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Tini a Tangaroa

Assessment of hoki (*Macruronus novaezelandiae*) in 2025

New Zealand Fisheries Assessment Report 2026/04

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PLAIN LANGUAGE SUMMARY

Integrated stock assessments provide estimates of stock status based on available data and information. Stock status is the current biomass of the stock as a percentage of the biomass before the stock was fished.

This report presents an integrated stock assessment for hoki, New Zealand's largest finfish fishery. It includes information on movement and biology of hoki and data from commercial fisheries and research surveys.

The base model assumes there are two hoki stocks: an eastern stock that spawns in the Cook Strait and off the east coast of South Island; and a western stock that spawns off the west coast of South Island. To allow for uncertainty in this assumed stock structure, an alternative model with a single stock is also presented.

Results from the assessment estimated current stock status to be at 55% of its unfished level for the eastern stock and 39% for the western stock. The combined stock status was estimated to be 45% (two-stock model) or 44% (single-stock model) of its unfished level. All assessments indicate the stock status for hoki is currently within the management target range of 35–50% of its unfished level.

EXECUTIVE SUMMARY

McGregor-Tiatia, V.L.¹; Langley, A.D.² (2026). Assessment of hoki (*Macruronus novaezelandiae*) in 2025.

New Zealand Fisheries Assessment Report 2026/04. 241 p.

This report describes the 2025 hoki stock assessment. This was an update of the previous (2024) assessment. No developments to the assessment models were carried out, only updating of the models with new data, and analyses of the model diagnostics and results.

The hoki fishery is monitored with annual stock assessments, and the key inputs to the assessment are surveys and catch-at-age data. There are two biennial trawl surveys that are used in the assessment: the Chatham Rise summer trawl surveys and the sub-Antarctic summer trawl surveys, providing abundance indices and corresponding proportions-at-age. There are also acoustic spawning surveys that have been carried out in the Cook Strait, east coast South Island, and west coast South Island. The commercial catches enter the model along with catch-at-age data.

The base model has western and eastern stocks, with fish residing in four regions based on stock, time of year, age, maturity, and sex. An alternative model that assumes a single stock but retains the spatial and temporal structure of the base model was also updated.

New data were available from a trawl survey in Sub-Antarctic in summer 2024-25 and an acoustic survey of WCSI in winter 2024. The age data used in the assessment were similar to those used in the 2024 assessment, but with one additional year of data. There were two more years of age data available for the ECSI spawning fishery (2023 and 2024) that were not used in the assessment due to inconsistencies in sampling compared to the earlier part of this series. It should be possible to bring these data into the assessment models when there are more years of age data from this fishery and the 2023 and 2024 data are further analysed to ensure consistency through the time series.

Current combined (eastern and western) stock status in 2025 was estimated to be 44% B_0 (single stock model) or 45% B_0 (base model). The eastern stock status was estimated to be 55% B_0 and the western stock 39% B_0 .

Models were projected forward five years (2025 to 2029) with future catches assumed at the current TACC of 110 000 tonnes (45 000 tonnes western stock, 65 000 tonnes eastern stock), and with two alternative recruitment scenarios: future recruitment at the level of average recruitment over the long term; or future recruitment at the level of recent average recruitment. Median estimates of stock status in 2029 ranged from 45 to 49% B_0 for the combined stock. The status of the Eastern stock in 2029 was estimated to be higher (49–51% B_0) than for the western stock (44–46% B_0). The probability of $SSB_{2029}(\% SSB_0)$ being within the management target zone of 35%–50% under the recent recruitment scenario was 0.41 for the eastern stock, and 0.62 for the western stock. The combined stock had a probability of 0.64 (two-stock model) or 0.63 (single-stock model) of $SSB_{2029}(\% SSB_0)$ being within the management target.

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1. INTRODUCTION

Hoki (*Macruronus novaezelandiae*) is New Zealand's largest finfish fishery and is managed within a single quota management area (HOK 1) (Figure 1) where it is assessed as two separate stocks, western and eastern. The current hypothesis is that juveniles from both stocks mix on Chatham Rise and recruit to their respective stocks as they approach sexual maturity. The Total Allowable Commercial Catch (TACC) for HOK 1 has been 110 000 t since 1 October 2021 with a catch split of 45 000 t from the western stock areas and 55 000 t for the eastern stock areas. In 2023–24 the annual catch entitlement (ACE) (this allows for TAC, voluntary shelving, and carry-over) for HOK 1 was 113 476 t and the actual catches were just below this at 107 035 t (Ballara et al. 2025).

Hoki are widely distributed throughout New Zealand's Exclusive Economic Zone, with most hoki target commercial fishing at depths of 200–800 m. There are four main fisheries: two targeting aggregations on winter spawning grounds (west coast South Island and Cook Strait); and two over wider areas on summer feeding grounds (Chatham Rise and sub-Antarctic). In addition, there are two smaller spawning fisheries (Puysegur and east coast South Island), although catches from Puysegur have become very small and catches from east coast South Island have been increasing over recent years (Ballara et al. 2025).

The hoki fishery is monitored with annual stock assessments, and the key inputs to the assessment are surveys and catch-at-age data. There are two biennial trawl surveys that are used in the assessment: the Chatham Rise summer trawl surveys and the sub-Antarctic summer trawl surveys, providing abundance indices and corresponding proportions-at-age. There are also acoustic spawning surveys that have been carried out in the Cook Strait, east coast South Island (ECSI), and west coast South Island (WCSI). The commercial catches enter the model along with catch-at-age data. Ballara et al. (2025) provide the most recent data collation for the hoki assessment.

New data were available from a trawl survey in Sub-Antarctic in summer 2024/2025 and an acoustic survey of WCSI in winter 2024. New age data were available for the 2025 fishing year for all fisheries except ECSI. The ECSI spawning fishery age data from the 2024 and 2023 fishing years were not used in the assessment, due to inconsistencies in sampling compared to the earlier part of this series (Fisheries New Zealand 2025). It should be possible to bring these data into the assessment models when there are more years of age data from this fishery and the 2023 and 2024 data are further analysed to ensure consistency through the time series.

Hoki is a recruitment driven fishery, and recruitment to the hoki fisheries has shown marked changes over time. In the earlier years of the fishery (1970s) when catches were mostly from WCSI and Chatham Rise, the stock assessment models estimate above average recruitment to the western stock up until the mid-1980s. Western stock recruitment is then estimated to have fluctuated from very low to very high and then to a historical low period from 1995 to 2001. The eastern stock is estimated to have had fairly low recruitment up until the mid-1980s, followed by almost yearly fluctuations with the exception of the mid-2000s when it is estimated to have been stable and generally above average. The 2019 year class was estimated to be high for the eastern stock in both the 2022 and 2023 assessments but average in the 2024 assessment, and lower than average for the western stock in the 2022 and 2023 assessments respectively but high in the 2024 assessment (McGregor et al. 2023, McGregor et al. 2024 and McGregor & Langley 2025). The 2020 year class was estimated in the 2024 assessment as high for the eastern stock and low for the western stock (McGregor & Langley 2025).

This report documents the stock assessment of New Zealand hoki completed in 2025 for the fisheries management area HOK 1. The previous accepted assessment of this stock was completed in 2024 (McGregor & Langley 2025). The 2024 assessment estimated current stock status to be 51% B_0 for the eastern stock and 41% B_0 for the western stock. Projections estimated stock status for the eastern and western stocks in the next five years (out to 2029) of 36–41% B_0 and 44–57% B_0 , respectively.

The work reported here addresses objective two of the Fisheries New Zealand project HOK2024-02: to complete a stock assessment for hoki including estimates of current biomass and yields, the status of the stock in relation to management reference points, and future projections of stock status as required to support management. The project was led by Earth Sciences New Zealand, with collaboration between Earth Sciences New Zealand (Vidette McGregor-Tiatia) and Trophica Ltd. (Adam Langley).

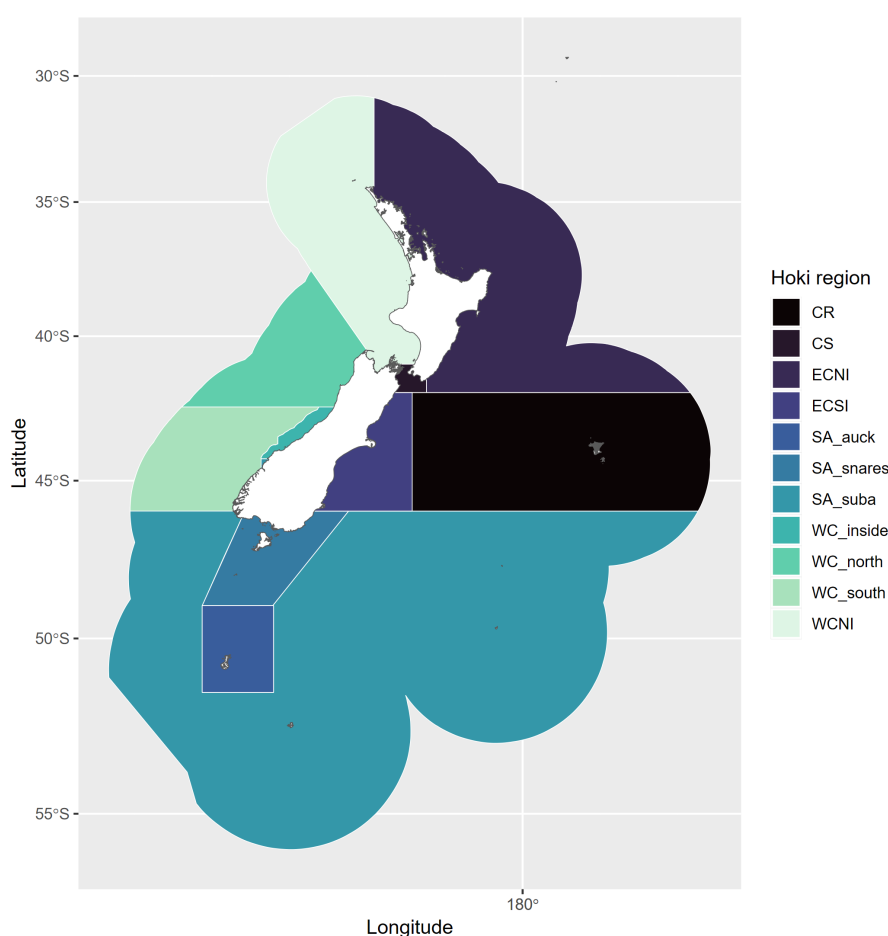


Figure 1: Fisheries management area HOK 1 (all of New Zealand’s EEZ except HOK 10 (Kermadec)) divided into regions defined for the hoki stock assessment. CR: Chatham Rise, CS: Cook Strait, ECNI: east coast North Island, ECSI: east coast South Island, SA_auck: sub-Antarctic Auckland Islands, SA_snares: sub-antarctic Snares, SA_suba: sub-antarctic ‘other’, WC_inside: west coast South Island inside 25 nautical mile line, WC_north: west coast South Island north, WC_south: west coast South Island south, WCNI: west coast North Island. Eastern stock spawning fisheries take place in Cook Strait and east coast South Island regions; western stock spawning fisheries take place in west coast South Island regions.

2. MODEL STRUCTURE AND ASSUMPTIONS

This section describes the structure and parameterisation of the base hoki assessment model which assumes two stocks and the alternative single-stock model. As there was no model development for this stock assessment, this section is a repeat of that in McGregor & Langley (2025).

The stock assessment presented used an integrated age-based model, with Bayesian parameter estimation, implemented using the general-purpose stock assessment program Casal2 (Doonan et al. 2016) v23.04. The models integrate a range of datasets from research surveys and commercial fisheries, including catch, trawl survey abundance indices and age compositions, acoustic survey abundance indices, and catch-at-age data from the commercial fisheries. All analyses of model inputs and outputs were carried out using R-4.4.3 (R Core Team 2022).

Abbreviations used in the 2025 hoki assessment:

CR: Chatham Rise

CS: Cook Strait

SA: sub-Antarctic

WC: West coast South Island (also abbreviated WCSI)

PUY: Puysegur region (south of South Island)

ECSI: East coast South Island

spwn: spawn

YCS: Year Class Strength

AEX: FV *Amaltal Explorer* commercial fishing vessel

SHI: FV *Shinkai Maru* commercial fishing vessel

Naming conventions used in the 2025 hoki assessment:

Model regions: CR, CS, SA, WC

Fisheries: **fishery_[region]_[subfishery]** e.g., fishery_CR_deep

Fisheries —age: **fishery_[region]_[subfishery]_age** e.g., fishery_CR_deep_age

Surveys —abundance: **survey_[region]_[subsurvey]_abundance** e.g., survey_SA_summer_abundance

Surveys —age: **survey_[region]_[subsurvey]_age** e.g., survey_SA_summer_age

Selectivities: **[type]_[region]_[subsurvey/subfishery]_select** e.g., survey_SA_summer_select

Migrations: **[region from]_to_[region to]** e.g., CR_to_SA

2.1 Spatial, temporal, and stock structure

The base stock structure adopted was two stocks, eastern and western, with mixing of juveniles of both stocks on Chatham Rise, but spatially separate adult stocks. The western stock adults were assumed to spawn off the west coast South Island and otherwise reside in the sub-Antarctic following age-based migration from the Chatham Rise. The eastern stock adults were assumed to spawn in Cook Strait including ECSI and otherwise reside on Chatham Rise, along with the juveniles of both stocks (Figure 2).

The spatial and temporal structure of the model is shown graphically for the initial year in Figure 3 and defined in Table 1. Model years matched fishing years for hoki and were 1 October–30 September, labelled by the later year such that 1 October 2021–30 September 2022 was denoted 2022.

The single stock model retained the temporal and spatial structure of the base model, but without the stock structure. Fish recruited to the fishery on the Chatham Rise were not identified as eastern or western stock.

As in the base model, once fish migrated to the sub-Antarctic, they did not return to the Chatham Rise, thus effectively becoming ‘western stock’ fish. The main difference between the single stock and base models was the estimation of only one vector of year class strengths (YCS) in the single stock model, which does not allow for between-year differences in recruitment to the eastern and western fisheries.

The model annual cycle was split into five time steps. The first time step migrated all mature fish from the spawning grounds back to their ‘home’ grounds. Hence, for time step two, all fish were either on Chatham Rise or in the sub-Antarctic. In time step two, new recruitment arrived on Chatham Rise (new juveniles of both stocks). In this time step, the summer surveys and fisheries took place for both Chatham Rise and sub-Antarctic. In time step three, western fish migrated from Chatham Rise to sub-Antarctic, and the age-based ogive controlling this was estimated separately for males and females. In the single stock model these ogives were applied to all fish on the Chatham Rise rather than to only western stock fish on the Chatham Rise. The sub-Antarctic autumn survey occurred after this migration. In time step four, all adults migrated to the spawning grounds (western fish from sub-Antarctic to west coast South Island, and eastern fish from Chatham Rise to Cook Strait/ECSI); nothing else took place during this time step. In time step five, spawning fisheries and spawning acoustic surveys occurred for the Cook Strait, Pegasus Canyon (ECSI) and west coast South Island. This was followed again by time step one, when fish returned from spawning grounds to their home grounds. Growth and natural mortality were assumed to occur throughout the year by applying proportions within each time step (Table 1).

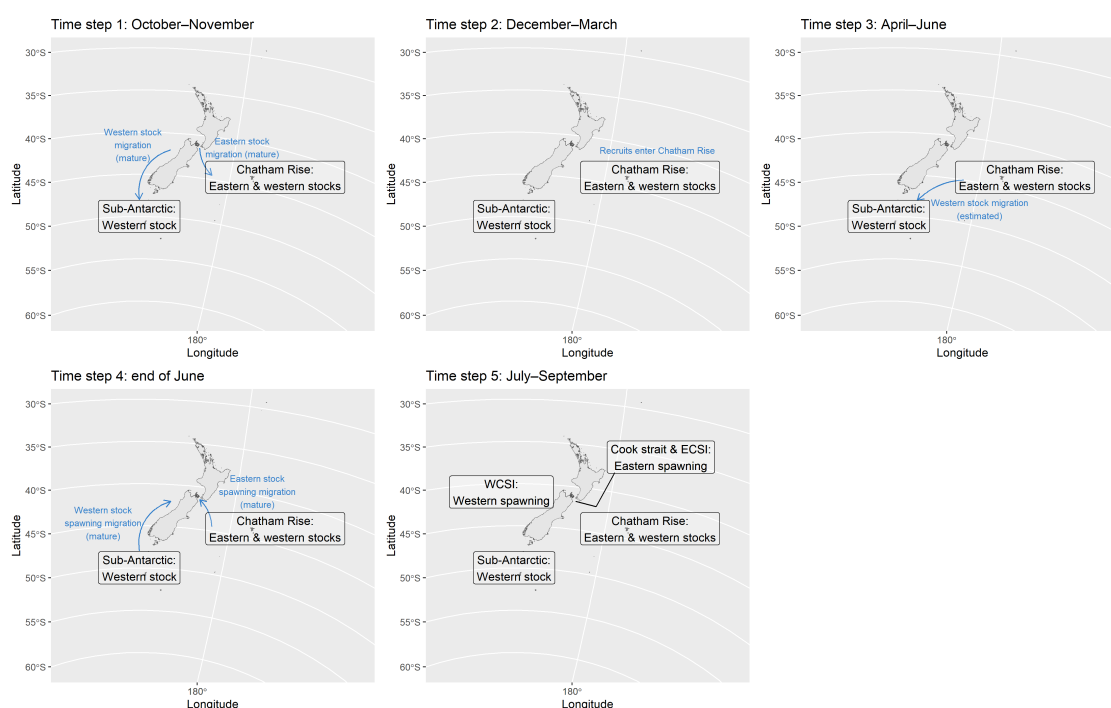


Figure 2: Graphical representation of migration in the base model. The single stock model has the same migration, except that fish are not assigned to a stock.

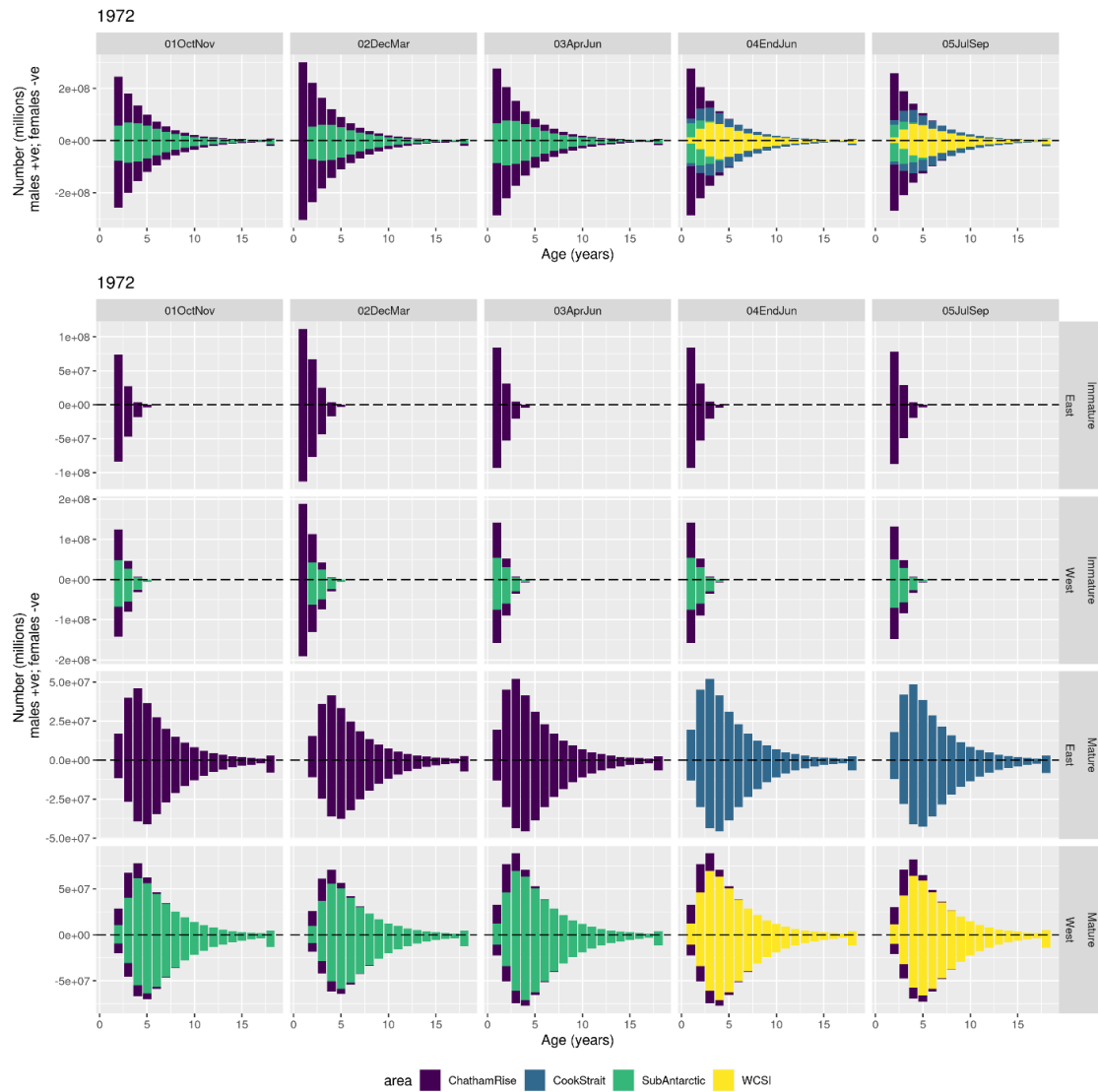


Figure 3: Base model population in the initial year (1972) by region (colour of bars), time-step (columns) and sex (top row), and expanded by stock and maturity (bottom four rows).

Table 1: Actions within the model annual cycle by time step 1–5. Each time step relates approximately to a month range, although these are not specified within the model; only the order of the time steps is specified. Fisheries are defined in Section 3.1. CS: Cook Strait; CR: Chatham Rise; ECSI: east coast South Island; WC: west coast South Island; SA: sub-Antarctic. On the Chatham Rise, deep: bottom depth ≥ 475 m; shallow: bottom depth < 475 m. ‘All ages’ is 1–18 years, where 18 is a plus group.

Type	Name	Region	Stock	Maturity stage/Age
<i>Time step 1: October–November</i>				
Migration	CS_to_CR	CS, CR	East	Mature
Migration	WC_to_SA	WC, SA	West	Mature
<i>Time step 2: December–March</i>				
Population	Recruitment	CR	East, West	Age 0
Abundance	survey_CR_summer_abundance	CR	East, West	2–13 years
	survey_SA_summer_abundance	SA	West	4–15 years
Proportion_at_age	survey_CR_summer_age	CR	East, West	2–13 years
	survey_SA_summer_age	SA	West	4–15 years
Catches	fishery_CR_deep	CR	East, West	All ages
	fishery_CR_shallow	CR	East, West	All ages
	fishery_SA_suba	SA	West	All ages
	fishery_SA_snares	SA	West	All ages
Catch_at_age	fishery_SA_auck	SA	West	All ages
	fishery_CR_deep_age	CR	East, West	All ages
	fishery_CR_shallow_age	CR	East, West	All ages
	fishery_SA_suba_age	SA	West	All ages
	fishery_SA_snares	SA	West	All ages
	fishery_SA_auck	SA	West	All ages
<i>Time step 3: April–June</i>				
Migration	CR_to_SA	CR, SA	West	All ages
Abundance	survey_SA_autumn_abundance	SA	West	2–15 years
Proportion_at_age	survey_SA_autumn_age	SA	West	2–15 years
<i>Time step 4: End of June</i>				
Migration	CR_to_CS	CR, SA	East	Mature
Migration	SA_to_WC	CR, SA	West	Mature
<i>Time step 5: July–September</i>				
Population	Ageing	All	East, West	All ages
Abundance	survey_CS_spawning_abundance	CS	East	Mature
	survey_WC_spawning_abundance	WC	West	Mature
Catches	fishery_CS	CS	East	Mature
	fishery_ECSI	CS	East	Mature
	fishery_WC_inside	WC	West	Mature
	fishery_WC_north	WC	West	Mature
	fishery_WC_south	WC	West	Mature
Catch_at_age	fishery_CS_age	CS	East	Mature
	fishery_WC_inside	WC	West	Mature
	fishery_WC_north	WC	West	Mature
	fishery_WC_south	WC	West	Mature
Population	Spawning	CS	East	Mature
	Spawning	WC	West	Mature

2.2 Parameters and priors

Biological parameters for length-at-age, length-weight conversion, and stock-recruitment were defined following the previous assessments for hoki (McGregor et al. 2023, 2024) (Table 2). Biological parameters for length-at-age and length-weight conversion were updated as part of this project (McGregor-Tiatia & Langley 2025) and these new estimates will be applied in future assessments. The values of natural mortality rate for males and females were adopted as given by McGregor et al. (2022) which followed the review work of Langley (2020). M was specified by sex as parameters M_{avg} and M_{diff} such that $M_{male} = M_{avg} + M_{diff}/2$ and $M_{female} = M_{avg} - M_{diff}/2$.

Maturation was defined as given by McGregor et al. (2023, 2024) and McGregor & Langley (2025) based on the composition data in the spawning fisheries. Maturation defines the age at which fish migrate to the spawning grounds and hence are available to the spawning fisheries (west coast South Island and Cook Strait/ECSI). The model specified age at maturation as one year younger than the effective age at maturation due to the order of events within the annual cycle. Ageing occurs in the model at the beginning of the spawning fishery time step, which is after migrating to the spawning ground. For example, in order for four year old fish to be available to the spawning fisheries, they need to migrate there as three year olds, which requires them to be defined as mature within the model at age three.

Estimated parameters were in five main categories: model initialisation (B_0), recruitment (YCS), migration, catchability, and selectivity ogives (Table 3). The largest set of estimated parameters were YCSs, then the selectivity ogives. Selectivity ogives were all either logistic capped or double normal capped, depending on whether older fish were generally present within the relevant composition data, and following investigative model runs. The selectivity ogives could, in principle, reflect spatial and temporal dynamics not otherwise modelled through the relatively coarse spatial and temporal structure of the model, as well as attributes of the fishing gear and fisher behaviour. Selectivity to the Chatham Rise summer trawl survey was not estimated; it was fixed as knife-edge, selecting all fish 2-years and older. Selectivity to the WCSI acoustic survey was also not estimated, and was fixed as constant (select-all) selectivity as this survey is intended to index the WCSI spawning population. Selectivities estimated for the Cook Strait and ECSI spawning fisheries were applied to the corresponding acoustic surveys as these surveys index different parts of the eastern stock spawning fishery, with younger fish generally seen in ECSI than Cook Strait. While using the fishery selectivity for the Cook Strait acoustic survey was not entirely correct given the survey extends beyond the fishery, applying a select-all to this survey was not consistent within the model given the assumption of both ECSI and Cook Strait spawning fisheries to be within the eastern stock spawning area and both with corresponding surveys.

Table 2: Biological parameter values used in the stock assessment base model.

Function	Parameter	Western		Eastern		Source
		Male	Female	Male	Female	
Growth von Bertalanffy	L_{∞}	92.6	104.0	89.5	101.8	Horn & Sullivan (1996)
	K	0.261	0.213	0.232	0.161	Horn & Sullivan (1996)
	t_0	-0.50	-0.60	-1.23	-2.18	Horn & Sullivan (1996)
Maturation Logistic	a_{50}	2	3	2	3	Assumed (McGregor et al. 2022)
	a_{50to95}	2	3	2	3	Assumed (McGregor et al. 2022)
All						
length-weight $w = al^b$ $w(t), l(cm)$	a				4.79e-9	Francis (2003)
	b				2.89	Francis (2003)
Recruitment Beverton-Holt	h				0.75	Assumed (McGregor et al. 2022)
	p_{male}				0.5	Assumed (McGregor et al. 2022)
Natural mortality	M_{avg}				0.275	Assumed (Langley 2020)
	M_{diff}				0.05	Assumed (Langley 2020)

Table 3: Estimated parameters in the stock assessment base and single-stock models. E: eastern stock; W: western stock. Years (e.g., 1975–2021) are model years. Informed catchability priors were from O’Driscoll et al. (2016) for ECSI, CS and WCSI. Informed priors for YCS were taken from the previous hoki assessment model (McGregor & Langley 2025).

Function	Component	Parameters	Prior
Base model			
Initialisation	Unfished biomass [E]	B_0	uniform-log
Initialisation	Unfished biomass [W]	B_0	uniform-log
Recruitment deviates	YCS.[W]	1975–2021	lognormal ($\mu = 1$, CV= 0.95)
Recruitment deviates	YCS.[E]	1975–2021	lognormal ($\mu = 1$, CV= 0.95)
Movement ogives (CR to SA)			
logistic-producing (1-8 years)	WestHomeMigration_male	a_{50}, a_{50to95}	uniform
logistic-producing (1-8 years)	WestHomeMigration_female	a_{50}, a_{50to95}	uniform
Single-stock model			
Initialisation	Unfished biomass	B_0	uniform-log
Recruitment deviates	YCS	1975–2021	lognormal ($\mu = 1$, CV= 0.95)
Movement ogives (CR to SA)			
constant	WestHomeMigration_male	c	uniform
constant	WestHomeMigration_female	c	uniform
Both models			
Catchability	survey_CS_spawning_q	q	lognormal ($\mu = 0.55$, CV= 0.90)
Catchability	survey_ECSI_spawning_q	q	uniform
Catchability	survey_WC_spawning_q	q	lognormal ($\mu = 0.39$, CV= 0.77)
Catchability	survey_CR_summer_q	q	uniform
Catchability	survey_SA_summer_q	q	uniform
Catchability	survey_SA_autumn_q	q	uniform
Selectivity ogives - surveys (age-based)			
logistic capped	survey_SA_summer_select	$a_{50}, a_{50to95}, a_{max}$	normal
logistic capped	survey_SA_autumn_select	$a_{50}, a_{50to95}, a_{max}$	uniform
logistic capped	survey_SA_AEX_select	$a_{50}, a_{50to95}, a_{max}$	uniform
logistic capped	survey_SA_SHI_select	$a_{50}, a_{50to95}, a_{max}$	uniform
Selectivity ogives - fisheries (age-based)			
logistic capped	fishery_CR_deep_select	$a_{50}, a_{50to95}, a_{max}$	uniform
double normal capped	fishery_CR_shallow_select	a_1, a_L, a_R, a_{max}	uniform
logistic capped	fishery_CS_spwn_select.male	$a_{50}, a_{50to95}, a_{max}$	uniform
logistic capped	fishery_CS_spwn_select.female	$a_{50}, a_{50to95}, a_{max}$	uniform
double normal capped	fishery_ECSI_spwn_select.male	a_1, a_L, a_R, a_{max}	uniform
double normal capped	fishery_ECSI_spwn_select.female	a_1, a_L, a_R, a_{max}	uniform
logistic capped	fishery_SA_auck_select	$a_{50}, a_{50to95}, a_{max}$	normal
double normal capped	fishery_SA_snares_select	a_1, a_L, a_R, a_{max}	normal
logistic capped	fishery_SA_suba_select	$a_{50}, a_{50to95}, a_{max}$	uniform
logistic capped	fishery_WC_inside_select.male	$a_{50}, a_{50to95}, a_{max}$	uniform
logistic capped	fishery_WC_inside_select.female	$a_{50}, a_{50to95}, a_{max}$	uniform
double normal capped	fishery_WC_north_select.male	a_1, a_L, a_R, a_{max}	normal
double normal capped	fishery_WC_north_select.female	a_1, a_L, a_R, a_{max}	uniform
logistic capped	fishery_WC_south_select.male	$a_{50}, a_{50to95}, a_{max}$	uniform
logistic capped	fishery_WC_south_select.female	$a_{50}, a_{50to95}, a_{max}$	uniform

3. MODEL INPUTS

Inputs into the model consisted of commercial catches, corresponding catch-at-age, survey biomass indices (acoustic and trawl), and proportion-at-age from the trawl surveys (Table 4). These inputs are described in detail by Ballara et al. (2025).

Trawl surveys were assigned process error CVs of 0.10. Effective sample sizes on composition data were then calculated by applying the Francis re-weighting algorithm (Francis 2011). Resulting samples sizes are summarised in Table 5. Datasets survey_CR_SHI_age, survey_SA_SHI_age, and survey_SA_summer_age were given nominal sample sizes and were not re-weighted due to the low number of years in these observations.

Age composition data for the ECSI spawning fishery in 2023 and 2024 were available but not used due to inconsistencies in sampling compared to the earlier part of this series (Fisheries New Zealand 2025).

New data in the 2025 assessment:

- Catches (2024 fishing year)
- Commercial catch-at-age (2024 fishing year)
- Assumed catch (2025 fishing year assumed equal to 2024)
- SA trawl survey abundance index (summer 2024–25)
- SA trawl survey proportions-at-age (summer 2024–25)
- WCSI acoustic survey (winter (2024)

Table 4: Model inputs overview for the hoki stock assessment base model where Years are fishing years which run October–September and are labelled by the latter year (i.e., 2025: October 2024–September 2025). Catches are assumed in the model, meaning they are entered without error, rather than being an observation that the model fits to. (Continued on next page)

Region	Stock	Name	Years
<i>Catches (assumed)</i>			
CS	E	fishery_CS_spwn	1988–2025
CS	E	fishery_ECSI_spwn	1988–2025
CR	E + W	fishery_CR_deep	1972–2025
CR	E + W	fishery_CR_shallow	1972–2024
SA	W	fishery_SA_auck	1983–2025
SA	W	fishery_SA_snares	1983–2025
SA	W	fishery_SA_suba	1983–2025
WC	W	fishery_WC_inside	1972–2025
WC	W	fishery_WC_north	1972–2025
WC	W	fishery_WC_south	1972–2025
<i>Catch-at-age (observed)</i>			
CS	E	fishery_CS_spwn_age	1990–2005, 2007–2010, 2014–2024
CS	E	fishery_ECSI_spwn_age	2003, 2004, 2006, 2008, 2019, 2022
CR	E + W	fishery_CR_deep	2001–2024
CR	E + W	fishery_CR_shallow	2001–2019, 2021–2024
SA	W	fishery_SA_auck	2001, 2003, 2004, 2006–2024
SA	W	fishery_SA_snares	2001, 2006–2024
SA	W	fishery_SA_suba	2001–2003, 2009, 2012, 2016, 2018–2024
WC	W	fishery_WC_inside	2000–2010, 2012–2024

WC	W	fishery_WC_north	1998–2024
WC	W	fishery_WC_south	1988–2024
<i>Survey (observed)</i>			
CS	E	survey_CS_spawning_abundance	1991, 1993–2003, 2005 –2009, 2011, 2013, 2015, 2017, 2019, 2021, 2023
WC	W	survey_WC_spawning_abundance	1988–1993, 1997, 2000, 2012, 2013, 2018, 2024
CR	E + W	survey_CR_summer_abundance	1992 –2014, 2016, 2018, 2020, 2022, 2024
SA	W	survey_SA_summer_abundance	1992–1994, 2001–2010, 2012, 2013, 2015, 2017, 2019, 2021, 2023, 2025
SA	W	survey_SA_autumn_abundance	1992, 1996, 1998
<i>Proportion-at-age (observed)</i>			
SA	W	survey_SA_AEX_age	1990, 1991
SA	W	survey_SA_SHI_age	1984
CR	E + W	survey_CR_SHI_age	1983
CR	E + W	survey_CR_summer_age	1992 –2014, 2016, 2018, 2020, 2022, 2024
SA	W	survey_SA_summer_age	1992–1994, 2001–2010, 2012, 2013, 2015, 2017, 2019, 2021, 2023, 2025
SA	W	survey_SA_autumn_age	1992, 1996, 1998

Table 5: Composition data initial sample sizes and re-weighted sample sizes from the base and single-stock models. Values are averages for each dataset. Values for each year within the datasets are in Appendix B. Datasets survey_CR_SHI_age, survey_SA_SHI_age, and survey_SA_summer_age were given a nominal sample size and were not re-weighted due to the low number of years in these observations.

