivity (males, pre-1987)	1	ARITHMETIC	41.200	1.660	40.523	1.447	40.414	1.445	40.579	1.455	40.000	0.000	40.551	1.460	40.632	1.470	40.279	1.435
		pS1[2]	z50 for NMFS survey selectivity (males, 1982+)	1	ARITHMETIC	34.918	4.148	60.559	3.860	60.320	3.866	59.994	4.069	45.864	0.000	59.233	3.916	60.546	4.082	53.955	4.100
		pS1[20]	z50 for GF.AllGear selectivity (males, 1987-1996)	1	ARITHMETIC	40.000	0.000	40.000	0.000	40.000	0.000	40.000	0.000	40.000	0.000	40.000	0.001	40.000	0.000	40.000	0.000
		pS1[21]	z50 for GF.AllGear selectivity (males, 1997+)	1	ARITHMETIC	76.113	2.531	89.513	3.574	89.596	3.572	89.893	3.646	88.229	0.000	89.333	3.565	90.008	3.673	88.170	3.414
		pS1[22]	z95 for RKF selectivity (males, pre-1997)	1	ARITHMETIC	158.210	6.552	162.780	6.349	162.748	6.346	180.000	0.000	180.000	0.000	162.703	6.355	180.000	0.000	180.000	0.000
		pS1[23]	z95 for RKF selectivity (males, 1997-2004)	1	ARITHMETIC	180.000	0.005	180.000	0.031	180.000	0.027	174.567	17.243	172.095	0.000	180.000	0.026	174.941	17.383	172.765	17.435
		pS1[24]	z95 for RKF selectivity (males, 2005+)	1	ARITHMETIC	180.000	0.000	180.000	0.000	180.000	0.000	180.000	0.052	177.451	0.000	180.000	0.000	180.000	0.011	178.620	9.136
		pS1[25]	z95 for RKF selectivity (females, pre-1997)	1	ARITHMETIC	121.572	37.669	117.584	27.062	117.616	27.109	116.170	23.315	115.396	0.000	117.586	27.051	116.210	23.335	115.278	22.148
		pS1[26]	z95 for RKF selectivity (females, 1997-2004)	1	ARITHMETIC	121.215	53.480	117.823	46.948	117.862	47.068	121.919	60.311	121.222	0.000	117.815	46.985	121.981	60.449	120.787	57.138
		pS1[27]	z95 for RKF selectivity (females, 2005+)	1	ARITHMETIC	140.000	0.034	140.000	0.091	140.000	0.089	140.000	0.063	140.000	0.000	140.000	0.091	140.000	0.063	140.000	0.081
		pS1[28]	z50 for TCF retention (2005-2009)	1	ARITHMETIC	138.717	1.632	139.082	1.407	139.081	1.407	139.312	1.320	139.049	0.000	139.064	1.415	139.346	1.306	139.157	1.379
		pS1[29]	z50 for TCF retention (2013-2015)	1	ARITHMETIC	125.037	0.758	125.257	0.576	125.257	0.576	125.261	0.574	125.151	0.000	125.252	0.766	125.259	0.573	125.200	0.761
		pS1[3]	z50 for NMFS survey selectivity (females, pre-1982)	1	ARITHMETIC	56.293	2.856	100.000	0.001	100.000	0.001	100.000	0.001	57.880	0.000	100.000	0.000	100.000	0.001	76.566	2.069
		pS1[4]	z50 for NMFS survey selectivity (females, 1982+)	1	ARITHMETIC	-29.135	26.960	-50.000	0.003	-50.000	0.003	-50.000	0.003	26.998	0.000	-50.000	0.003	-50.000	0.003	-50.000	0.005
		pS1[5]	z50 for TCF retention (pre-1991)	1	ARITHMETIC	137.986	0.416	138.178	0.381	138.173	0.380	137.642	0.423	137.063	0.000	138.052	0.368	137.506	0.371	137.094	0.386
		pS1[6]	z50 for TCF retention (1991-1996)	1	ARITHMETIC	137.498	0.249	137.823	0.259	137.822	0.259	137.582	0.239	137.578	0.000	137.832	0.262	137.613	0.240	137.625	0.242
		pS1[7]	DUMMY VALUE	1	ARITHMETIC	4.884	0.000	4.884	0.000	4.884	0.000	4.884	0.000	4.884	0.000	4.884	0.000	4.884	0.000	4.884	0.000
		pS1[8]	ln(z50) for TCF selectivity (males)	1	ARITHMETIC	4.865	0.008	4.879	0.007	4.879	0.007	4.954	0.024	4.952	0.000	4.878	0.007	4.958	0.008	4.956	0.008
		pS1[9]	z50 for TCF selectivity (females)	1	ARITHMETIC	96.581	2.622	94.692	2.052	94.706	2.055	94.640	2.051	94.113	0.000	94.697	2.052	94.653	2.056	94.306	1.970
		pS2[1]	z95-z50 for NMFS survey selectivity (males, pre-	1	ARITHMETIC	23.496	3.492	69.941	3.616	70.262	3.643	70.493	3.706	24.042	0.000	69.910	3.612	69.393	3.605	24.554	0.000
		pS2[10]	ascending slope for SCF selectivity (males, pre-1997)	1	ARITHMETIC	0.374	0.129	0.251	0.086	0.251	0.086	0.218	0.088	0.231	0.000	0.252	0.087	0.224	0.087	0.237	0.094
		pS2[11]	ascending slope for SCF selectivity (males, 1997-	1	ARITHMETIC	0.208	0.063	0.168	0.044	0.168	0.044	0.199	0.052	0.208	0.000	0.165	0.042	0.197	0.052	0.203	0.054
		pS2[12]	ascending slope for SCF selectivity (males, 2005+)	1	ARITHMETIC	0.175	0.015	0.162	0.011	0.162	0.011	0.162	0.011	0.163	0.000	0.161	0.011	0.162	0.011	0.162	0.012
		pS2[13]	slope for SCF selectivity (females, pre-1997)	1	ARITHMETIC	0.220	0.128	0.276	0.217	0.276	0.215	0.261	0.184	0.271	0.000	0.277	0.215	0.264	0.182	0.263	0.191
		pS2[14]	slope for SCF selectivity (females, 1997-2004)	1	ARITHMETIC	0.264	0.129	0.267	0.139	0.267	0.139	0.271	0.141	0.274	0.000	0.266	0.138	0.271	0.141	0.272	0.141
		pS2[15]	slope for SCF selectivity (females, 2005+)	1	ARITHMETIC	0.156	0.049	0.154	0.053	0.154	0.053	0.171	0.058	0.182	0.000	0.153	0.052	0.167	0.057	0.175	0.058
		pS2[16]	slope for GF.AllGear selectivity (males, pre-1987)	1	ARITHMETIC	0.104	0.010	0.087	0.009	0.087	0.009	0.089	0.009	0.105	0.000	0.086	0.009	0.087	0.009	0.098	0.010
		pS2[17]	slope for GF.AllGear selectivity (males, 1987-1996)	1	ARITHMETIC	0.057	0.012	0.043	0.005	0.043	0.005	0.042	0.006	0.047	0.000	0.043	0.005	0.041	0.006	0.045	0.007
		pS2[18]	slope for GF.AllGear selectivity (males, 1997+)	1	ARITHMETIC	0.074	0.004	0.057	0.002	0.057	0.002	0.056	0.002	0.058	0.000	0.057	0.002	0.056	0.002	0.058	0.003
		pS2[19]	slope for GF.AllGear selectivity (females, pre-1987)	1	ARITHMETIC	0.137	0.022	0.150	0.022	0.150	0.022	0.149	0.022	0.154	0.000	0.149	0.022	0.148	0.022	0.152	0.022
		pS2[2]	z95-z50 for NMFS survey selectivity (males, 1982+)	1	ARITHMETIC	75.073	10.254	100.000	0.001	100.000	0.001	100.000	0.001	97.492	0.000	100.000	0.002	100.000	0.001	100.000	0.028
		pS2[20]	slope for GF.AllGear selectivity (females, 1987-1996)	1	ARITHMETIC	0.185	0.038	0.171	0.037	0.171	0.037	0.176	0.038	0.176	0.000	0.171	0.037	0.176	0.037	0.175	0.037
		pS2[21]	slope for GF.AllGear selectivity (females, 1997+)	1	ARITHMETIC	0.072	0.006	0.056	0.004	0.056	0.004	0.056	0.004	0.056	0.000	0.056	0.004	0.056	0.004	0.058	0.004
		pS2[22]	ln(z95-z50) for RKF selectivity (males, pre-1997)	1	ARITHMETIC	3.077	0.162	3.117	0.145	3.116	0.145	3.089	0.062	3.112	0.000	3.117	0.145	3.093	0.062	3.108	0.062
		pS2[23]	ln(z95-z50) for RKF selectivity (males, 1997-2004)	1	ARITHMETIC	3.552	0.085	3.510	0.077	3.511	0.077	3.452	0.205	3.452	0.000	3.513	0.077	3.455	0.205	3.450	0.215
		pS2[24]	ln(z95-z50) for RKF selectivity (males, 2005+)	1	ARITHMETIC	3.487	0.044	3.426	0.039	3.426	0.039	3.457	0.041	3.465	0.000	3.428	0.039	3.452	0.041	3.464	0.113
		pS2[25]	ln(z95-z50) for RKF selectivity (males, pre-1997)	1	ARITHMETIC	2.785	0.684	2.754	0.646	2.755	0.646	2.719	0.603	2.714	0.000	2.754	0.646	2.720	0.602	2.701	0.600
		pS2[26]	ln(z95-z50) for RKF selectivity (males, 1997-2004)	1	ARITHMETIC	2.849	0.903	2.832	0.978	2.832	0.978	2.896	1.018	2.896	0.000	2.831	0.978	2.896	1.016	2.881	1.022
		pS2[27]	ln(z95-z50) for RKF selectivity (males, 2005+)	1	ARITHMETIC	2.991	0.220	3.062	0.218	3.061	0.218	3.059	0.217	3.078	0.000	3.061	0.218	3.058	0.217	3.067	0.216
		pS2[28]	slope for TCF retention (2005-2009)	1	ARITHMETIC	0.894	0.725	0.797	0.438	0.797	0.438	0.745	0.338	0.803	0.000	0.801	0.447	0.738	0.326	0.776	0.399
		pS2[29]	slope for TCF retention (2013-2015)	1	ARITHMETIC	0.576	0.126	0.547	0.105	0.546	0.105	0.548	0.105	0.564	0.000	0.547	0.116	0.546	0.105	0.556	0.118
		pS2[3]	z95-z50 for NMFS survey selectivity (females, pre-	1	ARITHMETIC	39.982	5.871	69.449	4.225	69.752	4.260	69.861	4.280	43.747	0.000	69.173	4.190	69.245	4.203	43.444	0.000
		pS2[4]	z95-z50 for NMFS survey selectivity (females, 1982+)	1	ARITHMETIC	100.000	0.002	100.000	0.069	100.000	0.019	100.000	0.013	0.000	0.000	100.000	0.008	100.000	0.012	100.000	0.006
		pS2[5]	slope for TCF retention (pre-1991)	1	ARITHMETIC	0.690	0.126	0.740	0.128	0.741	0.128	0.748	0.131	0.764	0.000	0.748	0.129	0.740	0.129	0.749	0.129
		pS2[6]	slope for TCF retention (1997+)	1	ARITHMETIC	0.956	0.192	1.031	0.284	1.031	0.284	0.966	0.226	0.960	0.000	1.032	0.287	0.971	0.234	0.969	0.232
		pS2[7]	slope for TCF selectivity (males, pre-1997)	1	ARITHMETIC	0.118	0.006	0.121	0.006	0.121	0.006	0.099	0.003	0.098	0.000	0.121	0.006	0.098	0.003	0.097	0.003
		pS2[8]	slope for TCF selectivity (males, 1997+)	1	ARITHMETIC	0.155	0.008	0.158	0.007	0.158	0.007	0.160	0.008	0.161	0.000	0.158	0.007	0.159	0.007	0.160	0.008
		pS2[9]	slope for TCF selectivity (females)	1	ARITHMETIC	0.187	0.019	0.190	0.019	0.190	0.019	0.190	0.019	0.192	0.000	0.191	0.019	0.190	0.019	0.193	0.020
		pS3[1]	ln(dz50-az50) for SCF selectivity (males, pre-1997)	1	ARITHMETIC	3.956	0.040	3.675	0.169	3.673	0.170	3.469	0.287	3.422	0.000	3.679	0.171	3.516	0.255	3.498	0.243
		pS3[2]	ln(dz50-az50) for SCF selectivity (males, 1997-2004)	1	ARITHMETIC	3.730	0.210	3.599	0.382	3.597	0.384	3.823	0.169	3.845	0.000	3.552	0.447	3.810	0.175	3.825	0.163
		pS3[3]	ln(dz50-az50) for SCF selectivity (males, 2005+)	1	ARITHMETIC	3.446	0.082	3.332	0.103	3.332	0.103	3.337	0.105	3.353	0.000	3.327	0.105	3.332	0.107	3.342	0.102
		pS4[1]	descending slope for SCF selectivity (males, pre-	1	ARITHMETIC	0.500	0.001	0.100	0.000	0.100	0.000	0.100	0.000	0.100	0.000	0.100	0.000	0.100	0.000	0.100	0.000
		pS4[2]	descending slope for SCF selectivity (males, 1997-	1	ARITHMETIC	0.130	0.081	0.114	0.102	0.114	0.101	0.175	0.119	0.183	0.000	0.106	0.095	0.170	0.116	0.176	0.116
		pS4[3]	descending slope for SCF selectivity (males, 2005+)	1	ARITHMETIC	0.185	0.024	0.182	0.026	0.182	0.026	0.181	0.027	0.186	0.000	0.181	0.026	0.180	0.027	0.183	0.026

Table B.9. Estimated model parameter values and standard deviations related to selectivity and retention functions for B0 and the E model scenarios.