Dataset	Initial	Re-weighted	
		2025 base	2025 single-stock
ChathamRiseSHIAge	5.00	5.00	5.00
ChathamRiseSummerAge	826.71	48.01	27.70
FisheryChathamRiseDeepAge	367.79	19.89	15.52
FisheryChathamRiseShallowAge	72.17	7.58	7.79
FisheryCookStraitAge	737.68	39.54	17.80
FisheryECSISpawningAge	281.00	41.33	31.87
FisherySubAntarcticAucklandAge	108.68	6.26	7.77
FisherySubAntarcticSnaresAge	167.88	6.52	8.48
FisherySubAntarcticSubaAge	135.77	12.88	15.81
FisheryWCSIIInsideAge	554.33	13.67	12.51
FisheryWCSINorthAge	1117.84	43.96	36.29
FisheryWCSISouthAge	783.49	37.84	28.59
SubAntarcticAEXAge	5.00	5.00	5.00
SubAntarcticAutumnAge	26.36	21.33	14.44
SubAntarcticSHIAge	5.00	5.00	5.00
SubAntarcticSummerAge	443.38	11.50	11.35

3.1 Fisheries

Fisheries were the same structure as in the previous assessment (McGregor & Langley 2025), which were defined based on the review work of Langley (2020). The fisheries were defined within four main spatial regions: WC, the spawning ground for the western stock; CS, the spawning ground for the eastern stock; SA, the non-spawning ground for the western stock; CR, the non-spawning ground for the eastern stock and for juveniles of both stocks (Table 6 and Figure 1). Where there are multiple fisheries within one region, selectivity ogives account for differences in the age structure of fish available to each of the fisheries.

Highest catches were from the WC spawning fisheries which peaked in the late 1980s to early 1990s (Figure 4). Catches in the CR and CS fisheries peaked in the mid–late 1990s and then remained fairly steady from the mid–late 2000s with ECSI catches increasing from 2010 to 2024. Sub-Antarctic catches generally declined from 2014 to 2024, mostly attributed to declining catches from the Snares fishery. WC catches declined from 2015 to 2024 which was mostly attributed to declining catches in the north fishery; the WC inside and south catches remained fairly flat over this period.

Table 6: Fishery structure for the 2025 hoki stock assessment. Further details are given by McGregor et al. (2022) which also relates the 2021 structure to that of the 2019 assessment. ‘Age-structure’ summarises the key differences in relative age-structure where there are multiple fisheries in one region, and figures for these were given by McGregor et al. (2023). West coast spawning fisheries are effectively June–September due to few catches outside these months (Ballara et al. 2025). ‘Ogive’ is the assumed selectivity ogive shape.

Model area	Fishery	Age-structure	Months	Stock(s)	Spawning status	Ogive
Cook Strait	CS	Older	June–September	East	Spawning	Logistic
Cook Strait	ECSI	Younger	July–September	East	Spawning	Double-normal
Chatham Rise	CR_deep	Older	All months	East & West	Non-spawning	Logistic
Chatham Rise	CR_shallow	Younger	All months	East & West	Non-spawning	Double-normal
Sub-Antarctic	SA_auck	Medium	All months	West	Non-spawning	Double-normal
Sub-Antarctic	SA_snares	Younger	All months	West	Non-spawning	Double-normal
Sub-Antarctic	SA_suba	Older	All months	West	Non-spawning	Logistic
West coast	WC_south	Medium	All months	West	Spawning	Double-normal
West coast	WC_inside	Older	All months	West	Spawning	Logistic
West coast	WC_north	Younger	All months	West	Spawning	Double-normal

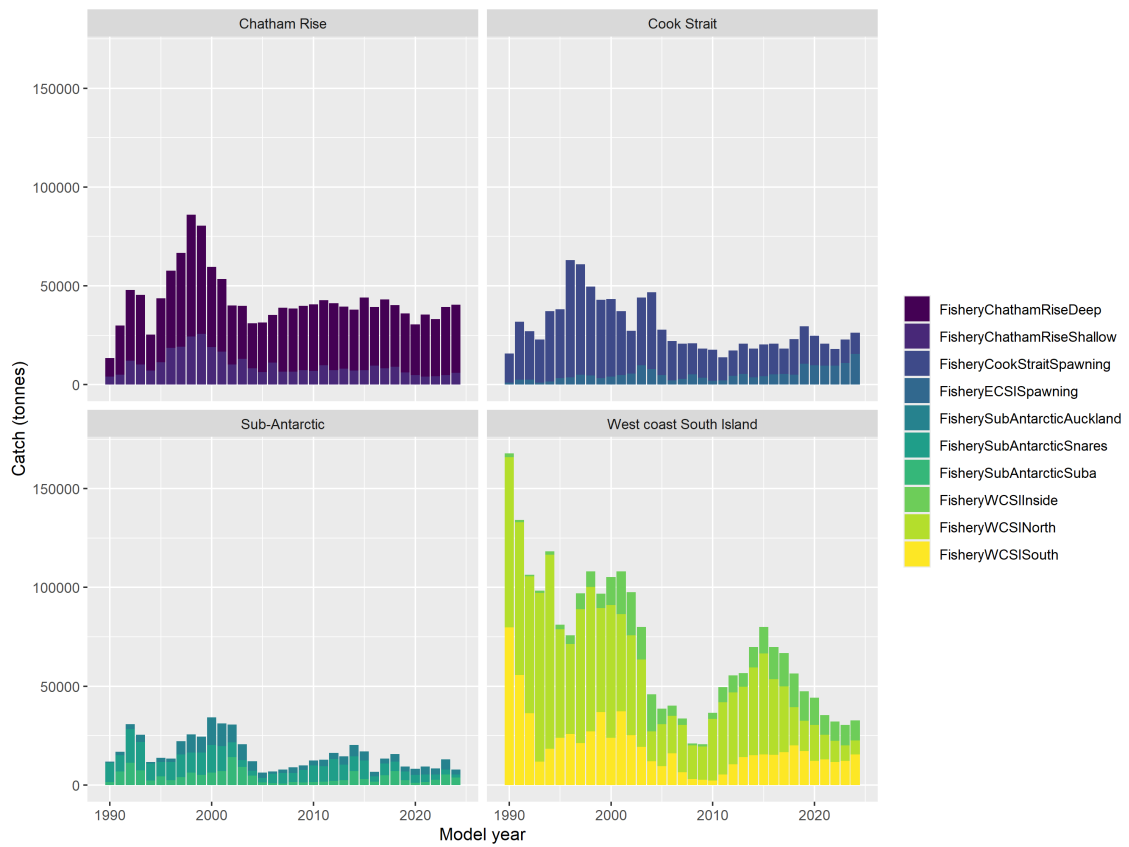


Figure 4: Hoki catch history by fishery as defined in the 2025 stock assessment model.

3.2 Survey abundance data

Survey abundance indices are available from the Chatham Rise and sub-Antarctic trawl surveys and acoustic surveys from west coast South Island, Cook Strait, and Pegasus Canyon (east coast South Island) (Figure 5). A new estimate was available for the 2025 fishing year from the sub-Antarctic survey, and the 2024 fishing year from the WCSI acoustic survey.

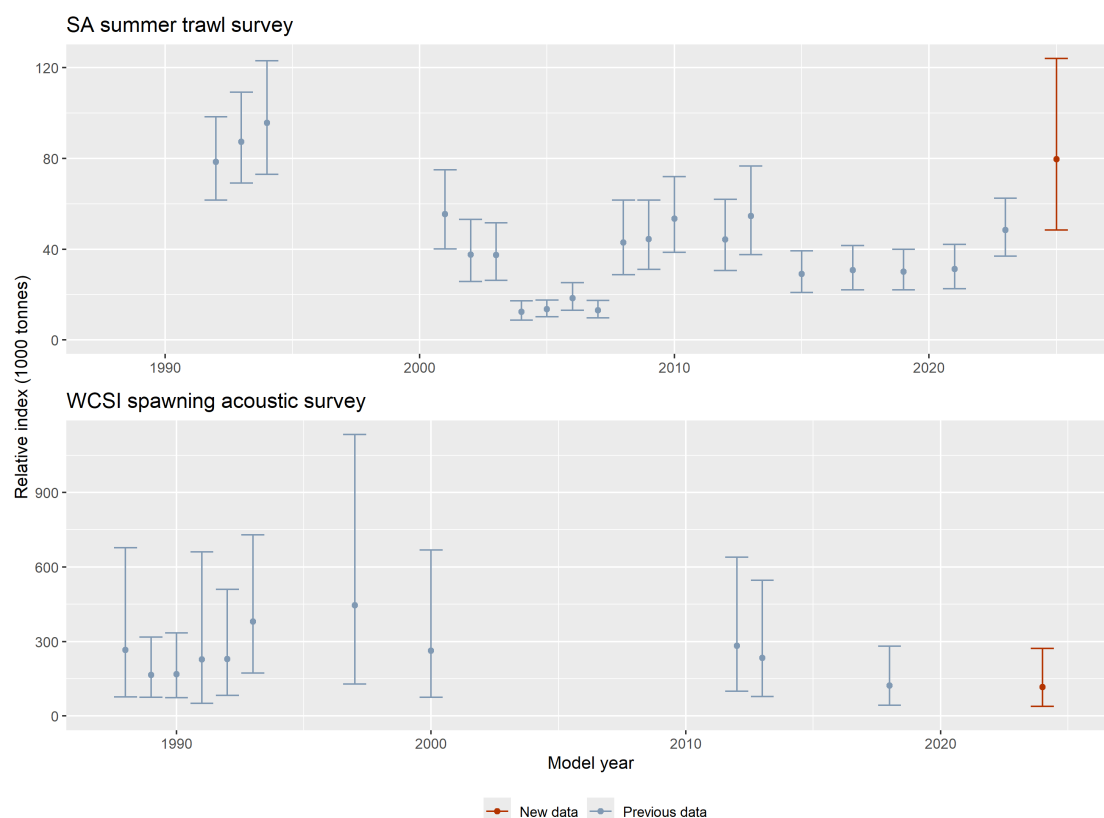


Figure 5: Sub-Antarctic trawl survey (top) and WCSI spawning acoustic survey (bottom) abundance indices. Red points and error bars are the new data for the 2025 assessment; Error bars are 95% Confidence intervals.

3.3 Composition data

The age-structure of new composition data are shown overlaid with data from earlier years in Figure 6. The Chatham Rise fisheries in 2024 had a higher proportion of 1-year olds than on average in previous years, particularly in the shallow fishery. The WC fisheries had fewer 2- and 3-year olds in 2024 than in earlier years, which was particularly apparent in the WC north fishery.

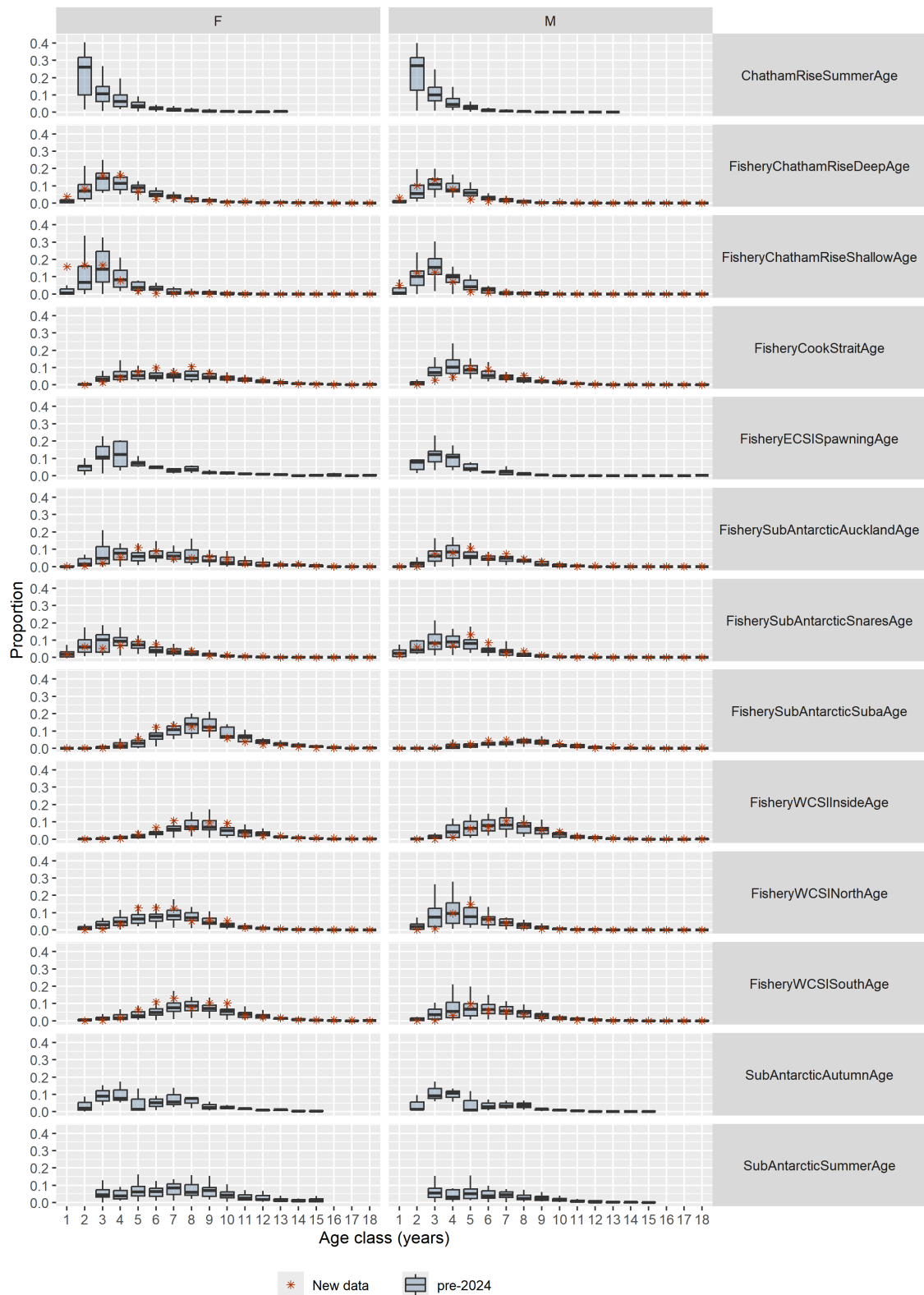


Figure 6: Summary of age composition data, separated by sex (female (left), male (right)). Red asterisks are the new data for the 2025 assessment (i.e., proportions-at-age from the 2024 fishing year or summer 2024-25 in the case of the trawl survey; these are single points as they are only from one year); boxplots are proportions-at-age from all earlier fishing years and give median, upper and lower quantiles, and upper and lower 95% confidence intervals.

3.4 Informing year classes

Year class strengths were estimated for 1975–2021. Table 7 gives a summary of observations informing the 2020 and 2021 year classes. The 2021 year class entered the model as 1-year olds in the summer time-step in 2023 and as 2-year olds in the spawning time-step of the same year, but these observations were highly uncertain. The first reliable observations of the 2021 year class were of 2-year olds from the summer observations in 2024 (CR and SA fisheries and CR summer trawl survey), as 3-year olds in 2024 from the spawning fisheries (CS, ECSI and WCSI), and as 3-year olds in 2025 from the SA summer trawl survey.

The 2021 year class was not used in projections using the two-stock model and sampling from ‘recent’ recruitment due to insufficient observations to inform the split in recent recruitment between stocks.

Table 7: Summary of observations for the 2020 and 2021 year classes, giving the age of fish observed from each observation, model year, and year class. Text in grey are highly uncertain observations. CR: Chatham Rise; SA: Sub-Antarctic.

Datasets	Model year	2020 year class	2021 year class
Summer CR and SA fisheries	2022	1	
Spawning CS, ECSI and WCSI fisheries	2022	2	
Summer CR and SA fisheries	2023	2	1
Spawning CS, ECSI and WCSI fisheries	2023	3	2
CR summer trawl survey	2024	3	2
Summer CR and SA fisheries	2024	3	2
Spawning CS, ECSI and WCSI fisheries	2024	4	3
SA summer trawl survey	2025	4	3

4. MODEL SENSITIVITY ANALYSES (MPD)

Parameter sensitivity analyses were performed on the base and single stock models, with alternative values of male and female M , recruitment h , and maturity a_{50} , and with new biological parameters as estimated in (McGregor-Tiatia & Langley 2025) (Table 8). In both the base and single stock models, the ‘Mature early’ and ‘M high’ sensitivity runs gave improved fits to the models with base parameter values. The largest improvement in fits in the base model was to the WCSI south age observations under earlier maturation (Figure 7). The largest improvements in fits in the single stock model were to the WCSI south and north age observations under earlier maturity or higher natural mortality (Figure 8).

Table 9 gives estimated B_0 , SSB_{2025} , and $SSB(\%B_0)$ from the parameter sensitivity runs of the base and single stock models and Figures 9 to 12 show estimated $SSB(\%B_0)$, stock status, recruitment and YCS. The highest stock status was estimated in the high M sensitivity runs in both models and the lowest stock status from the low M sensitivity runs. Recruitment increased the most under high M and was lowest under low M , but true YCS changed very little under any of the parameter sensitivity runs after the mid-1980s (Figures 10 and 12).

Table 8: Summary of MPD parameter sensitivity runs on the base model and single stock model. Negative log-likelihood values (rounded to nearest 2 decimal places) are given and the lowest negative log-likelihood value (and hence the best model) is given in bold. Base model values in italics. The likelihood values are not comparable between the base and single stock models due to different sample sizes on the composition datasets, but they are comparable for parameter sensitivity runs within each model.

Sensitivity	Value	Negative log-likelihood	
		Base	Single stock
<i>(M base value: male $M = 0.30$; female $M = 0.22$)</i>		11 818.00	10 243.92
Mhigh	male $M = 0.35$; female $M = 0.30$	11 784.04	10 190.68
Mlow	male $M = 0.25$; female $M = 0.20$	11 943.56	10 346.12
<i>(Steepness base value: $h = 0.75$)</i>			
hhigh	$h = 0.70$	11 862.64	10 223.34
hlow	$h = 0.80$	11 866.60	10 227.85
<i>(Maturity base value: male $a_{50} = 2$; female $a_{50} = 3$)</i>			
MatureEarlier	male $a_{50} = 1$; female $a_{50} = 2$	11 777.50	10 195.26
MatureLater	male $a_{50} = 3$; female $a_{50} = 4$	11 990.92	10 367.24
<i>(New biological parameters)</i>			
Length-to-weight		11 815.26	10 222.32
Growth		11 857.86	10 216.59

Table 9: Summary of outputs from parameter sensitivity runs on the base and single stock models. B_0 and SSB_{2025} are in tonnes.

Model/sensitivity	Stock	B_0	SSB_{2025}	$SSB(\%B_0)$
Base model				
Base model	East	760 570	471 893	62.04
Base model	West	1 174 860	459 107	39.08
Base model	Total	1 935 430	931 000	48.10
h low	East	737 771	512 032	69.40
h low	West	1 182 020	379 632	32.12
h low	Total	1 919 791	891 664	46.45
h high	East	703 192	515 280	73.28
h high	West	1 107 360	382 639	34.55
h high	Total	1 810 552	897 919	49.59
M low	East	793 687	401 219	50.55
M low	West	1 305 950	353 948	27.10
M low	Total	2 099 637	755 167	35.97
M high	East	769 521	584 195	75.92
M high	West	1 194 840	545 808	45.68
M high	Total	1 964 361	1 130 000	57.53
Mature early	East	818 490	550 072	67.21
Mature early	West	1 219 500	491 370	40.29
Mature early	Total	2 037 990	1 041 440	51.10
Mature late	East	691 862	386 721	55.90
Mature late	West	1 123 690	424 067	37.74
Mature late	Total	1 815 552	810 788	44.66
New length-weight	East	792 727	485 426	61.23
New length-weight	West	1 189 400	463 657	38.98
New length-weight	Total	1 982 127	949 082	47.88
Alt growth	East	734 474	532 014	72.43
Alt growth	West	1 142 120	386 350	33.83
Alt growth	Total	1 876 594	918 364	48.94
Single stock model				
Single stock model	Total	1 993 760	928 102	46.55
h low	Total	2 039 450	930 285	45.61
h high	Total	1 939 220	942 424	48.60
M low	Total	2 143 400	739 189	34.49
M high	Total	2 020 510	1 140 060	56.42
Mature early	Total	2 101 190	1 065 800	50.72
Mature late	Total	1 862 630	835 291	44.84
New length-weight	Total	2 026 580	959 234	47.33
Alt growth	Total	2 016 800	979 908	48.59

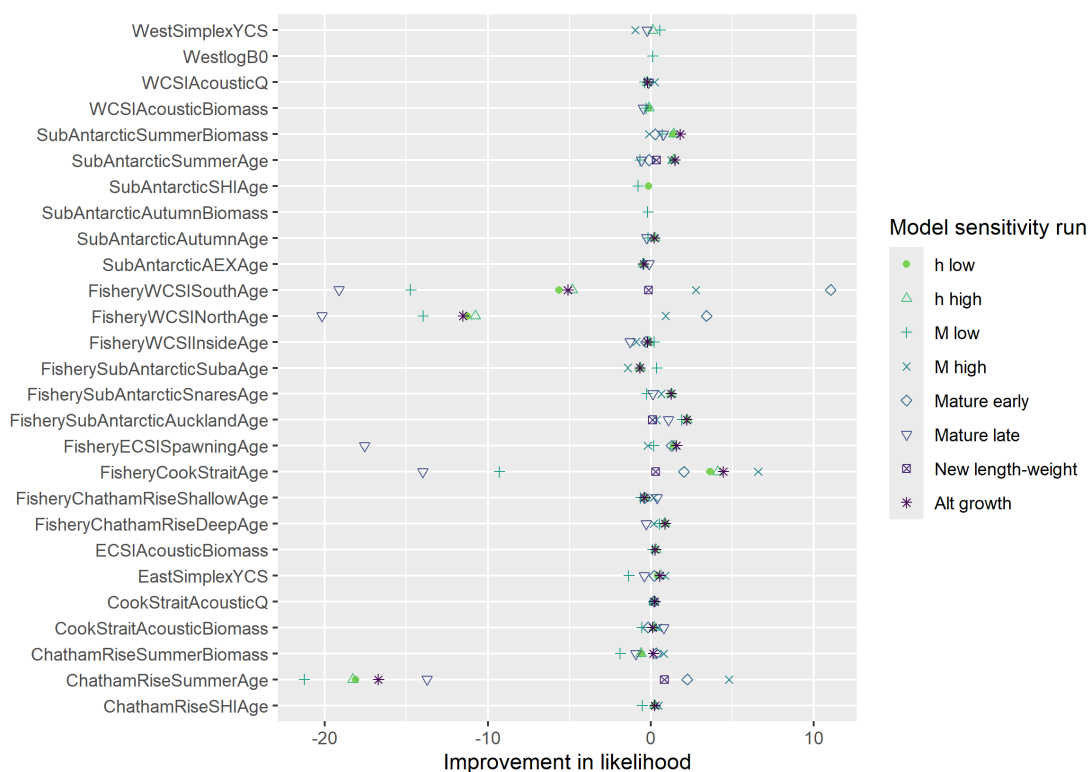


Figure 7: Changes in objective components from parameter sensitivity runs on the base model, showing changes that have an absolute value of at least 1 likelihood unit.

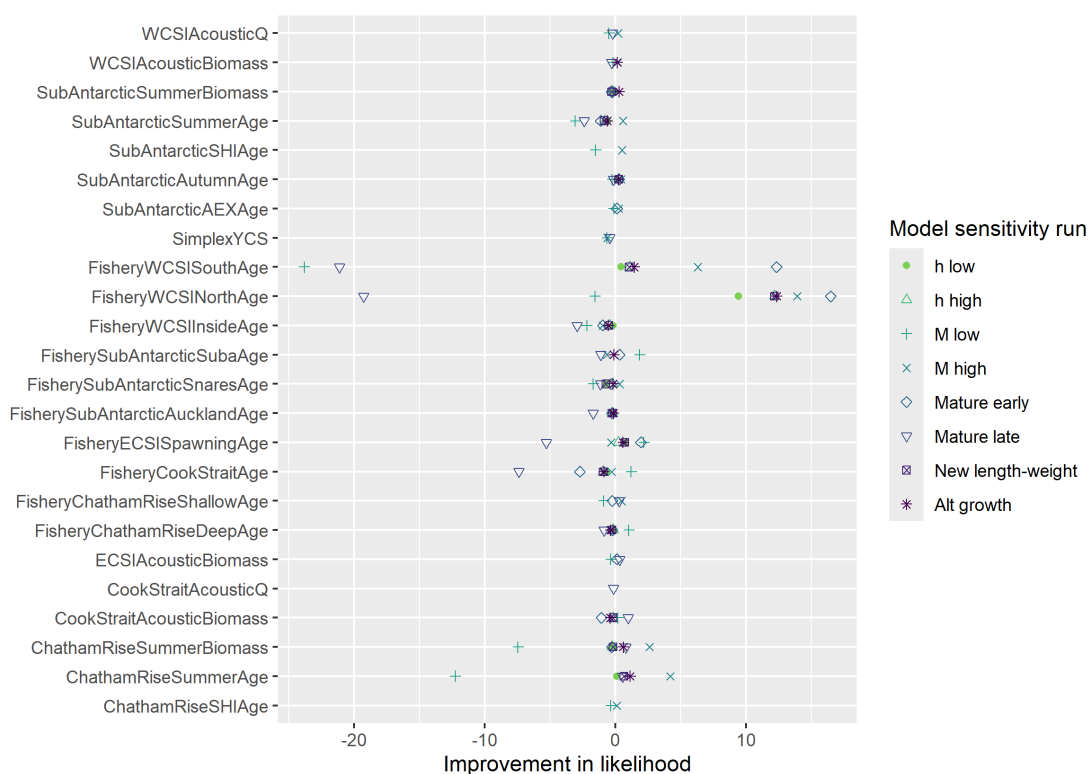


Figure 8: Changes in objective components from parameter sensitivity runs on the single stock model, showing changes that have an absolute value of at least 1 likelihood unit.



Figure 9: Spawning Stock Biomass (SSB) (top) and stock status (bottom) from parameter sensitivity runs on the base two stock model. For ease of reading the runs have been split into two sets.

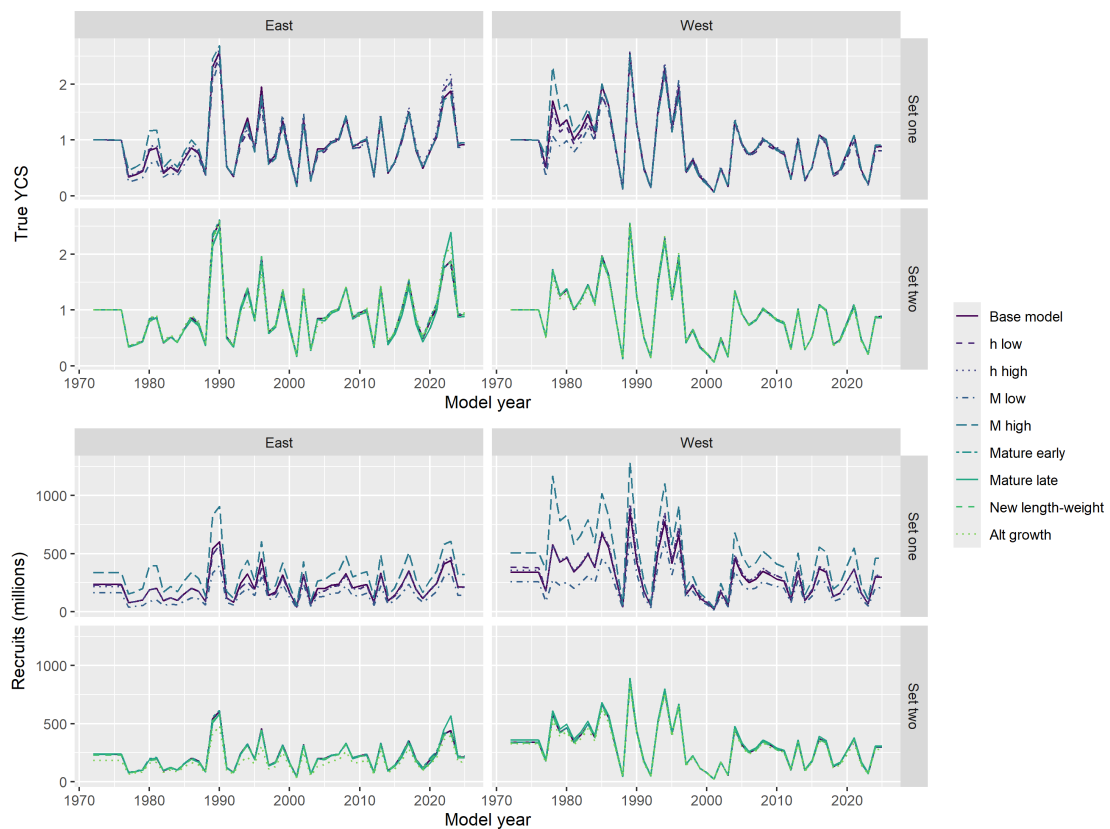


Figure 10: True year class strength (YCS) (top) and recruitment (bottom) from parameter sensitivity runs on the base two stock model. For ease of reading the runs have been split into two sets.

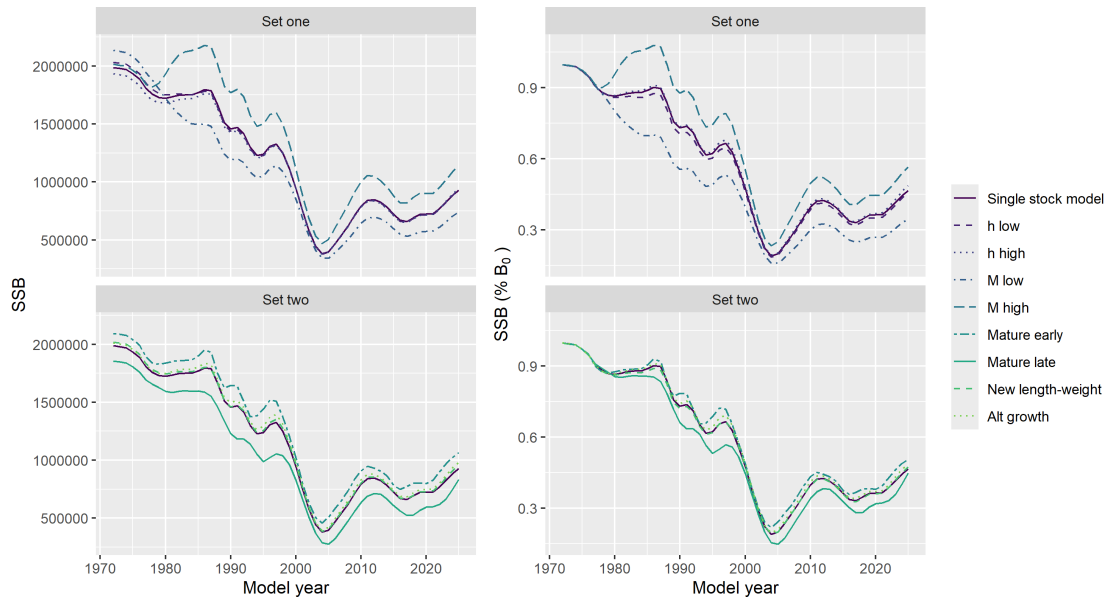


Figure 11: SSB (left) and stock status (right) from parameter sensitivity runs on the single stock model. For ease of reading the runs have been split into two sets.

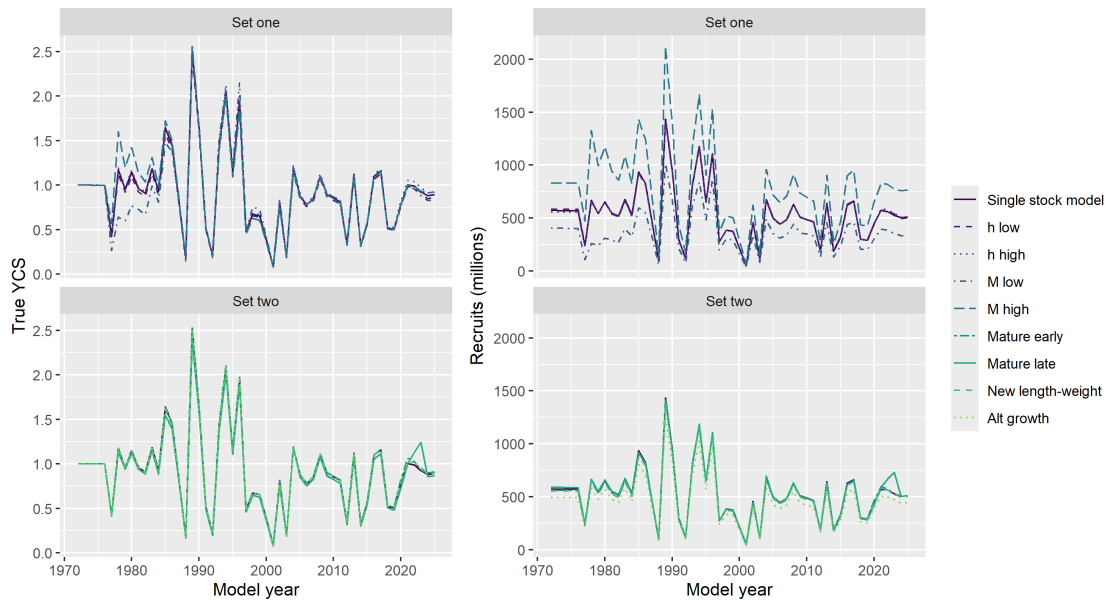


Figure 12: True YCS (left) and recruitment (right) from parameter sensitivity runs on the single stock model. For ease of reading the runs have been split into two sets.

5. FINAL MODEL ASSESSMENT RESULTS (MCMC)

MCMCs were run on the base two stock model and the alternative single stock model. Both models showed acceptable convergence and mixing. Outputs from the MCMCs are compared for these two models for biomass and stock status (Table 10), recruitment (Figure 13), SSB (Figure 14), and vulnerable biomass (Figure 15). MCMC trace plots and posterior distributions are given in Figures 16 to 23. The full set of MCMC outputs and diagnostics for both models are given in Appendix A.

Recruitment was very similar between models, although variability was higher in some years from the base model, and there were larger differences in the most recent year class (2021). Current stock status (estimated for 2025) was 44% B_0 in the single stock model and 45% B_0 in the base model, with the eastern and western stock status in the base model estimated as 55 and 39% B_0 respectively. SSB was very similar between models from 2000 and the single stock model estimated higher SSB pre-2000. Vulnerable biomass showed more differences between models: the single stock model estimated greater uncertainty pre-2000 for vulnerable biomass to the Cook Strait fishery; vulnerable biomass to the ECSI spawning fishery was higher in the single stock model over all years; vulnerable biomass was generally lower for the WCSI fisheries in the single stock model, except since 2020 when they were similar, and pre-1985 when they were generally higher.

The estimated Chatham Rise summer survey catchability was lower from the single stock model, and the MPD estimate was within the posterior distribution for both models (Figure 18). The Cook Strait catchability MPD estimate and posterior distribution were closer to the prior distribution in the single stock model than the base model which estimated this catchability to be higher (Figure 19). Estimates of ECSI acoustic survey, sub-Antarctic autumn survey, and WCSI acoustic survey catchabilities were fairly similar between models (Figure 20, 21 and 23). The sub-Antarctic summer survey catchability was poorly estimated in both models with a very flat posterior distribution, although it was slightly improved in the single stock model (Figure 22).

Table 10: Estimates of spawning biomass (tonnes) (medians of marginal posterior, with 95% confidence intervals in parentheses). B_{2025} is the biomass in mid-season 2025.

Base model	B_0 ('000t)	B_{2025} ('000t)	B_{2025}/B_0
East	727 (676, 785)	396 (284, 540)	55 (41, 70)
West	1 176 (1 131, 1 223)	456 (356, 572)	39 (31, 47)
Total	1 903 (1 807, 2 008)	855 (719, 1 020)	45 (40, 51)
Single stock model	B_0 ('000t)	B_{2025} ('000t)	B_{2025}/B_0
Total	1 959 (1 903, 2 022)	866 (720, 1 036)	44 (38, 51)

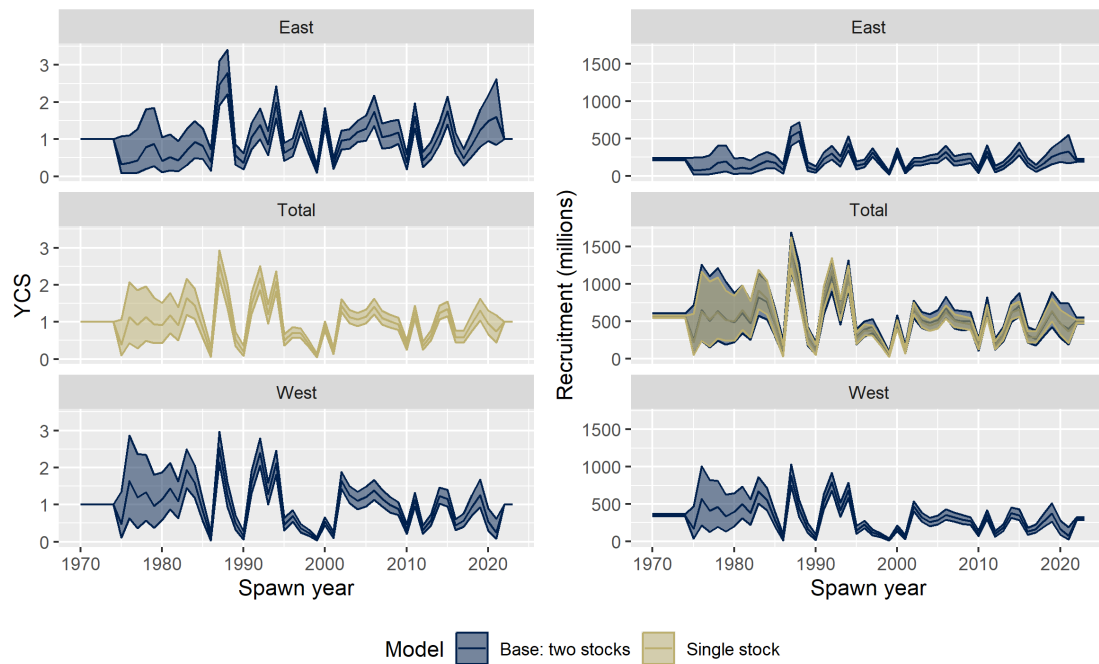


Figure 13: MCMC YCS (left) and recruitment (right) outputs for the base two-stock model and alternative single-stock model, for eastern stock (top), single or combined stock (middle), and western stock (bottom). Shaded areas are 95% credible intervals (left); lines are medians.

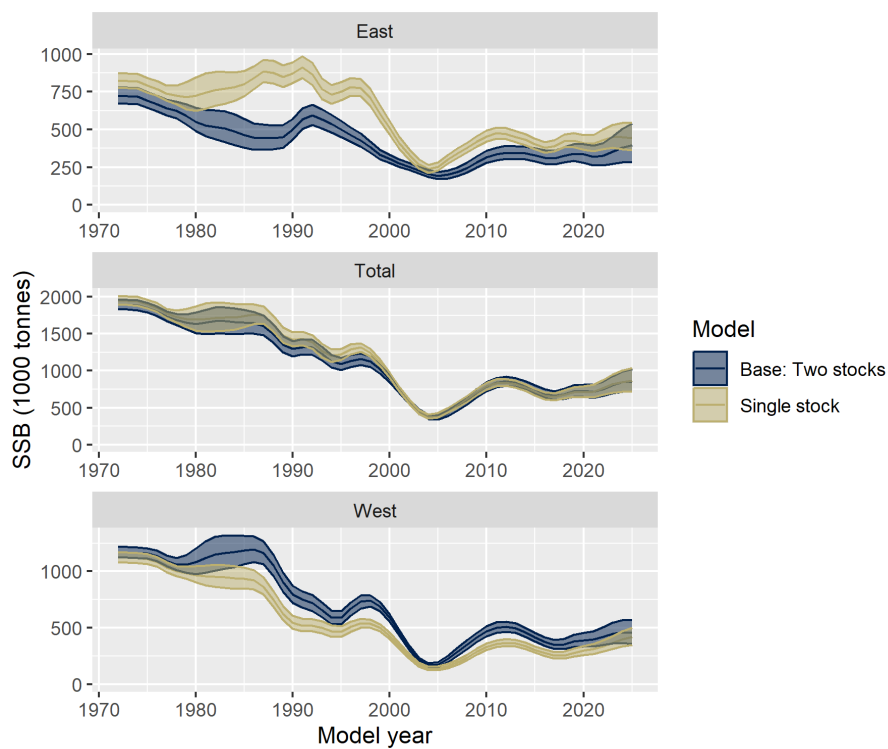


Figure 14: MCMC SSB outputs for the base two-stock model and alternative single-stock model, for eastern stock (top), single or combined stock (middle), and western stock (bottom). Shaded areas are 95% credible intervals (left); lines are medians.

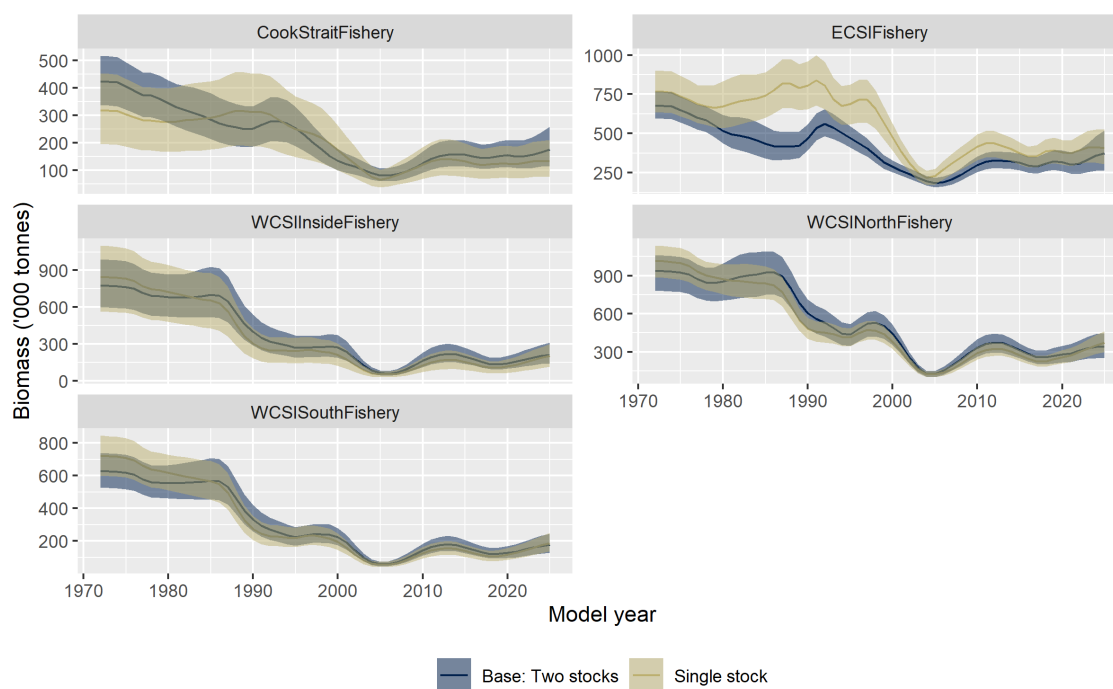


Figure 15: MCMC vulnerable biomass to the spawning fisheries outputs for the base two-stock model and alternative single-stock model. Shaded areas are 95% credible intervals; lines are medians.

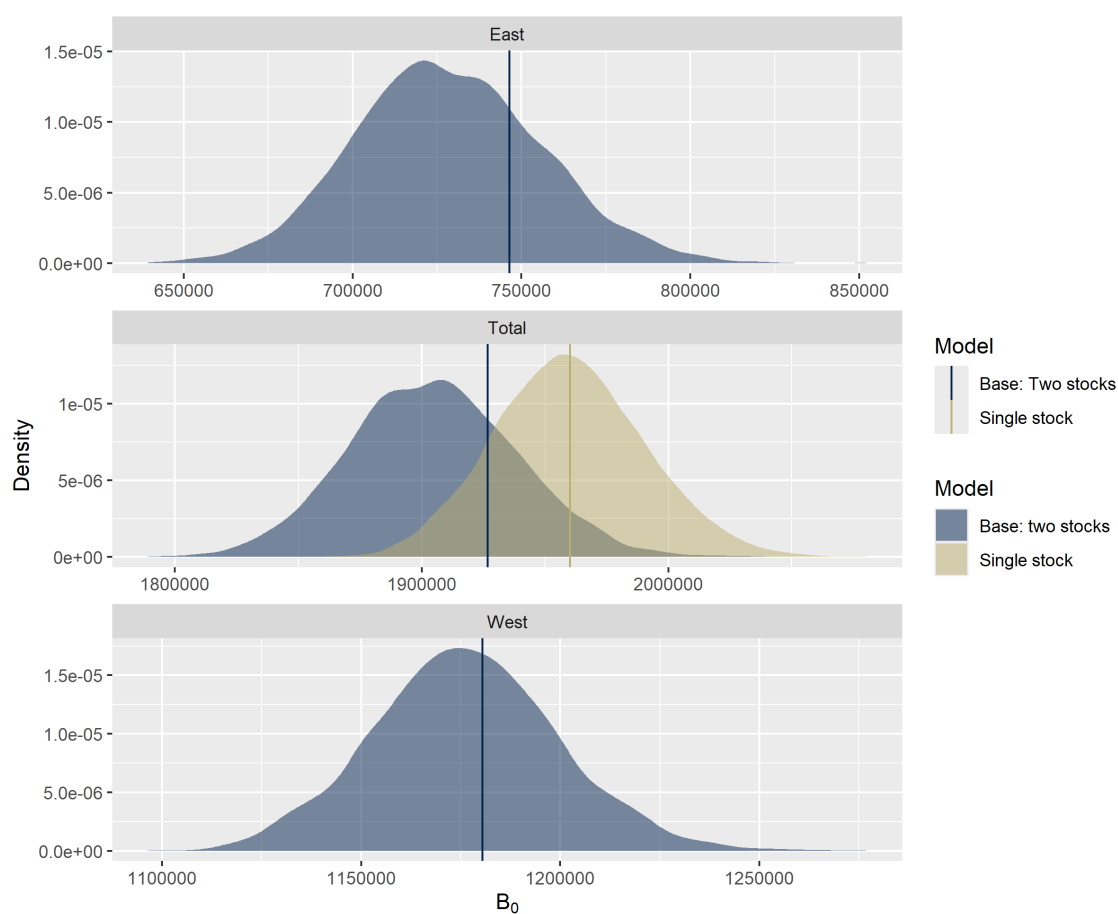


Figure 16: MCMC posterior distribution of B_0 by stock for the base two-stock model and alternative single-stock model. Vertical lines are the corresponding MPD estimates.

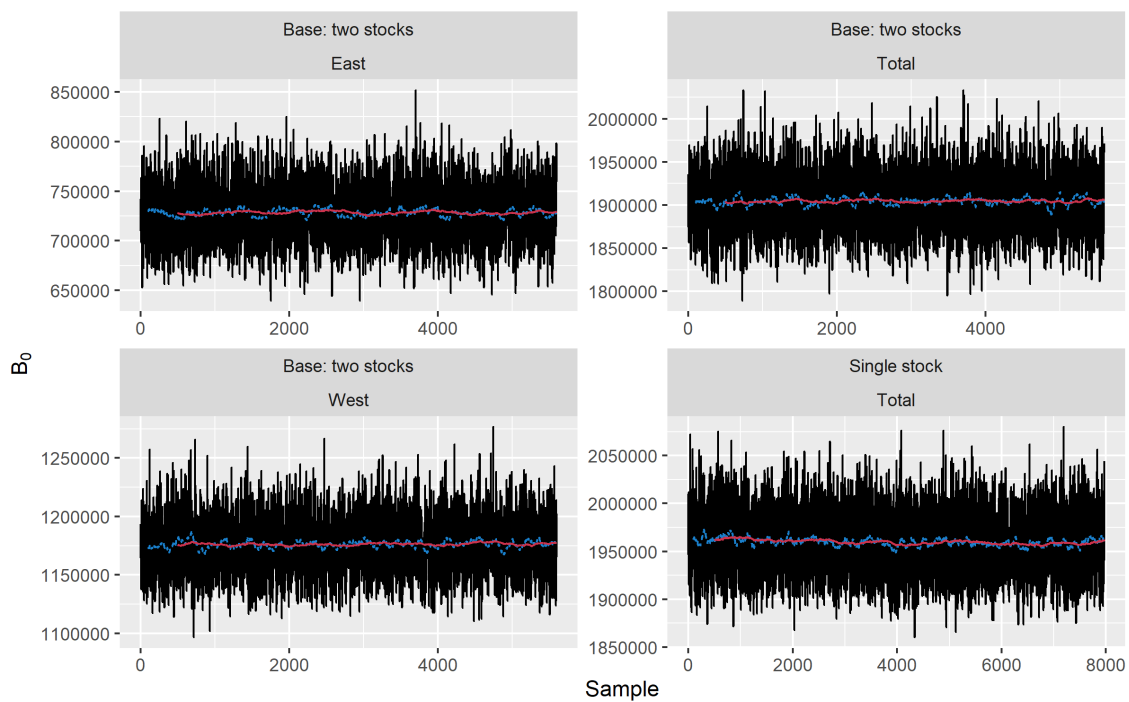


Figure 17: MCMC B_0 traces by stock for the base two-stock model and alternative single-stock model.

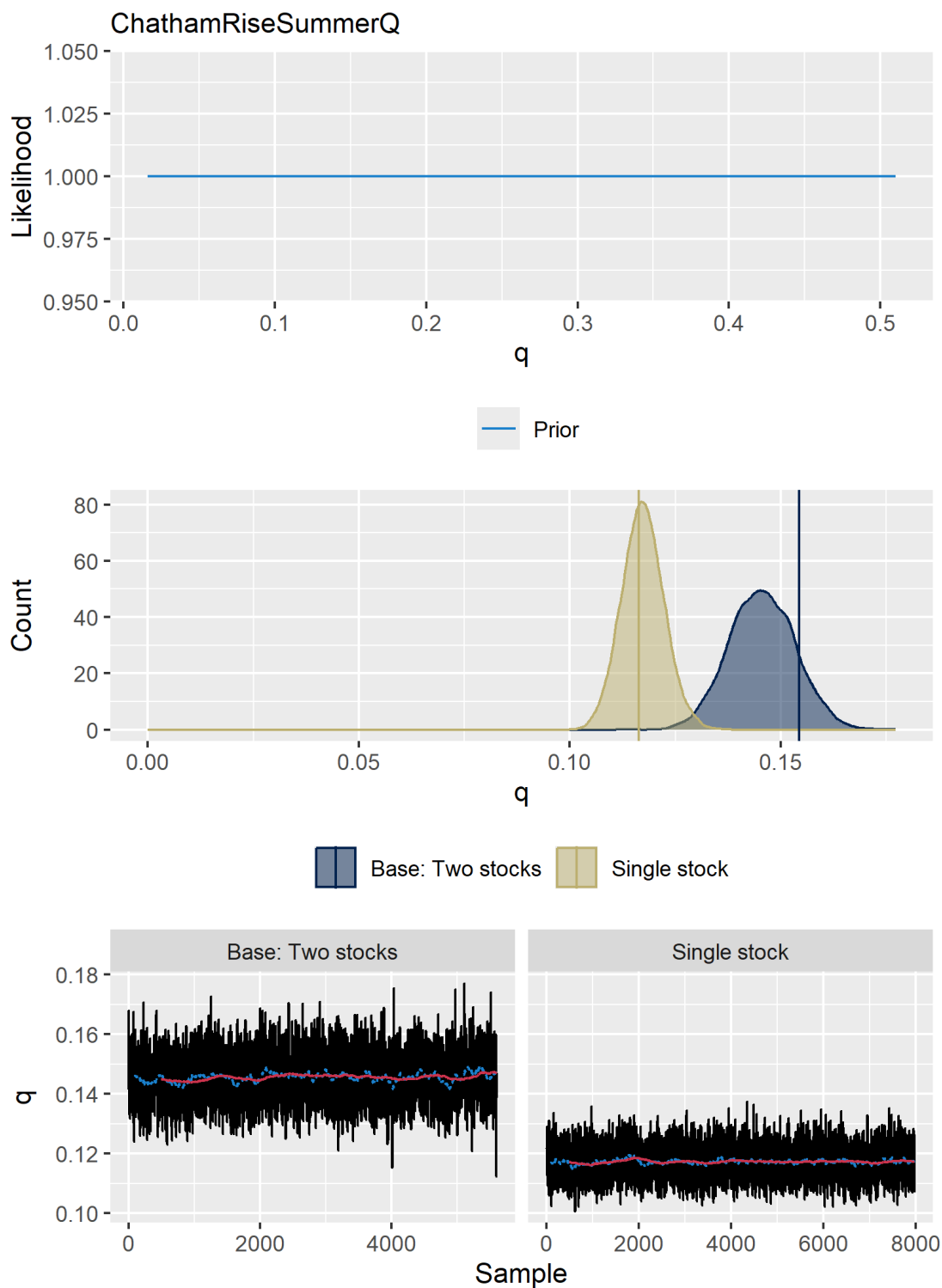


Figure 18: MCMC catchability prior (top), posterior (middle), and trace (bottom) for the Chatham Rise summer trawl survey from the base two-stock model and alternative single-stock model. Vertical lines in the middle panel are the corresponding MPD estimates. This prior is uniform (i.e., non-informative), and an improper prior.

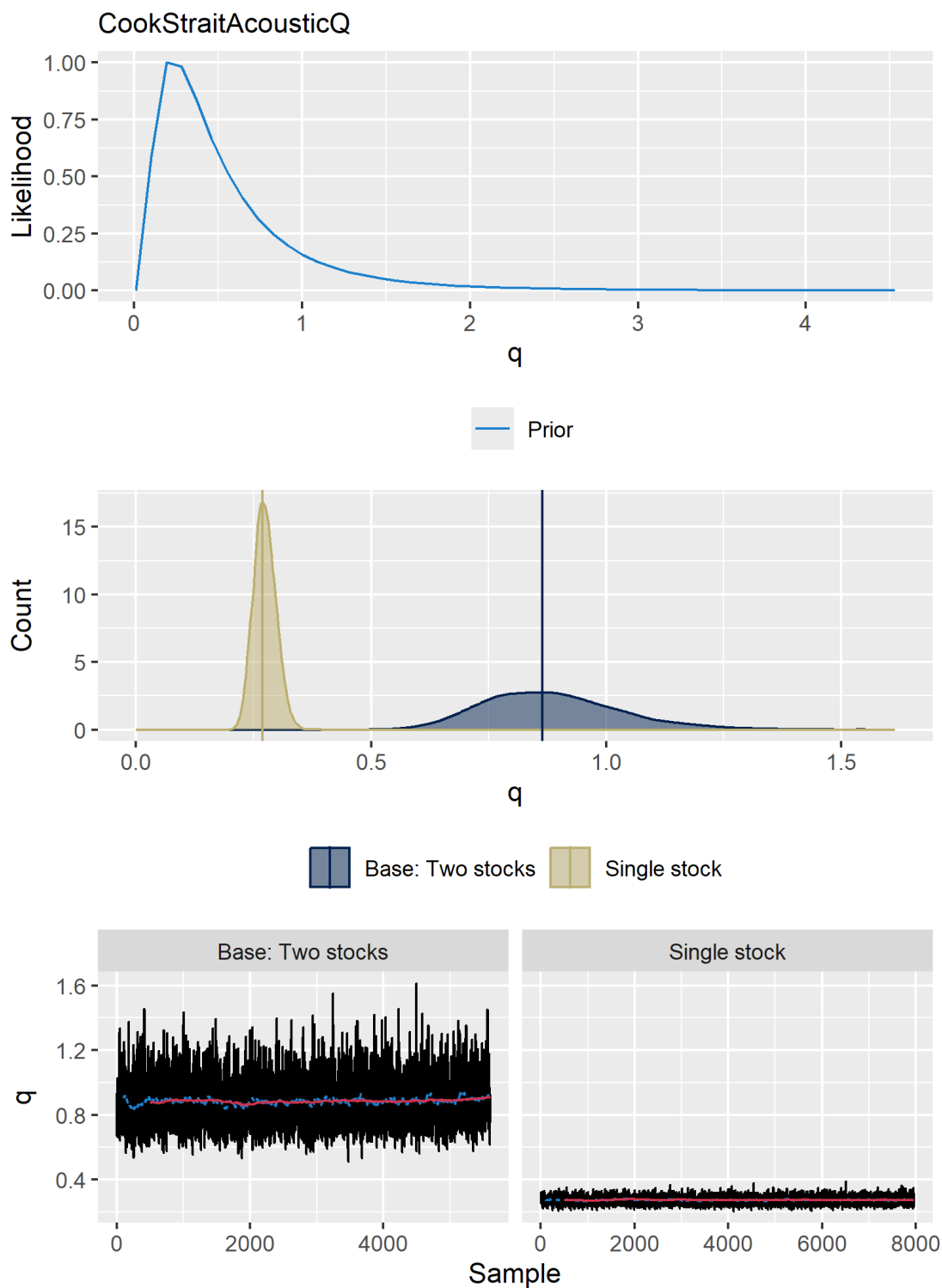


Figure 19: MCMC catchability prior (top), posterior (middle), and trace (bottom) for the Cook Strait acoustic survey from the base two-stock model and alternative single-stock model. Vertical lines in the middle panel are the corresponding MPD estimates.

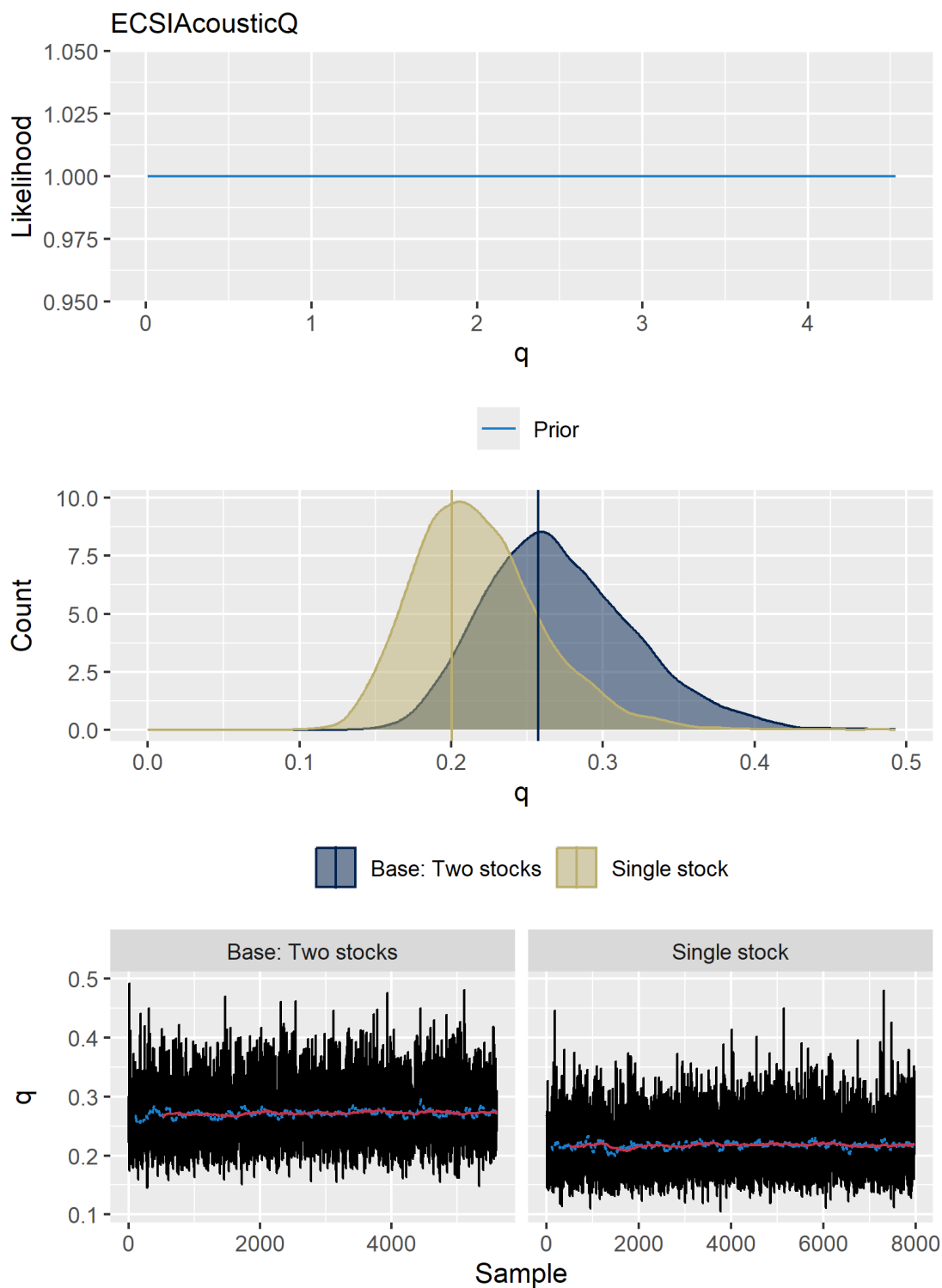


Figure 20: MCMC catchability prior (top), posterior (middle), and trace (bottom) for the Pegasus Canyon (ECSI) acoustic survey from the base two-stock model and alternative single-stock model. Vertical lines in the middle panel are the corresponding MPD estimates. This prior is uniform (i.e., non-informative), and an improper prior.

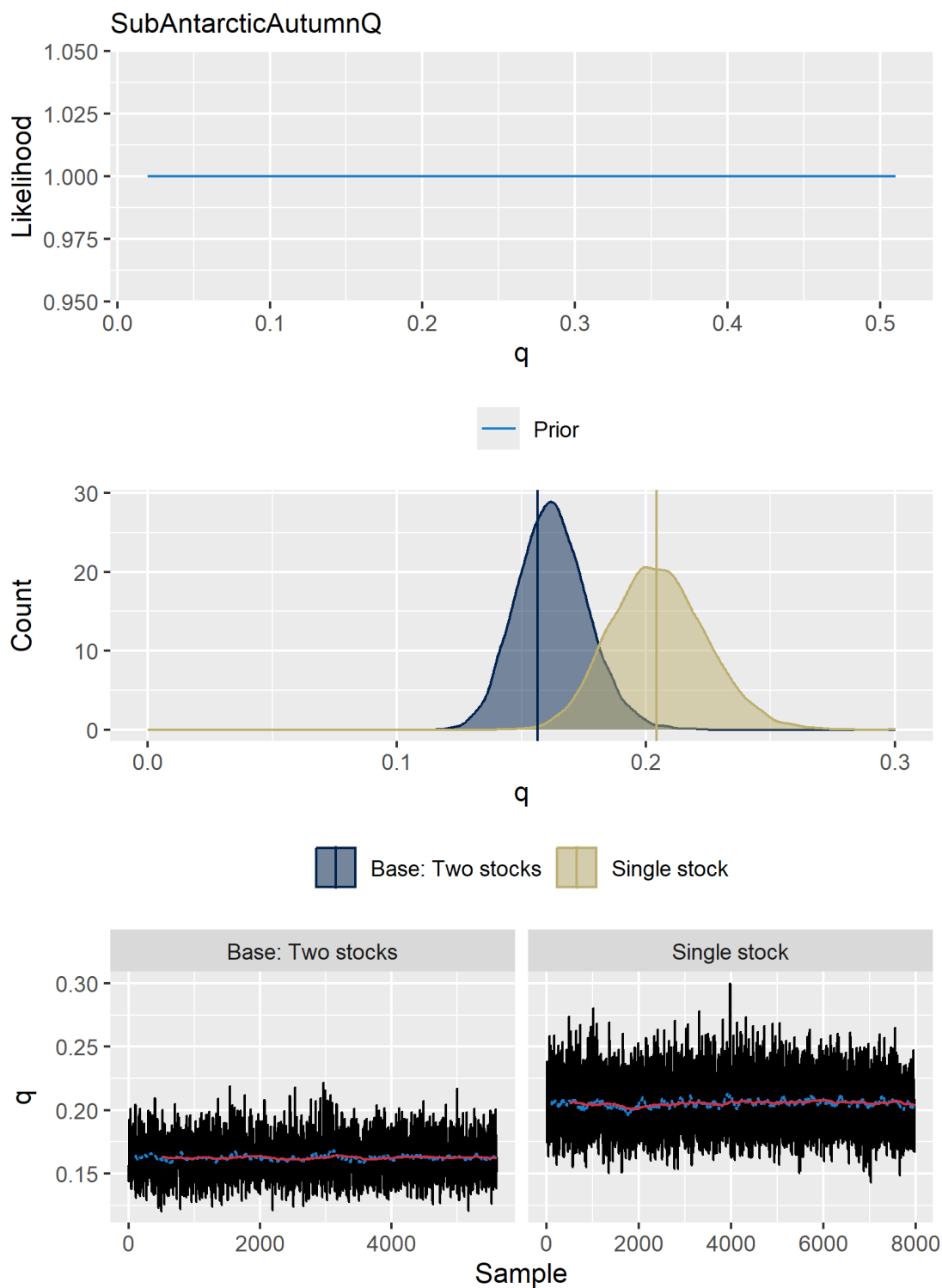


Figure 21: MCMC catchability prior (top), posterior (middle), and trace (bottom) for the sub-Antarctic autumn trawl survey from the base two-stock model and alternative single-stock model. Vertical lines in the middle panel are the corresponding MPD estimates. This prior is uniform (i.e., non-informative), and an improper prior.

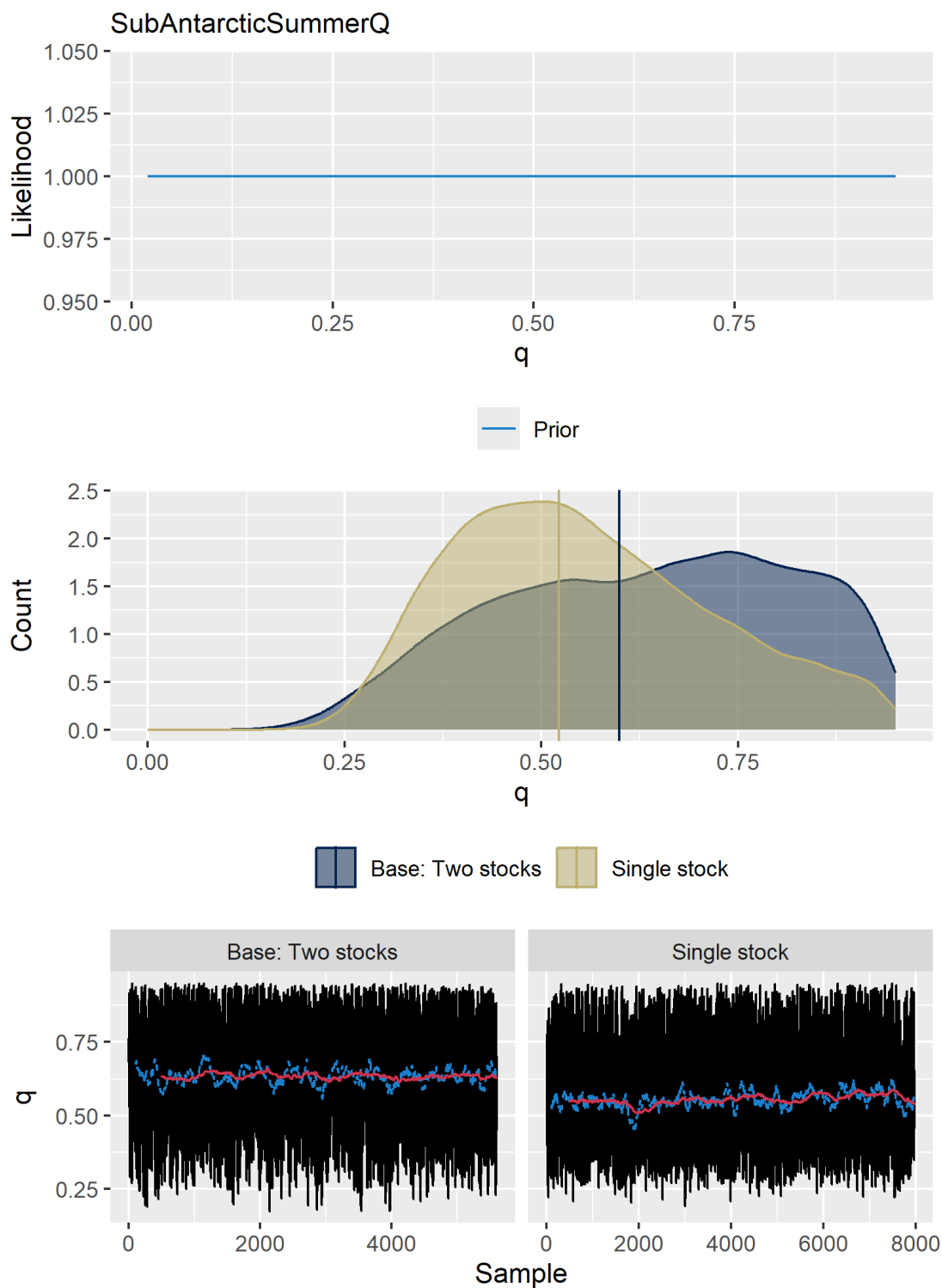


Figure 22: MCMC catchability prior (top), posterior (middle), and trace (bottom) for the sub-Antarctic summer trawl survey from the base two-stock model and alternative single-stock model. Vertical lines in the middle panel are the corresponding MPD estimates. This prior is uniform (i.e., non-informative), and an improper prior.