category	process	name	label	index	parameter scale	Scenarios B0 param. value	std. dev.	E0 param. value	std. dev.	E0a param. value	std. dev.	E0b param. value	std. dev.	E0c param. value	std. dev.	E1 param. value	std. dev.	E1b param. value	std. dev.	E1c param. value	std. dev.
selectivity	selectivity	pDevsS1[1]	ln(z50 devs) for TCF selectivity (males, 1991+)	1	ARITHMETIC	0.029	0.018	0.068	0.000	0.067	0.017	0.088	0.000	0.091	0.029	0.065	0.017	0.107	0.032	0.095	0.030
				2	ARITHMETIC	0.116	0.012	0.119	0.000	0.118	0.012	0.143	0.000	0.187	0.018	0.116	0.012	0.181	0.018	0.185	0.018
				3	ARITHMETIC	0.097	0.014	0.065	0.000	0.065	0.011	0.082	0.000	0.142	0.037	0.063	0.011	0.141	0.032	0.144	0.037
				4	ARITHMETIC	0.077	0.021	0.013	0.000	0.013	0.019	0.025	0.000	0.500	0.000	0.011	0.019	0.500	0.001	0.500	0.000
				5	ARITHMETIC	-0.010	0.027	-0.058	0.000	-0.058	0.028	-0.053	0.000	-0.051	0.033	-0.060	0.028	-0.074	0.033	-0.056	0.033
				6	ARITHMETIC	0.120	0.040	0.093	0.000	0.093	0.042	0.090	0.000	0.145	0.060	0.094	0.042	0.119	0.054	0.143	0.059
				7	ARITHMETIC	-0.086	0.017	-0.067	0.000	-0.067	0.015	-0.077	0.000	-0.160	0.017	-0.066	0.015	-0.153	0.016	-0.159	0.017
				8	ARITHMETIC	-0.095	0.018	-0.070	0.000	-0.070	0.015	-0.081	0.000	-0.160	0.016	-0.069	0.015	-0.156	0.016	-0.160	0.016
				9	ARITHMETIC	-0.131	0.016	-0.102	0.000	-0.102	0.014	-0.112	0.000	-0.193	0.015	-0.101	0.014	-0.188	0.015	-0.193	0.015
				10	ARITHMETIC	0.010	0.014	0.017	0.000	0.017	0.013	0.007	0.000	-0.073	0.014	0.018	0.013	-0.066	0.014	-0.072	0.014
				11	ARITHMETIC	0.180	0.016	0.157	0.000	0.157	0.013	0.145	0.000	0.070	0.015	0.158	0.013	0.076	0.014	0.070	0.015
				12	ARITHMETIC	-0.048	0.017	-0.023	0.000	-0.023	0.014	-0.034	0.000	-0.114	0.016	-0.022	0.014	-0.109	0.015	-0.114	0.016
				13	ARITHMETIC	-0.109	0.014	-0.087	0.000	-0.085	0.012	-0.093	0.000	-0.173	0.014	-0.084	0.012	-0.170	0.013	-0.173	0.014
				14	ARITHMETIC	-0.149	0.016	-0.125	0.000	-0.123	0.013	-0.131	0.000	-0.211	0.015	-0.122	0.013	-0.207	0.014	-0.211	0.015
		pS1[1]	z50 for NMFS survey selectivity (males, pre-1982)	1	ARITHMETIC	52.306	2.115	90.000	0.000	90.000	0.000	90.000	0.000	52.689	0.000	90.000	0.000	90.000	0.000	56.858	1.418
		pS1[10]	ascending z50 for SCF selectivity (males, pre-1997)	1	ARITHMETIC	87.704	1.564	88.330	0.000	88.361	2.143	89.653	0.000	87.382	1.962	88.253	2.184	88.747	2.640	87.428	2.093
		pS1[11]	ascending z50 for SCF selectivity (males, 1997-2004)	1	ARITHMETIC	95.698	3.754	99.455	0.000	99.523	4.273	97.155	0.000	95.773	2.937	100.176	4.818	97.055	3.226	96.236	3.038
		pS1[12]	ascending z50 for SCF selectivity (males, 2005+)	1	ARITHMETIC	105.606	1.419	109.232	0.000	109.256	1.434	109.184	0.000	107.908	1.351	109.386	1.470	109.089	1.468	108.250	1.394
		pS1[13]	ascending z50 for SCF selectivity (females, pre-1997)	1	ARITHMETIC	70.265	5.030	68.612	0.000	68.650	4.933	69.206	0.000	67.992	5.415	68.735	4.860	69.310	4.809	68.678	5.084
		pS1[14]	ascending z50 for SCF selectivity (females, 1997-	1	ARITHMETIC	76.295	4.524	75.318	0.000	75.321	4.677	75.231	0.000	75.042	4.689	75.364	4.678	75.268	4.687	75.160	4.680
		pS1[15]	ascending z50 for SCF selectivity (females, 2005+)	1	ARITHMETIC	85.218	5.644	83.294	0.000	83.336	5.389	82.178	0.000	80.655	4.394	83.625	5.547	81.905	4.849	81.166	4.522
		pS1[16]	z50 for GF.AllGear selectivity (males, pre-1987)	1	ARITHMETIC	55.023	1.859	59.577	0.000	59.487	2.187	59.523	0.000	54.549	1.755	59.734	2.216	58.936	2.199	56.375	1.894
		pS1[17]	z50 for GF.AllGear selectivity (males, 1987-1996)	1	ARITHMETIC	59.073	4.849	79.572	0.000	79.425	4.476	79.250	0.000	73.011	4.434	79.159	4.464	77.674	4.734	75.034	4.481
		pS1[18]	z50 for GF.AllGear selectivity (males, 1997+)	1	ARITHMETIC	80.841	2.175	94.976	0.000	95.028	2.226	94.655	0.000	89.650	2.162	95.011	2.224	95.088	2.325	91.030	2.167
		pS1[19]	z50 for GF.AllGear selectivity (males, pre-1987)	1	ARITHMETIC	41.200	1.660	40.000	0.000	40.000	0.001	40.000	0.000	40.000	0.000	40.000	0.001	40.000	0.001	40.000	0.000
		pS1[2]	z50 for NMFS survey selectivity (males, 1982+)	1	ARITHMETIC	34.918	4.148	47.893	0.000	47.894	2.843	47.315	0.000	38.034	2.442	47.622	2.832	46.762	3.006	42.039	2.527
		pS1[20]	z50 for GF.AllGear selectivity (males, 1987-1996)	1	ARITHMETIC	40.000	0.000	44.307	0.000	44.258	2.071	44.010	0.000	43.490	1.987	44.058	2.026	42.954	1.874	43.513	1.932
		pS1[21]	z50 for GF.AllGear selectivity (males, 1997+)	1	ARITHMETIC	76.113	2.531	83.330	0.000	83.473	3.057	82.984	0.000	81.187	2.905	83.470	3.067	83.519	3.106	81.283	2.908
		pS1[22]	z95 for RKF selectivity (males, pre-1997)	1	ARITHMETIC	158.210	6.552	160.883	0.000	160.887	6.862	180.000	0.000	180.000	0.000	160.885	6.896	180.000	0.000	180.000	0.000
		pS1[23]	z95 for RKF selectivity (males, 1997-2004)	1	ARITHMETIC	180.000	0.005	175.600	0.000	175.623	16.163	164.005	0.000	165.922	17.215	175.668	16.220	169.453	17.343	166.432	17.167
		pS1[24]	z95 for RKF selectivity (males, 2005+)	1	ARITHMETIC	180.000	0.000	180.000	0.000	180.000	0.001	173.538	0.000	172.323	9.149	180.000	0.001	177.250	9.184	173.420	9.135
		pS1[25]	z95 for RKF selectivity (females, pre-1997)	1	ARITHMETIC	121.572	37.669	117.102	0.000	117.144	26.979	115.772	0.000	114.710	22.134	117.039	26.661	115.568	22.769	114.664	21.755
		pS1[26]	z95 for RKF selectivity (females, 1997-2004)	1	ARITHMETIC	121.215	53.480	116.874	0.000	116.837	44.695	120.102	0.000	119.508	54.130	117.012	45.058	120.672	56.656	119.565	53.890
		pS1[27]	z95 for RKF selectivity (females, 2005+)	1	ARITHMETIC	140.000	0.034	140.000	0.000	140.000	0.152	140.000	0.000	140.000	0.099	140.000	0.145	140.000	0.075	140.000	0.104
		pS1[28]	z50 for TCF retention (2005-2009)	1	ARITHMETIC	138.717	1.632	138.665	0.000	138.674	1.662	138.781	0.000	138.596	1.751	138.682	1.652	139.026	1.435	138.688	1.654
		pS1[29]	z50 for TCF retention (2013-2015)	1	ARITHMETIC	125.037	0.758	125.201	0.000	125.012	0.757	125.068	0.000	124.926	0.757	124.997	0.758	125.141	0.757	124.954	0.757
		pS1[3]	z50 for NMFS survey selectivity (females, pre-1982)	1	ARITHMETIC	56.293	2.856	100.000	0.000	100.000	0.001	100.000	0.000	57.880	0.000	100.000	0.001	100.000	0.001	72.290	1.676
		pS1[4]	z50 for NMFS survey selectivity (females, 1982+)	1	ARITHMETIC	-29.135	26.960	-45.715	0.000	-49.823	2703.100	-34.761	0.000	-16.554	241340.000	-49.099	13798.000	26.060	11686.000	26.891	1058.400
		pS1[5]	z50 for TCF retention (pre-1991)	1	ARITHMETIC	137.986	0.416	137.586	0.000	137.587	0.345	137.681	0.000	135.515	0.566	137.519	0.344	136.753	0.416	135.691	0.554
		pS1[6]	z50 for TCF retention (1991-1996)	1	ARITHMETIC	137.498	0.249	137.834	0.000	137.836	0.264	137.872	0.000	137.621	0.247	137.849	0.268	137.597	0.243	137.639	0.248
		pS1[7]	DUMMY VALUE	1	ARITHMETIC	4.884	0.000	4.884	0.000	4.884	0.000	4.884	0.000	4.884	0.000	4.884	0.000	4.884	0.000	4.884	0.000
		pS1[8]	ln(z50) for TCF selectivity (males)	1	ARITHMETIC	4.865	0.008	4.860	0.000	4.860	0.007	4.866	0.000	4.940	0.009	4.859	0.007	4.945	0.009	4.942	0.009
		pS1[9]	z50 for TCF selectivity (females)	1	ARITHMETIC	96.581	2.622	94.500	0.000	94.510	1.992	94.488	0.000	93.908	1.926	94.500	1.993	94.474	1.998	94.031	1.922
		pS2[1]	z95-z50 for NMFS survey selectivity (males, pre-	1	ARITHMETIC	23.496	3.492	75.683	0.000	75.872	3.851	75.251	0.000	24.042	0.000	74.991	3.774	76.561	3.918	24.554	0.000
		pS2[10]	ascending slope for SCF selectivity (males, pre-1997)	1	ARITHMETIC	0.374	0.129	0.308	0.000	0.307	0.110	0.260	0.000	0.381	0.154	0.304	0.110	0.291	0.119	0.363	0.149
		pS2[11]	ascending slope for SCF selectivity (males, 1997-	1	ARITHMETIC	0.208	0.063	0.180	0.000	0.180	0.047	0.204	0.000	0.218	0.059	0.175	0.046	0.205	0.054	0.213	0.057
		pS2[12]	ascending slope for SCF selectivity (males, 2005+)	1	ARITHMETIC	0.175	0.015	0.165	0.000	0.165	0.011	0.164	0.000	0.168	0.012	0.164	0.011	0.165	0.012	0.167	0.012
		pS2[13]	slope for SCF selectivity (females, pre-1997)	1	ARITHMETIC	0.220	0.128	0.275	0.000	0.275	0.209	0.260	0.000	0.282	0.263	0.276	0.207	0.264	0.184	0.273	0.217
		pS2[14]	slope for SCF selectivity (females, 1997-2004)	1	ARITHMETIC	0.264	0.129	0.272	0.000	0.272	0.143	0.274	0.000	0.278	0.150	0.271	0.143	0.274	0.145	0.276	0.147
		pS2[15]	slope for SCF selectivity (females, 2005+)	1	ARITHMETIC	0.156	0.049	0.160	0.000	0.159	0.054	0.169	0.000	0.182	0.060	0.157	0.053	0.171	0.057	0.178	0.059
		pS2[16]	slope for GF.AllGear selectivity (males, pre-1987)	1	ARITHMETIC	0.104	0.010	0.088	0.000	0.088	0.008	0.087	0.000	0.102	0.010	0.087	0.008	0.088	0.009	0.097	0.009
		pS2[17]	slope for GF.AllGear selectivity (males, 1987-1996)	1	ARITHMETIC	0.057	0.012	0.048	0.000	0.048	0.005	0.048	0.000	0.050	0.006	0.048	0.005	0.047	0.005	0.049	0.005
		pS2[18]	slope for GF.AllGear selectivity (males, 1997+)	1	ARITHMETIC	0.074	0.004	0.061	0.000	0.061	0.003	0.061	0.000	0.063	0.003	0.061	0.003	0.060	0.003	0.063	0.003
		pS2[19]	slope for GF.AllGear selectivity (females, pre-1987)	1	ARITHMETIC	0.137	0.022	0.160	0.000	0.160	0.022	0.159	0.000	0.161	0.022	0.159	0.022	0.159	0.022	0.160	0.022
		pS2[2]	z95-z50 for NMFS survey selectivity (males, 1982+)	1	ARITHMETIC	75.073	10.254	76.408	0.000	76.664	5.926	76.384	0.000	66.781	5.699	76.275	5.900	78.857	6.549	68.904	5.496
		pS2[20]	slope for GF.AllGear selectivity (females, 1987-1996)	1	ARITHMETIC	0.185	0.038	0.136	0.000	0.136	0.030	0.138	0.000	0.143	0.031	0.139	0.030	0.151	0.032	0.145	0.031
		pS2[21]	slope for GF.AllGear selectivity (females, 1997+)	1	ARITHMETIC	0.072	0.006	0.062	0.000	0.062	0.005	0.062	0.000	0.064	0.005	0.062	0.005	0.062	0.005	0.064	0.005
		pS2[22]	ln(z95-z50) for RKF selectivity (males, pre-1997)	1	ARITHMETIC	3.077	0.162	3.132	0.000	3.132	0.157	3.275	0.000	3.171	0.064	3.136	0.158	3.165	0.064	3.172	0.064
		pS2[23]	ln(z95-z50) for RKF selectivity (males, 1997-2004)	1	ARITHMETIC	3.552	0.085	3.497	0.000	3.497	0.203	3.373	0.000	3.407	0.243	3.499	0.203	3.424	0.226	3.408	0.239
		pS2[24]	ln(z95-z50) for RKF selectivity (males, 2005+)	1	ARITHMETIC	3.487	0.044	3.471	0.000	3.471	0.040	3.426	0.000	3.442	0.128	3.470	0.040	3.460	0.116	3.446	0.125
		pS2[25]	ln(z95-z50) for RKF selectivity (males, pre-1997)	1	ARITHMETIC	2.785	0.684	2.748	0.000	2.749	0.660	2.714	0.000	2.701	0.620	2.746	0.656	2.708	0.608	2.694	0.611
		pS2[26]	ln(z95-z50) for RKF selectivity (males, 1997-2004)	1	ARITHMETIC	2.849	0.903	2.815	0.000	2.814	0.976	2.870	0.000	2.868	1.035	2.817	0.976	2.877	1.018	2.866	1.027
		pS2[27]	ln(z95-z50) for RKF selectivity (males, 2005+)	1	ARITHMETIC	2.991	0.220	3.073	0.000	3.072	0.219	3.070	0.000	3.087	0.218	3.073	0.219	3.069	0.217	3.082	0.217
		pS2[28]	slope for TCF retention (2005-2009)	1	ARITHMETIC	0.894	0.725	0.923	0.000	0.919	0.793	0.880	0.000	0.949	0.918	0.916	0.780	0.804	0.463	0.910	0.770
		pS2[29]	slope for TCF retention (2013-2015)	1	ARITHMETIC	0.576	0.126	0.561	0.000	0.580	0.127	0.575	0.000	0.595	0.134	0.580	0.128	0.565	0.121	0.590	0.132
		pS2[3]	z95-z50 for NMFS survey selectivity (females, pre-	1	ARITHMETIC	39.982	5.871	69.430	0.000	69.627	3.836	69.535	0.000	43.747	0.000	69.026	3.771	69.568	3.834	43.444	0.000
		pS2[4]	z95-z50 for NMFS survey selectivity (females, 1982+)	1	ARITHMETIC	100.000	0.002	6.752	0.000	9.685	8370.900	0.034	0.000	5.123	29873.000	0.065	915.220	0.104	1291.200	0.013	125.660
		pS2[5]	slope for TCF retention (pre-1991)	1	ARITHMETIC	0.690	0.126	0.749	0.000	0.749	0.127	0.735	0.000	0.667	0.122	0.745	0.126	0.717	0.124	0.655	0.117
		pS2[6]	slope for TCF retention (1997+)	1	ARITHMETIC	0.956	0.192	1.027	0.000	1.027	0.283	1.025	0.000	0.961	0.233	1.029	0.288	0.966	0.237	0.966	0.240
		pS2[7]	slope for TCF selectivity (males, pre-1997)	1	ARITHMETIC	0.118	0.006	0.121	0.000	0.121	0.006	0.114	0.000	0.093	0.004	0.121	0.006	0.092	0.004	0.092	0.004
		pS2[8]	slope for TCF selectivity (males, 1997+)	1	ARITHMETIC	0.155	0.008	0.164	0.000	0.164	0.008	0.166	0.000	0.164	0.009	0.163	0.008	0.163	0.008	0.164	0.008
		pS2[9]	slope for TCF selectivity (females)	1	ARITHMETIC	0.187	0.019	0.192	0.000	0.192	0.019	0.192	0.000	0.194	0.020	0.192	0.019	0.192	0.019	0.194	0.020
		pS3[1]	ln(dz50-az50) for SCF selectivity (males, pre-1997)	1	ARITHMETIC	3.956	0.040	3.674	0.000	3.674	0.141	3.535	0.000	3.598	0.140	3.683	0.142	3.554	0.182	3.603	0.144
		pS3[2]	ln(dz50-az50) for SCF selectivity (males, 1997-2004)	1	ARITHMETIC	3.730	0.210	3.673	0.000	3.668	0.240	3.804	0.000	3.866	0.137	3.619	0.303	3.812	0.158	3.842	0.144
		pS3[3]	ln(dz50-az50) for SCF selectivity (males, 2005+)	1	ARITHMETIC	3.446	0.082	3.344	0.000	3.342	0.094	3.344	0.000	3.393	0.082	3.332	0.098	3.347	0.096	3.378	0.086
		pS4[1]	descending slope for SCF selectivity (males, pre-	1	ARITHMETIC	0.500	0.001	0.100	0.000	0.100	0.000	0.100	0.000	0.100	0.000	0.100	0.000	0.100	0.000	0.100	0.000
		pS4[2]	descending slope for SCF selectivity (males, 1997-	1	ARITHMETIC	0.130	0.081	0.142	0.000	0.141	0.096	0.179	0.000	0.199	0.125	0.129	0.096	0.179	0.112	0.191	0.118
		pS4[3]	descending slope for SCF selectivity (males, 2005+)	1	ARITHMETIC	0.185	0.024	0.190	0.000	0.189	0.026	0.189	0.000	0.196	0.025	0.188	0.026	0.187	0.026	0.193	0.026

Table B.10. Estimated model parameter values and standard deviations related to selectivity and retention functions for B0 and the F and G model scenarios.