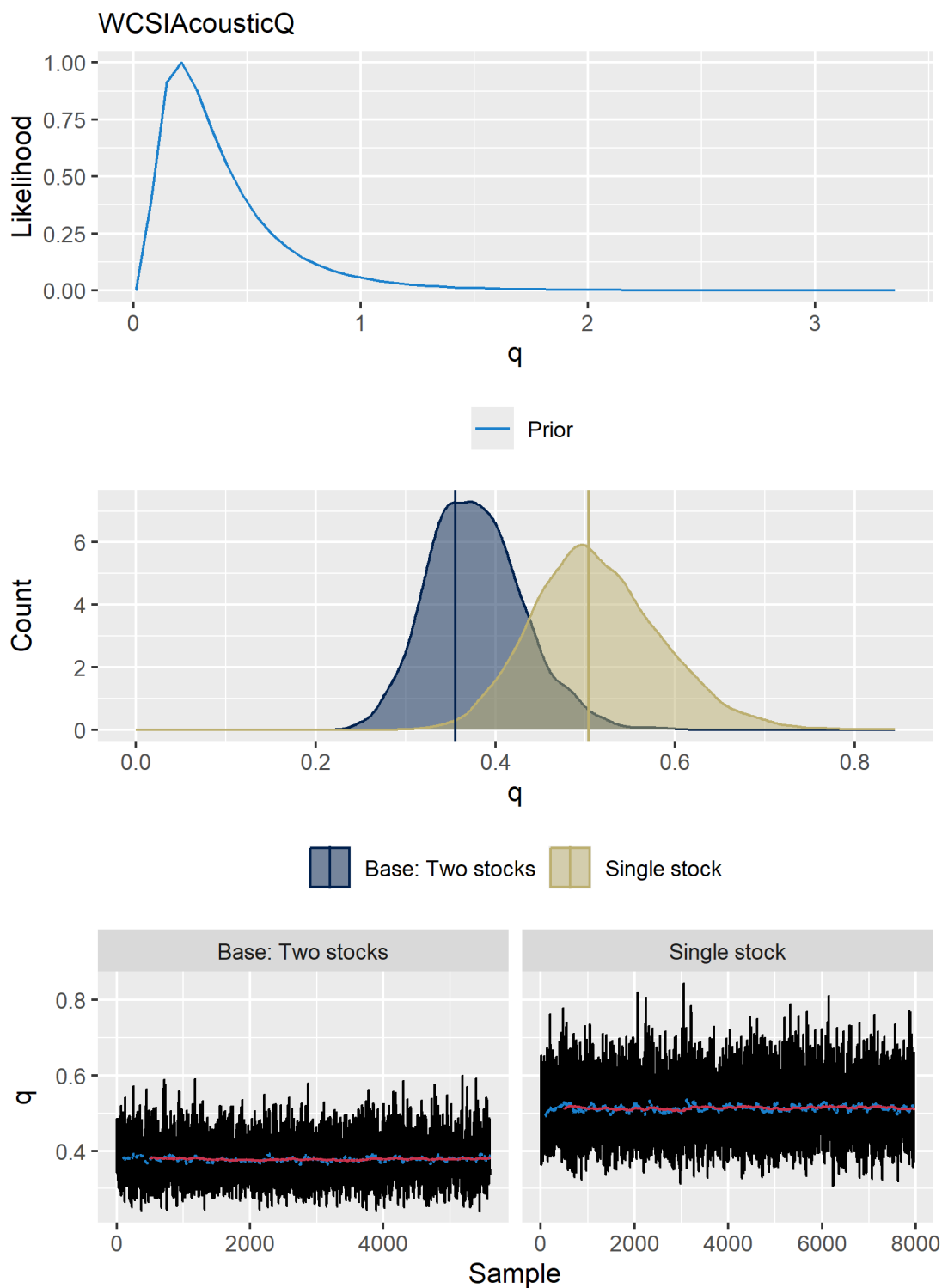


Figure 23: MCMC catchability prior (top), posterior (middle), and trace (bottom) for the WCSI acoustic survey from the base two-stock model and alternative single-stock model. Vertical lines in the middle panel are the corresponding MPD estimates.

6. PROJECTIONS

Five-year projections were carried out from base two stock model and the single stock model for two recruitment scenarios. Model estimates of recruitment for 1975–2020 (Base: two stocks) and 1975–2021 (Single Stock) were used. Future recruitments (2021 onwards for Base: two stocks and 2022 onwards for Single Stock) were randomly selected based on two scenarios: (i) recruitments estimated for 2011–2020 (Base: two stocks) 2011–2021 (Single Stock) (recent recruitment); and (ii) recruitments estimated for 1975–2021 (Base: two stocks) 1975–2021 (Single Stock) (long-term recruitment). Future annual catch scenarios were assumed constant at the TACC of 110 000 tonnes (45 000 tonnes western stock, 65 000 tonnes eastern stock). These future catches were apportioned by fishery using proportions from the average of the 2020–2024 fishing years and the resulting catches by fishery are given in Table 11. The projections indicated that the eastern biomass would remain constant under long-term recruitment and decline over the next 5 years under recent recruitment but would likely remain within the target range (see Figure 24, Table 12 and Table 13). The western biomass was projected to increase under long-term recruitment to above the target range and remain constant and within target range under recent recruitment (see Figure 24, Table 12 and Table 13). Total biomass in both the single stock model and base two stock model was projected to increase under long-term recruitment and remain constant under recent recruitment.

For both eastern and western stocks, the estimated probability of being less than the soft or the hard limit at the end of the five-year projection period was less than 5% (Table 13). This was also the case for the combined stocks in both the base two stock model and the single stock model.

Table 11: Projected catches (tonnes).

Fishery	Projected catch
FisheryChathamRiseDeep	34 500
FisheryChathamRiseShallow	5 382
FisheryCookStraitSpawning	12 821
FisheryECSISpawning	12 296
FisherySubAntarcticAuckland	3 629
FisherySubAntarcticSnares	2 897
FisherySubAntarcticSuba	3 031
FisheryWCSIIInside	10 923
FisheryWCSINorth	11 223
FisheryWCSISouth	13 298

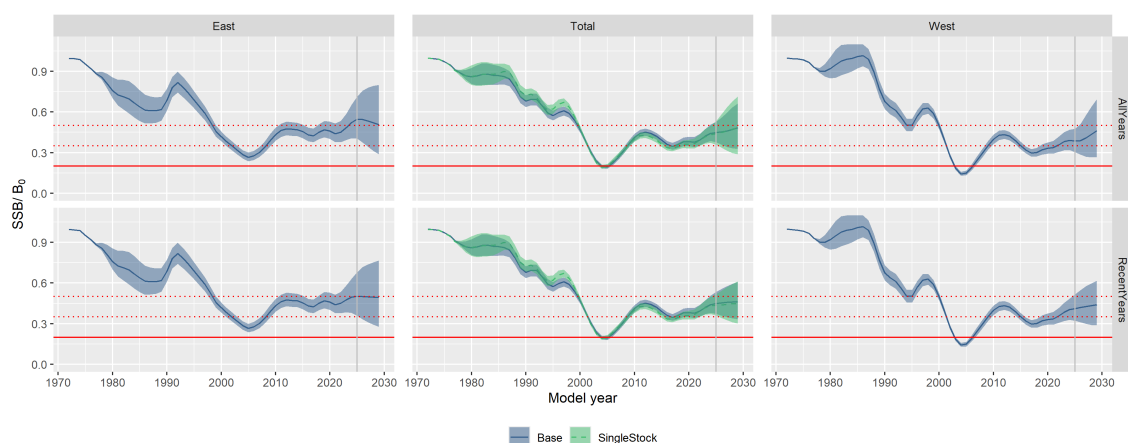


Figure 24: Projected spawning biomass (as % B_0) from the base model (blue) and single stock (green) under two recruitment scenarios where recruitment levels were randomly selected from: recent years 2011–2020 (base model) 2011–2021 (single stock model) ('Recent' recruitment, bottom); or all years 1975–2021 ('Long-term' recruitment, top), for eastern stock (left), total (middle), and western stock (right), with catches assumed at the current TACC (110 000 tonnes). The horizontal dotted red lines represent the target management range of 35–50% B_0 . The horizontal solid red line shows 20% B_0 . Shaded areas give 95% CIs, and central line gives median SSB/B_0 .

Table 12: Projected median SSB (% B_0) for 2025 to 2029 from the base model, assuming future estimated catch levels of 110 000 tonnes (65 000 tonnes eastern stock, 45 000 tonnes western stock), and with recruitment levels randomly selected from: recent years 2011–2020 (base model) 2011–2021 (single stock model) ('Recent' recruitment); or all years 1975–2021 ('Long-term' recruitment). Values are in '000 tonnes.

Model	Projection	Stock	2025	2026	2027	2028	2029
Base: two stocks	Long-term	All	45	45	46	47	48
	Long-term	East	55	55	53	52	51
	Long-term	West	39	39	41	44	46
	Recent	All	45	45	46	46	46
	Recent	East	50	50	50	50	49
	Recent	West	41	42	43	43	44
Single stock	Long-term	All	44	45	46	47	49
	Recent	All	44	44	44	45	45

Table 13: Projected probabilities (to two decimal places) from the base model and single stock model of *SSB* being below, within, or above various levels of % B_0 for 2025 to 2029, assuming future estimated catch levels of 110 000 tonnes (65 000 tonnes eastern stock, 45 000 tonnes western stock) and with recruitment levels randomly selected from: recent years 2011–2020 (base model) 2011–2021 (single stock model) ('Recent' recruitment); or all years 1975–2021 ('Long-term' recruitment). 'Within target range': [0.35, 0.5).

	2025	2026	2027	2028	2029	Stock
Base long-term						
< 20%	0.00	0.00	0.00	0.00	0.00	East
< 35%	0.00	0.01	0.03	0.06	0.08	East
Within target range	0.27	0.30	0.35	0.38	0.39	East
> 50%	0.72	0.69	0.62	0.57	0.53	East
< 20%	0.00	0.00	0.00	0.00	0.00	West
< 35%	0.20	0.24	0.22	0.18	0.15	West
Within target range	0.80	0.72	0.64	0.56	0.48	West
> 50%	0.01	0.04	0.14	0.26	0.37	West
< 20%	0.00	0.00	0.00	0.00	0.00	All
< 35%	0.00	0.01	0.03	0.05	0.05	All
Within target range	0.90	0.81	0.69	0.60	0.52	All
> 50%	0.10	0.18	0.27	0.35	0.43	All
Base recent						
< 20%	0.00	0.00	0.00	0.00	0.00	East
< 35%	0.02	0.04	0.07	0.09	0.11	East
Within target range	0.47	0.45	0.44	0.42	0.41	East
> 50%	0.51	0.51	0.50	0.49	0.48	East
< 20%	0.00	0.00	0.00	0.00	0.00	West
< 35%	0.09	0.11	0.13	0.13	0.13	West
Within target range	0.86	0.79	0.71	0.66	0.62	West
> 50%	0.04	0.10	0.16	0.21	0.25	West
< 35%	0.01	0.01	0.03	0.04	0.04	All
Within target range	0.88	0.80	0.73	0.68	0.64	All
> 50%	0.12	0.19	0.24	0.29	0.31	All
Single stock long-term						
< 20%	0.00	0.00	0.00	0.00	0.00	All
< 35%	0.01	0.04	0.07	0.09	0.09	All
Within target range	0.90	0.75	0.62	0.53	0.47	All
> 50%	0.09	0.21	0.31	0.39	0.44	All
Single stock recent						
< 35%	0.01	0.04	0.07	0.09	0.10	All
Within target range	0.92	0.84	0.74	0.68	0.63	All
> 50%	0.06	0.12	0.19	0.24	0.27	All

7. DISCUSSION

The stock assessment models and sensitivity analyses presented here provided the best available representation of current knowledge and data for the hoki stock and fishery in 2025, as presented to and reviewed by the Fisheries New Zealand Deepwater Working Group. The base two-stock model and alternative single-stock model used to project stock status to fishing year 2029 estimated that with current catches the combined stock status was likely to be within the management target level of 35 to 50% B_0 in 2029.

The most notable difference between results of the 2025 and 2024 hoki stock assessments was the estimated 2019 year class strength, in particular the apportioning of this year class to the eastern and western stocks. The 2024 assessment estimated a strong 2019 western stock year class and an average 2019 eastern stock year class. The 2025 assessment estimated the 2019 western stock year class to be only slightly above average, and the eastern stock 2019 year class to be strong. This change in allocation of the 2019 year class resulted in a lower estimate of western stock status in 2025 (39% B_0) compared to the projected B_{2025} from the 2024 assessment of 44% B_0 and conversely a higher eastern stock status in 2025 of 55% B_0 compared with the projected 43% B_0 .

As this was an update-only assessment and did not include model development, the list of research considerations remains the same. The plenary report (Fisheries New Zealand 2025) listed the following future research considerations for modelling in the hoki stock assessment (split into modelling and data categories here, although some items contribute to both):

Model development and analysis

- Continue development and review of the single stock model. Specifically addressing presentation of trajectory and status of the stock components. Reconcile differences in the outputs with the two stock model.
- Explore alternative spatial and movement hypotheses, including evidence for density dependent movement from CR, spatial and temporal structure of the SA fisheries, and separation of maturity from migration to the spawning grounds for both the single stock and two stock models.
- Explore differences in Cook Strait acoustic catchability between models and how these relate to corresponding selectivity ogives.
- Explore combining the Chatham Rise and sub-Antarctic fisheries within the models so as to simplify assumptions about migration, or structure a series of sensitivity analyses that explore different migration hypotheses to highlight plausible options.
- Investigate the potential impacts on model results of mature fish not spawning every year, noting that previous studies have been conducted to estimate the average percentage of mature fish not migrating to spawn.
- Investigate the potential effects of cryptic mortality, focusing on years of high juvenile abundance where density-dependent effects may occur.

Data analysis and exploration

- Conduct spatial and temporal analysis of age structure for the hoki fishery.
- Explore environmental drivers of recruitment and the spatial distribution of the hoki stock, explicitly considering new information on temperature at depth that has been collected within the Moana project (Souza et al. 2023).
- Explore spatial and temporal variability in length-weight relationships and growth by sex. Some trends in mean size-at-age (growth rates) are not accounted for in the model. This affects the conversion of catches in tonnes to mortality in numbers.
- Length to weight ratios change when fish are about to spawn, which also affects the conversion of

catches in tonnes to mortality in numbers. This was tested in the 2024 assessment and found to have little to no effect but the length and weight data used were not defined by sex.

- Investigate the appropriateness of age based selectivity ogives shared by sex in non-spawning fisheries where growth rates vary by sex.
- Further investigate alternative M values and alternative implementations (e.g., length based M) and assess appropriate values for sensitivity runs.
- Explore alternative model structures in conjunction with ways of making better use of fishery dependent data (e.g., CPUE or industry collected length data), for example by examining whether it can be used to track young fish when they leave the Chatham Rise and arrive at the Stewart-Snares shelf. The size of fish indexed by the CPUE also needs to be considered.

The biological data inputs of growth and length-to-weight conversion parameters have been re-estimated (McGregor-Tiatia & Langley 2025). These were used in sensitivity runs for this assessment and will be applied in the next hoki assessment which is scheduled for 2027.

8. FULFILMENT OF BROADER OUTCOMES

As required under Government Procurement rules³, Fisheries New Zealand considered broader outcomes (secondary benefits such as environmental, social, economic or cultural benefits) that would be generated by this project. The following broader outcomes were delivered:

- *Supporting women in science*
The lead researcher of the project was a woman.
- *Building capacity and capability in the research sector*
The team working on the project brought together a diverse range of skill sets and experience levels.

9. ACKNOWLEDGEMENTS

We thank Sira Ballara, Richard O'Driscoll, and Pablo Escobar-Flores for providing data, and members of the Deepwater Working Group for suggestions during the assessment process. This work was funded under Fisheries New Zealand project HOK202401. Thank you to Steven Holmes for reviewing the manuscript. Thank you to Gretchen Skea for chairing the Deepwater Working Group meetings.

³<https://www.procurement.govt.nz/procurement/principles-charter-and-rules/government-procurement-rules/planning-your-procurement/broader-outcomes/>

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Appendices

Appendix A MCMCs

A.1 Model 1: base two-stock model

A.2 Outputs

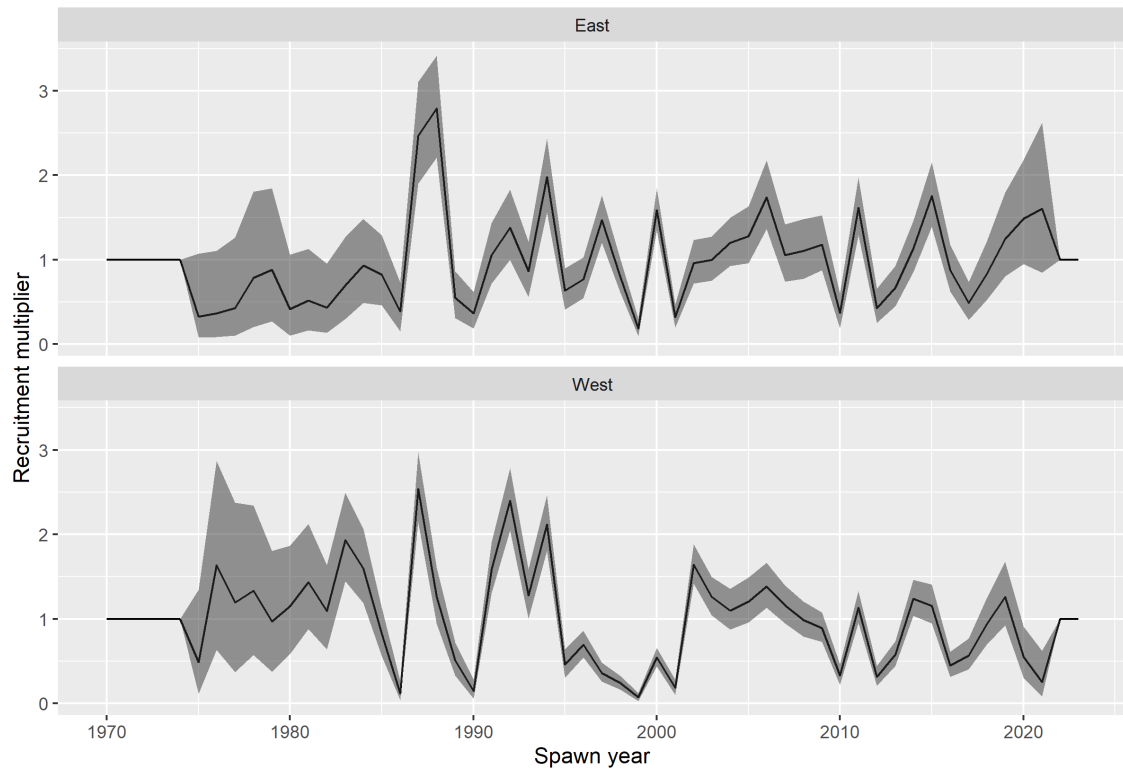


Figure 25: MCMC output for recruitment multipliers from the base two stock model.

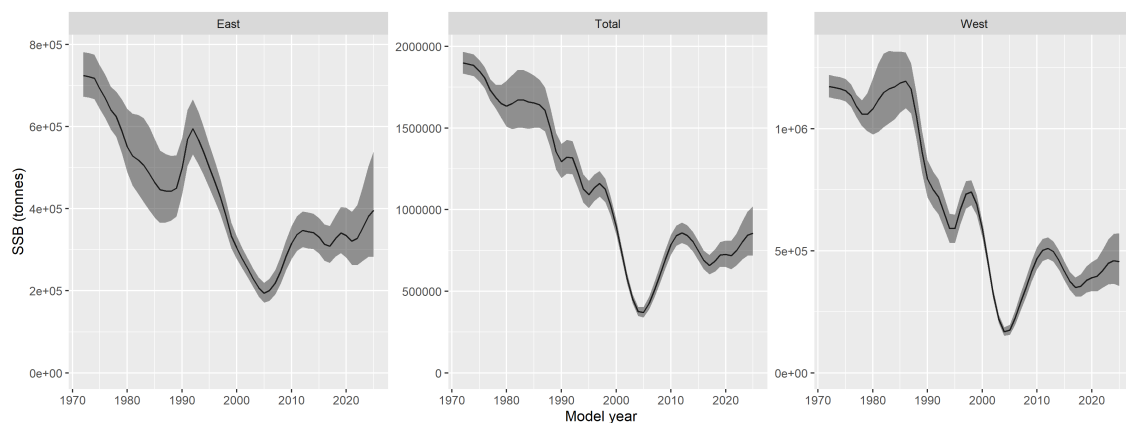


Figure 26: MCMC output for SSB from the base two stock model.

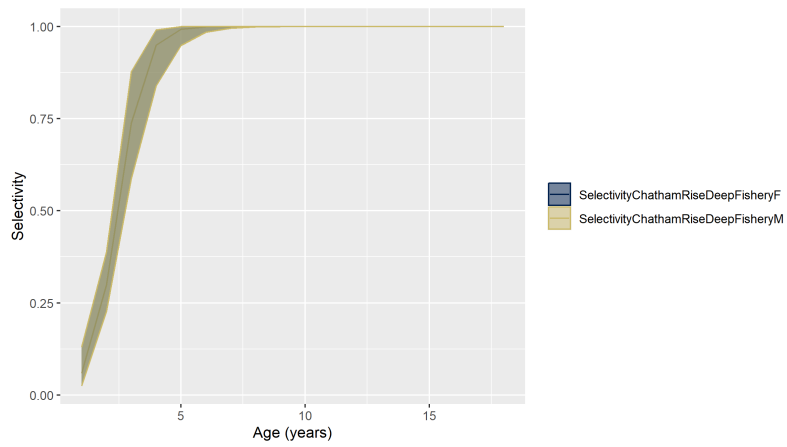


Figure 27: MCMC output for SelectivityChathamRiseDeepFishery from the base two stock model.

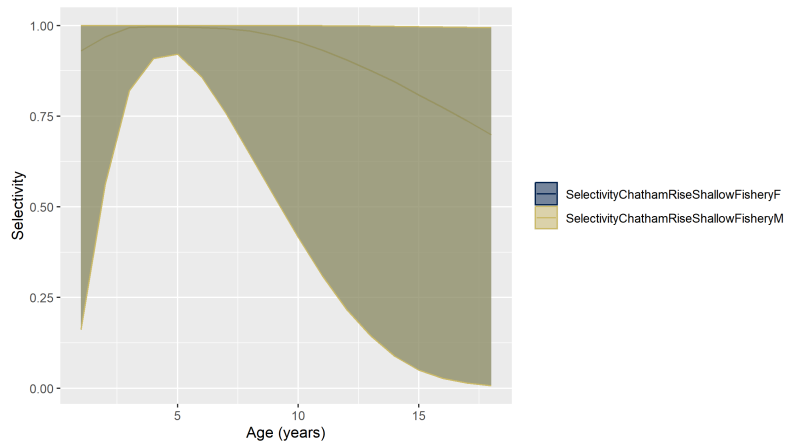


Figure 28: MCMC output for SelectivityChathamRiseShallowFishery from the base two stock model.

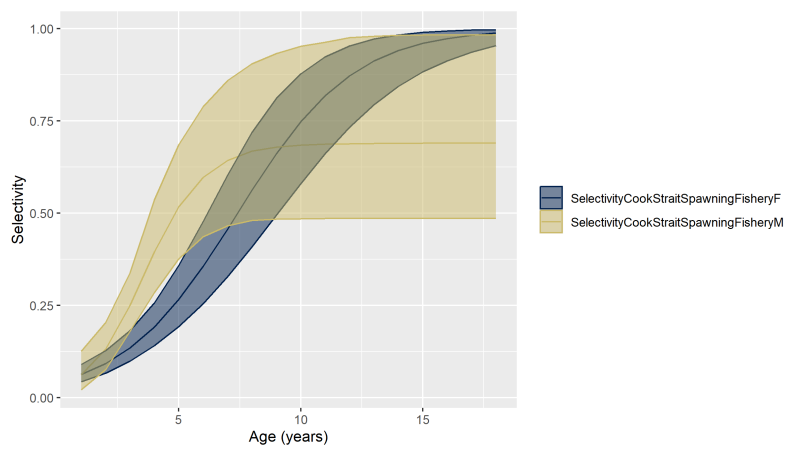


Figure 29: MCMC output for SelectivityCookStraitSpawningFishery from the base two stock model.

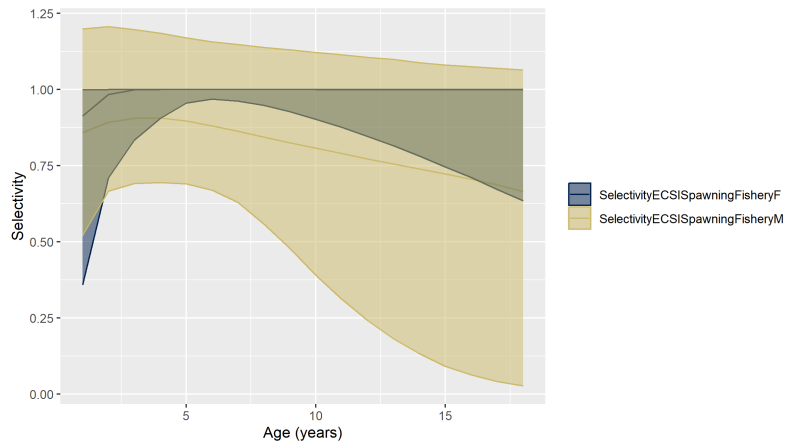


Figure 30: MCMC output for SelectivityECSISpawningFishery from the base two stock model.

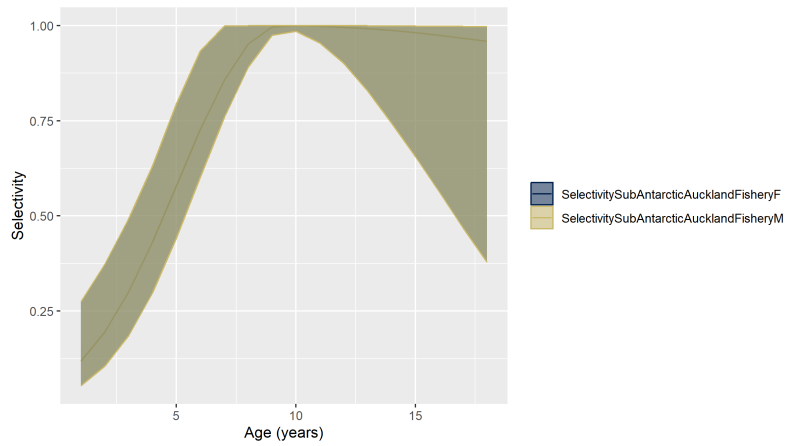


Figure 31: MCMC output for SelectivitySubAntarcticAucklandFishery from the base two stock model.

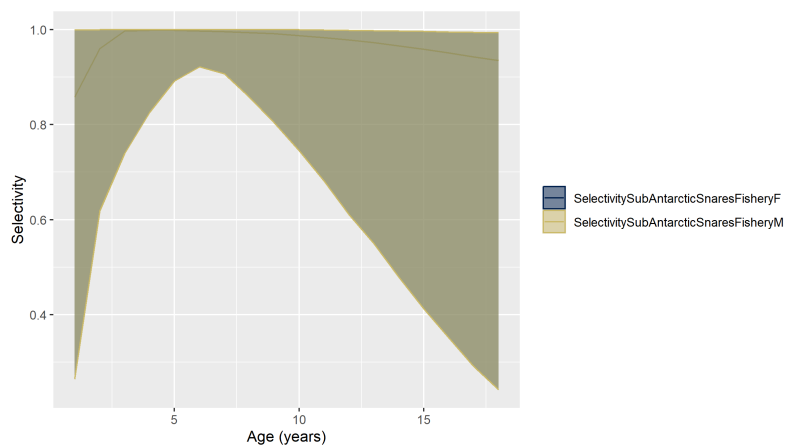


Figure 32: MCMC output for SelectivitySubAntarcticSnaresFishery from the base two stock model.

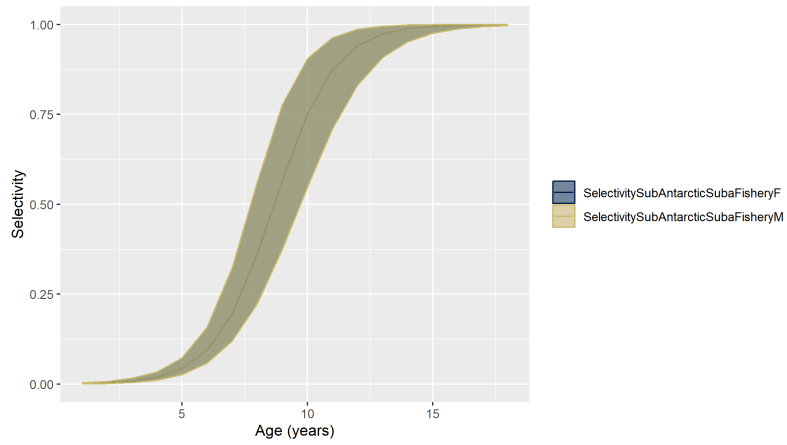


Figure 33: MCMC output for SelectivitySubAntarcticSubaFishery from the base two stock model.

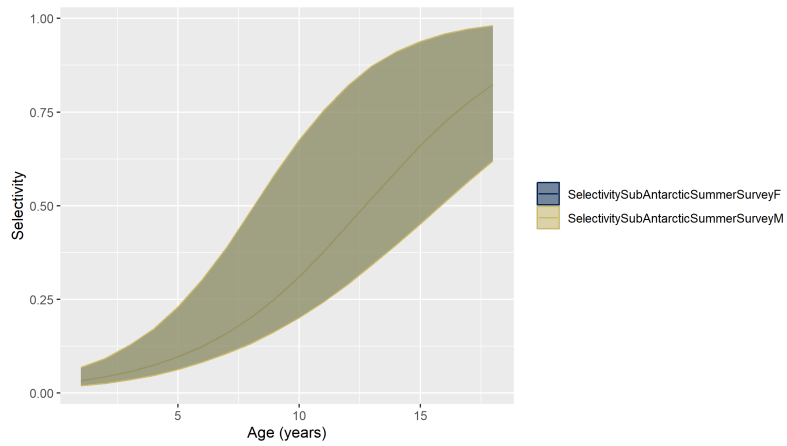


Figure 34: MCMC output for SelectivitySubAntarcticSummerSurvey from the base two stock model.

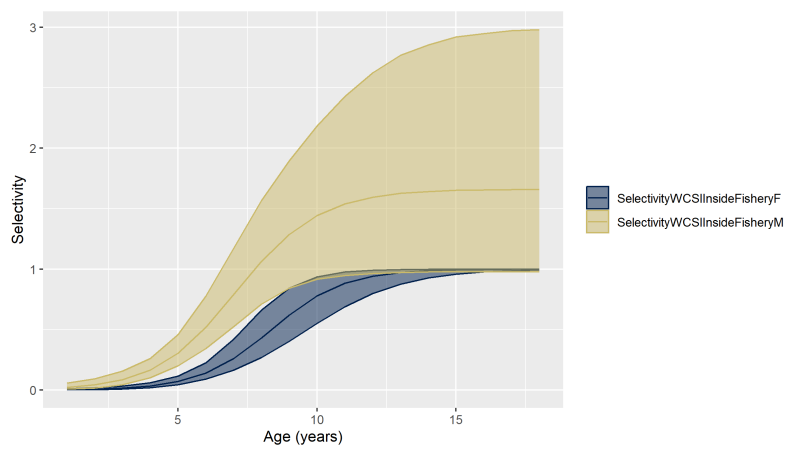


Figure 35: MCMC output for SelectivityWCSIIInsideFishery from the base two stock model.

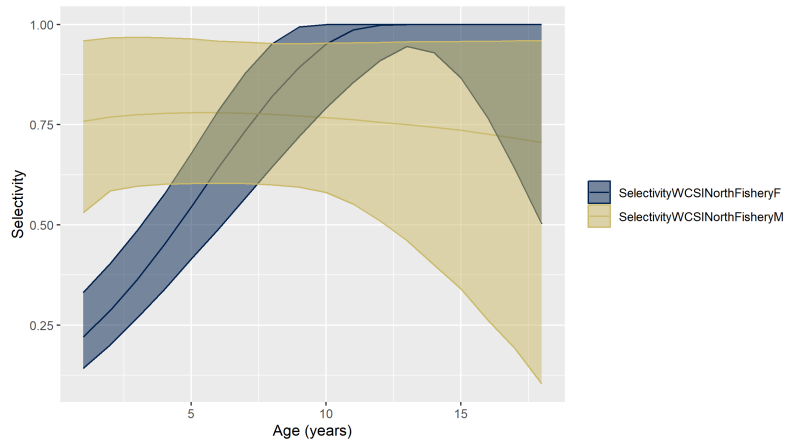


Figure 36: MCMC output for SelectivityWCSINorthFishery from the base two stock model.

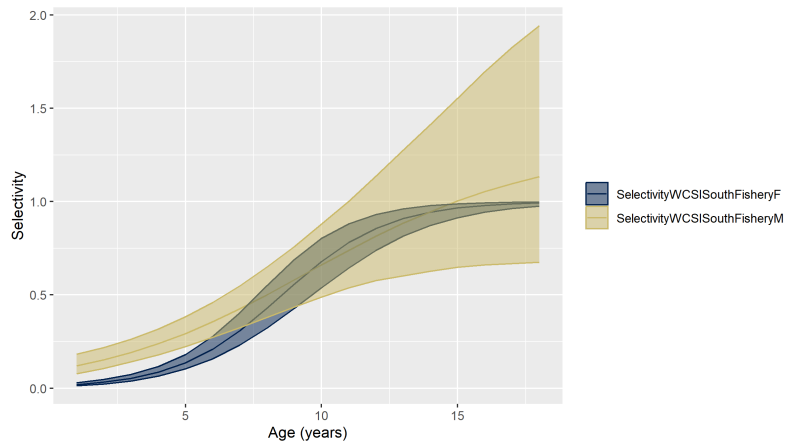


Figure 37: MCMC output for SelectivityWCSISouthFishery from the base two stock model.

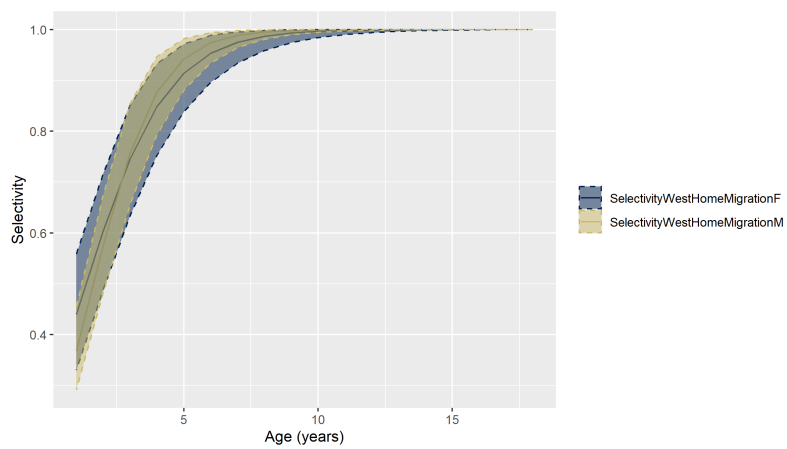


Figure 38: MCMC output for SelectivityWestHomeMigration from the base two stock model.

A.3 Diagnostics

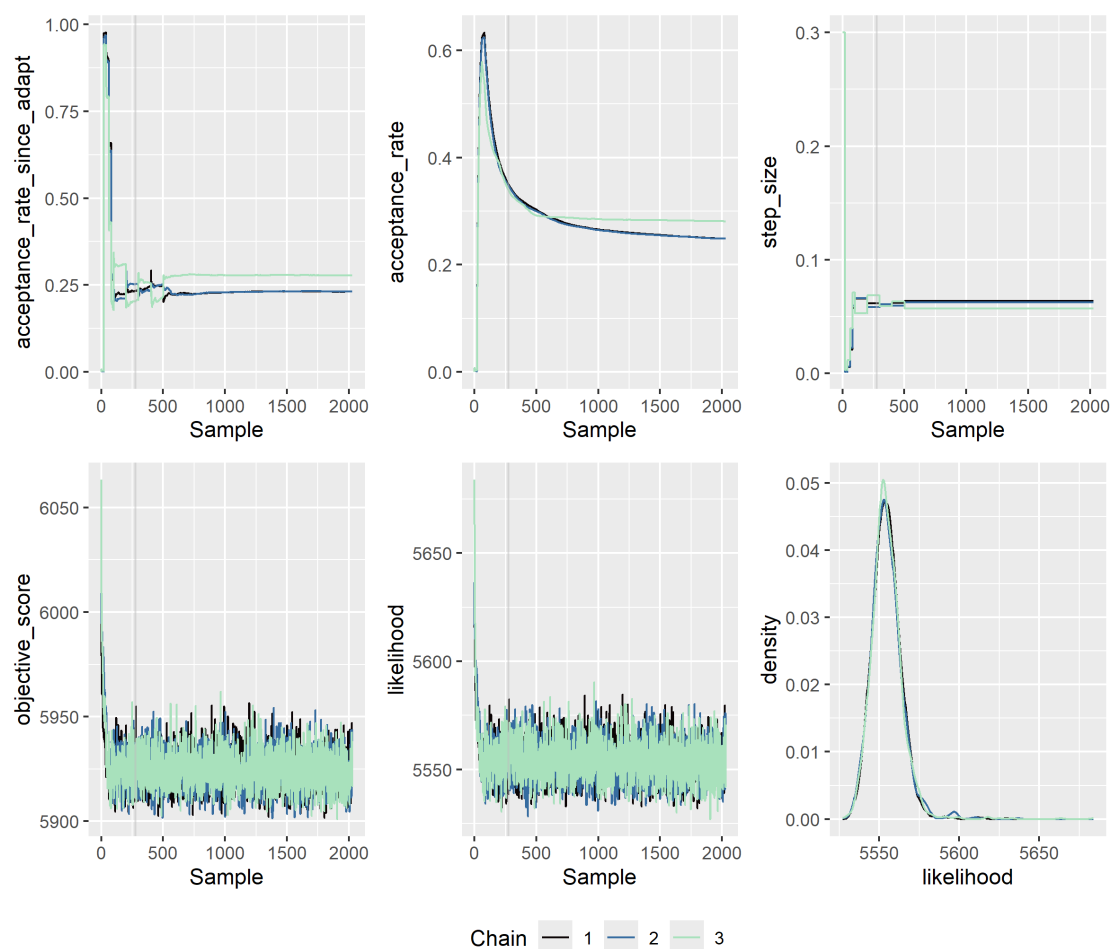


Figure 39: MCMC chain diagnostics from the base two stock model.

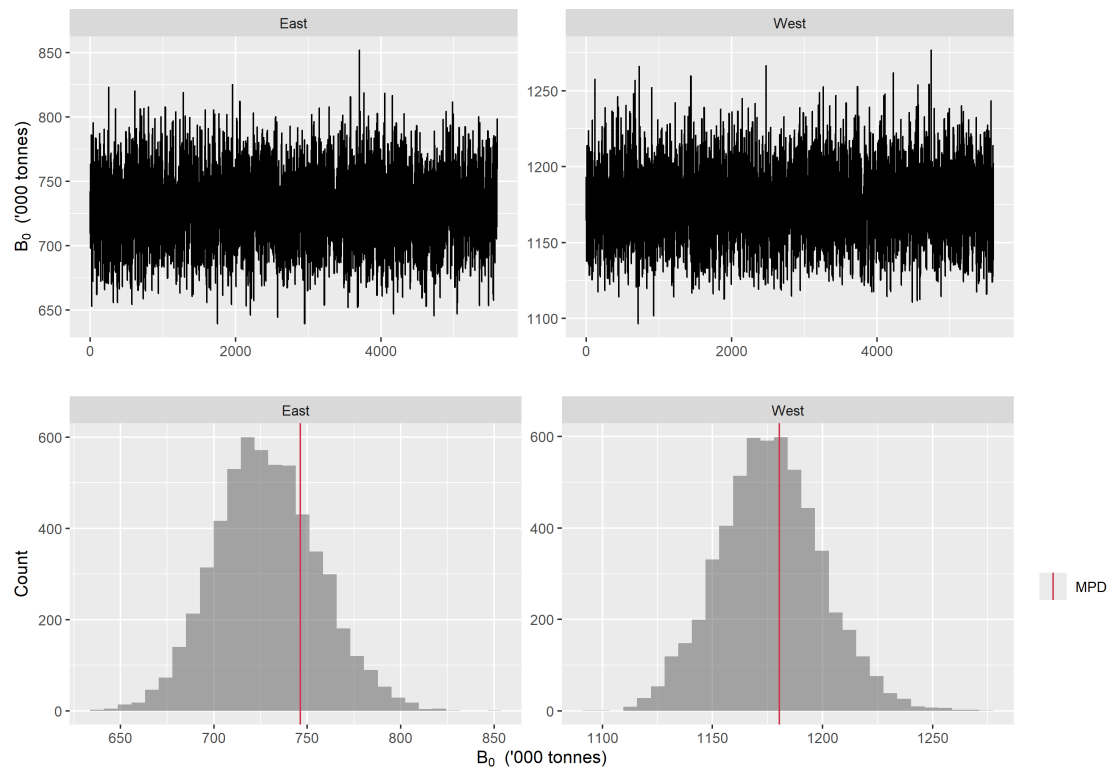


Figure 40: MCMC diagnostic plots for B_0 from the base two stock model.

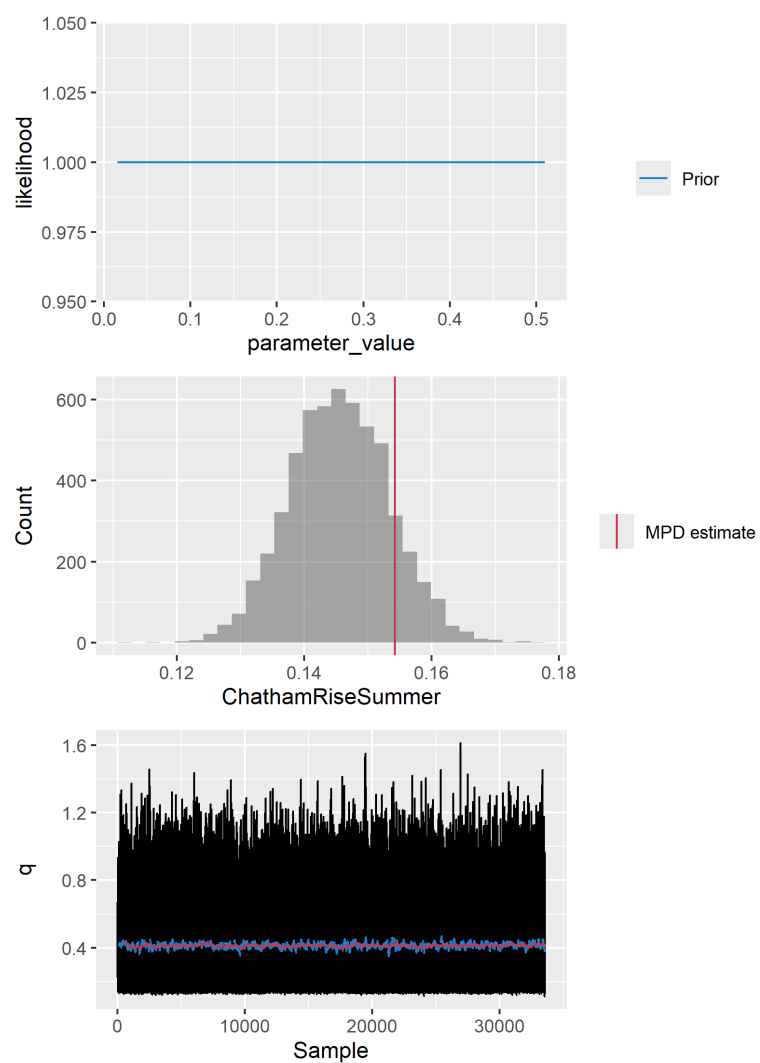


Figure 41: MCMC diagnostic plots for Catchability ChathamRiseSummerQ from the base two stock model.

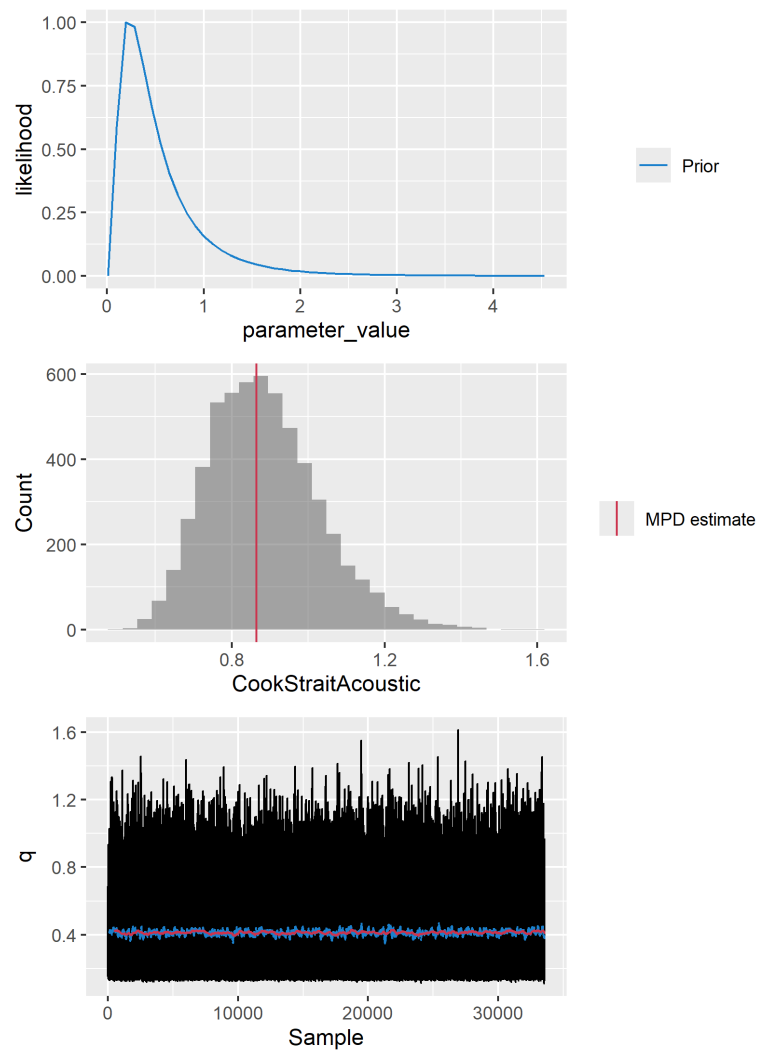


Figure 42: MCMC diagnostic plots for Catchability CookStraitAcousticQ from the base two stock model.

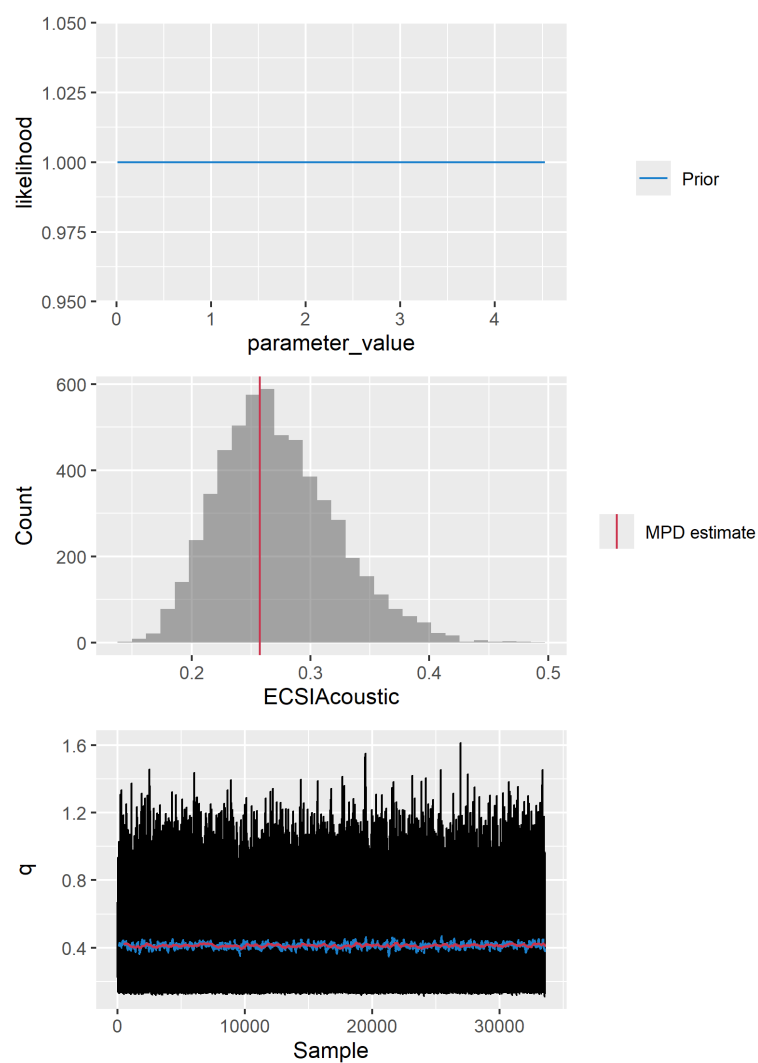


Figure 43: MCMC diagnostic plots for Catchability ECSIAcousticQ from the base two stock model.

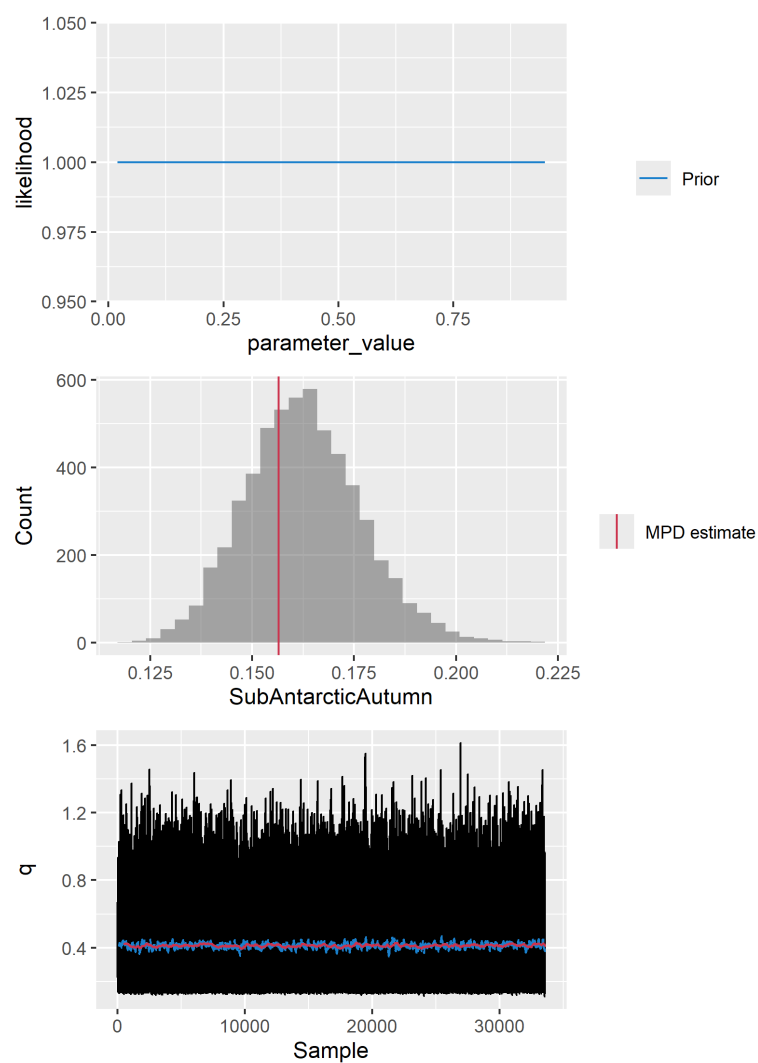


Figure 44: MCMC diagnostic plots for Catchability SubAntarcticAutumnQ from the base two stock model.

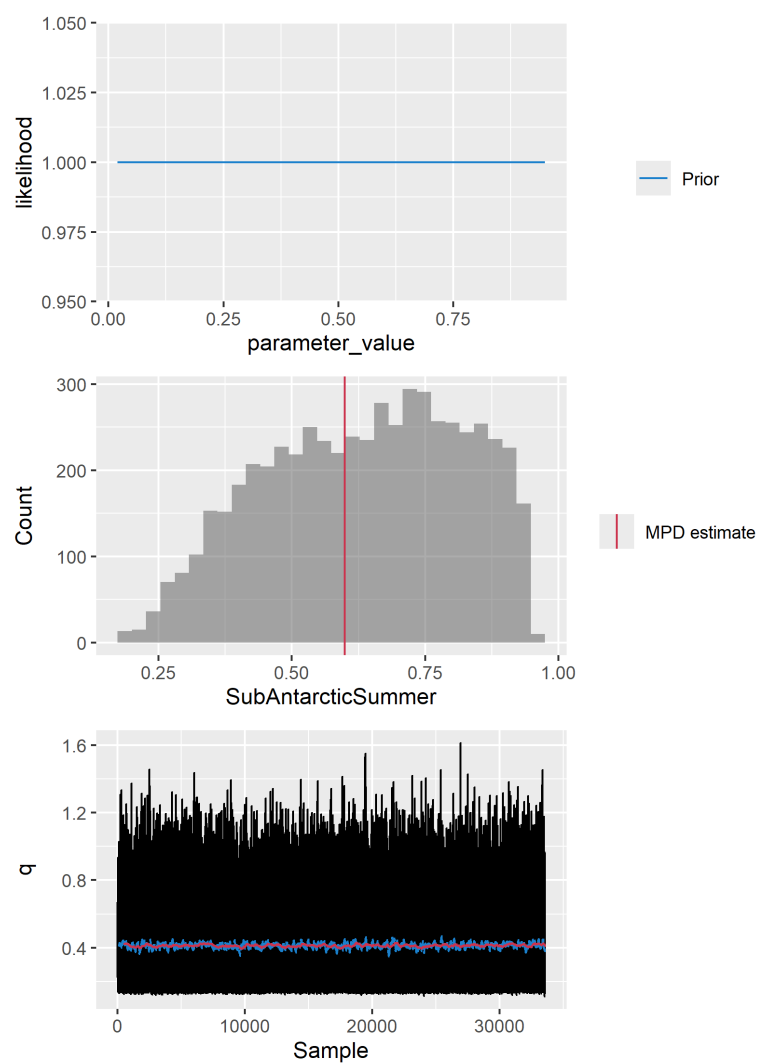


Figure 45: MCMC diagnostic plots for Catchability SubAntarcticSummerQ from the base two stock model.

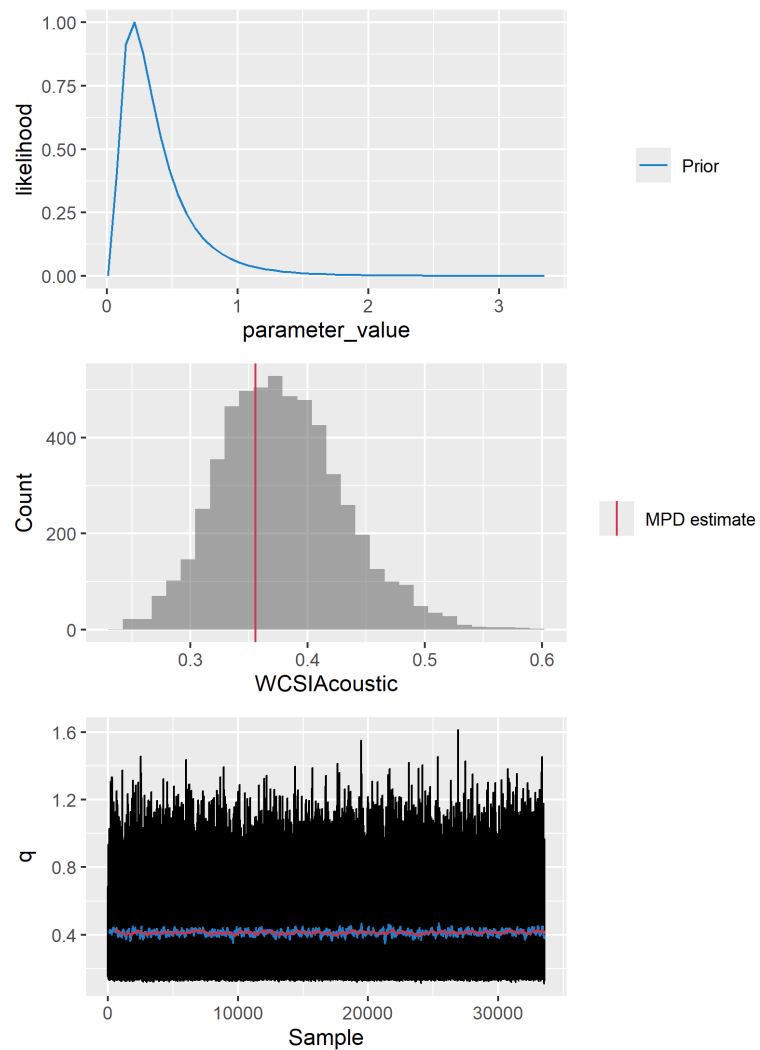


Figure 46: MCMC diagnostic plots for Catchability WCSIAcousticQ from the base two stock model.

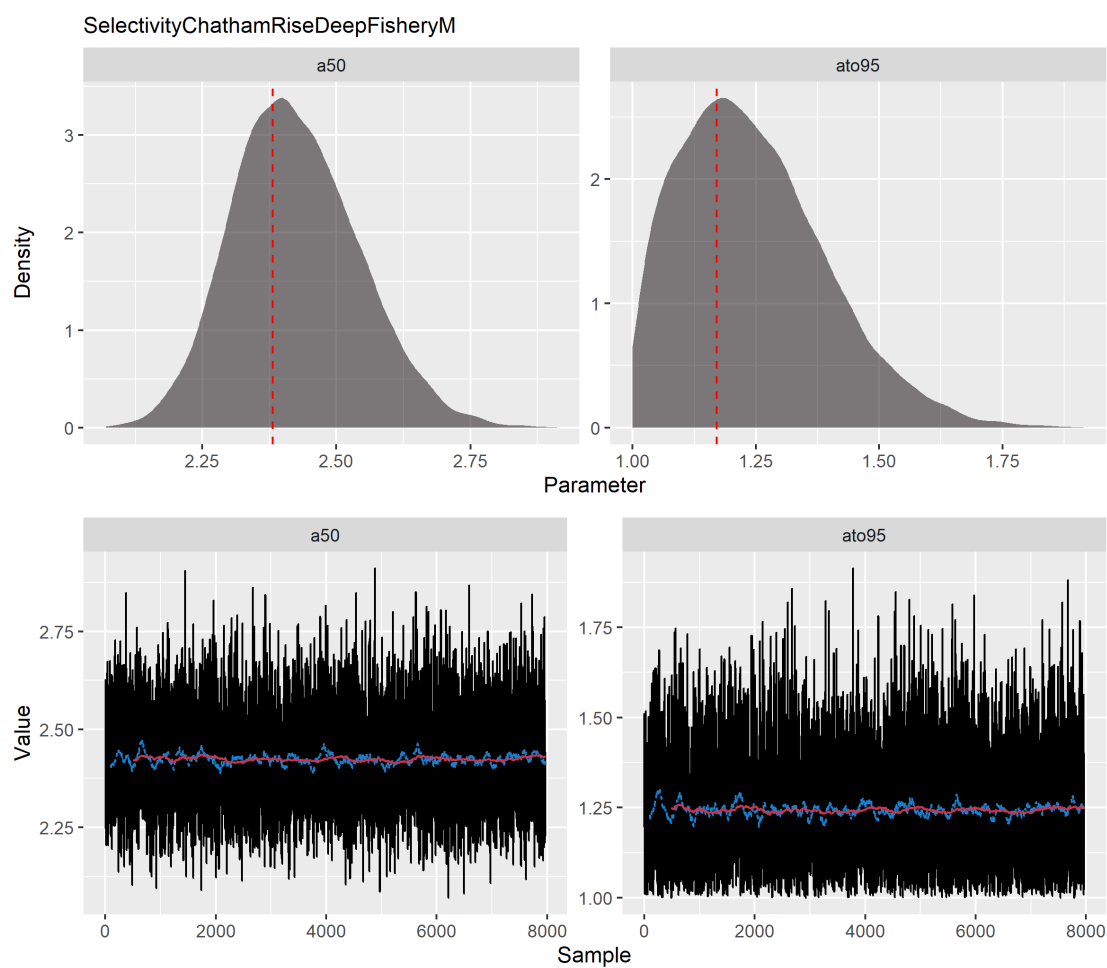


Figure 47: MCMC diagnostic plots for ChathamRiseDeepFisheryM selectivity parameters from the base two stock model.

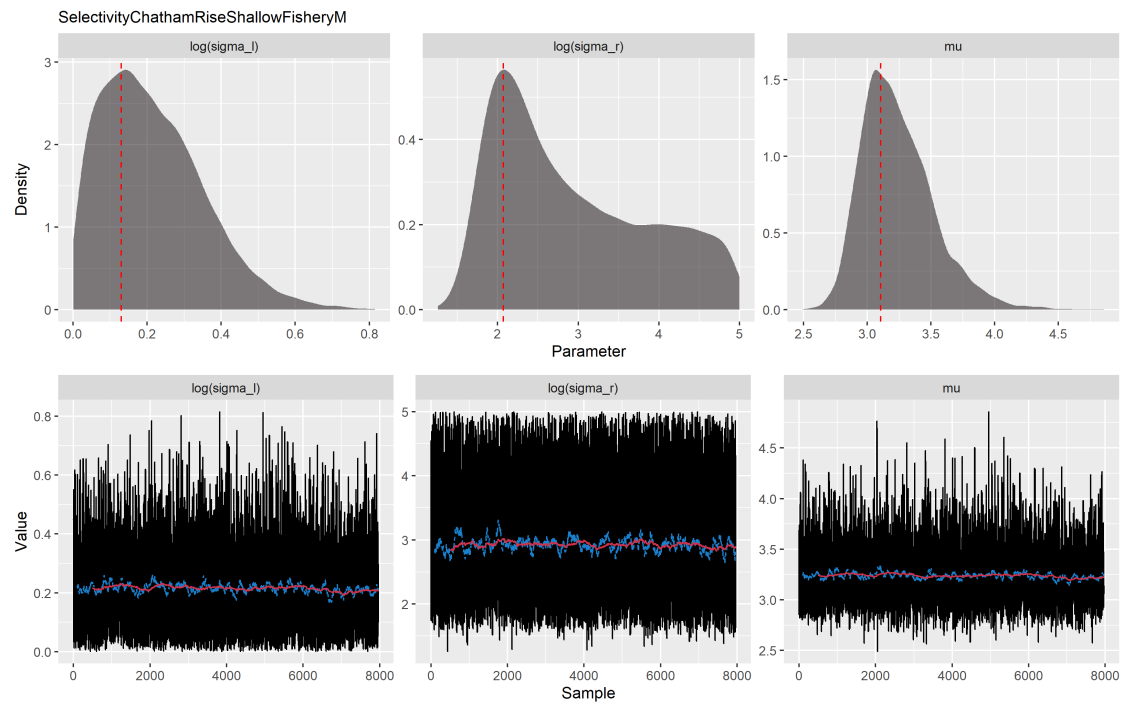


Figure 48: MCMC diagnostic plots for ChathamRiseShallowFisheryM selectivity parameters from the base two stock model.

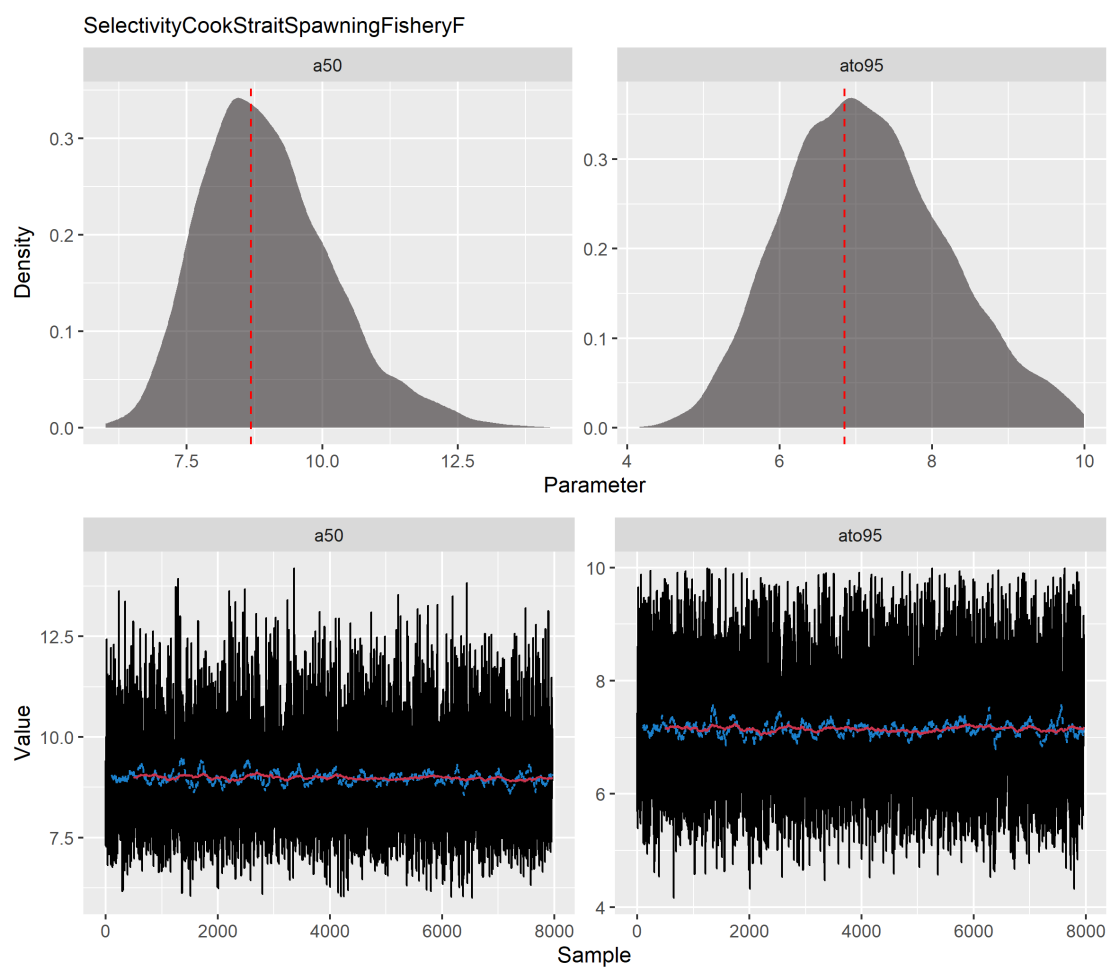


Figure 49: MCMC diagnostic plots for CookStraitSpawningFisheryF selectivity parameters from the base two stock model.

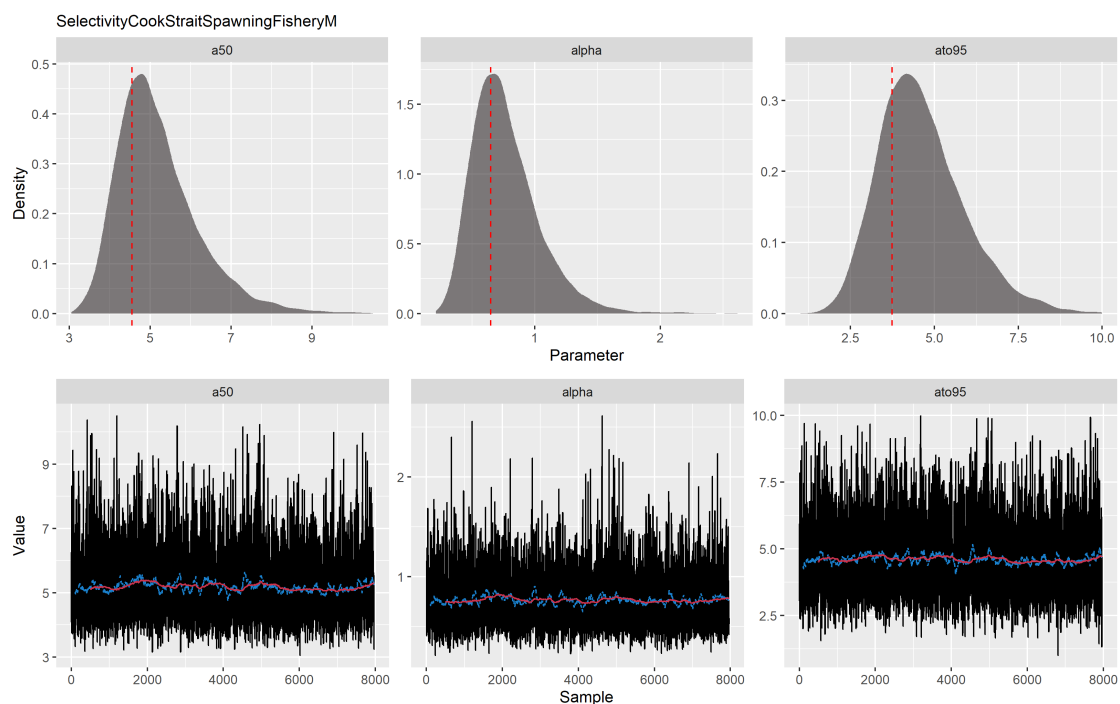


Figure 50: MCMC diagnostic plots for CookStraitSpawningFisheryM selectivity parameters from the base two stock model.

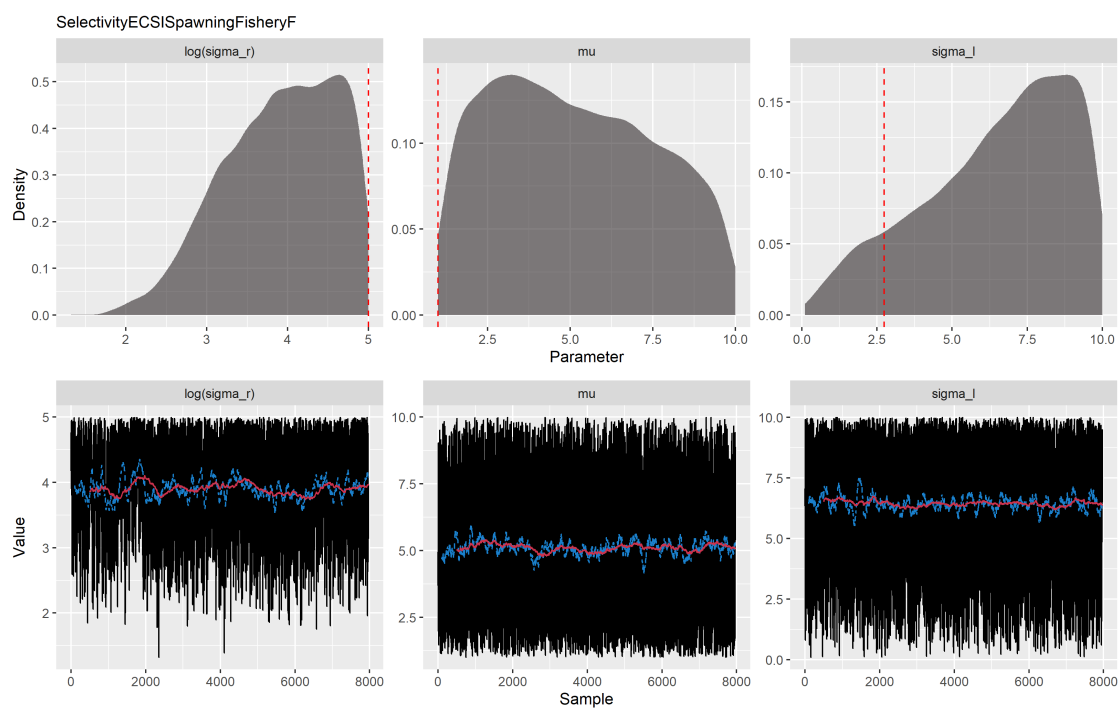


Figure 51: MCMC diagnostic plots for ECSISpawningFisheryF selectivity parameters from the base two stock model.