						Scenarios																					
						B0		F0		F0a		F0c		G0		G0a		G0b		G0bd		G0bde		G0bde-Fr		G0bde-Mcl	
category	process	name	label	index	parameter scale	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.
selectivity	selectivity	pDevsS1[1]	ln(z50 devs) for TCF selectivity (males, 1991+)	1	ARITHMETIC	0.029	0.018	0.076	0.016	0.076	0.016	0.104	0.035	0.084	0.016	0.072	0.015	0.500	0.000	0.500	0.000	0.500	0.000	-0.500	0.000	0.500	0.000
				2	ARITHMETIC	0.116	0.012	0.115	0.011	0.115	0.011	0.178	0.017	0.087	0.010	0.073	0.009	0.059	0.014	0.062	0.014	0.062	0.014	0.131	0.033	0.063	0.015
				3	ARITHMETIC	0.097	0.014	0.063	0.010	0.063	0.010	0.137	0.034	0.072	0.010	0.057	0.010	0.068	0.016	0.065	0.017	0.069	0.017	0.252	0.030	0.074	0.019
				4	ARITHMETIC	0.077	0.021	0.009	0.017	0.009	0.017	0.500	0.000	0.032	0.013	0.016	0.014	0.038	0.023	0.026	0.023	0.037	0.024	0.381	0.038	0.072	0.036
				5	ARITHMETIC	-0.010	0.027	-0.052	0.025	-0.052	0.024	-0.051	0.029	-0.057	0.016	-0.075	0.018	0.500	0.000	0.500	0.000	0.500	0.000	0.500	0.000	0.500	0.000
				6	ARITHMETIC	0.120	0.040	0.086	0.036	0.086	0.036	0.104	0.043	0.123	0.014	0.124	0.015	0.089	0.018	0.088	0.019	0.089	0.019	0.072	0.035	0.083	0.020
				7	ARITHMETIC	-0.086	0.017	-0.063	0.014	-0.063	0.014	-0.148	0.015	-0.047	0.010	-0.036	0.010	-0.157	0.010	-0.157	0.010	-0.157	0.010	0.033	0.018	-0.161	0.010
				8	ARITHMETIC	-0.095	0.018	-0.066	0.014	-0.066	0.014	-0.152	0.015	-0.068	0.011	-0.056	0.010	-0.176	0.010	-0.176	0.010	-0.180	0.010	0.031	0.018	-0.180	0.011
				9	ARITHMETIC	-0.131	0.016	-0.101	0.013	-0.101	0.013	-0.186	0.014	-0.119	0.011	-0.105	0.010	-0.227	0.010	-0.226	0.010	-0.226	0.010	0.006	0.018	-0.230	0.011
				10	ARITHMETIC	0.010	0.014	0.015	0.012	0.015	0.012	-0.071	0.013	0.025	0.009	0.031	0.009	-0.091	0.009	-0.089	0.009	-0.091	0.009	0.097	0.017	-0.097	0.009
				11	ARITHMETIC	0.180	0.016	0.139	0.012	0.139	0.012	0.055	0.013	0.108	0.010	0.112	0.010	-0.012	0.010	-0.010	0.010	-0.013	0.010	0.124	0.018	-0.020	0.010
				12	ARITHMETIC	-0.048	0.017	-0.023	0.013	-0.023	0.013	-0.108	0.014	-0.038	0.011	-0.029	0.011	-0.153	0.011	-0.150	0.011	-0.153	0.012	-0.130	0.048	-0.158	0.012
				13	ARITHMETIC	-0.109	0.014	-0.082	0.011	-0.082	0.011	-0.165	0.012	-0.084	0.010	-0.077	0.010	-0.202	0.010	-0.199	0.010	-0.200	0.010	-0.497	0.101	-0.205	0.011
				14	ARITHMETIC	-0.149	0.016	-0.117	0.012	-0.117	0.012	-0.198	0.013	-0.120	0.011	-0.110	0.011	-0.237	0.011	-0.235	0.011	-0.237	0.011	-0.500	0.001	-0.241	0.012
		pS1[1]	z50 for NMFS survey selectivity (males, pre-1982)	1	ARITHMETIC	52.306	2.115	90.000	0.000	90.000	0.000	52.689	0.000	90.000	0.000	90.000	0.000	90.000	0.000	90.000	0.000	90.000	0.000	90.000	0.001	90.000	0.000
		pS1[10]	ascending z50 for SCF selectivity (males, pre-1997)	1	ARITHMETIC	87.704	1.564	90.160	2.433	90.202	2.443	89.605	2.876	89.451	2.404	85.222	1.163	84.375	1.554	105.052	2.631	104.312	2.595	140.000	0.000	106.771	1.502
		pS1[11]	ascending z50 for SCF selectivity (males, 1997-2004)	1	ARITHMETIC	95.698	3.754	100.185	3.665	100.183	3.666	97.417	2.959	100.351	3.384	100.584	3.103	98.314	2.702	106.893	3.945	108.238	3.985	129.855	17.998	114.302	1.507
		pS1[12]	ascending z50 for SCF selectivity (males, 2005+)	1	ARITHMETIC	105.606	1.419	110.278	1.325	110.273	1.324	109.798	1.342	110.405	1.327	110.540	1.241	110.313	1.201	111.093	1.394	111.119	1.439	140.000	0.001	110.558	0.730
		pS1[13]	ascending z50 for SCF selectivity (females, pre-1997)	1	ARITHMETIC	70.265	5.030	69.181	4.864	69.196	4.856	69.532	4.863	67.354	4.634	65.308	2.728	64.810	2.426	74.491	5.362	73.761	5.183	99.158	21.345	71.334	1.357
		pS1[14]	ascending z50 for SCF selectivity (females, 1997-	1	ARITHMETIC	76.295	4.524	75.708	4.533	75.703	4.534	75.606	4.525	77.046	3.727	77.435	3.248	76.269	3.009	72.013	3.676	72.289	3.762	50.000	0.003	76.466	1.290
		pS1[15]	ascending z50 for SCF selectivity (females, 2005+)	1	ARITHMETIC	85.218	5.644	83.756	5.365	83.733	5.357	81.144	4.412	120.000	0.018	118.317	5.111	120.000	0.005	106.847	5.738	105.058	5.656	86.020	8.590	89.185	2.359
		pS1[16]	z50 for GF.AllGear selectivity (males, pre-1987)	1	ARITHMETIC	55.023	1.859	66.656	2.895	66.534	2.893	59.722	2.198	66.980	2.873	75.084	3.530	74.085	3.792	68.689	3.566	67.423	3.528	97.560	10.758	72.106	3.608
		pS1[17]	z50 for GF.AllGear selectivity (males, 1987-1996)	1	ARITHMETIC	59.073	4.849	89.238	5.266	89.117	5.264	81.972	5.257	89.237	5.273	115.363	9.310	120.000	0.001	120.000	0.001	120.000	0.001	120.000	0.000	120.000	0.000
		pS1[18]	z50 for GF.AllGear selectivity (males, 1997+)	1	ARITHMETIC	80.841	2.175	102.336	2.145	102.338	2.148	99.298	2.176	102.643	2.164	106.730	2.069	108.908	2.330	108.628	2.230	108.970	2.340	120.000	0.001	111.337	2.006
		pS1[19]	z50 for GF.AllGear selectivity (males, pre-1987)	1	ARITHMETIC	41.200	1.660	40.857	1.437	40.771	1.437	40.000	0.000	41.080	1.429	43.744	1.765	43.411	1.804	43.007	1.784	42.894	1.689	120.000	0.005	45.065	1.641
		pS1[2]	z50 for NMFS survey selectivity (males, 1982+)	1	ARITHMETIC	34.918	4.148	68.596	3.072	68.591	3.078	60.936	2.972	69.000	0.001	69.000	0.000	69.000	0.000	69.000	0.000	69.000	0.000	69.000	0.000	69.000	0.000
		pS1[20]	z50 for GF.AllGear selectivity (males, 1987-1996)	1	ARITHMETIC	40.000	0.000	45.282	3.076	45.217	3.066	43.698	2.821	44.167	2.666	65.457	8.937	66.283	6.324	76.786	7.404	75.548	6.923	115.253	10.211	77.433	5.824
		pS1[21]	z50 for GF.AllGear selectivity (males, 1997+)	1	ARITHMETIC	76.113	2.531	85.913	3.251	85.970	3.254	86.321	3.061	85.793	3.254	82.834	2.935	84.439	3.207	90.515	3.404	90.448	3.404	109.945	6.648	91.855	2.921
		pS1[22]	z95 for RKF selectivity (males, pre-1997)	1	ARITHMETIC	158.210	6.552	160.734	6.503	160.744	6.501	180.000	0.000	154.103	5.611	155.028	5.936	180.000	0.000	180.000	0.001	180.000	0.000	137.289	43.713	180.000	0.001
		pS1[23]	z95 for RKF selectivity (males, 1997-2004)	1	ARITHMETIC	180.000	0.005	169.077	13.750	169.137	13.762	161.648	14.504	155.116	9.169	155.619	8.713	159.910	12.532	158.960	12.556	160.418	12.732	95.000	0.012	166.594	6.109
		pS1[24]	z95 for RKF selectivity (males, 2005+)	1	ARITHMETIC	180.000	0.000	177.909	7.794	177.948	7.800	164.998	6.956	180.000	0.001	180.000	0.001	170.329	6.635	168.954	6.567	170.852	6.758	143.617	13.851	173.672	3.117
		pS1[25]	z95 for RKF selectivity (females, pre-1997)	1	ARITHMETIC	121.572	37.669	117.250	26.030	117.276	26.079	115.304	22.322	108.855	4.256	111.176	11.067	120.973	16.115	119.203	15.417	119.421	15.251	100.000	0.005	123.090	3.966
		pS1[26]	z95 for RKF selectivity (females, 1997-2004)	1	ARITHMETIC	121.215	53.480	117.665	46.346	117.690	46.434	120.118	54.721	140.000	0.006	140.000	0.013	140.000	0.068	140.000	0.043	140.000	0.038	100.000	0.005	119.061	4.363
		pS1[27]	z95 for RKF selectivity (females, 2005+)	1	ARITHMETIC	140.000	0.034	140.000	0.130	140.000	0.128	140.000	0.090	140.000	0.193	140.000	0.025	133.191	23.794	130.856	22.910	129.029	21.302	119.271	27.186	128.748	3.260
		pS1[28]	z50 for TCF retention (2005-2009)	1	ARITHMETIC	138.717	1.632	138.372	2.241	138.374	2.234	138.265	2.680	140.758	0.531	140.646	0.532	140.641	0.524	140.651	0.526	140.567	0.524	139.558	1.763	140.605	0.558
		pS1[29]	z50 for TCF retention (2013-2015)	1	ARITHMETIC	125.037	0.758	125.122	0.758	125.122	0.758	124.991	0.759	124.826	0.606	124.675	0.613	125.016	0.591	124.928	0.596	124.973	0.591	85.000	0.002	124.952	0.704
		pS1[3]	z50 for NMFS survey selectivity (females, pre-1982)	1	ARITHMETIC	56.293	2.856	100.000	0.000	100.000	0.000	57.880	0.000	100.000	0.000	100.000	0.000	100.000	0.000	100.000	0.000	100.000	0.000	91.806	1.906	100.000	0.000
		pS1[4]	z50 for NMFS survey selectivity (females, 1982+)	1	ARITHMETIC	-29.135	26.960	-45.712	63736.000	-49.820	2736.100	-32.890	226010.000	-44.641	78049.000	27.253	7.721	16.230	9.388	7.237	11.219	8.786	7.991	69.000	0.000	32.560	6.784
		pS1[5]	z50 for TCF retention (pre-1991)	1	ARITHMETIC	137.986	0.416	137.306	0.341	137.300	0.341	134.746	0.634	137.457	0.331	137.295	0.318	136.492	0.418	136.456	0.426	136.484	0.420	85.000	0.001	133.270	0.689
		pS1[6]	z50 for TCF retention (1991-1996)	1	ARITHMETIC	137.498	0.249	137.842	0.263	137.841	0.263	137.627	0.250	138.548	0.389	138.996	0.394	138.434	0.363	138.424	0.364	138.423	0.362	85.000	0.001	138.322	0.454
		pS1[7]	DUMMY VALUE	1	ARITHMETIC	4.884	0.000	4.884	0.000	4.884	0.000	4.884	0.000	4.884	0.000	4.500	0.000	4.500	0.000	4.500	0.000	4.500	0.000	4.500	0.000	4.500	0.000
		pS1[8]	ln(z50) for TCF selectivity (males)	1	ARITHMETIC	4.865	0.008	4.864	0.006	4.864	0.006	4.942	0.008	4.856	0.005	4.855	0.005	4.987	0.006	4.981	0.006	4.986	0.006	4.803	0.017	4.997	0.007
		pS1[9]	z50 for TCF selectivity (females)	1	ARITHMETIC	96.581	2.622	94.792	2.009	94.800	2.012	94.247	1.955	95.000	2.086	94.881	1.904	94.764	2.012	94.749	2.004	94.850	2.024	80.000	0.001	97.267	1.048
		pS2[1]	z95-z50 for NMFS survey selectivity (males, pre-	1	ARITHMETIC	23.496	3.492	67.089	3.006	67.279	3.019	24.042	0.000	66.790	2.992	57.900	2.706	59.625	2.908	68.246	3.491	72.417	3.591	31.215	3.303	69.015	3.771
		pS2[10]	ascending slope for SCF selectivity (males, pre-1997)	1	ARITHMETIC	0.374	0.129	0.266	0.091	0.265	0.090	0.299	0.132	0.270	0.095	0.353	0.094	0.235	0.055	0.123	0.019	0.125	0.020	0.370	0.159	0.124	0.011
		pS2[11]	ascending slope for SCF selectivity (males, 1997-	1	ARITHMETIC	0.208	0.063	0.181	0.042	0.180	0.042	0.207	0.050	0.179	0.039	0.183	0.038	0.204	0.044	0.151	0.025	0.145	0.023	0.100	0.000	0.136	0.010
		pS2[12]	ascending slope for SCF selectivity (males, 2005+)	1	ARITHMETIC	0.175	0.015	0.167	0.011	0.167	0.011	0.166	0.011	0.166	0.010	0.170	0.010	0.170	0.010	0.167	0.010	0.166	0.010	0.134	0.041	0.171	0.006
		pS2[13]	slope for SCF selectivity (females, pre-1997)	1	ARITHMETIC	0.220	0.128	0.261	0.179	0.261	0.178	0.257	0.175	0.366	0.405	0.500	0.001	0.500	0.001	0.189	0.097	0.200	0.103	0.050	0.000	0.262	0.045
		pS2[14]	slope for SCF selectivity (females, 1997-2004)	1	ARITHMETIC	0.264	0.129	0.274	0.139	0.274	0.139	0.278	0.141	0.252	0.113	0.270	0.108	0.292	0.120	0.411	0.260	0.397	0.246	0.050	0.000	0.288	0.041
		pS2[15]	slope for SCF selectivity (females, 2005+)	1	ARITHMETIC	0.156	0.049	0.161	0.053	0.161	0.053	0.183	0.059	0.074	0.006	0.082	0.012	0.081	0.005	0.090	0.015	0.092	0.016	0.273	0.393	0.140	0.014
		pS2[16]	slope for GF.AllGear selectivity (males, pre-1987)	1	ARITHMETIC	0.104	0.010	0.074	0.007	0.074	0.007	0.087	0.009	0.074	0.007	0.063	0.005	0.061	0.006	0.067	0.007	0.067	0.007	0.059	0.008	0.061	0.005
		pS2[17]	slope for GF.AllGear selectivity (males, 1987-1996)	1	ARITHMETIC	0.057	0.012	0.043	0.004	0.043	0.004	0.043	0.004	0.042	0.004	0.039	0.003	0.035	0.002	0.036	0.002	0.035	0.002	0.065	0.004	0.037	0.001
		pS2[18]	slope for GF.AllGear selectivity (males, 1997+)	1	ARITHMETIC	0.074	0.004	0.060	0.002	0.060	0.002	0.059	0.002	0.059	0.002	0.061	0.002	0.058	0.002	0.059	0.002	0.057	0.002	0.066	0.003	0.057	0.002
		pS2[19]	slope for GF.AllGear selectivity (females, pre-1987)	1	ARITHMETIC	0.137	0.022	0.147	0.021	0.147	0.021	0.154	0.021	0.147	0.021	0.123	0.018	0.122	0.018	0.123	0.018	0.127	0.018	0.040	0.005	0.113	0.013
		pS2[2]	z95-z50 for NMFS survey selectivity (males, 1982+)	1	ARITHMETIC	75.073	10.254	88.352	5.364	88.435	5.375	87.540	5.777	88.935	4.104	76.994	4.168	85.913	5.270	85.839	5.256	100.000	0.007	28.073	1.872	92.864	5.849
		pS2[20]	slope for GF.AllGear selectivity (females, 1987-1996)	1	ARITHMETIC	0.185	0.038	0.110	0.035	0.110	0.035	0.115	0.039	0.118	0.035	0.055	0.013	0.049	0.009	0.040	0.006	0.043	0.006	0.064	0.009	0.043	0.005
		pS2[21]	slope for GF.AllGear selectivity (females, 1997+)	1	ARITHMETIC	0.072	0.006	0.062	0.005	0.062	0.005	0.062	0.004	0.062	0.005	0.075	0.005	0.072	0.005	0.066	0.004	0.066	0.004	0.082	0.008	0.067	0.004
		pS2[22]	ln(z95-z50) for RKF selectivity (males, pre-1997)	1	ARITHMETIC	3.077	0.162	3.097	0.150	3.097	0.150	3.154	0.060	2.994	0.156	3.023	0.159	3.202	0.059	3.214	0.060	3.204	0.060	3.534	1.170	3.230	0.028
		pS2[23]	ln(z95-z50) for RKF selectivity (males, 1997-2004)	1	ARITHMETIC	3.552	0.085	3.402	0.199	3.403	0.199	3.322	0.229	3.218	0.201	3.206	0.190	3.256	0.211	3.243	0.214	3.260	0.211	3.438	0.864	3.331	0.087
		pS2[24]	ln(z95-z50) for RKF selectivity (males, 2005+)	1	ARITHMETIC	3.487	0.044	3.442	0.104	3.442	0.104	3.312	0.118	3.446	0.036	3.432	0.035	3.323	0.101	3.312	0.103	3.331	0.102	2.500	0.004	3.347	0.044
		pS2[25]	ln(z95-z50) for RKF selectivity (males, pre-1997)	1	ARITHMETIC	2.785	0.684	2.743	0.633	2.743	0.633	2.706	0.605	2.500	0.011	2.544	0.421	2.725	0.373	2.696	0.386	2.702	0.382	4.000	0.000	2.773	0.070
		pS2[26]	ln(z95-z50) for RKF selectivity (males, 1997-2004)	1	ARITHMETIC	2.849	0.903	2.818	0.961	2.819	0.962	2.864	1.003	3.455	0.133	3.379	0.151	3.517	0.324	3.554	0.313	3.554	0.309	4.000	0.000	2.790	0.096
		pS2[27]	ln(z95-z50) for RKF selectivity (males, 2005+)	1	ARITHMETIC	2.991	0.220	3.055	0.215	3.055	0.215	3.066	0.215	3.217	0.103	3.137	0.122	3.182	0.393	3.167	0.406	3.111	0.399	3.151	0.653	2.928	0.049
		pS2[28]	slope for TCF retention (2005-2009)	1	ARITHMETIC	0.894	0.725	1.097	1.688	1.095	1.678	1.170	2.383	0.598	0.114	0.611	0.117	0.618	0.117	0.615	0.117	0.626	0.119	2.000	0.004	0.668	0.155
		pS2[29]	slope for TCF retention (2013-2015)	1	ARITHMETIC	0.576	0.126	0.565	0.121	0.565	0.121	0.584	0.129	0.610	0.127	0.619	0.134	0.573	0.113	0.586	0.118	0.579	0.115	2.000	0.020	0.590	0.154
		pS2[3]	z95-z50 for NMFS survey selectivity (females, pre-	1	ARITHMETIC	39.982	5.871	70.244	3.972	70.509	4.001	43.747	0.000	69.239	3.853	66.428	3.117	68.788	4.254	67.638	4.031	66.027	3.630	35.078	2.995	54.342	2.958
		pS2[4]	z95-z50 for NMFS survey selectivity (females, 1982+)	1	ARITHMETIC	100.000	0.002	6.754	82864.000	9.667	7266.500	0.194	2742.000	7.719	33428.000	100.000	0.000	100.000	0.000	100.000	0.000	100.000	0.000	54.080	3.441	100.000	0.000
		pS2[5]	slope for TCF retention (pre-1991)	1	ARITHMETIC	0.690	0.126	0.772	0.127	0.772	0.127	0.727	0.160	0.782	0.128	0.825	0.131	0.833	0.132	0.825	0.132	0.823	0.131	1.000	0.007	1.000	0.015
		pS2[6]	slope for TCF retention (1997+)	1	ARITHMETIC	0.956	0.192	1.025	0.277	1.024	0.277	0.959	0.235	0.891	0.208	0.738	0.124	0.817	0.175	0.818	0.177	0.816	0.175	2.000	0.010	0.820	0.240
		pS2[7]	slope for TCF selectivity (males, pre-1997)	1	ARITHMETIC	0.118	0.006	0.127	0.006	0.127	0.006	0.099	0.004	0.127	0.006	0.133	0.006	0.087	0.003	0.085	0.003	0.084	0.003	0.069	0.004	0.083	0.003
		pS2[8]	slope for TCF selectivity (males, 1997+)	1	ARITHMETIC	0.155	0.008	0.169	0.008	0.169	0.008	0.171	0.008	0.184	0.008	0.181	0.008	0.175	0.007	0.179	0.008	0.177	0.007	0.400	0.000	0.173	0.007
		pS2[9]	slope for TCF selectivity (females)	1	ARITHMETIC	0.187	0.019	0.192	0.019	0.192	0.019	0.194	0.020	0.188	0.019	0.197	0.019	0.197	0.019	0.197	0.019	0.196	0.019	0.050	0.000	0.192	0.007
		pS3[1]	ln(dz50-az50) for SCF selectivity (males, pre-1997)	1	ARITHMETIC	3.956	0.040	3.581	0.170	3.578	0.171	3.398	0.235	3.670	0.148	3.652	0.077	3.676	0.078	2.000	0.000	2.000	0.000	2.000	0.008	2.000	0.000
		pS3[2]	ln(dz50-az50) for SCF selectivity (males, 1997-2004)	1	ARITHMETIC	3.730	0.210	3.718	0.190	3.718	0.190	3.863	0.146	3.715	0.172	3.748	0.155	3.886	0.145	3.278	0.320	3.133	0.352	2.000	0.121	2.000	0.001
		pS3[3]	ln(dz50-az50) for SCF selectivity (males, 2005+)	1	ARITHMETIC	3.446	0.082	3.333	0.090	3.334	0.090	3.344	0.088	3.329	0.091	3.348	0.085	3.378	0.080	3.317	0.101	3.315	0.105	4.416	94.953	3.367	0.051
		pS4[1]	descending slope for SCF selectivity (males, pre-	1	ARITHMETIC	0.500	0.001	0.100	0.000	0.100	0.000	0.100	0.000	0.100	0.000	0.138	0.024	0.139	0.021	0.100	0.000	0.100	0.000	0.100	0.000	0.100	0.000
		pS4[2]	descending slope for SCF selectivity (males, 1997-	1	ARITHMETIC	0.130	0.081	0.163	0.107	0.163	0.107	0.208	0.143	0.162	0.104	0.177	0.114	0.210	0.156	0.100	0.000	0.100	0.000	0.100	0.001	0.100	0.000
		pS4[3]	descending slope for SCF selectivity (males, 2005+)	1	ARITHMETIC	0.185	0.024	0.191	0.026	0.191	0.026	0.195	0.026	0.188	0.026	0.193	0.027	0.192	0.028	0.184	0.028	0.182	0.028	0.350	62.038	0.190	0.016