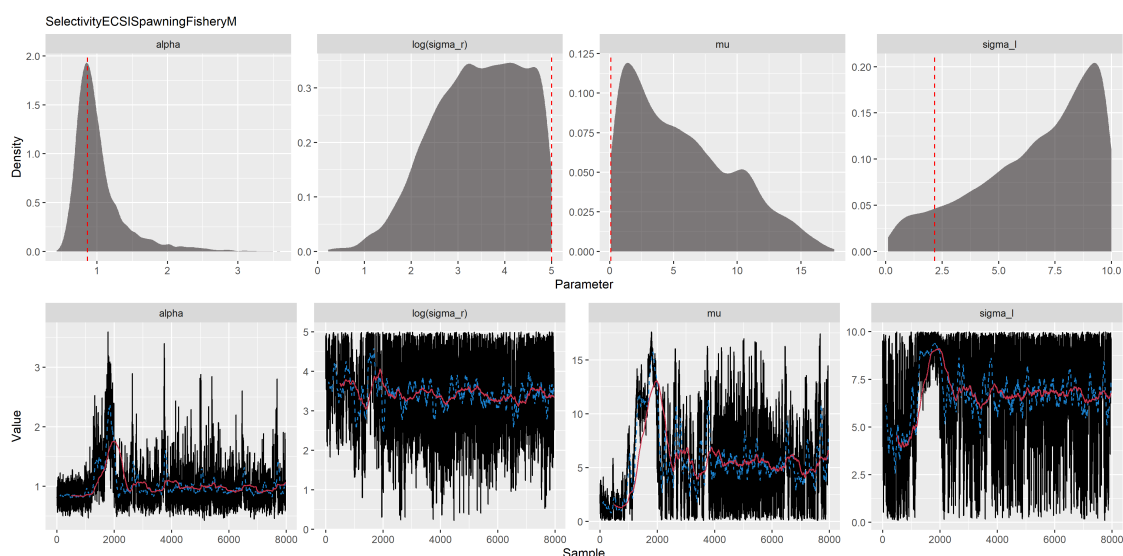


Figure 52: MCMC diagnostic plots for ECSISpawningFisheryM selectivity parameters from the base two stock model.

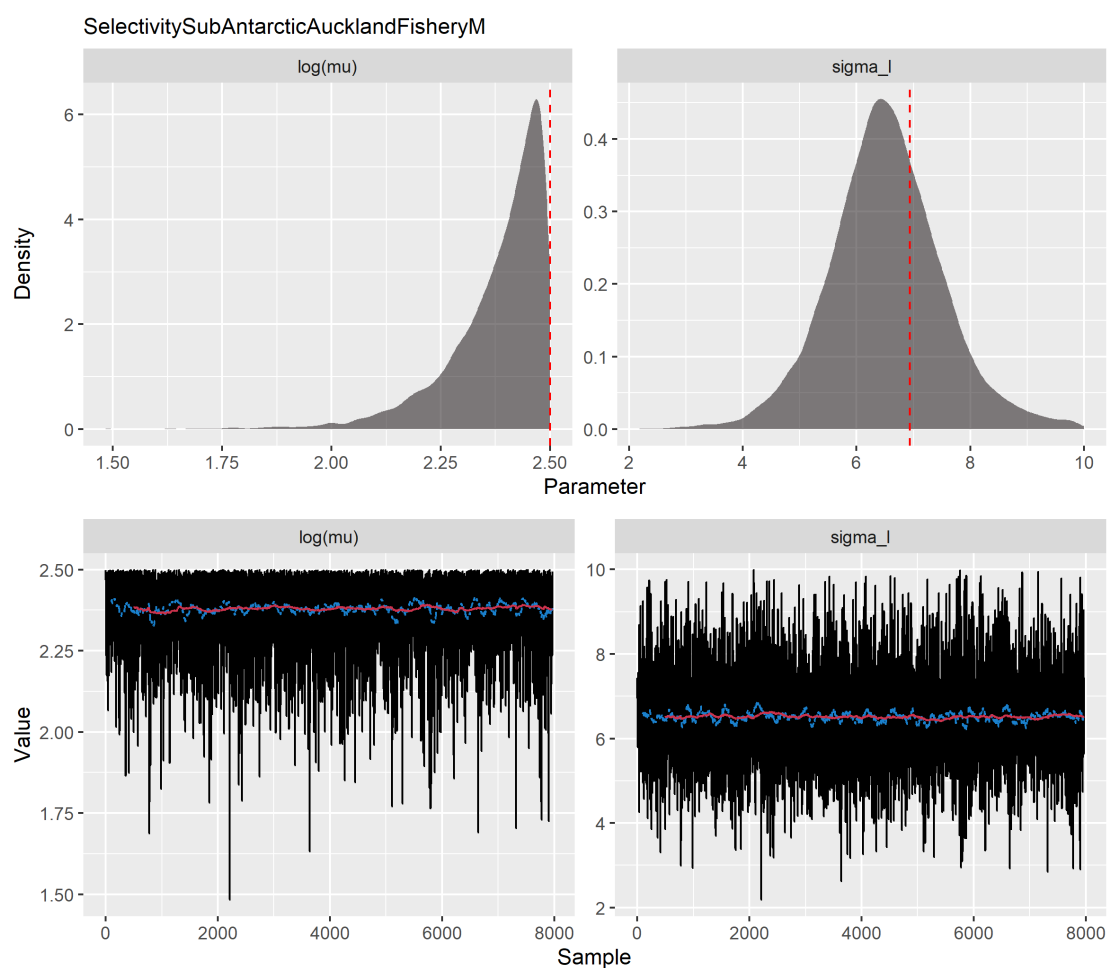


Figure 53: MCMC diagnostic plots for SubAntarcticAucklandFisheryM selectivity parameters from the base two stock model.

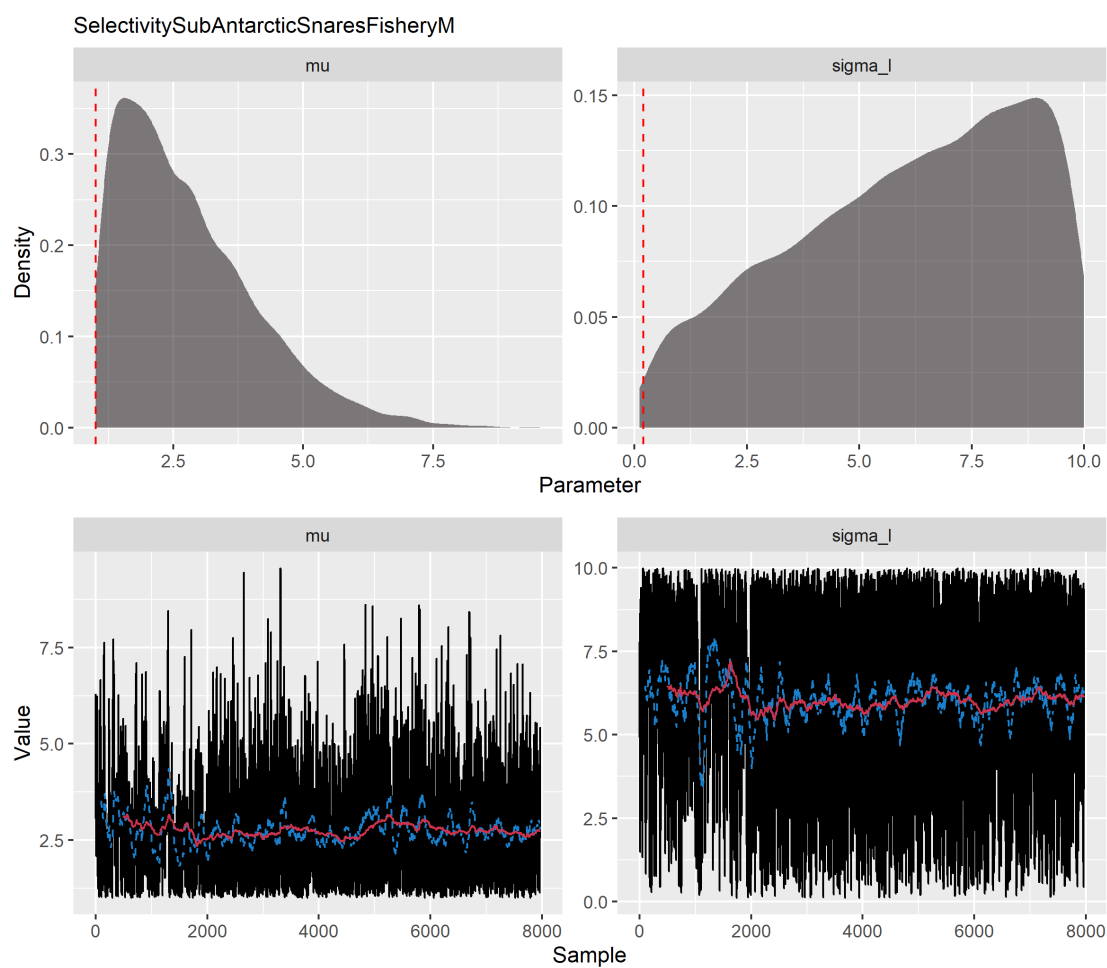


Figure 54: MCMC diagnostic plots for SubAntarcticSnaresFisheryM selectivity parameters from the base two stock model.

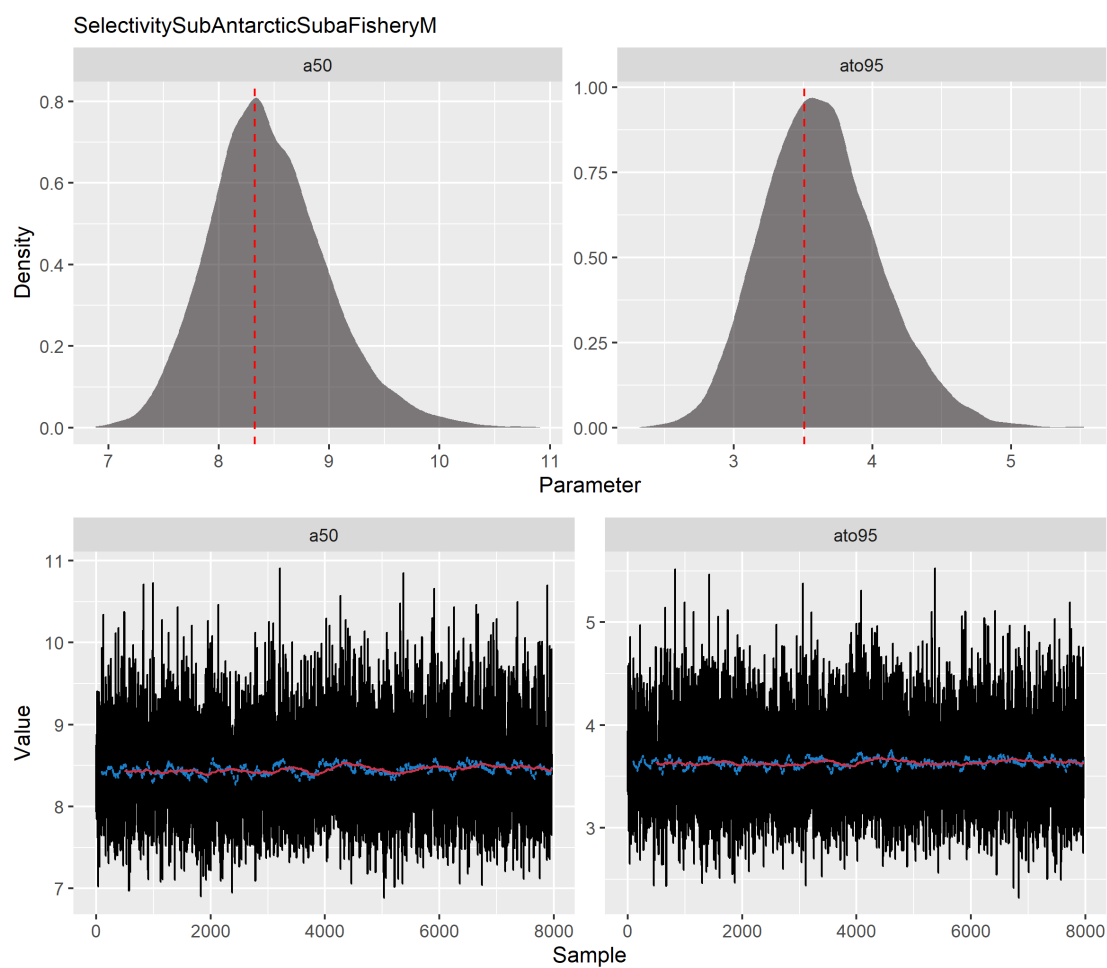


Figure 55: MCMC diagnostic plots for SubAntarcticSubaFisheryM selectivity parameters from the base two stock model.

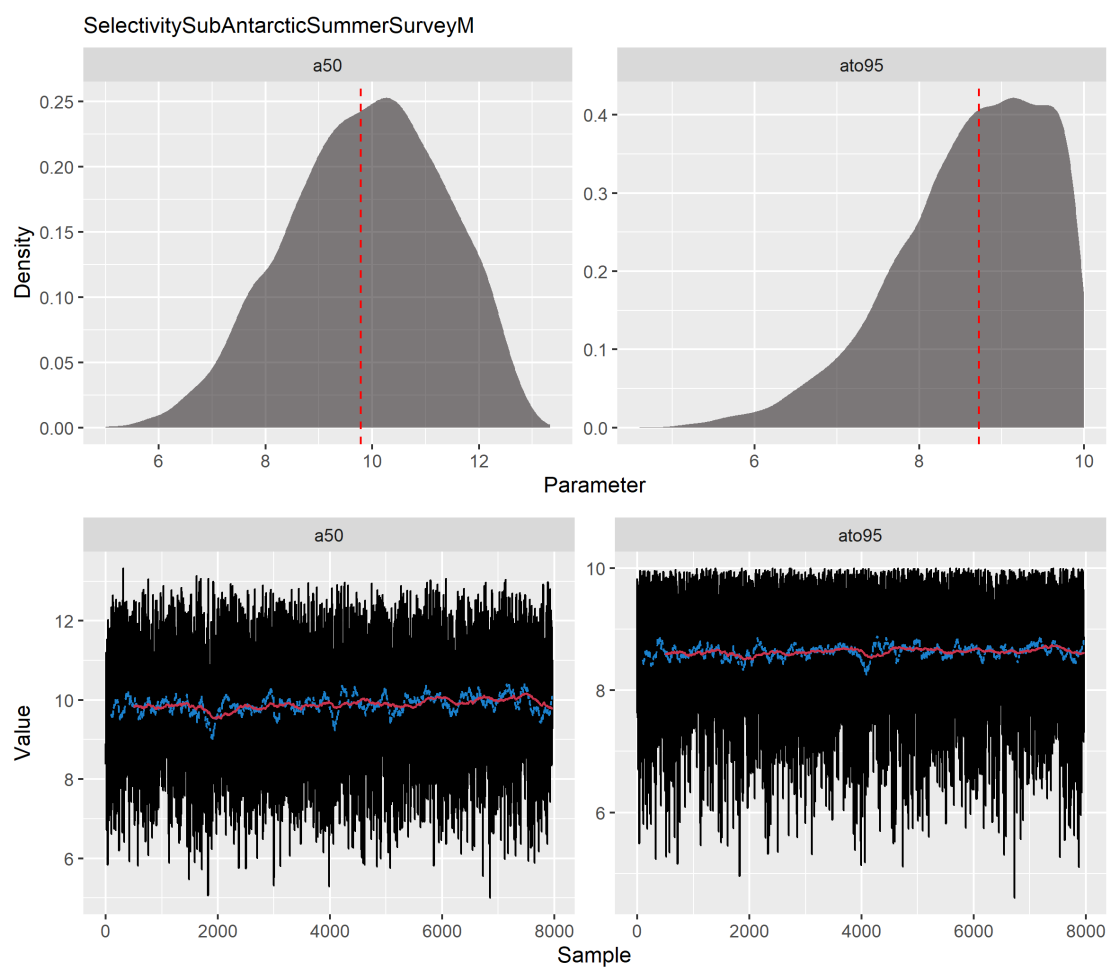


Figure 56: MCMC diagnostic plots for SubAntarcticSummerSurveyM selectivity parameters from the base two stock model.

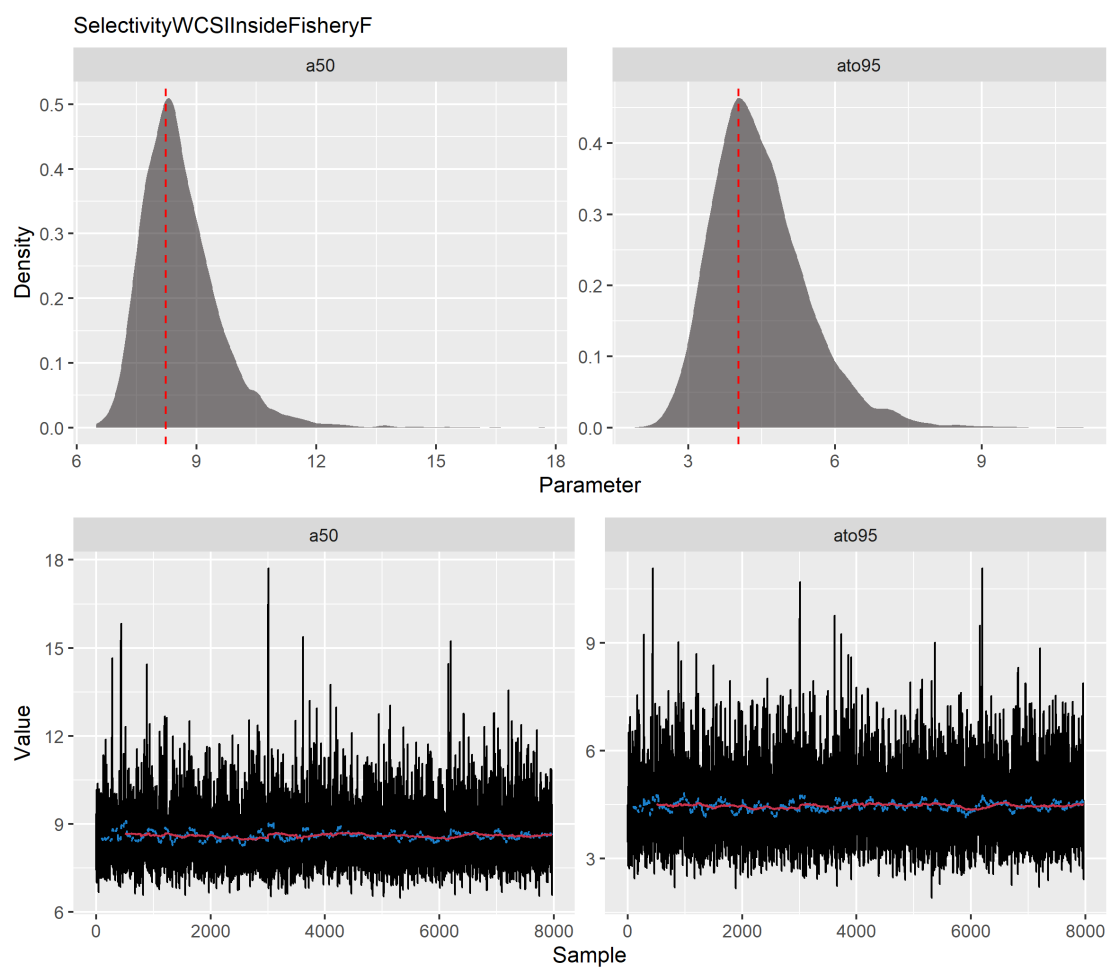


Figure 57: MCMC diagnostic plots for WCSIInsideFisheryF selectivity parameters from the base two stock model.

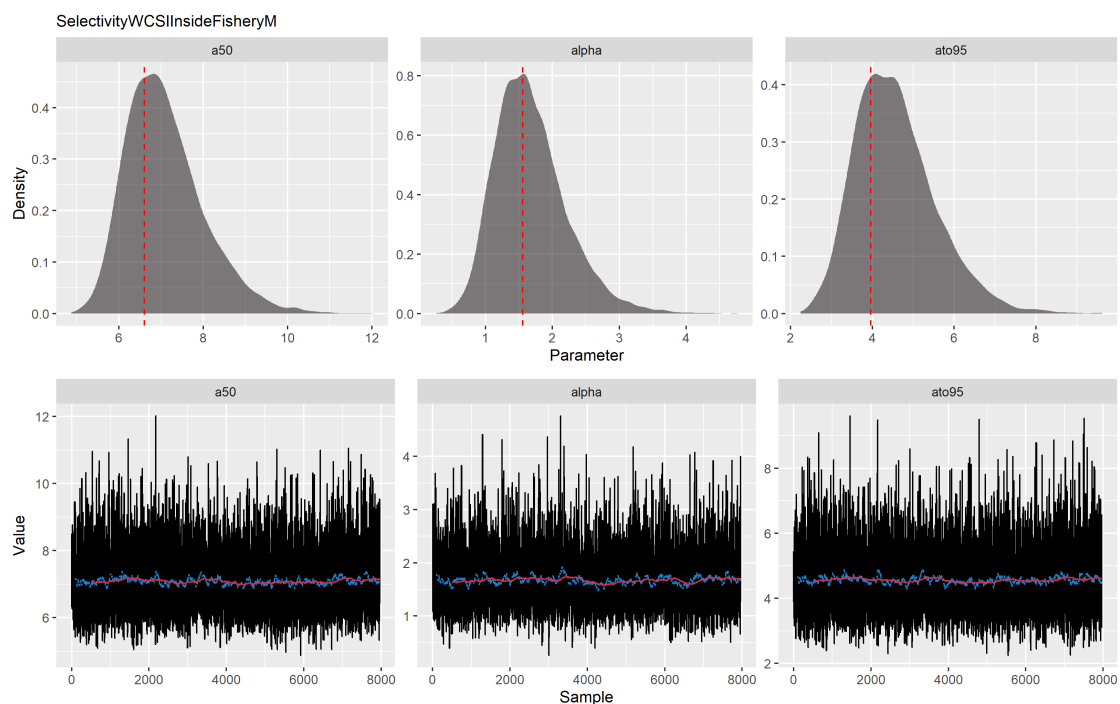


Figure 58: MCMC diagnostic plots for WCSIInsideFisheryM selectivity parameters from the base two stock model.

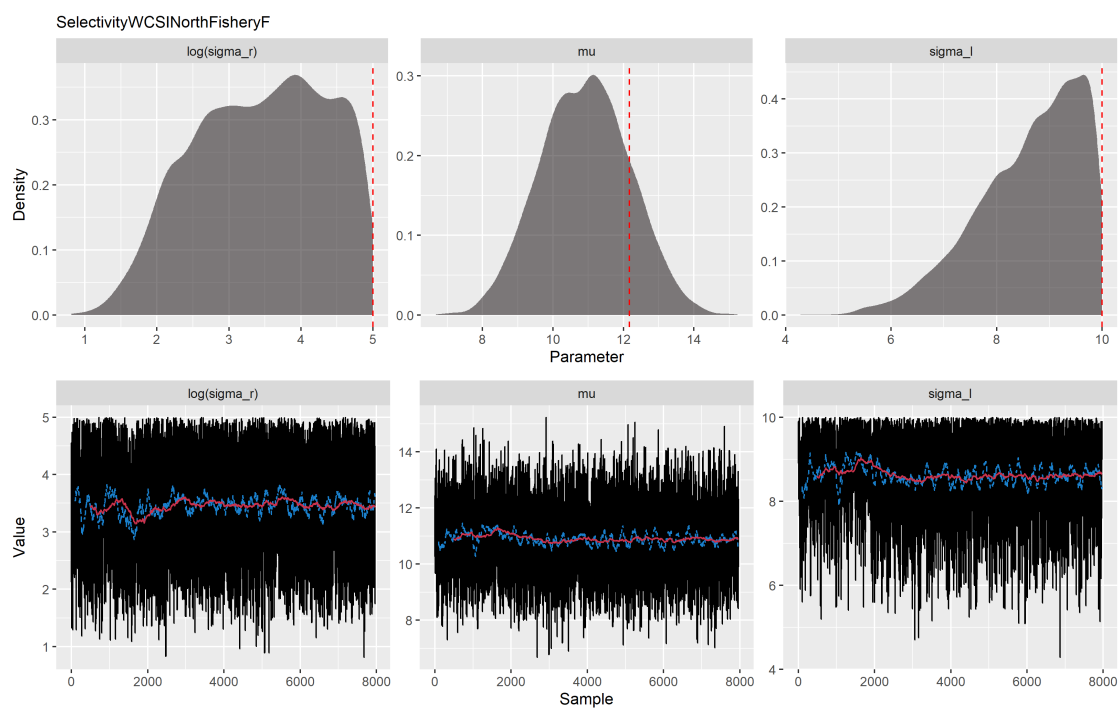


Figure 59: MCMC diagnostic plots for WCSINorthFisheryF selectivity parameters from the base two stock model.

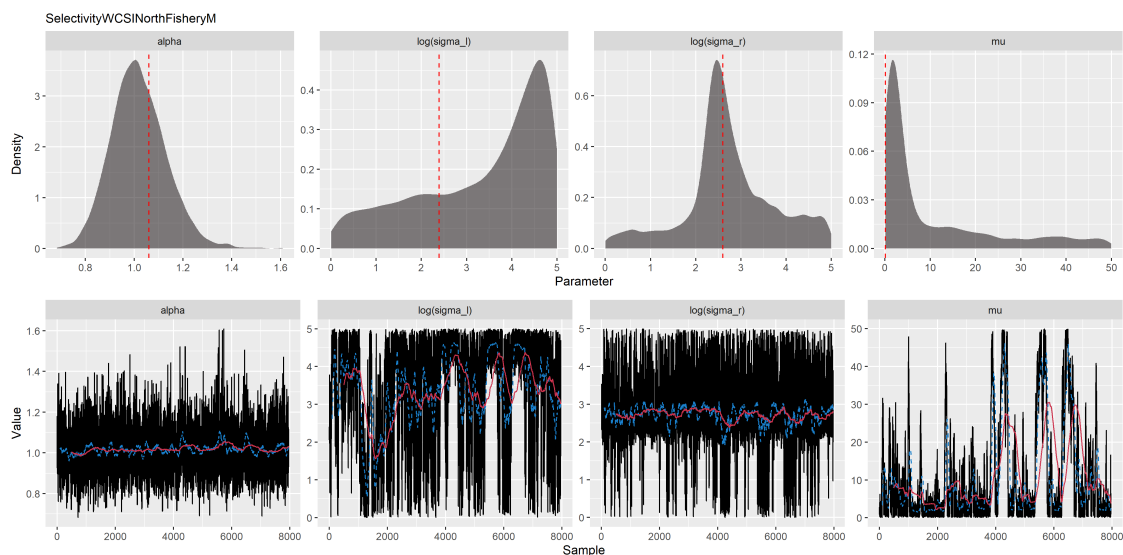


Figure 60: MCMC diagnostic plots for WCSINorthFisheryM selectivity parameters from the base two stock model.

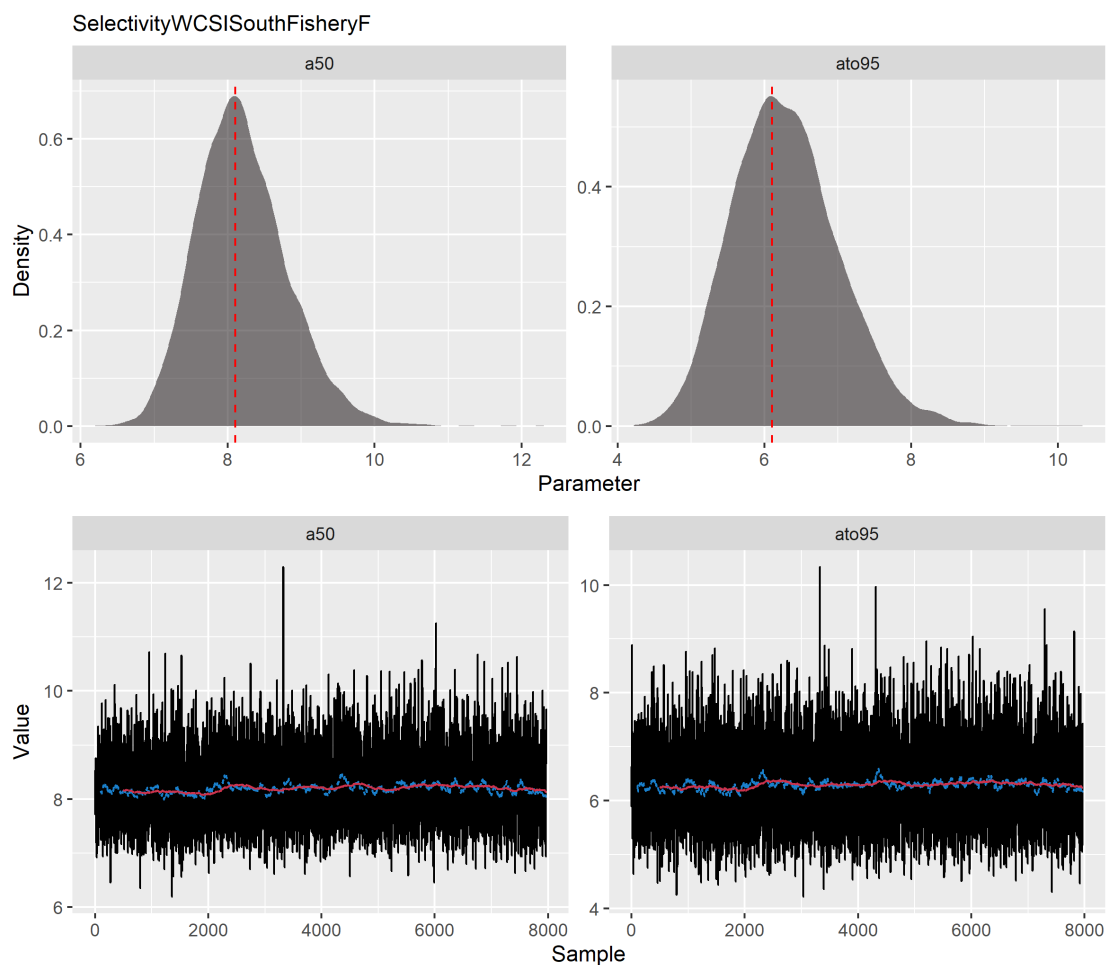


Figure 61: MCMC diagnostic plots for WCSISouthFisheryF selectivity parameters from the base two stock model.

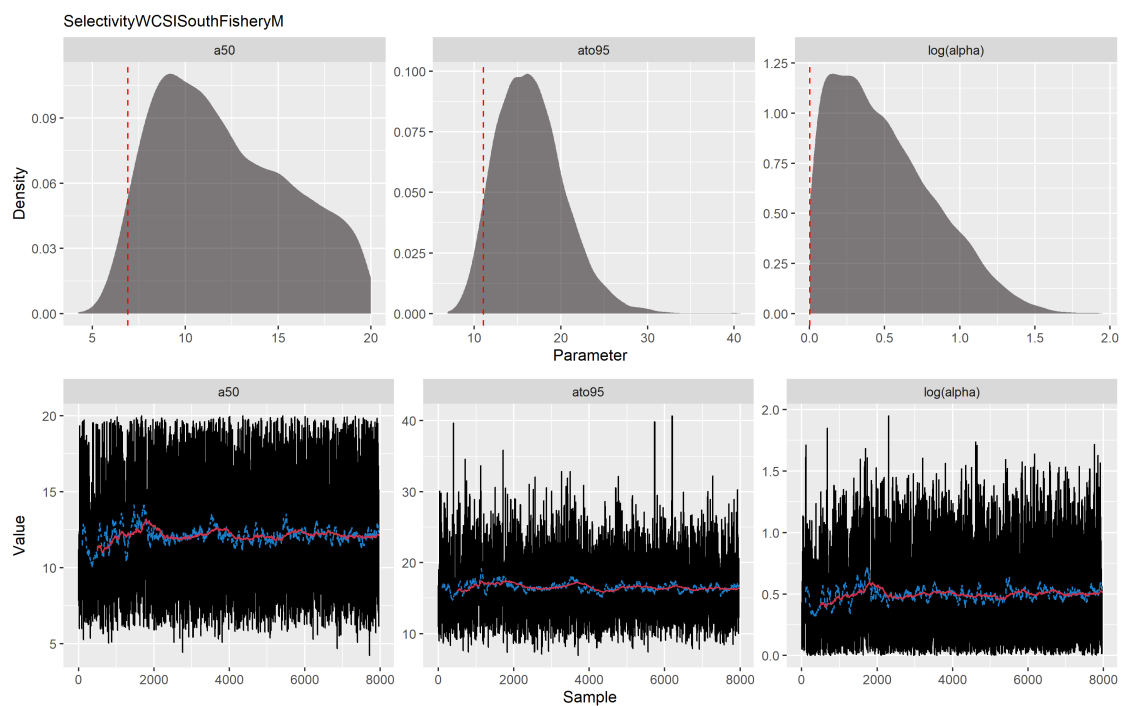


Figure 62: MCMC diagnostic plots for WCSISouthFisheryM selectivity parameters from the base two stock model.

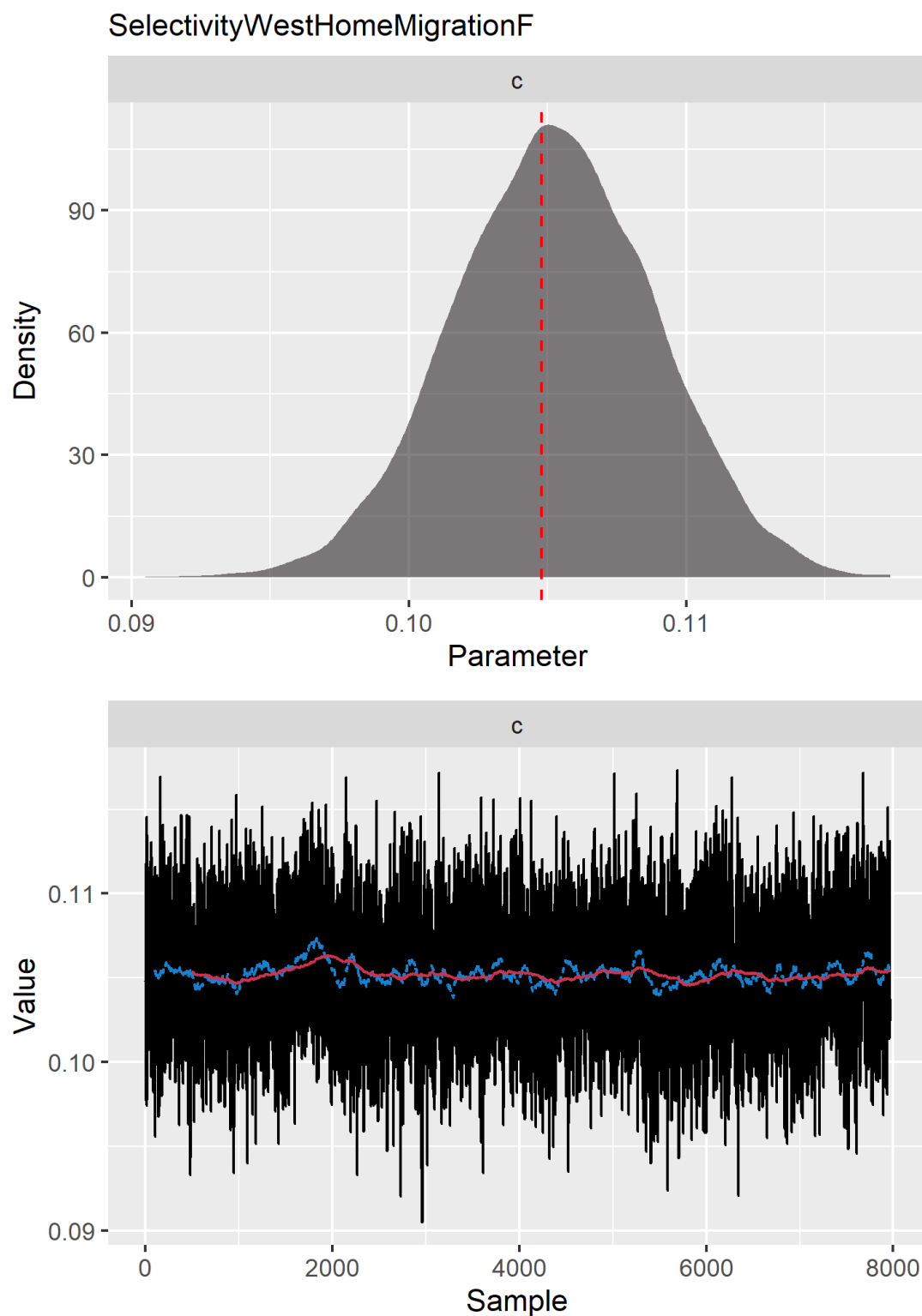


Figure 63: MCMC diagnostic plots for WestHomeMigrationF selectivity parameters from the base two stock model.

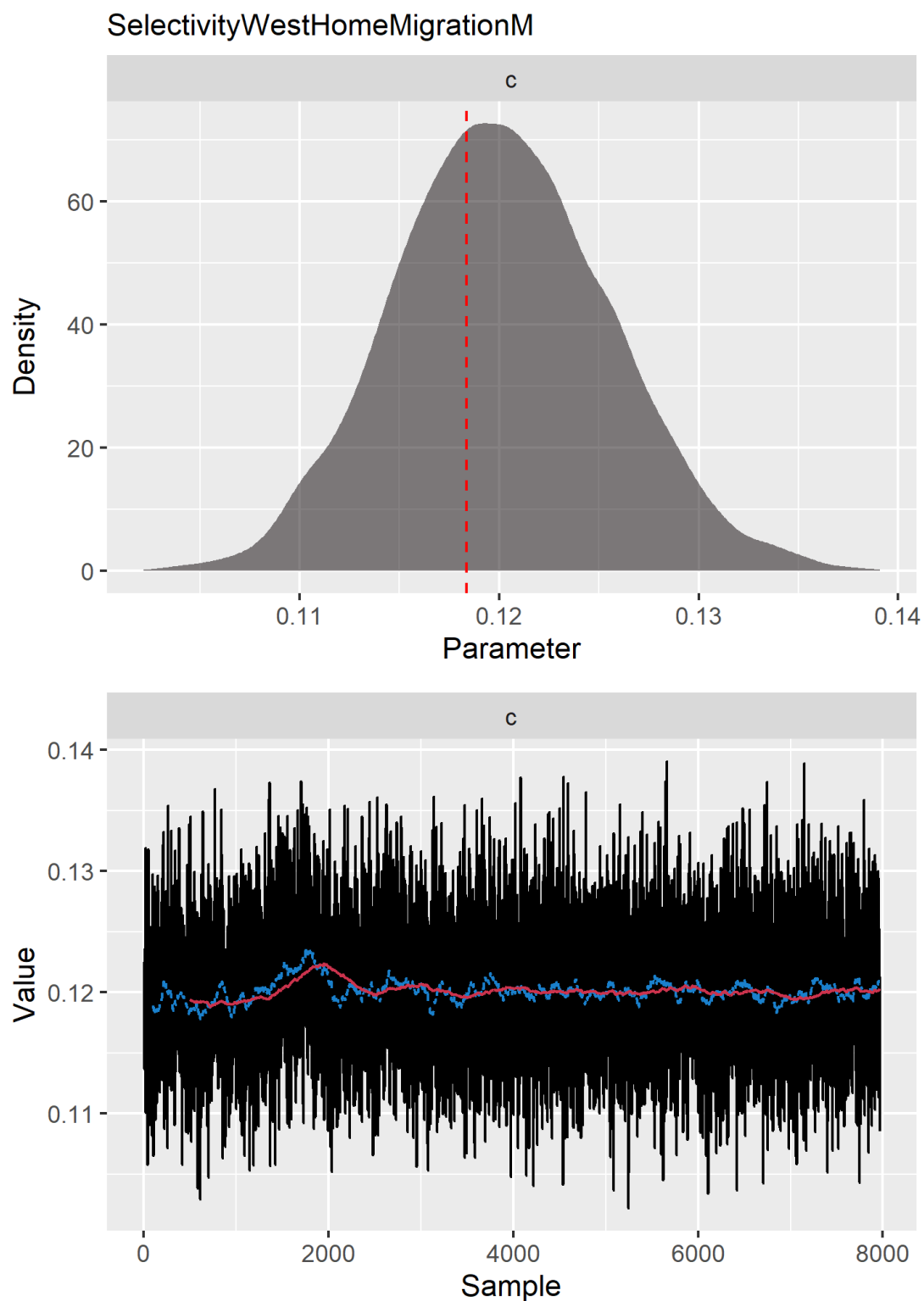


Figure 64: MCMC diagnostic plots for WestHomeMigrationM selectivity parameters from the base two stock model.

A.4 Single-stock: alternative single-stock model

A.5 Outputs

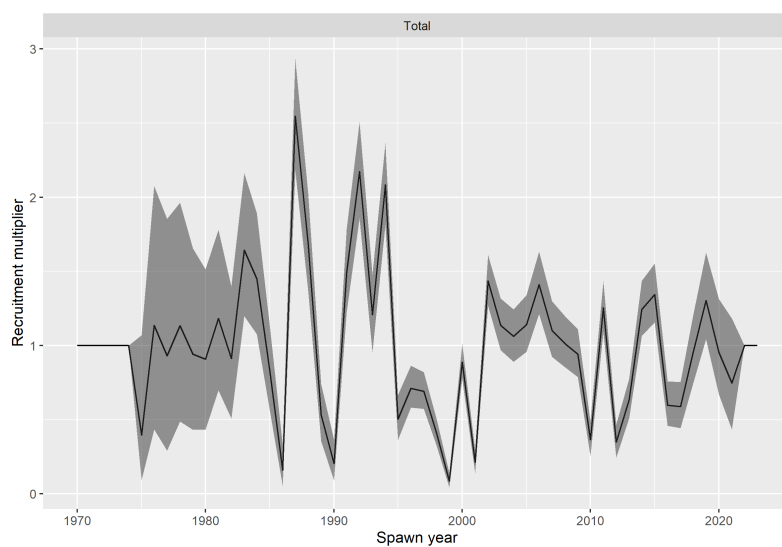


Figure 65: MCMC output for recruitment multipliers from the single stock model.



Figure 66: MCMC output for SSB from the single stock model.

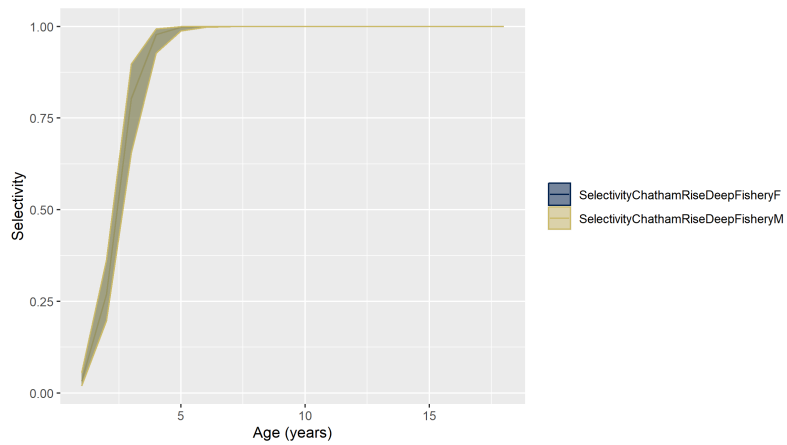


Figure 67: MCMC output for SelectivityChathamRiseDeepFishery from the single stock model.

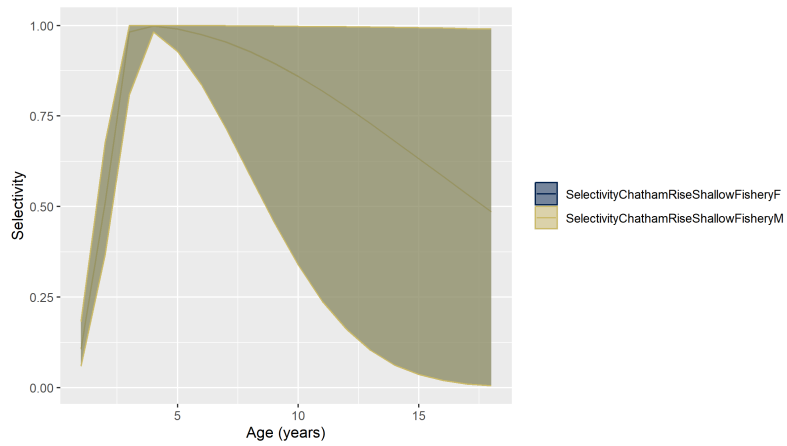


Figure 68: MCMC output for SelectivityChathamRiseShallowFishery from the single stock model.

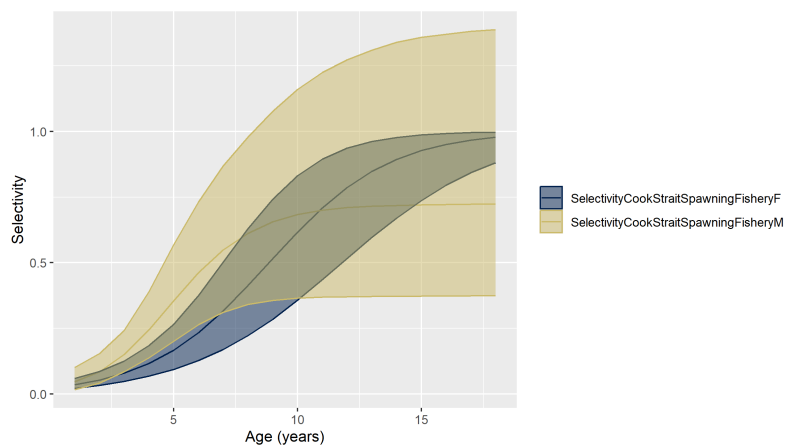


Figure 69: MCMC output for SelectivityCookStraitSpawningFishery from the single stock model.

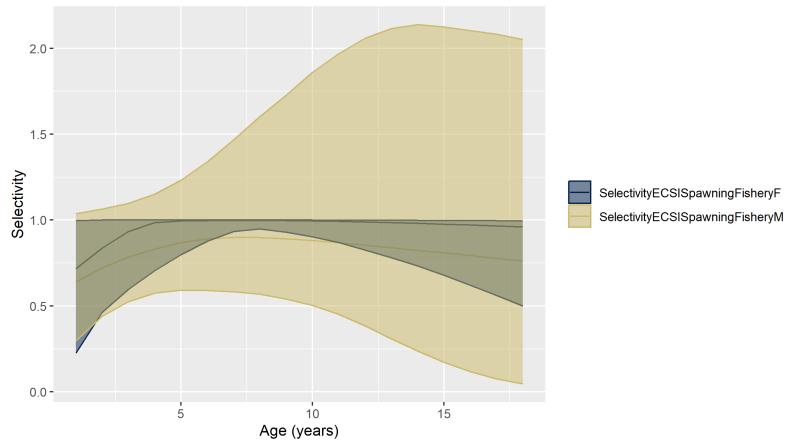


Figure 70: MCMC output for SelectivityECSISpawningFishery from the single stock model.

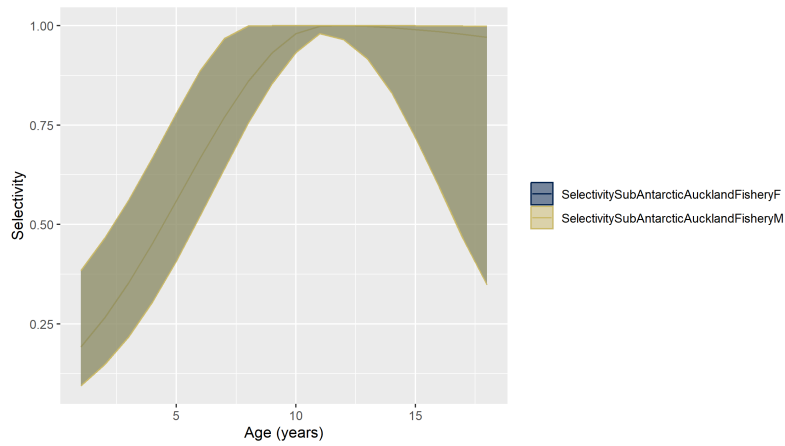


Figure 71: MCMC output for SelectivitySubAntarcticAucklandFishery from the single stock model.

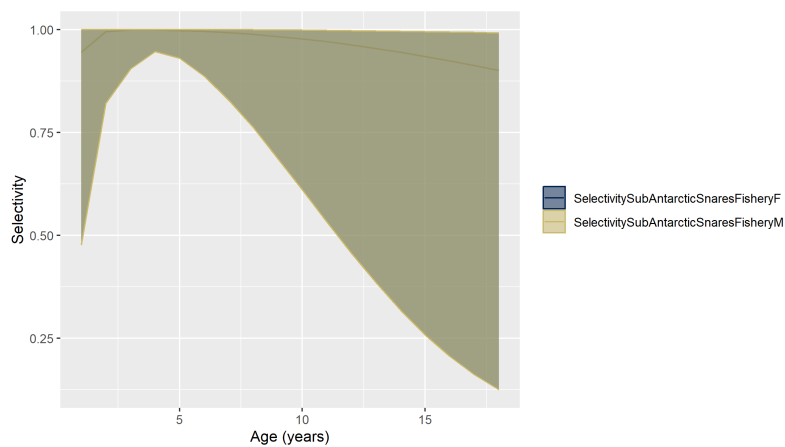


Figure 72: MCMC output for SelectivitySubAntarcticSnaresFishery from the single stock model.

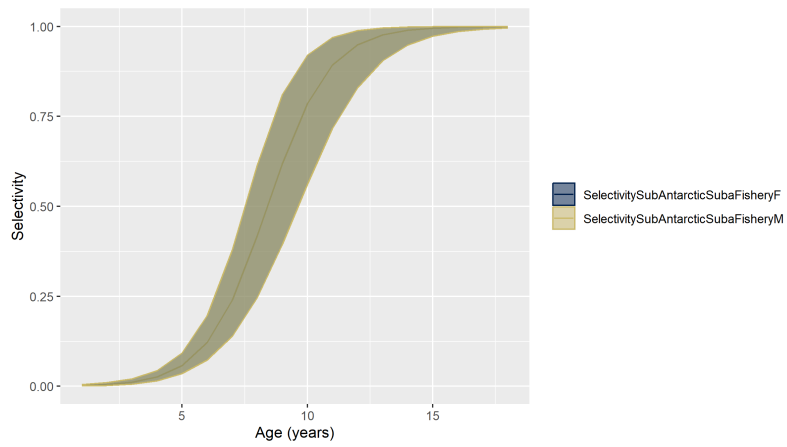


Figure 73: MCMC output for SelectivitySubAntarcticSubaFishery from the single stock model.

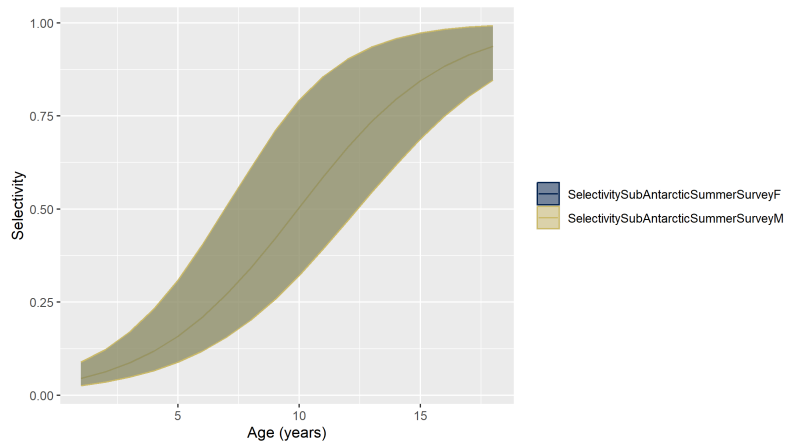


Figure 74: MCMC output for SelectivitySubAntarcticSummerSurvey from the single stock model.

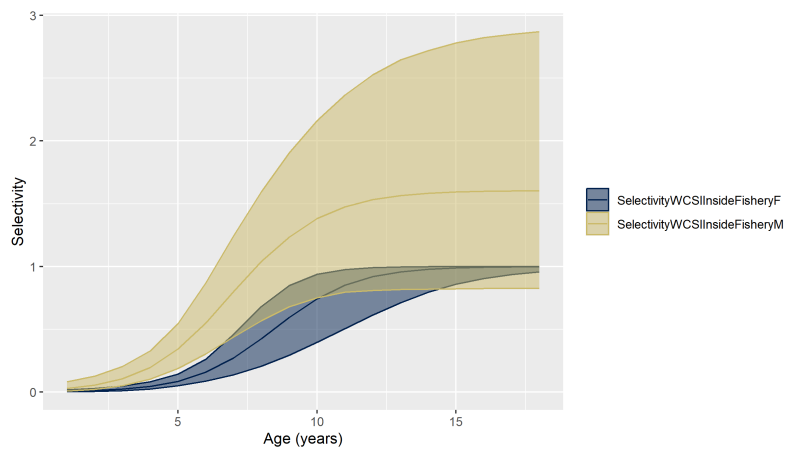


Figure 75: MCMC output for SelectivityWCSIIInsideFishery from the single stock model.

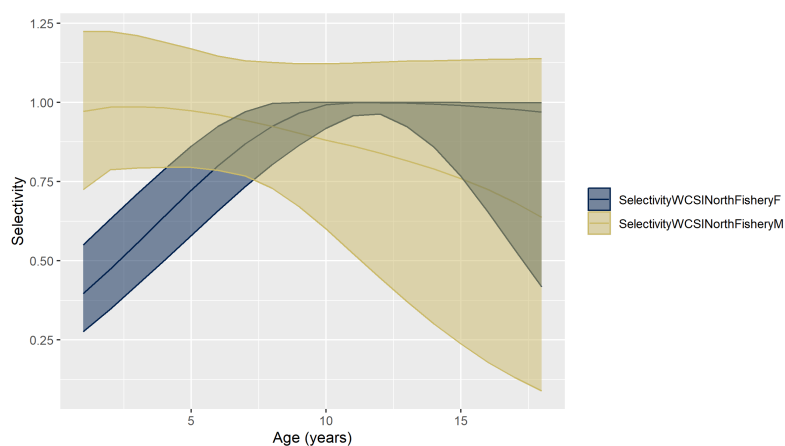


Figure 76: MCMC output for SelectivityWCSINorthFishery from the single stock model.

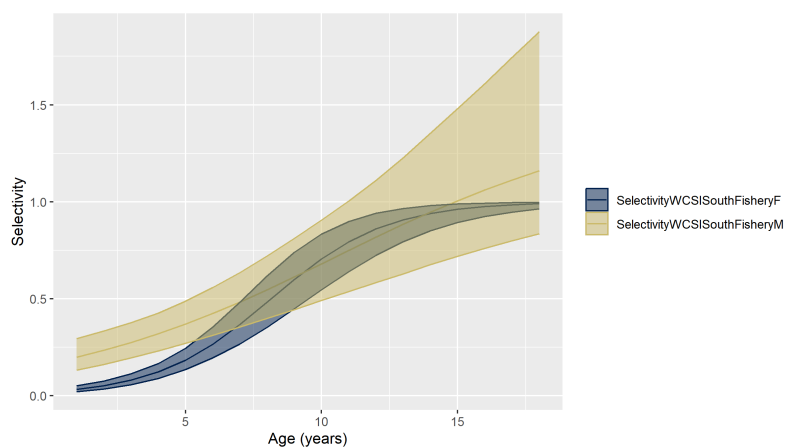


Figure 77: MCMC output for SelectivityWCSISouthFishery from the single stock model.

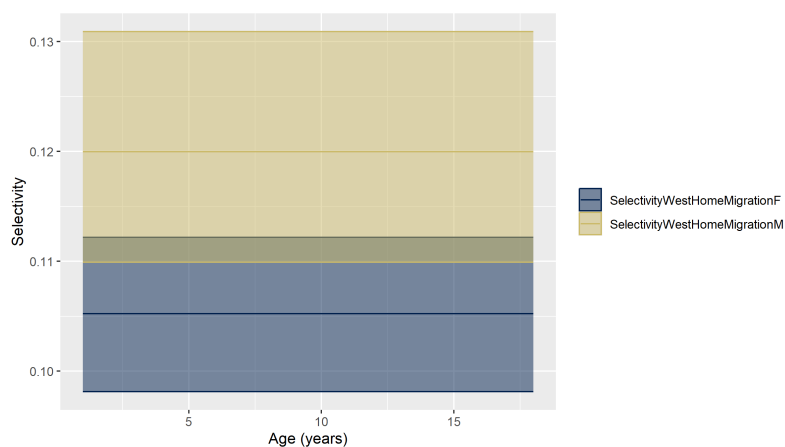


Figure 78: MCMC output for SelectivityWestHomeMigration from the single stock model.

A.6 Diagnostics

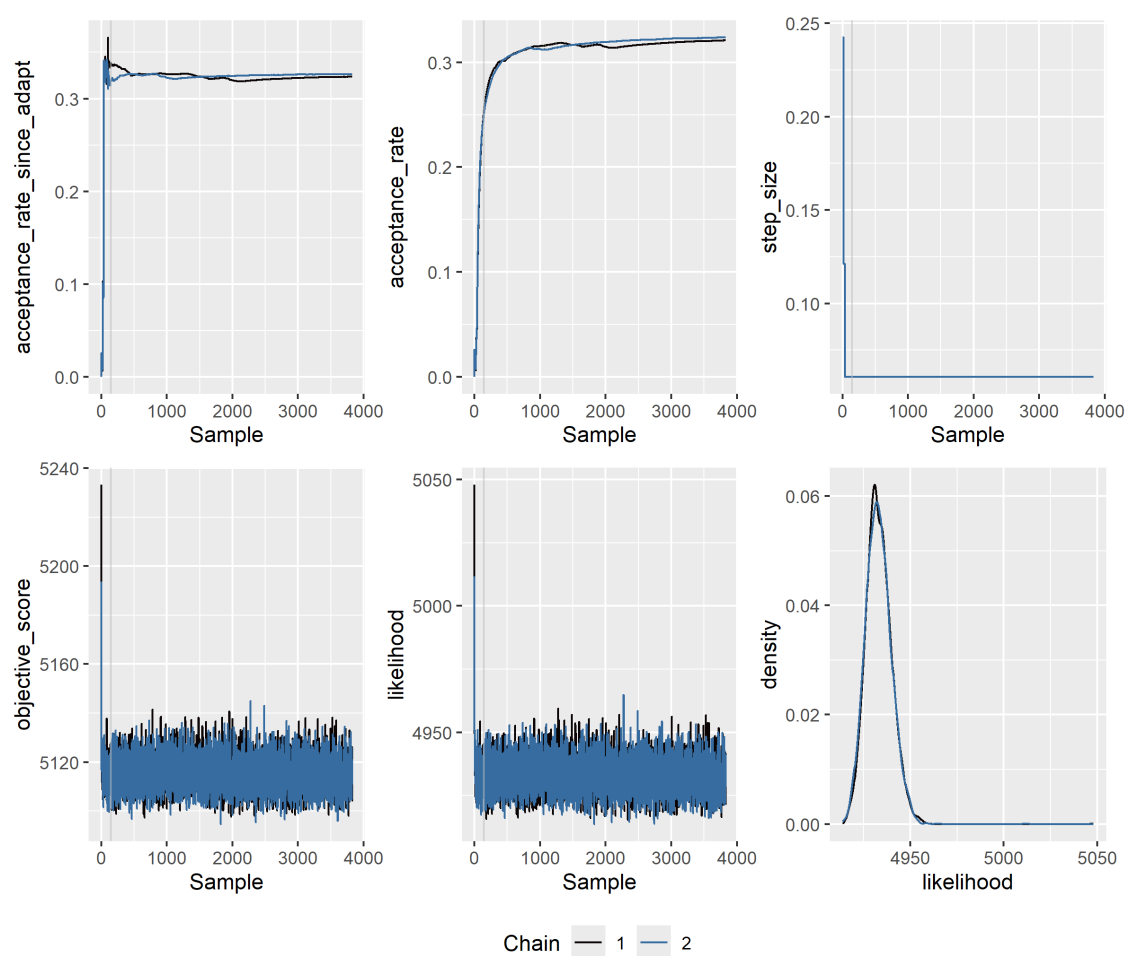


Figure 79: MCMC chain diagnostics from the the single stock model.

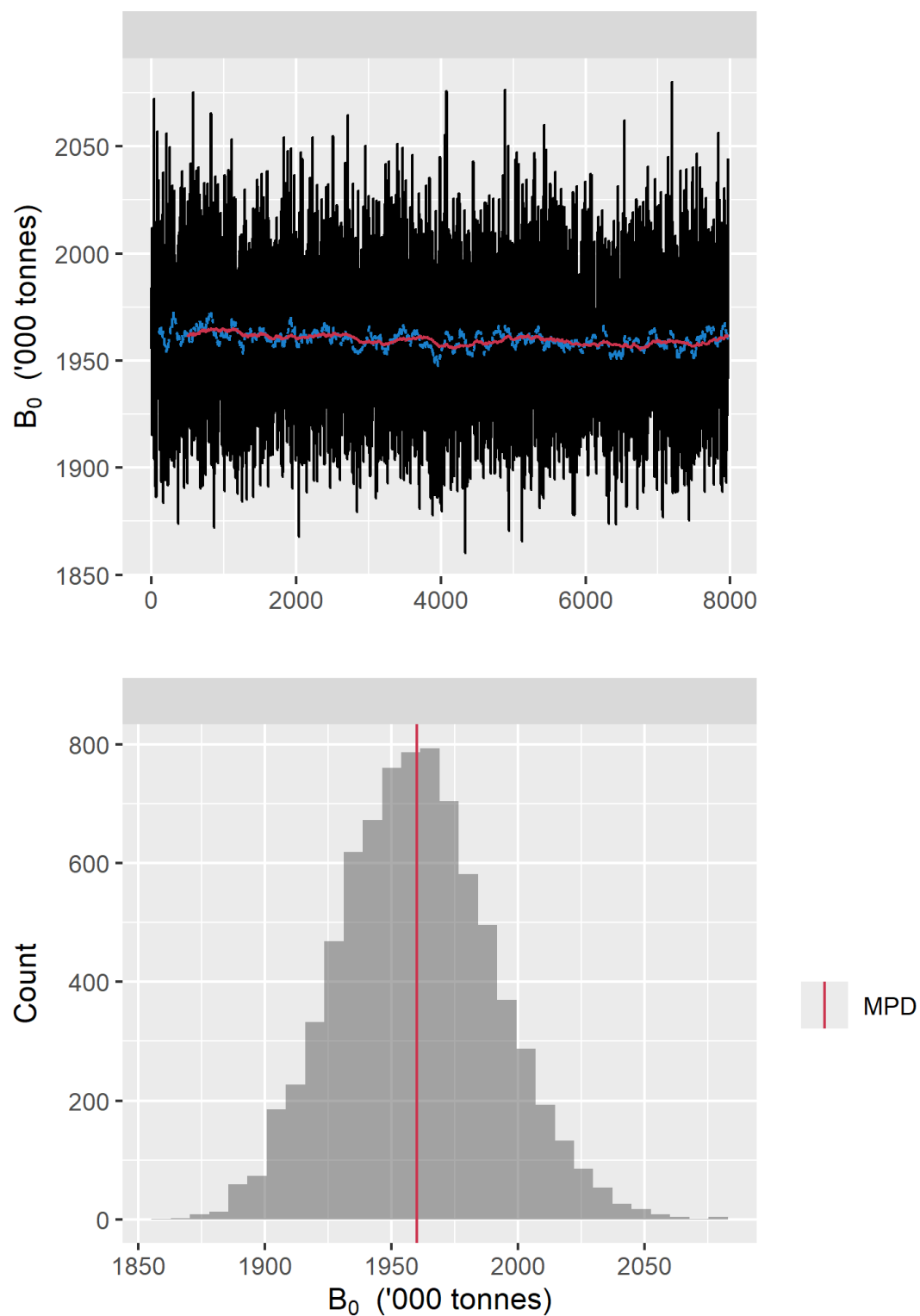


Figure 80: MCMC diagnostic plots for B_0 from the single stock model.

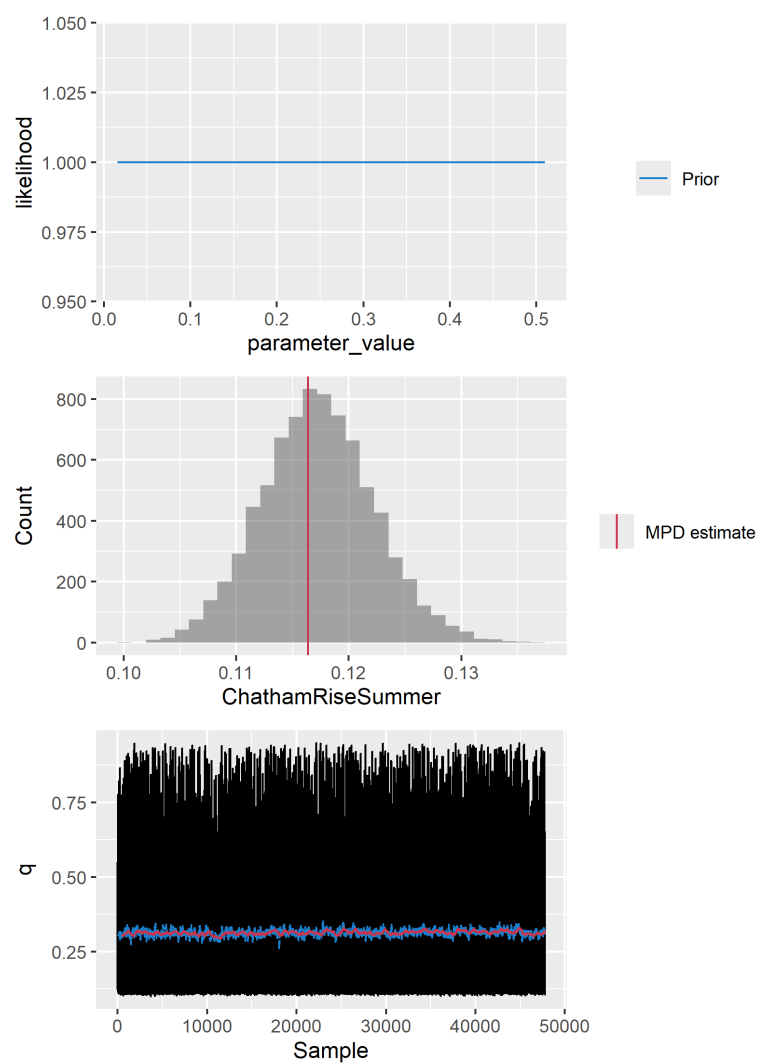


Figure 81: MCMC diagnostic plots for Catchability ChathamRiseSummerQ from the single stock model.

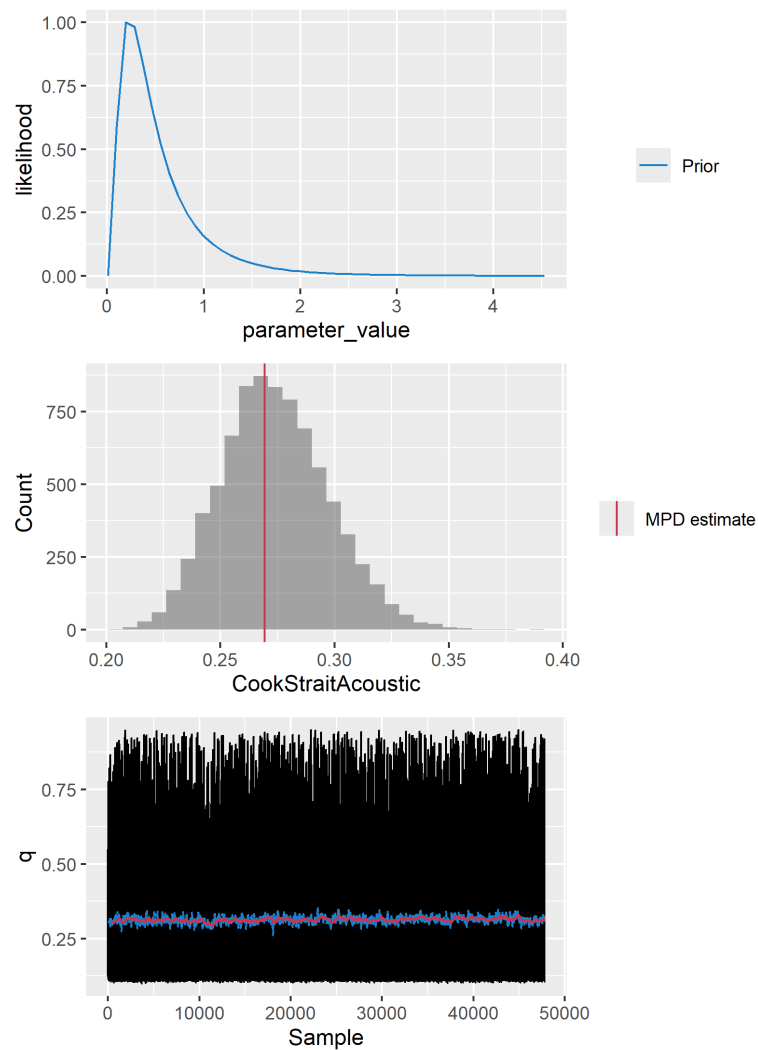


Figure 82: MCMC diagnostic plots for Catchability CookStraitAcousticQ from the single stock model.

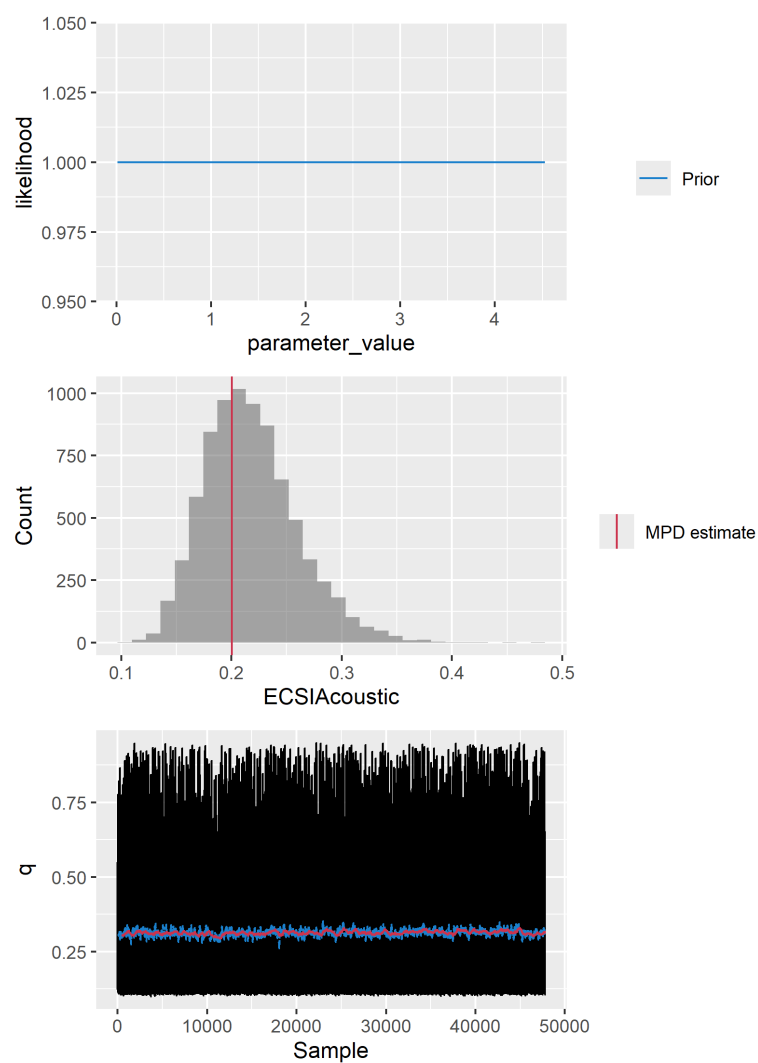


Figure 83: MCMC diagnostic plots for Catchability ECSIAcousticQ from the single stock model.