Table B.11. Estimated fishery and survey-related model parameter values and standard deviations for the B model scenarios.

						Scenarios B0		B0-Fr		B0-Mcl		B0a		B0b		B0c		B0q		B1		B1b		B1c	
category	process	name	label	index	parameter scale	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.
fisheries	fisheries	pDC2[1]	TCF: female offset	1	ARITHMETIC	-2.323	0.304	-1.193	0.580	-2.110	0.230	-2.307	0.000	-3.585	0.492	-3.592	0.493	-2.029	0.292	-2.445	0.320	-3.687	0.531	-3.653	0.000
		pDC2[2]	SCF: female offset	1	ARITHMETIC	-1.759	0.151	-1.843	0.301	-1.940	0.116	-1.734	0.000	-1.721	0.152	-1.722	0.151	-1.499	0.156	-1.773	0.155	-1.716	0.153	-1.712	0.000
		pDC2[3]	GTF: female offset	1	ARITHMETIC	-0.956	0.072	-0.447	0.341	-0.881	0.060	-0.890	0.000	-0.931	0.073	-0.931	0.070	-0.704	0.061	-1.025	0.081	-0.926	0.074	-0.922	0.000
		pDC2[4]	RKF: female offset	1	ARITHMETIC	-0.835	2.864	4.084	3.438	-1.575	1.038	-0.779	0.000	-2.854	2.304	-2.857	2.310	-0.414	4.626	-0.958	2.728	-2.866	2.323	-2.855	0.000
		pHM[1]	handling mortality for pot fisheries	1	ARITHMETIC	0.321	0.000	0.321	0.000	0.321	0.000	0.321	0.000	0.321	0.000	0.321	0.000	0.321	0.000	0.321	0.000	0.321	0.000	0.321	0.000
		pHM[2]	handling mortality for groundfish trawl fisheries	1	ARITHMETIC	0.800	0.000	0.800	0.000	0.800	0.000	0.800	0.000	0.800	0.000	0.800	0.000	0.800	0.000	0.800	0.000	0.800	0.000	0.800	0.000
		pLgtRet[1]	TCF: logit-scale max retention (pre-1997)	1	ARITHMETIC	14.999	2.251	14.986	54.419	15.000	1.650	14.999	0.000	14.999	2.457	14.999	2.455	14.999	2.309	14.999	2.319	14.999	2.433	14.999	0.000
		pLgtRet[2]	TCF: logit-scale max retention (2005-2009)	1	ARITHMETIC	2.011	1.197	14.147	3419.700	1.959	1.104	2.017	0.000	2.695	2.317	2.697	2.320	1.966	1.178	1.982	1.193	2.660	2.252	2.659	0.000
		pLgtRet[3]	TCF: logit-scale max retention (2013-2015)	1	ARITHMETIC	4.159	2.554	14.407	3367.800	5.076	5.520	4.003	0.000	4.485	3.547	4.474	3.506	4.219	2.735	4.887	5.410	4.388	3.227	4.389	0.000
		pLnC[1]	TCF: base capture rate, pre-1965 (=0.05)	1	ARITHMETIC	-2.996	0.000	-2.996	0.000	-2.996	0.000	-2.996	0.000	-2.996	0.000	-2.996	0.000	-2.996	0.000	-2.996	0.000	-2.996	0.000	-2.996	0.000
		pLnC[2]	TCF: base capture rate, 1965+	1	ARITHMETIC	-1.355	0.085	-1.036	0.185	-1.416	0.081	-1.375	0.000	-0.764	0.131	-0.686	0.144	-1.565	0.089	-1.389	0.086	-0.782	0.103	-0.774	0.000
		pLnC[3]	SCF: base capture rate, pre-1978 (=0.01)	1	ARITHMETIC	-4.605	0.000	-4.605	0.000	-4.605	0.000	-4.605	0.000	-4.605	0.000	-4.605	0.000	-4.605	0.000	-4.605	0.000	-4.605	0.000	-4.605	0.000
		pLnC[4]	SCF: base capture rate, 1992+	1	ARITHMETIC	-2.834	0.102	-1.200	0.233	-2.910	0.087	-2.829	0.000	-3.082	0.189	-3.076	0.189	-3.121	0.135	-3.035	0.123	-3.144	0.186	-3.150	0.000
		pLnC[5]	DUMMY CAPTURE RATE	1	ARITHMETIC	-4.181	0.000	-4.181	0.000	-4.181	0.000	-4.181	0.000	-4.181	0.000	-4.181	0.000	-4.181	0.000	-4.181	0.000	-4.181	0.000	-4.181	0.000
		pLnC[6]	GTF: base capture rate, ALL YEARS	1	ARITHMETIC	-4.331	0.065	-3.597	0.108	-4.461	0.065	-4.333	0.000	-4.412	0.075	-4.408	0.075	-4.616	0.072	-4.504	0.072	-4.469	0.077	-4.471	0.000
		pLnC[7]	RKF: base capture rate, pre-1953 (=0.02)	1	ARITHMETIC	-3.912	0.000	-3.912	0.000	-3.912	0.000	-3.912	0.000	-3.912	0.000	-3.912	0.000	-3.912	0.000	-3.912	0.000	-3.912	0.000	-3.912	0.000
		pLnC[8]	RKF: base capture rate, 1992+	1	ARITHMETIC	-3.958	0.162	-3.326	0.486	-3.935	0.149	-3.968	0.000	-5.261	2.880	-5.267	32.962	-4.248	0.166	-4.060	0.165	-5.362	140.070	-5.341	0.000
surveys	surveys	pQ[1]	NMFS trawl survey: males, 1975-1981	1	LOG	-0.693	0.000	-0.644	0.166	-0.693	0.000	-0.691	0.000	-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.693	0.000
		pQ[2]	NMFS trawl survey: males, 1982+	1	LOG	-0.443	0.054	-0.108	0.049	-0.580	0.056	-0.443	0.000	-0.474	0.053	-0.469	0.053	-0.780	0.067	-0.614	0.066	-0.537	0.057	-0.540	0.000
		pQ[3]	NMFS trawl survey: females, 1975-1981	1	LOG	-0.693	0.000	0.001	0.004	-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.693	0.000
		pQ[4]	NMFS trawl survey: females, 1982+	1	LOG	-0.911	0.073	-0.131	0.055	-0.999	0.077	-0.882	0.000	-0.899	0.074	-0.896	0.070	-0.911	0.000	-1.182	0.092	-0.965	0.079	-0.958	0.000

Table B.12. Estimated fishery and survey-related model parameter values and standard deviations for B0 and the C model scenarios.

						Scenarios B0		C0		C0a		C0b		C0c		C1		C1b		C1c	
category	process	name	label	index	parameter scale	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.
fisheries	fisheries	pDC2[1]	TCF: female offset	1	ARITHMETIC	-2.323	0.304	-2.773	0.329	-2.774	0.332	-4.362	0.574	-4.026	0.000	-2.723	0.328	-4.822	0.539	-4.228	0.743
		pDC2[2]	SCF: female offset	1	ARITHMETIC	-1.759	0.151	-1.907	0.159	-1.910	0.160	-1.907	0.156	-1.864	0.000	-1.900	0.160	-2.293	0.239	-1.855	0.154
		pDC2[3]	GTF: female offset	1	ARITHMETIC	-0.956	0.072	-1.279	0.087	-1.276	0.089	-1.247	0.090	-1.111	0.000	-1.269	0.084	-1.266	0.092	-1.112	0.075
		pDC2[4]	RKF: female offset	1	ARITHMETIC	-0.835	2.864	-1.245	2.770	-1.246	2.790	-3.476	2.439	-3.252	0.000	-1.232	2.769	-3.543	2.449	-3.315	2.327
		pHM[1]	handling mortality for pot fisheries	1	ARITHMETIC	0.321	0.000	0.321	0.000	0.321	0.000	0.321	0.000	0.321	0.000	0.321	0.000	0.321	0.000	0.321	0.000
		pHM[2]	handling mortality for groundfish trawl fisheries	1	ARITHMETIC	0.800	0.000	0.800	0.000	0.800	0.000	0.800	0.000	0.800	0.000	0.800	0.000	0.800	0.000	0.800	0.000
		pLgtRet[1]	TCF: logit-scale max retention (pre-1997)	1	ARITHMETIC	14.999	2.251	14.999	2.245	14.999	2.272	14.999	2.503	14.999	0.000	14.999	2.203	14.999	2.404	14.999	2.327
		pLgtRet[2]	TCF: logit-scale max retention (2005-2009)	1	ARITHMETIC	2.011	1.197	1.956	1.176	1.956	1.177	2.823	2.687	2.457	0.000	1.904	1.125	2.895	2.895	2.852	2.726
		pLgtRet[3]	TCF: logit-scale max retention (2013-2015)	1	ARITHMETIC	4.159	2.554	14.925	278.860	14.199	541.770	14.971	114.320	4.746	0.000	14.897	380.770	14.973	104.660	4.816	5.303
		pLnC[1]	TCF: base capture rate, pre-1965 (=0.05)	1	ARITHMETIC	-2.996	0.000	-2.996	0.000	-2.996	0.000	-2.996	0.000	-2.996	0.000	-2.996	0.000	-2.996	0.000	-2.996	0.000
		pLnC[2]	TCF: base capture rate, 1965+	1	ARITHMETIC	-1.355	0.085	-1.495	0.086	-1.511	0.086	-1.039	0.231	-0.951	0.000	-1.439	0.077	-0.734	0.156	-0.831	0.125
		pLnC[3]	SCF: base capture rate, pre-1978 (=0.01)	1	ARITHMETIC	-4.605	0.000	-4.605	0.000	-4.605	0.000	-4.605	0.000	-4.605	0.000	-4.605	0.000	-4.605	0.000	-4.605	0.000
		pLnC[4]	SCF: base capture rate, 1992+	1	ARITHMETIC	-2.834	0.102	-3.122	0.114	-3.150	0.116	-3.308	0.188	-3.129	0.000	-3.199	0.115	-3.316	0.187	-3.207	0.184
		pLnC[5]	DUMMY CAPTURE RATE	1	ARITHMETIC	-4.181	0.000	-4.181	0.000	-4.181	0.000	-4.181	0.000	-4.181	0.000	-4.181	0.000	-4.181	0.000	-4.181	0.000
		pLnC[6]	GTF: base capture rate, ALL YEARS	1	ARITHMETIC	-4.331	0.065	-4.508	0.075	-4.531	0.075	-4.531	0.081	-4.417	0.000	-4.573	0.067	-4.618	0.078	-4.480	0.079
		pLnC[7]	RKF: base capture rate, pre-1953 (=0.02)	1	ARITHMETIC	-3.912	0.000	-3.912	0.000	-3.912	0.000	-3.912	0.000	-3.912	0.000	-3.912	0.000	-3.912	0.000	-3.912	0.000
		pLnC[8]	RKF: base capture rate, 1992+	1	ARITHMETIC	-3.958	0.162	-4.037	0.169	-4.057	0.169	-5.375	21.687	-5.439	0.000	-4.120	0.162	-5.410	79.171	-5.367	1.224
surveys	surveys	pQ[1]	NMFS trawl survey: males, 1975-1981	1	LOG	-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.693	0.000
		pQ[2]	NMFS trawl survey: males, 1982+	1	LOG	-0.443	0.054	-0.709	0.066	-0.733	0.068	-0.683	0.061	-0.532	0.000	-0.792	0.052	-0.797	0.051	-0.604	0.059
		pQ[3]	NMFS trawl survey: females, 1975-1981	1	LOG	-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.693	0.000
		pQ[4]	NMFS trawl survey: females, 1982+	1	LOG	-0.911	0.073	-1.533	0.078	-1.565	0.087	-1.479	0.074	-1.206	0.000	-1.609	0.000	-1.609	0.002	-1.278	0.075

Table B.13. Estimated fishery and survey-related model parameter values and standard deviations for B0 and the D model scenarios.

						Scenarios															
						B0		D0		D0a		D0b		D0c		D1		D1b		D1c	
category	process	name	label	index	parameter scale	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.
fisheries	fisheries	pDC2[1]	TCF: female offset	1	ARITHMETIC	-2.323	0.304	-3.099	0.277	-3.097	0.277	-4.679	0.284	-4.592	0.000	-3.049	0.275	-4.619	0.281	-4.561	0.274
		pDC2[2]	SCF: female offset	1	ARITHMETIC	-1.759	0.151	-2.252	0.188	-2.251	0.189	-2.439	0.267	-2.444	0.000	-2.235	0.190	-2.391	0.245	-2.391	0.239
		pDC2[3]	GTF: female offset	1	ARITHMETIC	-0.956	0.072	-1.094	0.072	-1.089	0.072	-1.057	0.074	-0.904	0.000	-1.077	0.072	-1.065	0.075	-0.980	0.069
		pDC2[4]	RKF: female offset	1	ARITHMETIC	-0.835	2.864	-1.842	2.006	-1.838	2.012	-3.659	1.763	-3.553	0.000	-1.813	2.013	-3.617	1.774	-3.561	1.698
		pHM[1]	handling mortality for pot fisheries	1	ARITHMETIC	0.321	0.000	0.321	0.000	0.321	0.000	0.321	0.000	0.321	0.000	0.321	0.000	0.321	0.000	0.321	0.000
		pHM[2]	handling mortality for groundfish trawl fisheries	1	ARITHMETIC	0.800	0.000	0.800	0.000	0.800	0.000	0.800	0.000	0.800	0.000	0.800	0.000	0.800	0.000	0.800	0.000
		pLgtRet[1]	TCF: logit-scale max retention (pre-1997)	1	ARITHMETIC	14.999	2.251	14.999	2.119	14.999	2.116	14.999	2.455	14.999	0.000	15.000	1.940	14.999	2.496	14.999	2.269
		pLgtRet[2]	TCF: logit-scale max retention (2005-2009)	1	ARITHMETIC	2.011	1.197	2.289	1.558	2.285	1.553	4.286	10.871	3.494	0.000	2.222	1.465	4.232	10.357	3.543	5.169
		pLgtRet[3]	TCF: logit-scale max retention (2013-2015)	1	ARITHMETIC	4.159	2.554	14.923	387.370	14.203	1683.800	14.961	148.070	4.846	0.000	7.932	117.570	14.965	133.180	5.693	12.271
		pLnC[1]	TCF: base capture rate, pre-1965 (=0.05)	1	ARITHMETIC	-2.996	0.000	-2.996	0.000	-2.996	0.000	-2.996	0.000	-2.996	0.000	-2.996	0.000	-2.996	0.000	-2.996	0.000
		pLnC[2]	TCF: base capture rate, 1965+	1	ARITHMETIC	-1.355	0.085	-1.557	0.074	-1.560	0.074	-0.780	0.145	-0.744	0.000	-1.487	0.069	-0.764	0.096	-0.776	0.087
		pLnC[3]	SCF: base capture rate, pre-1978 (=0.01)	1	ARITHMETIC	-4.605	0.000	-4.605	0.000	-4.605	0.000	-4.605	0.000	-4.605	0.000	-4.605	0.000	-4.605	0.000	-4.605	0.000
		pLnC[4]	SCF: base capture rate, 1992+	1	ARITHMETIC	-2.834	0.102	-3.100	0.154	-3.105	0.154	-3.188	0.204	-2.982	0.000	-3.112	0.168	-3.267	0.199	-3.117	0.199
		pLnC[5]	DUMMY CAPTURE RATE	1	ARITHMETIC	-4.181	0.000	-4.181	0.000	-4.181	0.000	-4.181	0.000	-4.181	0.000	-4.181	0.000	-4.181	0.000	-4.181	0.000
		pLnC[6]	GTF: base capture rate, ALL YEARS	1	ARITHMETIC	-4.331	0.065	-4.604	0.059	-4.607	0.059	-4.573	0.075	-4.419	0.000	-4.621	0.059	-4.629	0.077	-4.519	0.074
		pLnC[7]	RKF: base capture rate, pre-1953 (=0.02)	1	ARITHMETIC	-3.912	0.000	-3.912	0.000	-3.912	0.000	-3.912	0.000	-3.912	0.000	-3.912	0.000	-3.912	0.000	-3.912	0.000
		pLnC[8]	RKF: base capture rate, 1992+	1	ARITHMETIC	-3.958	0.162	-4.114	0.164	-4.119	0.163	-5.468	23.119	-5.653	0.000	-4.150	0.163	-5.560	103.420	-5.909	25.466
surveys	surveys	pQ[1]	NMFS trawl survey: males, 1975-1981	1	LOG	-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.693	0.000
		pQ[2]	NMFS trawl survey: males, 1982+	1	LOG	-0.443	0.054	-0.829	0.042	-0.834	0.042	-0.736	0.053	-0.574	0.000	-0.859	0.043	-0.809	0.057	-0.682	0.051
		pQ[3]	NMFS trawl survey: females, 1975-1981	1	LOG	-0.693	0.000	-0.564	0.076	-0.559	0.076	-0.526	0.080	-0.693	0.000	-0.535	0.076	-0.538	0.080	-0.693	0.000
		pQ[4]	NMFS trawl survey: females, 1982+	1	LOG	-0.911	0.073	-1.609	0.000	-1.609	0.000	-1.498	0.060	-1.197	0.000	-1.609	0.000	-1.576	0.064	-1.361	0.057

Table B.14. Estimated fishery and survey-related model parameter values and standard deviations for B0 and the E model scenarios.

						Scenarios															
						B0		E0		E0a		E0b		E0c		E1		E1b		E1c	
category	process	name	label	index	parameter scale	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.
fisheries	fisheries	pDC2[1]	TCF: female offset	1	ARITHMETIC	-2.323	0.304	-2.818	0.000	-2.814	0.260	-3.181	0.000	-4.271	0.266	-2.750	0.256	-4.163	0.267	-4.208	0.264
		pDC2[2]	SCF: female offset	1	ARITHMETIC	-1.759	0.151	-2.266	0.000	-2.265	0.172	-2.375	0.000	-2.354	0.177	-2.252	0.173	-2.385	0.200	-2.366	0.179
		pDC2[3]	GTF: female offset	1	ARITHMETIC	-0.956	0.072	-1.172	0.000	-1.169	0.064	-1.168	0.000	-1.021	0.059	-1.170	0.065	-1.144	0.065	-1.086	0.061
		pDC2[4]	RKF: female offset	1	ARITHMETIC	-0.835	2.864	-1.653	0.000	-1.652	2.020	-2.642	0.000	-3.245	1.678	-1.633	2.003	-3.200	1.744	-3.237	1.674
		pHM[1]	handling mortality for pot fisheries	1	ARITHMETIC	0.321	0.000	0.321	0.000	0.321	0.000	0.321	0.000	0.321	0.000	0.321	0.000	0.321	0.000	0.321	0.000
		pHM[2]	handling mortality for groundfish trawl fisheries	1	ARITHMETIC	0.800	0.000	0.800	0.000	0.800	0.000	0.800	0.000	0.800	0.000	0.800	0.000	0.800	0.000	0.800	0.000
		pLgtRet[1]	TCF: logit-scale max retention (pre-1997)	1	ARITHMETIC	14.999	2.251	14.999	0.000	14.999	1.982	14.999	0.000	14.999	2.045	15.000	1.915	14.999	2.384	14.999	2.124
		pLgtRet[2]	TCF: logit-scale max retention (2005-2009)	1	ARITHMETIC	2.011	1.197	1.967	0.000	1.962	1.117	2.703	0.000	2.864	2.509	1.916	1.078	3.210	3.695	2.823	2.454
		pLgtRet[3]	TCF: logit-scale max retention (2013-2015)	1	ARITHMETIC	4.159	2.554	5.707	0.000	4.127	2.506	4.501	0.000	3.646	1.516	4.102	2.445	5.059	6.440	3.794	1.771
		pLnC[1]	TCF: base capture rate, pre-1965 (=0.05)	1	ARITHMETIC	-2.996	0.000	-2.996	0.000	-2.996	0.000	-2.996	0.000	-2.996	0.000	-2.996	0.000	-2.996	0.000	-2.996	0.000
		pLnC[2]	TCF: base capture rate, 1965+	1	ARITHMETIC	-1.355	0.085	-1.433	0.000	-1.437	0.073	-1.177	0.000	-0.554	0.129	-1.430	0.073	-0.632	0.083	-0.611	0.159
		pLnC[3]	SCF: base capture rate, pre-1978 (=0.01)	1	ARITHMETIC	-4.605	0.000	-4.605	0.000	-4.605	0.000	-4.605	0.000	-4.605	0.000	-4.605	0.000	-4.605	0.000	-4.605	0.000
		pLnC[4]	SCF: base capture rate, 1992+	1	ARITHMETIC	-2.834	0.102	-2.955	0.000	-2.964	0.115	-3.126	0.000	-2.858	0.211	-3.008	0.130	-3.089	0.196	-2.927	0.200
		pLnC[5]	DUMMY CAPTURE RATE	1	ARITHMETIC	-4.181	0.000	-4.181	0.000	-4.181	0.000	-4.181	0.000	-4.181	0.000	-4.181	0.000	-4.181	0.000	-4.181	0.000
		pLnC[6]	GTF: base capture rate, ALL YEARS	1	ARITHMETIC	-4.331	0.065	-4.396	0.000	-4.404	0.063	-4.449	0.000	-4.174	0.066	-4.451	0.065	-4.406	0.073	-4.243	0.068
		pLnC[7]	RKF: base capture rate, pre-1953 (=0.02)	1	ARITHMETIC	-3.912	0.000	-3.912	0.000	-3.912	0.000	-3.912	0.000	-3.912	0.000	-3.912	0.000	-3.912	0.000	-3.912	0.000
		pLnC[8]	RKF: base capture rate, 1992+	1	ARITHMETIC	-3.958	0.162	-4.181	0.000	-4.189	0.167	-5.667	0.000	-5.913	4.097	-4.254	0.169	-5.378	9.838	-5.913	44.754
surveys	surveys	pQ[1]	NMFS trawl survey: males, 1975-1981	1	LOG	-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.693	0.000
		pQ[2]	NMFS trawl survey: males, 1982+	1	LOG	-0.443	0.054	-0.723	0.000	-0.733	0.050	-0.723	0.000	-0.423	0.037	-0.795	0.055	-0.674	0.050	-0.506	0.041
		pQ[3]	NMFS trawl survey: females, 1975-1981	1	LOG	-0.693	0.000	-0.398	0.000	-0.399	0.065	-0.392	0.000	-0.693	0.000	-0.403	0.065	-0.372	0.065	-0.693	0.000
		pQ[4]	NMFS trawl survey: females, 1982+	1	LOG	-0.911	0.073	-1.489	0.000	-1.500	0.053	-1.479	0.000	-1.043	0.038	-1.558	0.056	-1.422	0.052	-1.184	0.044

Table B.15. Estimated fishery and survey-related model parameter values and standard deviations for B0 and the F and G model scenarios.

						Scenarios																					
						B0		F0		F0a		F0c		G0		G0a		G0b		G0bd		G0bde		G0bde-Fr		G0bde-McI	
category	process	name	label	index	parameter scale	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.	param. value	std. dev.
fisheries	fisheries	pDC2[1]	TCF: female offset	1	ARITHMETIC	-2.323	0.304	-3.069	0.267	-3.072	0.267	-4.585	0.277	-2.538	0.173	-2.355	0.164	-2.821	0.176	-2.838	0.175	-2.813	0.177	-3.997	0.107	-2.627	0.127
		pDC2[2]	SCF: female offset	1	ARITHMETIC	-1.759	0.151	-2.404	0.188	-2.406	0.189	-2.583	0.232	-1.994	0.157	-1.763	0.149	-1.602	0.123	-2.506	0.224	-2.536	0.220	-4.111	0.636	-3.050	0.096
		pDC2[3]	GTF: female offset	1	ARITHMETIC	-0.956	0.072	-1.352	0.076	-1.350	0.076	-1.178	0.065	-1.360	0.075	-1.437	0.094	-1.367	0.099	-1.231	0.097	-1.173	0.095	-0.350	0.390	-1.192	0.092
		pDC2[4]	RKF: female offset	1	ARITHMETIC	-0.835	2.864	-1.858	2.002	-1.860	2.006	-3.494	1.733	-1.889	0.461	-1.458	0.593	-2.091	1.126	-2.277	1.034	-2.263	1.018	-2.870	0.377	-1.728	0.290
		pHM[1]	handling mortality for pot fisheries	1	ARITHMETIC	0.321	0.000	0.321	0.000	0.321	0.000	0.321	0.000	0.321	0.000	0.500	0.000	0.500	0.000	0.500	0.000	0.500	0.000	0.500	0.000	0.500	0.000
		pHM[2]	handling mortality for groundfish trawl fisheries	1	ARITHMETIC	0.800	0.000	0.800	0.000	0.800	0.000	0.800	0.000	0.800	0.000	0.500	0.000	0.500	0.000	0.500	0.000	0.500	0.000	0.500	0.000	0.500	0.000
		pLgtRet[1]	TCF: logit-scale max retention (pre-1997)	1	ARITHMETIC	14.999	2.251	15.000	1.824	15.000	1.827	15.000	1.874	14.999	3.106	14.999	4.016	14.910	78.048	14.997	12.709	14.997	10.912	0.535	0.060	14.994	24.084
		pLgtRet[2]	TCF: logit-scale max retention (2005-2009)	1	ARITHMETIC	2.011	1.197	1.837	0.978	1.837	0.978	2.423	1.635	14.875	251.920	14.402	262.450	14.794	185.540	14.988	44.906	14.989	40.662	14.993	25.414	14.993	24.840
		pLgtRet[3]	TCF: logit-scale max retention (2013-2015)	1	ARITHMETIC	4.159	2.554	4.121	2.524	4.117	2.514	3.608	1.482	14.999	5.290	14.998	9.885	14.619	179.560	14.993	27.186	14.993	26.173	1.372	0.184	14.993	27.164
		pLnC[1]	TCF: base capture rate, pre-1965 (=0.05)	1	ARITHMETIC	-2.996	0.000	-2.996	0.000	-2.996	0.000	-2.996	0.000	-2.996	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		pLnC[2]	TCF: base capture rate, 1965+	1	ARITHMETIC	-1.355	0.085	-1.397	0.067	-1.398	0.068	-0.699	0.165	-1.449	0.062	-1.754	0.073	-1.812	0.079	-0.903	0.185	-0.888	0.183	-0.462	0.183	-0.860	0.203
		pLnC[3]	SCF: base capture rate, pre-1978 (=0.01)	1	ARITHMETIC	-4.605	0.000	-4.605	0.000	-4.605	0.000	-4.605	0.000	-4.605	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		pLnC[4]	SCF: base capture rate, 1992+	1	ARITHMETIC	-2.834	0.102	-2.935	0.101	-2.936	0.101	-2.870	0.241	-3.074	0.096	-3.258	0.086	-3.345	0.078	-2.819	0.103	-2.832	0.107	-0.880	0.238	-2.756	0.059
		pLnC[5]	DUMMY CAPTURE RATE	1	ARITHMETIC	-4.181	0.000	-4.181	0.000	-4.181	0.000	-4.181	0.000	-4.181	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		pLnC[6]	GTF: base capture rate, ALL YEARS	1	ARITHMETIC	-4.331	0.065	-4.333	0.057	-4.334	0.057	-4.183	0.067	-4.358	0.045	-4.388	0.057	-4.370	0.049	-4.296	0.047	-4.340	0.047	-3.030	0.096	-4.364	0.049
		pLnC[7]	RKF: base capture rate, pre-1953 (=0.02)	1	ARITHMETIC	-3.912	0.000	-3.912	0.000	-3.912	0.000	-3.912	0.000	-3.912	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		pLnC[8]	RKF: base capture rate, 1992+	1	ARITHMETIC	-3.958	0.162	-4.173	0.185	-4.172	0.185	-6.816	21.705	-5.198	0.092	-5.286	0.095	-5.149	0.142	-5.099	0.138	-5.095	0.145	-5.187	0.419	-5.057	0.093
surveys	surveys	pQ[1]	NMFS trawl survey: males, 1975-1981	1	LOG	-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.693	0.000	-0.693	0.000	0.001	0.000	-0.693	0.000
		pQ[2]	NMFS trawl survey: males, 1982+	1	LOG	-0.443	0.054	-0.633	0.038	-0.634	0.038	-0.410	0.038	-0.628	0.022	-0.825	0.043	-0.819	0.042	-0.724	0.039	-0.758	0.036	-0.250	0.041	-0.870	0.044
		pQ[3]	NMFS trawl survey: females, 1975-1981	1	LOG	-0.693	0.000	-0.532	0.063	-0.532	0.063	-0.693	0.000	-0.491	0.063	-0.693	0.000	-0.681	0.072	-0.466	0.064	-0.418	0.063	0.001	0.001	-0.262	0.068
		pQ[4]	NMFS trawl survey: females, 1982+	1	LOG	-0.911	0.073	-1.609	0.000	-1.609	0.000	-1.280	0.037	-1.609	0.000	-1.609	0.000	-1.609	0.000	-1.609	0.000	-1.609	0.000	-0.741	0.054	-1.609	0.000

Appendix C: Model Parameters At Bounds

This appendix includes tables of model parameters, by model scenario, that were estimated at their bounds. These tables are also provided as an Excel spreadsheet (“ParamsAtBounds.xlsx”) in the supplementary online material.

Table C.1. Model parameters at bounds for model scenarios (“case”) B0, B0-Fr, B0-McI, B0a, B0b, B0c, B1, B1b, B1c, C0, C0a, C0b, C0c, C1, C1b, C1c, D0, D0a, D0b, D0c, D1, D1b, and D1c. Blue highlighting (value=1) indicates the parameter was at or near the upper bound; red highlighting (value=-1) indicates the parameter was at or near the lower bound. The final row gives the total number of parameters at one of their bounds for each model scenario.

Sum of test_val								case																							
category	process	name	label	index	parameter_scale	min_param	max_param	B0	B0-Fr	B0-McI	B0a	B0b	B0c	B0q	B1	B1b	B1c	C0	C0a	C0b	C0c	C1	C1b	C1c	D0	D0a	D0b	D0c	D1	D1b	D1c
fisheries	fisheries	pLgtRet[1]	TCF: logit-scale max retention (pre-1997)	1	ARITHMETIC	0	15	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
population processes	growth	pGrBeta[1]	both sexes	1	ARITHMETIC	0.5	1		-1									1		1	1			1	1	1	1	1	1	1	1
	maturity	pLgtPrM2M[1]	males (entire model period)	32	ARITHMETIC	-15	15	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		pLgtPrM2M[2]	females (entire model period)	1	ARITHMETIC	-15	15	-1		-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
selectivity	selectivity	pDevsS1[1]	ln(z50 devs) for TCF selectivity (males, 1991+)	4	ARITHMETIC	-0.5	0.5																							1	1
		pS1[1]	z50 for NMFS survey selectivity (males, pre-1982)	1	ARITHMETIC	0	90		1						1			1	1	1		1	1		1	1	1		1	1	
		pS1[12]	ascending z50 for SCF selectivity (males, 2005+)	1	ARITHMETIC	40	140		1																						
		pS1[19]	z50 for GF.AllGear selectivity (males, pre-1987)	1	ARITHMETIC	40	120				-1								-1	-1	-1	-1		-1				-1			
		pS1[20]	z50 for GF.AllGear selectivity (males, 1987-1996)	1	ARITHMETIC	40	250	-1		-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
		pS1[22]	z95 for RKF selectivity (males, pre-1997)	1	ARITHMETIC	95	180		-1			1	1			1	1			1	1		1	1			1	1		1	1
		pS1[23]	z95 for RKF selectivity (males, 1997-2004)	1	ARITHMETIC	95	180	1	1	1	1	1	1	1	1	1	1					1			1	1			1		
		pS1[24]	z95 for RKF selectivity (males, 2005+)	1	ARITHMETIC	95	180	1	1	1	1	1	1	1	1	1	1	1	1			1			1	1	1		1	1	
		pS1[27]	z95 for RKF selectivity (females, 2005+)	1	ARITHMETIC	100	140	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		pS1[3]	z50 for NMFS survey selectivity (females, pre-1982)	1	ARITHMETIC	-200	100																		1	1	1		1	1	
		pS1[4]	z50 for NMFS survey selectivity (females, 1982+)	1	ARITHMETIC	-50	69											-1	-1	-1		-1	-1		-1	-1	-1		-1	-1	-1
		pS1[5]	z50 for TCF retention (pre-1991)	1	ARITHMETIC	85	160		-1																						
		pS2[11]	ascending slope for SCF selectivity (males, 1997-2004)	1	ARITHMETIC	0.1	0.5		-1																						
		pS2[13]	slope for SCF selectivity (females, pre-1997)	1	ARITHMETIC	0.05	0.5		1																						
		pS2[2]	z95-z50 for NMFS survey selectivity (males, 1982+)	1	ARITHMETIC	0	100							1				1	1	1	1	1	1	1	1	1	1		1	1	1
		pS2[25]	ln(z95-z50) for RKF selectivity (males, pre-1997)	1	ARITHMETIC	2.5	4		-1																						
		pS2[26]	ln(z95-z50) for RKF selectivity (males, 1997-2004)	1	ARITHMETIC	2.5	4		-1																						
		pS2[27]	ln(z95-z50) for RKF selectivity (males, 2005+)	1	ARITHMETIC	2.5	4		-1																						
		pS2[4]	z95-z50 for NMFS survey selectivity (females, 1982+)	1	ARITHMETIC	0	100	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-1	1	1	1
		pS2[6]	slope for TCF retention (1997+)	1	ARITHMETIC	0.2	2		1																						
		pS3[2]	ln(dz50-az50) for SCF selectivity (males, 1997-2004)	1	ARITHMETIC	2	4.5		-1																						
		pS4[1]	descending slope for SCF selectivity (males, pre-1997)	1	ARITHMETIC	0.1	0.5	1		-1	1	1	1		1	1	1	1	1	1	1		-1	1	-1	-1	-1	-1	-1	-1	-1
		pS4[2]	descending slope for SCF selectivity (males, 1997-200	1	ARITHMETIC	0.1	0.5		1																						
surveys	surveys	pQ[1]	NMFS trawl survey: males, 1975-1981	1	LOG	-0.6931472	0.0009995	-1		-1		-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
		pQ[3]	NMFS trawl survey: females, 1975-1981	1	LOG	-0.6931472	0.0009995	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1				-1			-1
		pQ[4]	NMFS trawl survey: females, 1982+	1	LOG	-1.6094379	0															-1	-1		-1	-1			-1		
total number of parameters								11	18	11	11	12	12	11	12	12	12	14	14	15	13	15	14	13	16	16	15	12	16	16	14

Table C.2. Model parameters at bounds for model scenarios ("case") B0, E0, E0a, E0b, E0c, E1, E1b, E1c, F0, F0a, F0c, G0, G0a, G0b, G0bd, G0bde, G0bde-Fr, G0bde-McI. Blue highlighting (value=1) indicates the parameter was at or near the upper bound; red highlighting (value=-1) indicates the parameter was at or near the lower bound. The final row gives the total number of parameters at one of their bounds for each model scenario.

Sum of test_val								case																	
category	process	name	label	index	parameter_scale	min_param	max_param	B0	E0	E0a	E0b	E0c	E1	E1b	E1c	F0	F0a	F0c	G0	G0a	G0b	G0bd	G0bde	G0bde-Fr	G0bde-McI
fisheries	fisheries	pLgtRet[1]	TCF: logit-scale max retention (pre-1997)	1	ARITHMETIC	0	15	1	1	1	1	1	1	1	1	1	1	1	1	1					
		pLgtRet[3]	TCF: logit-scale max retention (2013-2015)	1	ARITHMETIC	0	15												1						
population processes	growth	pGrBeta[1]	both sexes	1	ARITHMETIC	0.5	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-1	
	maturity	pLgtPrM2M[1]	males (entire model period)	24	ARITHMETIC	-15	15																1	1	1
				32	ARITHMETIC	-15	15	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			
		pLgtPrM2M[2]	females (entire model period)	1	ARITHMETIC	-15	15	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1			
selectivity	selectivity	pDevsS1[1]	ln(z50 devs) for TCF selectivity (males, 1991+)	1	ARITHMETIC	-0.5	0.5														1	1	1	-1	1
				4	ARITHMETIC	-0.5	0.5					1		1	1			1							
				5	ARITHMETIC	-0.5	0.5														1	1	1	1	1
				14	ARITHMETIC	-0.5	0.5																	-1	
		pS1[1]	z50 for NMFS survey selectivity (males, pre-1982)	1	ARITHMETIC	0	90		1	1	1		1	1		1	1		1	1	1	1	1	1	1
		pS1[10]	ascending z50 for SCF selectivity (males, pre-1997)	1	ARITHMETIC	40	140																	1	
		pS1[12]	ascending z50 for SCF selectivity (males, 2005+)	1	ARITHMETIC	40	140																	1	
		pS1[14]	ascending z50 for SCF selectivity (females, 1997-2004	1	ARITHMETIC	50	120																	-1	
		pS1[15]	ascending z50 for SCF selectivity (females, 2005+)	1	ARITHMETIC	50	120												1		1				
		pS1[17]	z50 for GF.AllGear selectivity (males, 1987-1996)	1	ARITHMETIC	40	120														1	1	1	1	1
		pS1[18]	z50 for GF.AllGear selectivity (males, 1997+)	1	ARITHMETIC	40	120																	1	
		pS1[19]	z50 for GF.AllGear selectivity (males, pre-1987)	1	ARITHMETIC	40	120		-1	-1	-1	-1	-1	-1	-1			-1						1	
		pS1[2]	z50 for NMFS survey selectivity (males, 1982+)	1	ARITHMETIC	0	69												1	1	1	1	1	1	1
		pS1[20]	z50 for GF.AllGear selectivity (males, 1987-1996)	1	ARITHMETIC	40	250	-1																	
		pS1[22]	z95 for RKF selectivity (males, pre-1997)	1	ARITHMETIC	95	180				1	1		1	1			1			1	1	1		1
		pS1[23]	z95 for RKF selectivity (males, 1997-2004)	1	ARITHMETIC	95	180	1																-1	
		pS1[24]	z95 for RKF selectivity (males, 2005+)	1	ARITHMETIC	95	180	1	1	1			1						1	1					
		pS1[25]	z95 for RKF selectivity (females, pre-1997)	1	ARITHMETIC	100	140																	-1	
		pS1[26]	z95 for RKF selectivity (females, 1997-2004)	1	ARITHMETIC	100	140												1	1	1	1	1	-1	
		pS1[27]	z95 for RKF selectivity (females, 2005+)	1	ARITHMETIC	100	140	1	1	1	1	1	1	1	1	1	1	1	1	1					
		pS1[29]	z50 for TCF retention (2013-2015)	1	ARITHMETIC	85	160																	-1	
		pS1[3]	z50 for NMFS survey selectivity (females, pre-1982)	1	ARITHMETIC	-200	100		1	1	1		1	1		1	1		1	1	1	1	1		1
		pS1[4]	z50 for NMFS survey selectivity (females, 1982+)	1	ARITHMETIC	-50	69																	1	
		pS1[5]	z50 for TCF retention (pre-1991)	1	ARITHMETIC	85	160																	-1	
		pS1[6]	z50 for TCF retention (1991-1996)	1	ARITHMETIC	85	160																	-1	
		pS1[9]	z50 for TCF selectivity (females)	1	ARITHMETIC	80	150																	-1	
		pS2[11]	ascending slope for SCF selectivity (males, 1997-2004)	1	ARITHMETIC	0.1	0.5																	-1	
		pS2[13]	slope for SCF selectivity (females, pre-1997)	1	ARITHMETIC	0.05	0.5													1	1			-1	
		pS2[14]	slope for SCF selectivity (females, 1997-2004)	1	ARITHMETIC	0.05	0.5																	-1	
		pS2[2]	z95-z50 for NMFS survey selectivity (males, 1982+)	1	ARITHMETIC	0	100																1		
		pS2[24]	ln(z95-z50) for RKF selectivity (males, 2005+)	1	ARITHMETIC	2.5	4																	-1	
		pS2[25]	ln(z95-z50) for RKF selectivity (males, pre-1997)	1	ARITHMETIC	2.5	4												-1					1	
		pS2[26]	ln(z95-z50) for RKF selectivity (males, 1997-2004)	1	ARITHMETIC	2.5	4																	1	
		pS2[28]	slope for TCF retention (2005-2009)	1	ARITHMETIC	0.2	2																	1	
		pS2[29]	slope for TCF retention (2013-2015)	1	ARITHMETIC	0.2	2																	1	
		pS2[4]	z95-z50 for NMFS survey selectivity (females, 1982+)	1	ARITHMETIC	0	100	1												1	1	1	1		1
		pS2[5]	slope for TCF retention (pre-1991)	1	ARITHMETIC	0.2	1																	1	1
		pS2[6]	slope for TCF retention (1997+)	1	ARITHMETIC	0.2	2																	1	
		pS2[8]	slope for TCF selectivity (males, 1997+)	1	ARITHMETIC	0.1	0.4																	1	
		pS2[9]	slope for TCF selectivity (females)	1	ARITHMETIC	0.05	0.75																	-1	
		pS3[1]	ln(dz50-az50) for SCF selectivity (males, pre-1997)	1	ARITHMETIC	2	4.5															-1	-1	-1	-1
		pS3[2]	ln(dz50-az50) for SCF selectivity (males, 1997-2004)	1	ARITHMETIC	2	4.5																	-1	-1
		pS4[1]	descending slope for SCF selectivity (males, pre-1997)	1	ARITHMETIC	0.1	0.5	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1			-1	-1	-1	-1
		pS4[2]	descending slope for SCF selectivity (males, 1997-200	1	ARITHMETIC	0.1	0.5															-1	-1	-1	-1
surveys	surveys	pQ[1]	NMFS trawl survey: males, 1975-1981	1	LOG	-0.6931472	0.0009995	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	-1
		pQ[3]	NMFS trawl survey: females, 1975-1981	1	LOG	-0.6931472	0.0009995	-1				-1			-1			-1		-1				1	
		pQ[4]	NMFS trawl survey: females, 1982+	1	LOG	-1.6094379	0									-1	-1		-1	-1	-1	-1	-1		-1
total number of parameters								11	11	11	11	11	11	12	11	10	10	11	16	15	16	17	17	39	16

Appendix D: Objective function components

This appendix contains tables related to values of various components in the model objective function, by scenario.

Table D.1. Contributions from data components to the model objective function for B and C scenarios.

Sum of nll									case																
category	fleet	catch.type	data.type	fit.type	nll.type	x	m	s	B0	B0-Fr	B0-McI	B0a	B0b	B0c	B0q	B1	B1b	B1c	C0	C0a	C0b	C0c	C1	C1b	C1c
fisheries data	GTF	total catch	abundance	BY_TOTAL	none	all sexes	all maturity	all shell conditions	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			biomass	BY_TOTAL	norm2	all sexes	all maturity	all shell conditions	0.07	0.08	0.07	0.07	0.03	0.03	0.07	0.07	0.03	0.03	0.06	0.06	0.02	0.02	0.06	0.01	0.02
			n.at.z	BY_XE	multinomial	female	all maturity	all shell conditions	251.59	56.56	402.82	252.88	248.75	247.59	243.67	251.13	247.72	249.42	252.80	252.42	252.23	248.47	251.17	250.89	249.15
						male	all maturity	all shell conditions	282.80	74.37	427.87	289.46	273.39	272.31	278.95	280.30	271.68	274.49	313.36	313.53	310.39	311.59	311.61	308.71	311.54
	RKF	total catch	abundance	BY_X	none	female	all maturity	all shell conditions	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						male	all maturity	all shell conditions	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			biomass	BY_X	norm2	female	all maturity	all shell conditions	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						male	all maturity	all shell conditions	0.39	0.10	0.72	0.39	0.01	0.01	0.37	0.39	0.01	0.01	0.38	0.38	0.01	0.01	0.38	0.01	0.01
			n.at.z	BY_X	multinomial	female	all maturity	all shell conditions	2.75	0.00	141.14	2.76	2.74	2.74	2.78	2.74	2.73	2.73	2.71	2.71	2.69	2.71	2.70	2.70	2.70
						male	all maturity	all shell conditions	45.99	0.00	162.28	46.14	38.54	38.56	45.48	45.87	38.81	38.71	43.82	43.68	37.71	38.03	43.23	38.23	38.05
	SCF	total catch	abundance	BY_X	none	female	all maturity	all shell conditions	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						male	all maturity	all shell conditions	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			biomass	BY_X	norm2	female	all maturity	all shell conditions	1.27	0.11	1.24	1.29	1.29	1.29	1.41	1.29	1.30	1.30	1.23	1.23	1.24	1.24	1.24	1.20	1.24
						male	all maturity	all shell conditions	0.09	0.06	0.09	0.09	0.03	0.03	0.08	0.09	0.03	0.03	0.09	0.09	0.02	0.02	0.09	0.02	0.02
			n.at.z	BY_X	multinomial	female	all maturity	all shell conditions	12.34	0.03	118.29	12.41	12.15	12.16	12.32	12.36	12.16	12.15	12.78	12.76	12.47	12.42	12.81	11.82	12.42
						male	all maturity	all shell conditions	55.32	0.25	199.00	55.73	55.77	55.82	55.05	54.13	55.42	55.43	54.40	54.26	54.97	56.27	53.90	53.18	55.87
	TCF	retained cat	abundance	BY_X	none	female	all maturity	all shell conditions	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						male	all maturity	all shell conditions	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			biomass	BY_X	norm2	female	all maturity	all shell conditions	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						male	all maturity	all shell conditions	0.86	0.10	1.52	0.87	0.99	0.99	0.75	0.81	0.95	0.96	0.74	0.73	1.10	1.04	0.70	1.04	1.00
			n.at.z	BY_X	multinomial	male	all maturity	all shell conditions	65.46	5.19	103.64	66.35	65.23	65.01	62.35	60.84	64.80	64.86	83.93	82.98	85.20	96.37	83.24	84.99	96.59
		total catch	biomass	BY_X	norm2	female	all maturity	all shell conditions	2.00	0.31	2.03	2.02	1.54	1.54	2.06	2.08	1.55	1.56	2.18	2.19	1.59	1.56	2.18	1.60	1.57
						male	all maturity	all shell conditions	0.26	0.02	0.45	0.27	0.26	0.26	0.27	0.27	0.26	0.27	0.25	0.25	0.26	0.24	0.25	0.27	0.24
			n.at.z	BY_X	multinomial	female	all maturity	all shell conditions	9.74	0.40	77.56	9.69	9.52	9.51	9.85	9.74	9.50	9.52	9.71	9.71	9.45	9.49	9.67	9.44	9.47
						male	all maturity	all shell conditions	87.59	6.19	136.15	88.25	84.15	84.11	84.39	82.91	84.27	84.32	93.98	93.46	91.01	101.44	93.72	90.12	100.80
growth data	(blank)	(blank)	EBS	(blank)	gamma	female	immature	new shell	126.94	116.66	128.67	129.75	126.32	126.68	122.58	120.76	125.28	124.87	130.25	129.60	129.77	130.70	130.13	127.64	130.02
						male	immature	new shell	190.60	162.50	192.00	192.82	191.33	191.85	181.42	178.67	189.33	189.20	179.77	179.13	180.47	190.36	179.76	177.39	188.27
			Kodiak	(blank)	gamma	female	immature	new shell	2,480.94	2,344.97	2,419.86	2,565.80	2,469.22	2,480.98	2,254.91	2,393.09	2,451.33	2,440.90	2,600.43	2,598.69	2,581.84	2,584.85	2,613.36	2,548.10	2,562.12
						male	immature	new shell	4,820.40	4,268.51	4,919.39	4,761.52	4,841.44	4,843.68	4,580.72	4,596.06	4,808.27	4,811.14	4,189.73	4,176.14	4,180.48	4,468.25	4,179.10	4,107.13	4,412.34
maturity data	(blank)	(blank)	MATURITY_(	(blank)	binomial	male	(blank)	new shell	2,005.32	3,071.77	2,058.87	2,029.63	2,050.45	2,051.14	1,984.56	1,812.01	2,033.74	2,038.10	592.47	593.78	598.05	618.22	593.91	600.62	618.10
surveys data	NMFS trawl survey (BC)	index catch	abundance	BY_XM	lognormal	female	immature	all shell conditions	231.53	5,140.60	239.30	234.43	214.34	216.78	210.93	220.56	210.55	204.77	220.16	215.75	216.35	226.12	211.93	212.47	212.99
							mature	all shell conditions	144.53	91.38	137.95	150.23	143.37	143.05	148.75	142.02	144.23	145.45	143.64	144.78	143.32	153.70	144.93	145.70	155.96
						male	immature	all shell conditions	281.87	1,733.33	286.08	276.16	271.77	273.28	298.60	279.06	266.07	262.78	266.54	260.98	270.27	274.01	257.30	264.03	264.97
							mature	all shell conditions	136.96	552.06	151.71	141.39	131.97	131.65	194.51	117.62	132.99	133.96	108.51	110.20	105.53	145.47	109.67	110.15	147.53
			biomass	BY_X_MATONLY	lognormal	female	mature	all shell conditions	111.34	65.81	108.40	114.65	112.49	112.12	117.68	113.36	114.70	115.72	113.56	115.01	114.67	120.56	116.33	119.06	124.30
						male	mature	all shell conditions	102.21	34.98	121.87	102.75	109.19	109.12	126.74	105.23	112.18	112.18	100.22	101.36	105.95	114.96	102.24	110.04	117.13
			n.at.z	BY_XME	multinomial	female	immature	all shell conditions	249.61	0.84	240.28	246.47	246.57	246.57	189.94	243.80	243.13	244.00	280.25	276.20	266.85	260.93	271.28	259.88	265.82
							mature	all shell conditions	194.00	0.07	184.35	176.84	186.64	188.51	110.81	197.78	191.61	184.07	221.50	223.95	222.87	208.99	224.03	231.97	204.33
						male	immature	all shell conditions	201.12	0.67	171.93	248.98	207.87	207.09	341.80	243.37	202.53	208.57	375.00	373.54	379.19	348.71	371.98	369.52	347.51
							mature	all shell conditions	316.24	0.01	259.43	321.04	313.18	314.99	337.73	285.63	313.79	309.43	143.69	142.66	150.26	194.38	144.86	148.32	187.08
	NMFS trawl survey (females only)	index catch	abundance	BY_XMS	lognormal	female	immature	new shell	231.53	5,140.60	239.30	234.43	214.34	216.78	210.93	220.56	210.55	204.77	220.16	215.75	216.35	226.12	211.93	212.47	212.99
								old shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
							mature	new shell	144.40	549.40	149.98	135.57	151.56	151.99	147.40	172.87	157.04	155.54	153.36	154.52	162.66	131.51	156.72	171.24	135.23
								old shell	213.51	140.14	208.53	223.29	213.36	212.98	214.93	202.28	216.05	217.37	215.17	216.75	214.28	238.84	217.46	219.49	242.68
						male	immature	new shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								old shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
							mature	new shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								old shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			biomass	BY_XMS	lognormal	female	immature	new shell	191.29	2,122.56	195.75	194.45	183.19	184.66	195.34	190.52	186.33	181.27	190.43	188.05	193.61	202.95	189.72	198.31	199.06
								old shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
							mature	new shell	136.14	410.85	141.84	126.97	144.37	144.66	144.02	165.64	151.42	150.01	147.30	148.64	157.36	125.41	151.25	167.21	130.57
								old shell	166.61	111.64	163.30	173.14	167.81	167.45	169.14	160.19	171.13	172.19	170.76	172.38	170.57	189.42	173.78	176.63	194.02
						male	immature	new shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								old shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
							mature	new shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								old shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			n.at.z	BY_XMS	multinomial	female	immature	new shell	359.15	0.01	245.99	491.59	357.30	358.16	385.20	355.16	355.67	355.84	368.70	364.69	363.24	364.15	361.51	360.40	361.36
							mature	new shell	444.00	0.01	200.87	442.79	439.38	439.41	430.69	443.72	437.53	439.40	446.19	444.47	440.78	436.23	441.01	438.79	435.09
								old shell	297.21	0.34	219.21	314.66	292.10	292.08	311.76	273.73	288.69	290.05	273.61	273.80	271.54	295.36	272.71	268.16	291.60
	NMFS trawl survey (males only)	index catch	abundance	BY_XS	lognormal	female	all maturity	new shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								old shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						male	all maturity	new shell	307.51	1,175.37	312.46	303.77	303.72	304.80	353.06	317.69	301.36	298.36	282.27	278.16	291.43	285.17	276.78	289.36	279.82
								old shell	456.79	1,563.42	447.21	473.15	446.81	445.08	494.05	386.78	450.46	454.70	505.07	507.55	506.67	601.46	503.17	507.24	605.37
			biomass	BY_XS	lognormal	female	all maturity	new shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								old shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						male	all maturity	new shell	207.68	483.41	229.97	207.15	218.63	219.97	262.53	251.23	226.27	222.50	205.20	204.28	220.21	186.77	209.28	229.00	188.62
								old shell	358.69	294.88	353.72	376.53	361.01	359.26	379.89	320.52	365.24	369.76	311.78	313.63	312.56	363.54	310.60	310.06	366.98
			n.at.z	BY_XS	multinomial	male	all maturity	new shell	470.69	1.59	440.31	486.67	469.01	469.34	475.89	465.17	468.50	471.13	452.27	451.39	450.63	457.07	445.97	444.16	456.59
								old shell	731.29	0.08	561.47	712.44	795.58	797.89	719.15	638.10	792.85	785.79	771.92	770.40	861.42	953.85	775.02	858.28	946.09

Table D.2. Contributions from data components to the model objective function for B0 and the D and E scenarios.

Sum of nll									case														
category	fleet	catch.type	data.type	fit.type	nll.type	x	m	s	B0	D0	D0a	D0b	D0c	D1	D1b	D1c	E0	E0a	E0b	E0c	E1	E1b	E1c
fisheries data	GTF	total catch	abundance	BY_TOTAL	none	all sexes	all maturity	all shell conditions	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			biomass	BY_TOTAL	norm2	all sexes	all maturity	all shell conditions	0.07	0.06	0.06	0.02	0.03	0.06	0.02	0.02	0.09	0.09	0.04	0.07	0.09	0.04	0.06
			n.at.z	BY_XE	multinomial	female	all maturity	all shell conditions	251.59	234.46	234.18	234.34	235.62	232.50	232.15	233.19	247.46	246.83	245.58	242.46	245.22	244.95	244.26
						male	all maturity	all shell conditions	282.80	325.27	325.13	320.61	329.18	323.46	317.55	319.14	320.28	319.88	315.26	326.68	318.82	313.77	318.60
	RKF	total catch	abundance	BY_X	none	female	all maturity	all shell conditions	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						male	all maturity	all shell conditions	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			biomass	BY_X	norm2	female	all maturity	all shell conditions	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						male	all maturity	all shell conditions	0.39	0.33	0.33	0.01	0.02	0.33	0.01	0.01	0.32	0.32	0.00	0.01	0.31	0.01	0.01
			n.at.z	BY_X	multinomial	female	all maturity	all shell conditions	2.75	2.65	2.65	2.64	2.65	2.65	2.64	2.63	2.66	2.66	2.65	2.66	2.66	2.65	2.65
						male	all maturity	all shell conditions	45.99	40.67	40.66	36.83	37.17	40.48	36.62	36.94	39.70	39.65	34.31	36.19	39.28	35.81	36.06
	SCF	total catch	abundance	BY_X	none	female	all maturity	all shell conditions	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						male	all maturity	all shell conditions	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			biomass	BY_X	norm2	female	all maturity	all shell conditions	1.27	1.16	1.17	1.15	1.14	1.18	1.17	1.14	1.09	1.09	1.06	1.08	1.11	1.09	1.06
						male	all maturity	all shell conditions	0.09	0.08	0.08	0.02	0.02	0.08	0.02	0.02	0.09	0.09	0.03	0.02	0.09	0.02	0.02
			n.at.z	BY_X	multinomial	female	all maturity	all shell conditions	12.34	13.03	13.01	12.62	12.79	13.03	12.68	12.67	13.05	13.05	12.86	12.95	13.10	12.75	12.86
						male	all maturity	all shell conditions	55.32	54.20	54.21	56.20	57.30	54.07	55.46	56.28	55.70	55.70	56.98	58.65	55.46	57.45	58.21
	TCF	retained cat	abundance	BY_X	none	female	all maturity	all shell conditions	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						male	all maturity	all shell conditions	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			biomass	BY_X	norm2	female	all maturity	all shell conditions	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						male	all maturity	all shell conditions	0.86	0.68	0.68	1.24	1.21	0.67	1.22	1.18	0.67	0.67	0.55	1.39	0.64	1.38	1.36
			n.at.z	BY_X	multinomial	male	all maturity	all shell conditions	65.46	72.98	72.86	80.05	93.83	74.19	81.00	91.15	91.50	91.10	90.23	131.56	91.32	109.85	128.69
		total catch	biomass	BY_X	norm2	female	all maturity	all shell conditions	2.00	2.32	2.32	1.64	1.63	2.31	1.65	1.63	2.32	2.32	2.43	1.80	2.31	1.80	1.78
						male	all maturity	all shell conditions	0.26	0.25	0.25	0.33	0.30	0.25	0.34	0.31	0.26	0.26	0.19	0.31	0.26	0.36	0.32
			n.at.z	BY_X	multinomial	female	all maturity	all shell conditions	9.74	9.23	9.22	9.02	9.07	9.21	9.01	9.02	9.67	9.66	9.63	9.48	9.65	9.38	9.43
						male	all maturity	all shell conditions	87.59	90.79	90.78	93.48	102.19	91.47	93.55	100.07	105.35	105.22	104.72	123.44	104.97	109.64	121.71
growth data	(blank)	(blank)	EBS	(blank)	gamma	female	immature	new shell	126.94	139.63	139.73	138.56	143.08	139.62	137.79	138.94	148.54	148.62	148.47	152.78	148.86	148.40	150.31
						male	immature	new shell	190.60	192.57	193.00	194.32	207.22	192.71	191.77	200.22	216.85	217.03	216.44	238.33	216.26	219.84	233.27
			Kodiak	(blank)	gamma	female	immature	new shell	2,480.94	2,706.02	2,714.94	2,683.01	2,754.22	2,708.18	2,668.36	2,630.81	2,879.62	2,888.75	2,886.06	2,945.55	2,899.82	2,892.82	2,882.86
						male	immature	new shell	4,820.40	4,429.65	4,438.91	4,465.29	4,789.51	4,432.40	4,398.81	4,619.18	5,052.31	5,054.26	5,037.63	5,547.79	5,034.04	5,099.68	5,431.32
maturity data	(blank)	(blank)	MATURITY_(	(blank)	binomial	male	(blank)	new shell	2,005.32	640.50	641.46	650.50	686.53	643.68	650.22	676.22	680.73	681.02	684.17	743.10	680.81	698.76	733.45
surveys data	NMFS trawl survey (BC)	index catch	abundance	BY_XM	lognormal	female	immature	all shell conditions	231.53	192.54	190.85	193.28	194.71	189.44	191.03	188.20	136.94	136.18	134.72	139.60	134.53	137.18	135.92
							mature	all shell conditions	144.53	120.77	121.53	120.67	138.35	122.09	122.95	129.41	97.54	98.30	98.85	101.92	99.78	98.30	99.54
						male	immature	all shell conditions	281.87	231.42	230.17	242.39	237.56	229.94	238.80	234.58	149.31	148.61	148.42	150.61	145.85	155.85	145.81
							mature	all shell conditions	136.96	144.01	144.04	134.79	161.50	141.16	136.09	175.60	92.89	93.27	93.31	96.37	95.28	90.62	101.07
			biomass	BY_X_MATONLY	lognormal	female	mature	all shell conditions	111.34	104.91	105.74	104.65	117.46	106.56	107.69	112.65	92.89	93.69	94.54	93.56	95.62	93.41	93.49
						male	mature	all shell conditions	102.21	112.81	112.90	111.03	106.89	111.16	112.95	119.33	86.24	86.45	88.86	77.01	88.53	89.07	83.14
			n.at.z	BY_XME	multinomial	female	immature	all shell conditions	249.61	335.74	333.60	313.34	281.77	321.75	306.23	380.80	336.10	336.28	331.61	327.65	336.04	329.18	384.99
							mature	all shell conditions	194.00	286.94	284.14	279.49	221.88	277.87	287.68	279.55	322.66	323.42	319.32	277.84	326.79	314.05	318.80
						male	immature	all shell conditions	201.12	391.69	394.89	415.72	400.19	400.11	407.07	337.40	218.24	216.48	214.60	188.75	209.49	221.90	153.71
							mature	all shell conditions	316.24	109.05	109.89	113.68	179.83	120.94	116.01	145.09	228.92	228.59	234.55	296.22	229.46	233.61	265.38
	NMFS trawl survey (females only)	index catch	abundance	BY_XMS	lognormal	female	immature	new shell	231.53	192.54	190.85	193.28	194.71	189.44	191.03	188.20	136.94	136.18	134.72	139.60	134.53	137.18	135.92
								old shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
							mature	new shell	144.40	127.65	128.32	134.24	110.39	128.82	137.48	123.75	105.41	106.14	107.71	98.38	106.99	110.51	104.98
								old shell	213.51	171.23	171.93	170.41	205.97	172.32	172.91	189.25	133.19	133.91	134.56	149.02	135.31	133.93	140.58
						male	immature	new shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								old shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
							mature	new shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								old shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			biomass	BY_XMS	lognormal	female	immature	new shell	191.29	150.84	150.14	154.26	154.60	151.21	156.40	151.94	109.74	109.71	109.87	112.59	110.46	113.51	110.71
								old shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
							mature	new shell	136.14	111.61	112.36	118.13	97.45	113.18	121.62	109.14	101.93	102.59	104.43	97.72	103.68	106.72	102.82
								old shell	166.61	147.96	148.67	146.80	174.64	149.28	149.76	163.62	118.48	119.21	119.91	127.93	120.92	118.87	123.24
						male	immature	new shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								old shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
							mature	new shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								old shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			n.at.z	BY_XMS	multinomial	female	immature	new shell	359.15	354.70	353.74	352.49	353.70	352.03	348.49	362.11	389.13	387.79	386.45	390.99	385.40	384.66	396.46
							mature	new shell	444.00	423.42	422.52	420.98	407.38	420.90	418.39	414.58	445.44	444.72	444.05	429.07	443.88	442.31	435.32
								old shell	297.21	230.48	230.65	229.64	259.22	230.77	228.25	235.22	237.85	237.77	237.47	267.79	236.88	236.03	248.25
	NMFS trawl survey (males only)	index catch	abundance	BY_XS	lognormal	female	all maturity	new shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								old shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						male	all maturity	new shell	307.51	242.66	242.37	257.18	246.69	244.22	256.55	244.60	152.89	152.77	154.76	151.84	151.53	163.76	147.51
								old shell	456.79	451.71	450.81	441.06	511.59	440.70	437.84	526.20	252.40	252.80	245.36	289.79	250.53	245.78	295.34
			biomass	BY_XS	lognormal	female	all maturity	new shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								old shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						male	all maturity	new shell	207.68	142.23	143.26	153.57	137.68	146.97	157.75	141.93	125.89	126.68	131.08	117.87	128.64	136.48	118.57
								old shell	358.69	290.60	290.44	284.83	321.15	284.05	282.37	327.32	158.10	158.53	155.29	178.22	156.43	154.44	177.45
			n.at.z	BY_XS	multinomial	male	all maturity	new shell	470.69	420.70	420.25	418.27	417.62	420.65	417.06	417.90	473.35	472.34	468.81	471.19	469.33	467.34	470.22
								old shell	731.29	567.09	566.30	577.74	641.39	569.53	577.34	646.93	639.47	638.50	648.15	727.26	641.87	645.38	731.88

Table D.3. Contributions from data components to the model objective function for B0 and the F and G scenarios.

Sum of nll									case								
category	fleet	catch.type	data.type	fit.type	nll.type	x	m	s	B0	F0	F0a	F0c	G0	G0a	G0b	G0bd	G0bde
fisheries data	GTF	total catch	abundance	BY_TOTAL	lognormal	all sexes	all maturity	all shell conditions					38.62	26.07	31.08	30.83	31.55
					none	all sexes	all maturity	all shell conditions	0.00	0.00	0.00	0.00					
			biomass	BY_TOTAL	lognormal	all sexes	all maturity	all shell conditions					0.94	0.67	0.19	0.15	0.14
					norm2	all sexes	all maturity	all shell conditions	0.07	0.09	0.09	0.07					
			n.at.z	BY_XE	multinomial	female	all maturity	all shell conditions	251.59	245.53	244.77	239.89	245.68	237.45	235.25	239.73	242.43
						male	all maturity	all shell conditions	282.80	350.17	349.94	361.43	344.27	318.38	314.48	324.57	319.71
	RKF	total catch	abundance	BY_X	lognormal	female	all maturity	all shell conditions					53.53	55.16	54.72	55.84	56.74
						male	all maturity	all shell conditions					299.70	300.50	288.68	289.30	288.56
					none	female	all maturity	all shell conditions	0.00	0.00	0.00	0.00					
						male	all maturity	all shell conditions	0.00	0.00	0.00	0.00					
			biomass	BY_X	lognormal	female	all maturity	all shell conditions					57.19	55.46	54.75	55.08	55.23
						male	all maturity	all shell conditions					58.98	56.94	49.32	49.45	49.53
					norm2	female	all maturity	all shell conditions	0.00	0.00	0.00	0.00					
						male	all maturity	all shell conditions	0.39	0.36	0.36	0.03					
			n.at.z	BY_X	multinomial	female	all maturity	all shell conditions	2.75	2.65	2.64	2.65	3.47	3.26	4.04	4.16	4.05
						male	all maturity	all shell conditions	45.99	43.23	43.21	39.19	47.95	44.56	35.53	36.08	35.54
	SCF	total catch	abundance	BY_X	lognormal	female	all maturity	all shell conditions					266.23	269.92	282.70	260.73	261.74
						male	all maturity	all shell conditions					322.07	324.15	332.46	312.68	315.82
					none	female	all maturity	all shell conditions	0.00	0.00	0.00	0.00					
						male	all maturity	all shell conditions	0.00	0.00	0.00	0.00					
			biomass	BY_X	lognormal	female	all maturity	all shell conditions					52.97	52.46	51.82	51.80	51.93
						male	all maturity	all shell conditions					53.28	53.42	52.90	54.67	54.07
					norm2	female	all maturity	all shell conditions	1.27	1.10	1.10	1.07					
						male	all maturity	all shell conditions	0.09	0.09	0.09	0.03					
			n.at.z	BY_X	multinomial	female	all maturity	all shell conditions	12.34	13.01	12.99	12.83	17.89	19.46	19.90	18.08	17.56
						male	all maturity	all shell conditions	55.32	57.29	57.29	64.11	57.45	75.62	76.59	64.70	64.95
	TCF	retained cat	abundance	BY_X	lognormal	female	all maturity	all shell conditions					0.00	0.00	0.00	0.00	0.00
						male	all maturity	all shell conditions					233.92	251.81	352.70	387.50	357.74
					none	female	all maturity	all shell conditions	0.00	0.00	0.00	0.00					
						male	all maturity	all shell conditions	0.00	0.00	0.00	0.00					
			biomass	BY_X	lognormal	female	all maturity	all shell conditions					0.00	0.00	0.00	0.00	0.00
						male	all maturity	all shell conditions					16.79	24.37	28.84	24.65	25.60
					norm2	female	all maturity	all shell conditions	0.00	0.00	0.00	0.00					
						male	all maturity	all shell conditions	0.86	0.74	0.74	1.75					
			n.at.z	BY_X	multinomial	male	all maturity	all shell conditions	65.46	136.97	136.84	204.30	126.82	124.73	133.51	140.69	131.32
		total catch	biomass	BY_X	lognormal	female	all maturity	all shell conditions					328.08	350.33	236.29	240.59	240.84
						male	all maturity	all shell conditions					24.84	22.62	127.99	129.17	127.36
					norm2	female	all maturity	all shell conditions	2.00	2.37	2.37	1.81					
						male	all maturity	all shell conditions	0.26	0.25	0.25	0.28					
			n.at.z	BY_X	multinomial	female	all maturity	all shell conditions	9.74	9.69	9.68	9.43	9.57	9.89	10.21	10.21	10.22
						male	all maturity	all shell conditions	87.59	127.24	127.15	151.65	114.21	113.01	135.64	146.17	136.37
growth data	(blank)	(blank)	EBS	(blank)	gamma	female	immature	new shell	126.94	132.08	132.10	132.60	131.93	133.37	133.93	133.91	134.91
						male	immature	new shell	190.60	177.93	178.01	183.19	177.88	179.62	177.27	177.94	186.44
			Kodiak	(blank)	gamma	female	immature	new shell	2,480.94	2,426.76	2,430.60	2,423.80	2,426.78	2,402.05	2,408.93	2,410.29	2,449.33
						male	immature	new shell	4,820.40	4,351.61	4,349.92	4,503.34	4,310.27	4,339.04	4,144.18	4,209.75	4,317.46
maturity data	(blank)	(blank)	MATURITY_	(blank)	binomial	male	(blank)	new shell	2,005.32	517.39	517.68	526.26	517.53	518.02	521.24	519.54	464.89
surveys data	NMFS trawl survey (BC)	index catch	abundance	BY_XM	lognormal	female	immature	all shell conditions	231.53	156.61	156.05	162.23	162.21	135.01	139.55	136.72	129.79
							mature	all shell conditions	144.53	102.27	102.71	117.32	102.34	105.23	108.93	102.58	102.08
						male	immature	all shell conditions	281.87	173.24	173.13	177.99	182.05	141.72	149.53	143.91	147.22
							mature	all shell conditions	136.96	88.99	89.03	97.07	83.10	70.03	69.87	71.59	79.89
			biomass	BY_X_MATONLY	lognormal	female	mature	all shell conditions	111.34	95.21	95.62	105.74	94.54	94.33	97.93	93.90	94.84
						male	mature	all shell conditions	102.21	89.16	89.20	81.23	86.13	78.02	81.18	78.42	78.78
			n.at.z	BY_XME	multinomial	female	immature	all shell conditions	249.61	225.16	224.02	233.28	216.51	360.76	328.90	348.46	364.18
							mature	all shell conditions	194.00	347.95	346.67	297.88	347.88	488.31	504.21	495.66	519.39
						male	immature	all shell conditions	201.12	435.58	437.01	400.77	447.27	190.23	217.77	199.04	59.41
							mature	all shell conditions	316.24	171.98	171.92	221.16	171.29	171.40	140.41	159.75	195.62
	NMFS trawl survey (females only)	index catch	abundance	BY_XMS	lognormal	female	immature	new shell	231.53	156.61	156.05	162.23	162.21	135.01	139.55	136.72	129.79
								old shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
							mature	new shell	144.40	111.48	112.07	100.50	111.69	111.72	114.57	113.98	112.05
								old shell	213.51	137.98	138.39	170.98	138.84	125.10	127.17	123.74	123.67
						male	immature	new shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								old shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
							mature	new shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								old shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			biomass	BY_XMS	lognormal	female	immature	new shell	191.29	122.19	122.18	131.86	126.62	110.43	114.14	114.10	109.39
								old shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
							mature	new shell	136.14	106.10	106.64	96.95	104.94	107.03	109.02	110.10	109.02
								old shell	166.61	121.29	121.66	146.59	121.86	110.04	113.41	111.08	111.80
						male	immature	new shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								old shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
							mature	new shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								old shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			n.at.z	BY_XMS	multinomial	female	immature	new shell	359.15	397.63	395.28	394.49	394.24	440.71	434.56	433.47	416.75
							mature	new shell	444.00	448.97	448.13	431.01	447.98	438.28	438.65	440.98	439.30
								old shell	297.21	236.88	237.00	265.00	235.50	242.78	244.53	246.70	245.46
	NMFS trawl survey (males only)	index catch	abundance	BY_XS	lognormal	female	all maturity	new shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								old shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						male	all maturity	new shell	307.51	174.17	174.48	174.45	183.26	129.74	140.07	138.26	138.70
								old shell	456.79	301.22	301.27	362.83	297.92	241.74	248.51	271.37	270.21
			biomass	BY_XS	lognormal	female	all maturity	new shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
								old shell	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						male	all maturity	new shell	207.68	132.83	133.53	124.47	136.46	112.45	118.30	123.88	120.78
								old shell	358.69	179.18	179.34	208.20	178.49	153.56	161.04	162.93	161.59
			n.at.z	BY_XS	multinomial	male	all maturity	new shell	470.69	495.92	495.10	498.43	496.74	550.87	546.44	522.30	489.76
								old shell	731.29	778.73	779.19	877.02	773.58	704.15	658.64	741.68	677.88