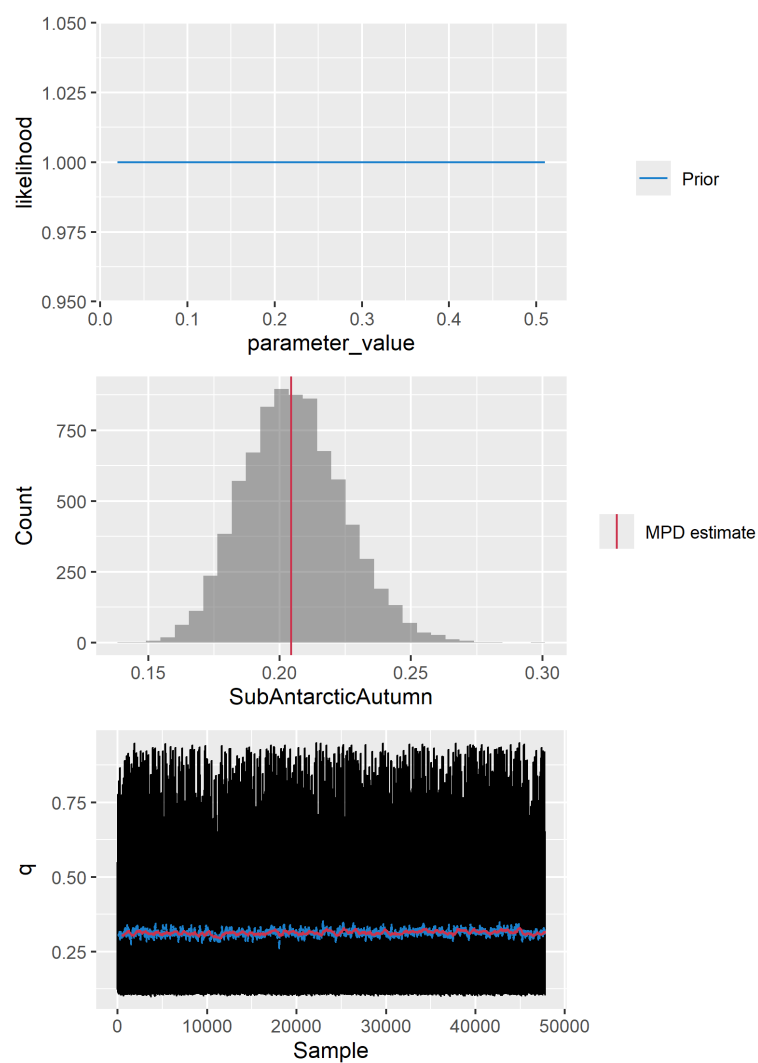


Figure 84: MCMC diagnostic plots for Catchability SubAntarcticAutumnQ from the single stock model.

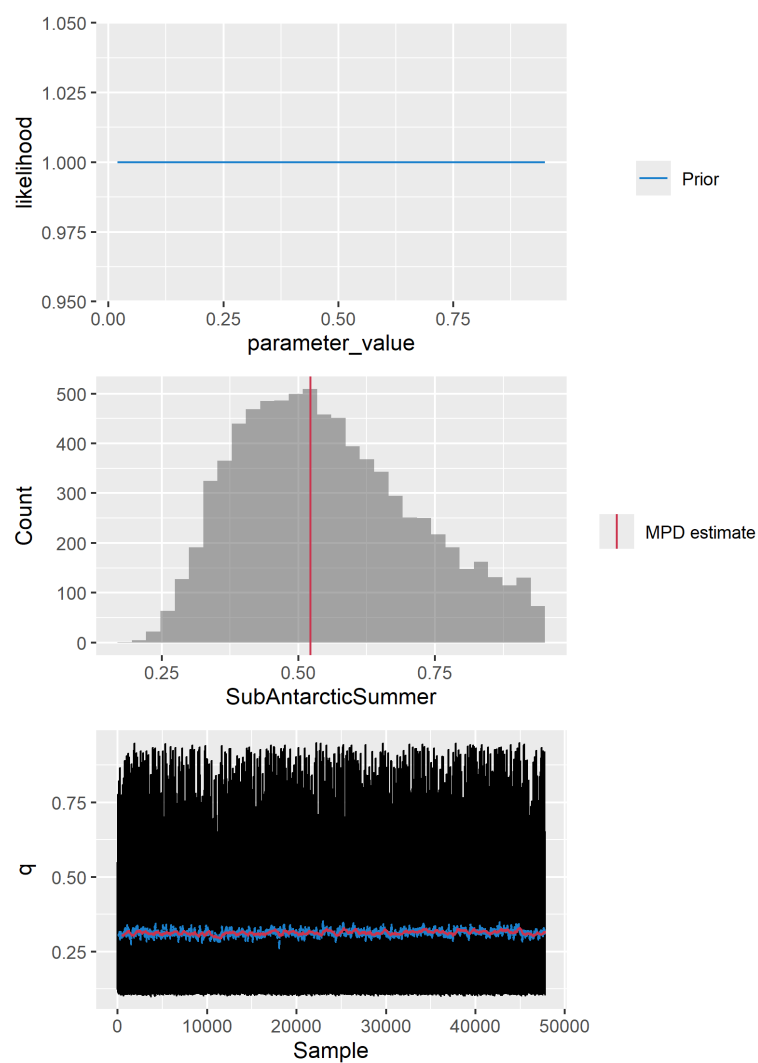


Figure 85: MCMC diagnostic plots for Catchability SubAntarcticSummerQ from the single stock model.

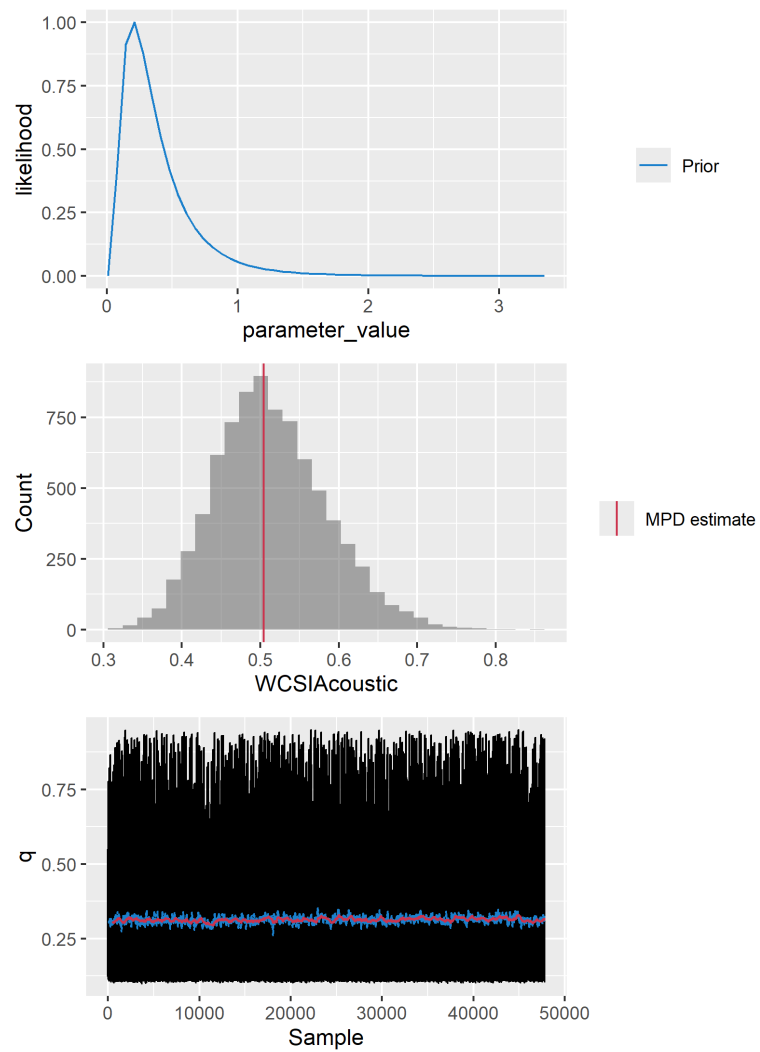


Figure 86: MCMC diagnostic plots for Catchability WCSIAcousticQ from the single stock model.

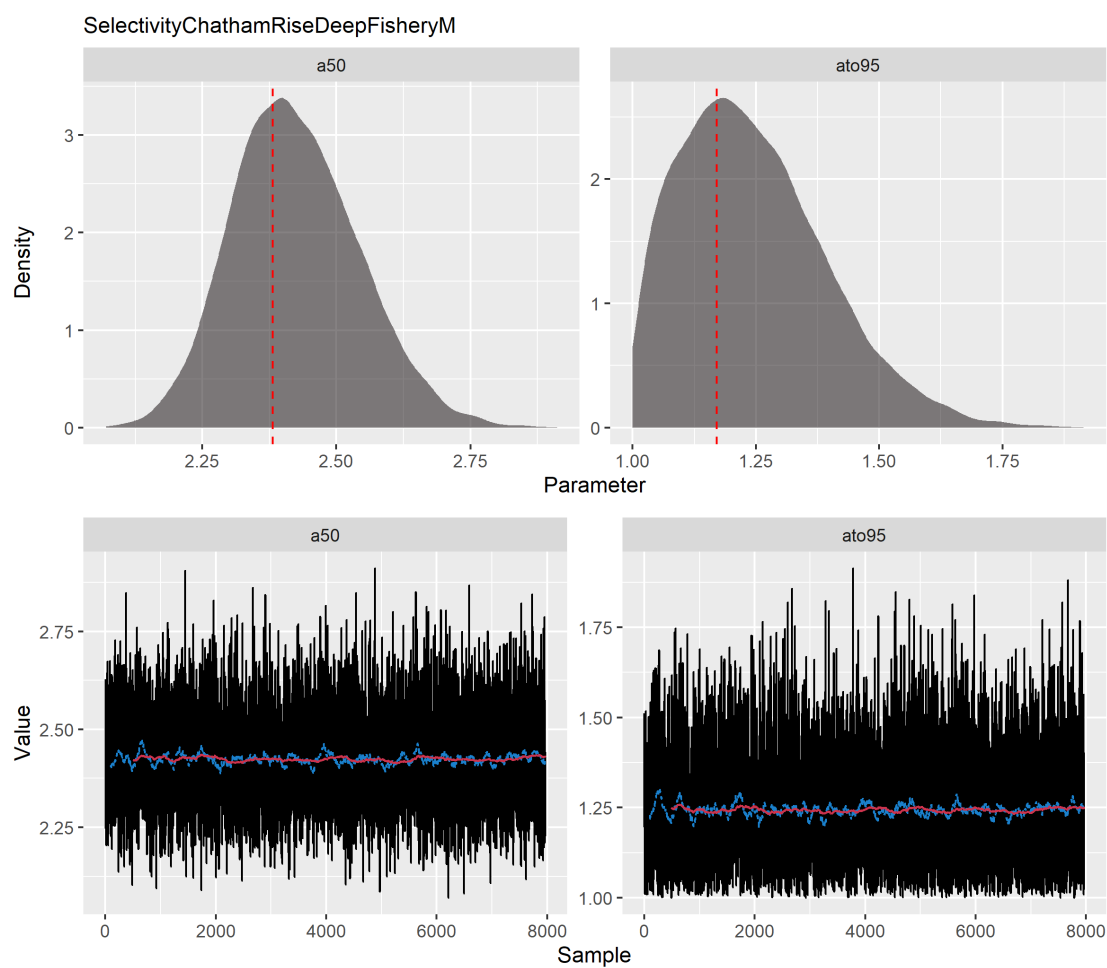


Figure 87: MCMC diagnostic plots for ChathamRiseDeepFisheryM selectivity parameters from the single stock model.

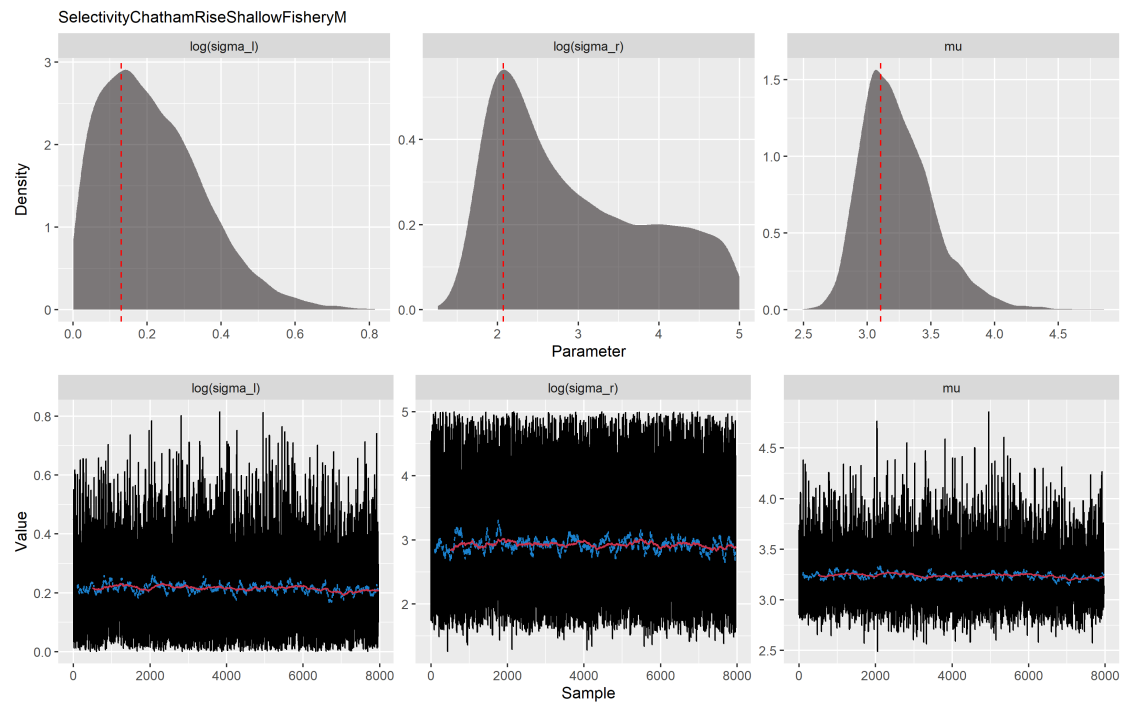


Figure 88: MCMC diagnostic plots for ChathamRiseShallowFisheryM selectivity parameters from the single stock model.

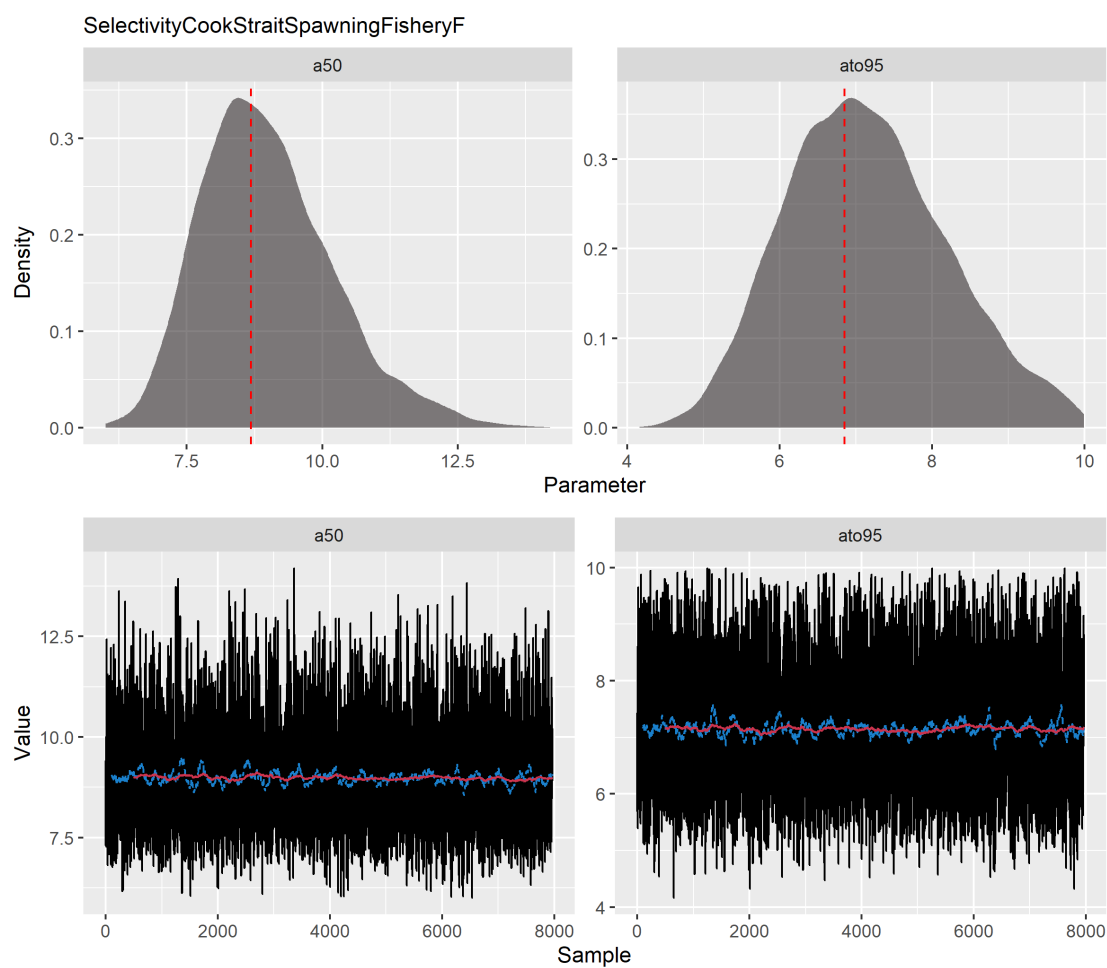


Figure 89: MCMC diagnostic plots for CookStraitSpawningFisheryF selectivity parameters from the single stock model.

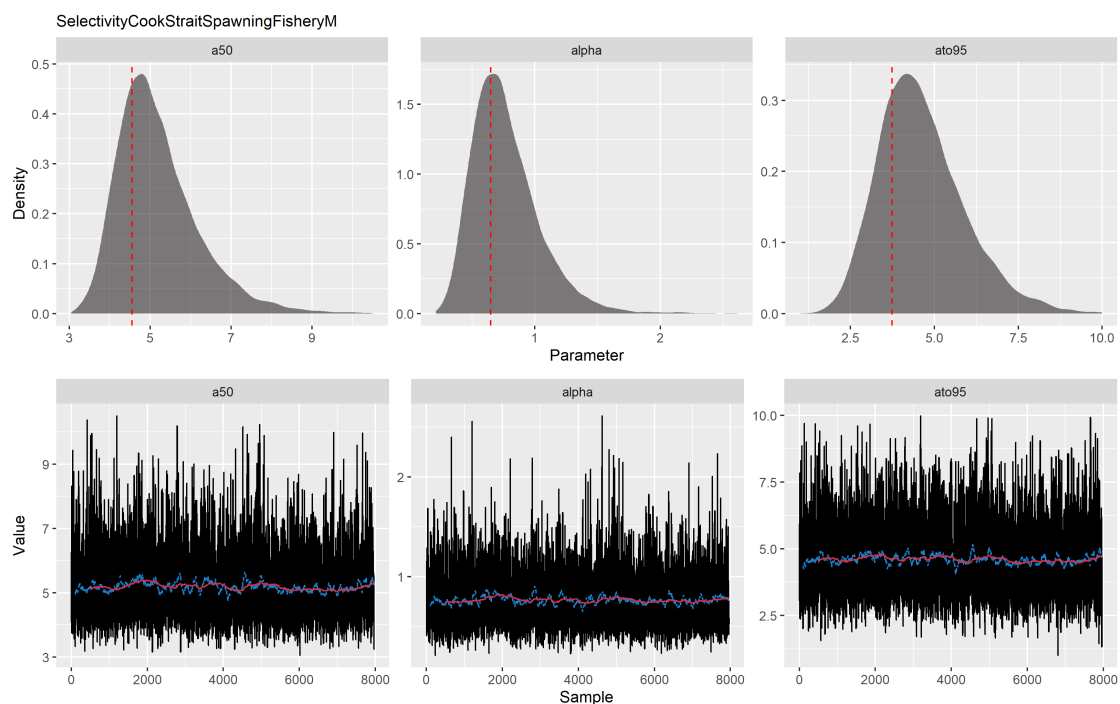


Figure 90: MCMC diagnostic plots for CookStraitSpawningFisheryM selectivity parameters from the single stock model.

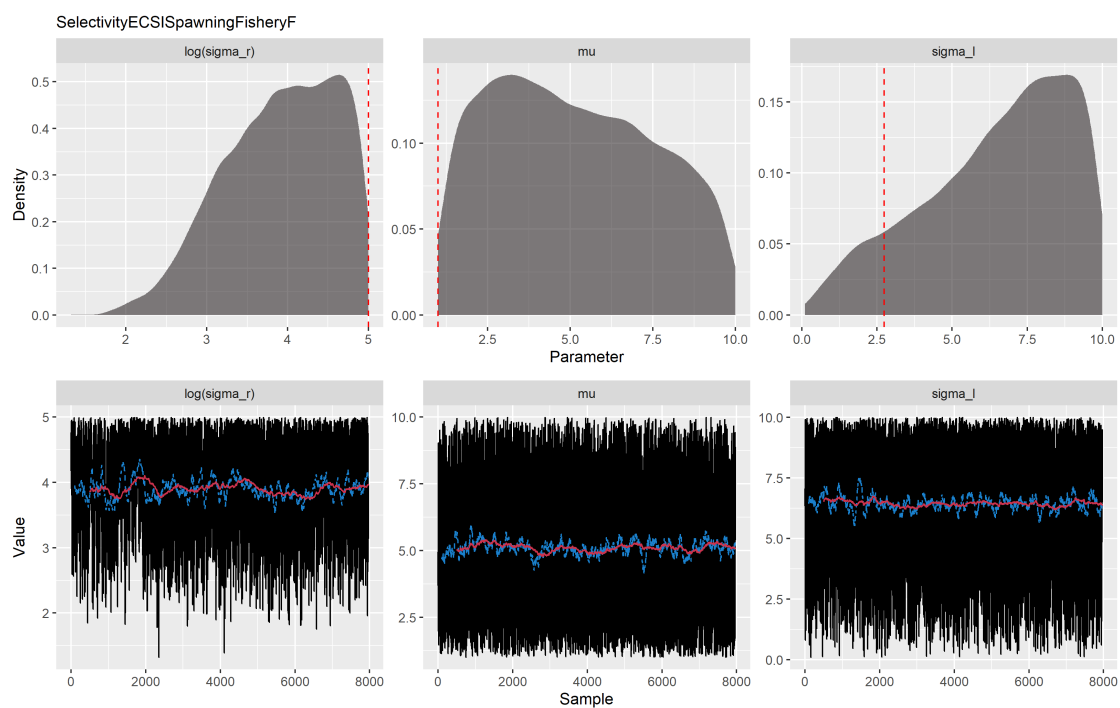


Figure 91: MCMC diagnostic plots for ECSISpawningFisheryF selectivity parameters from the single stock model.

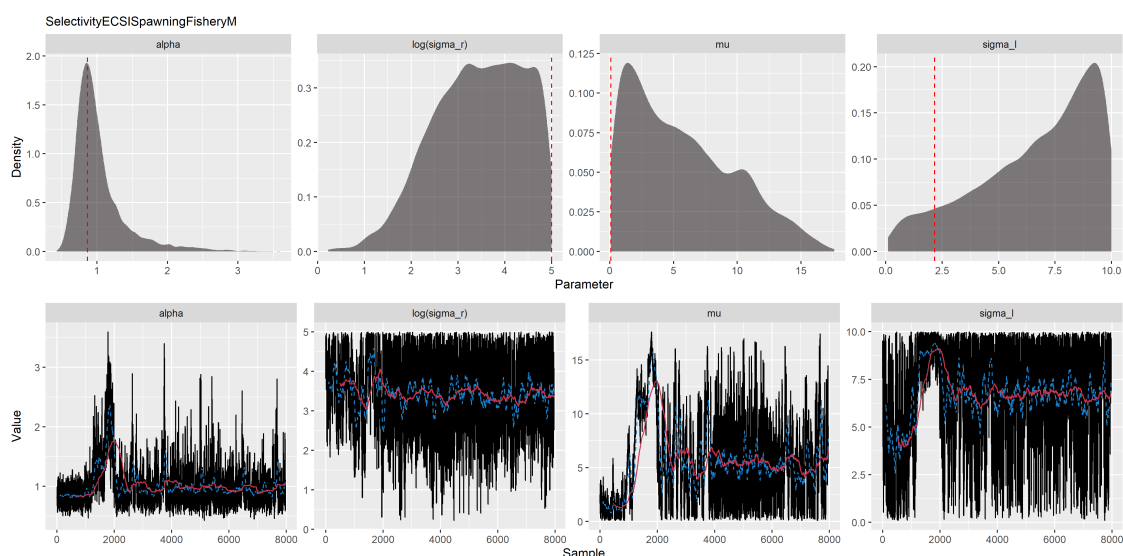


Figure 92: MCMC diagnostic plots for ECSISpawningFisheryM selectivity parameters from the single stock model.

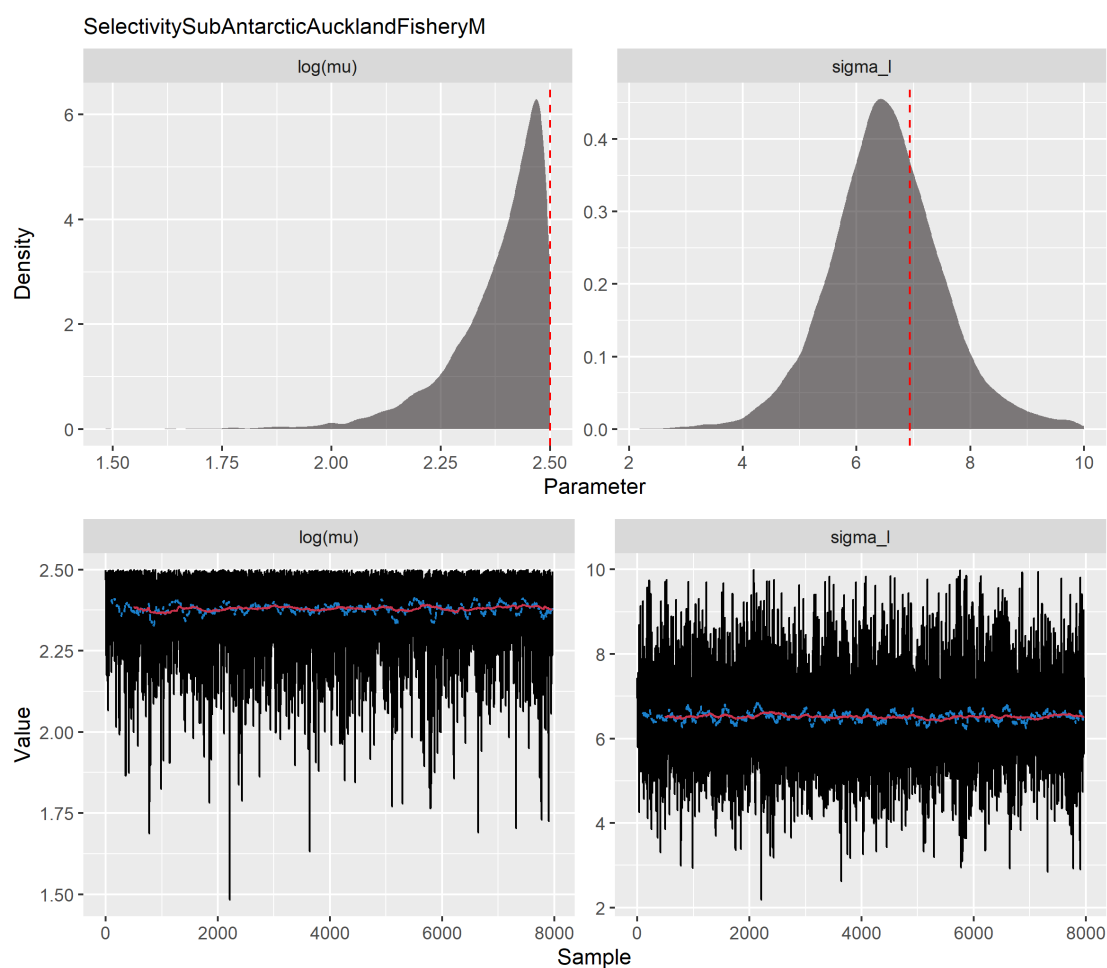


Figure 93: MCMC diagnostic plots for SubAntarcticAucklandFisheryM selectivity parameters from the single stock model.

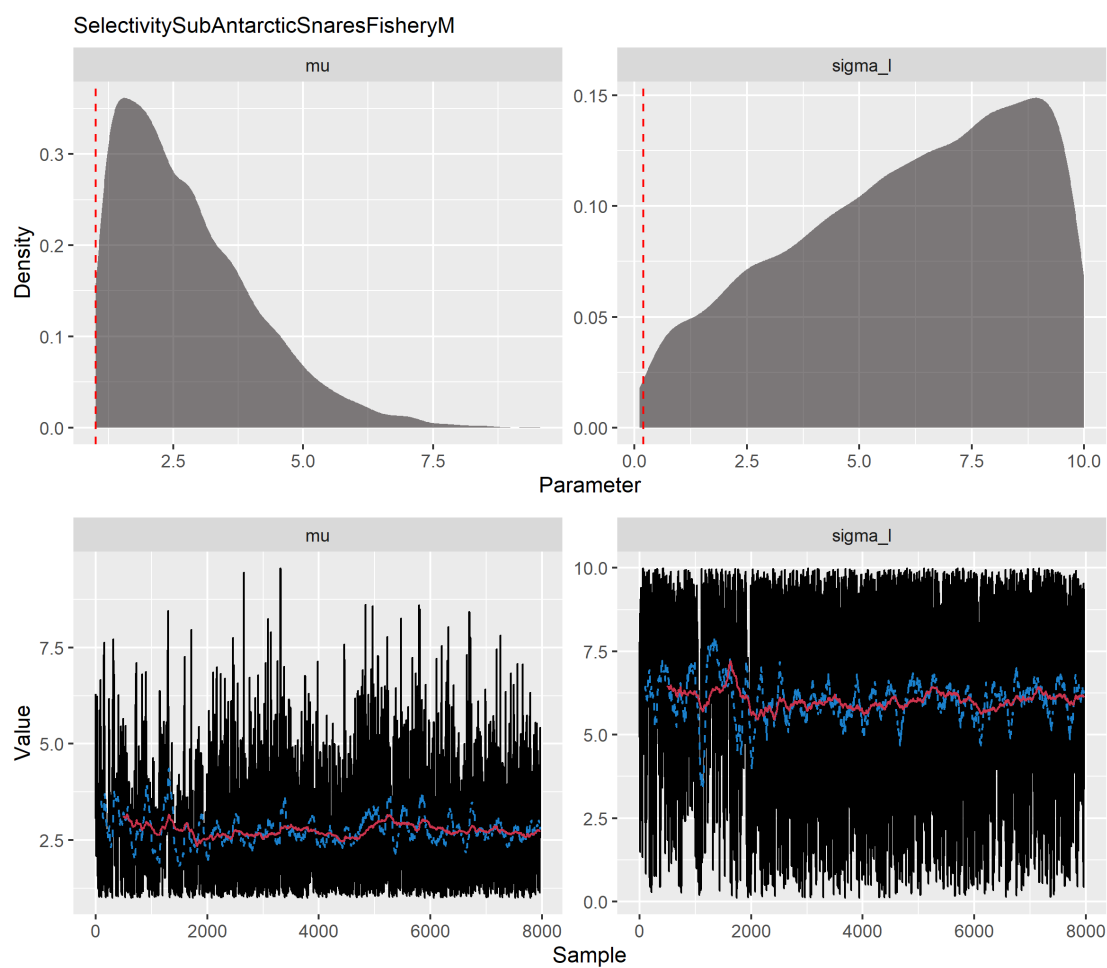


Figure 94: MCMC diagnostic plots for `SubAntarcticSnaresFisheryM` selectivity parameters from the single stock model.

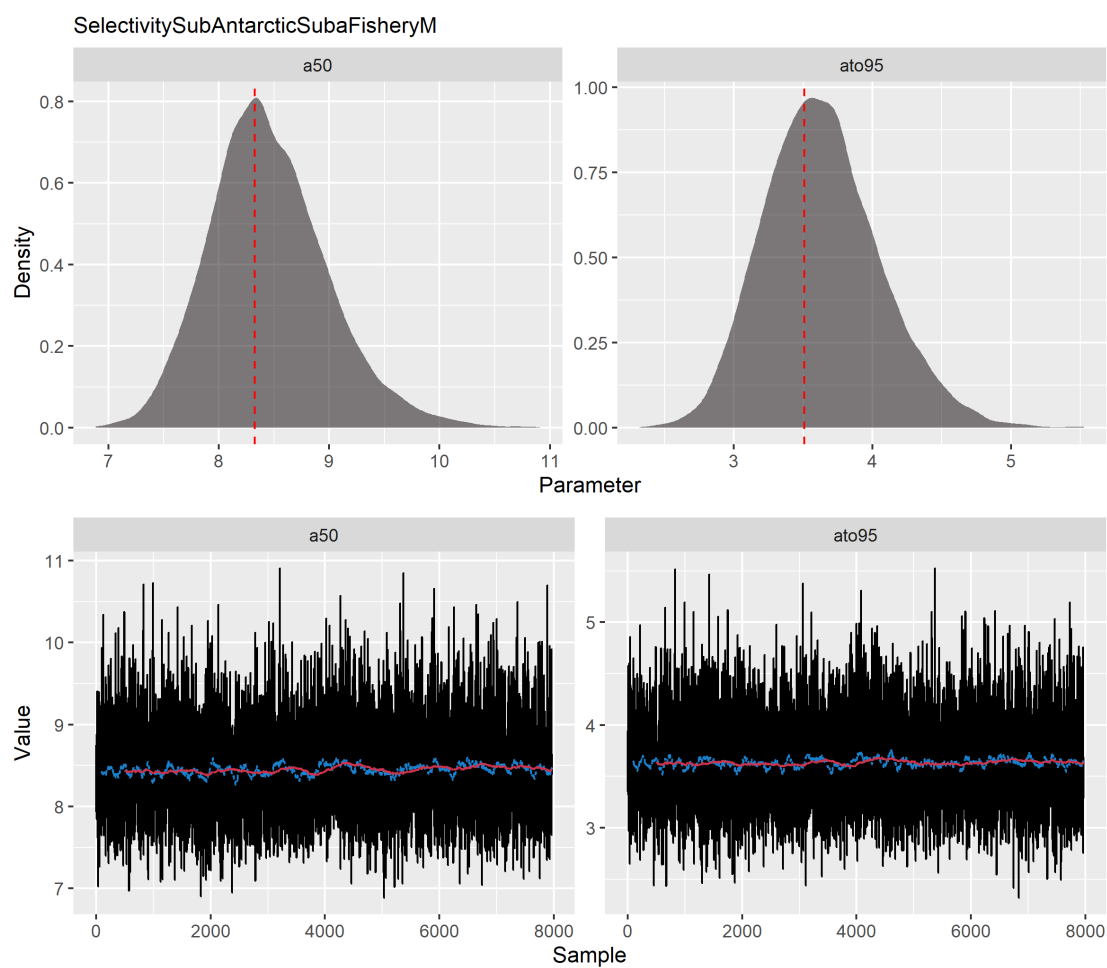


Figure 95: MCMC diagnostic plots for SubAntarcticSubaFisheryM selectivity parameters from the single stock model.

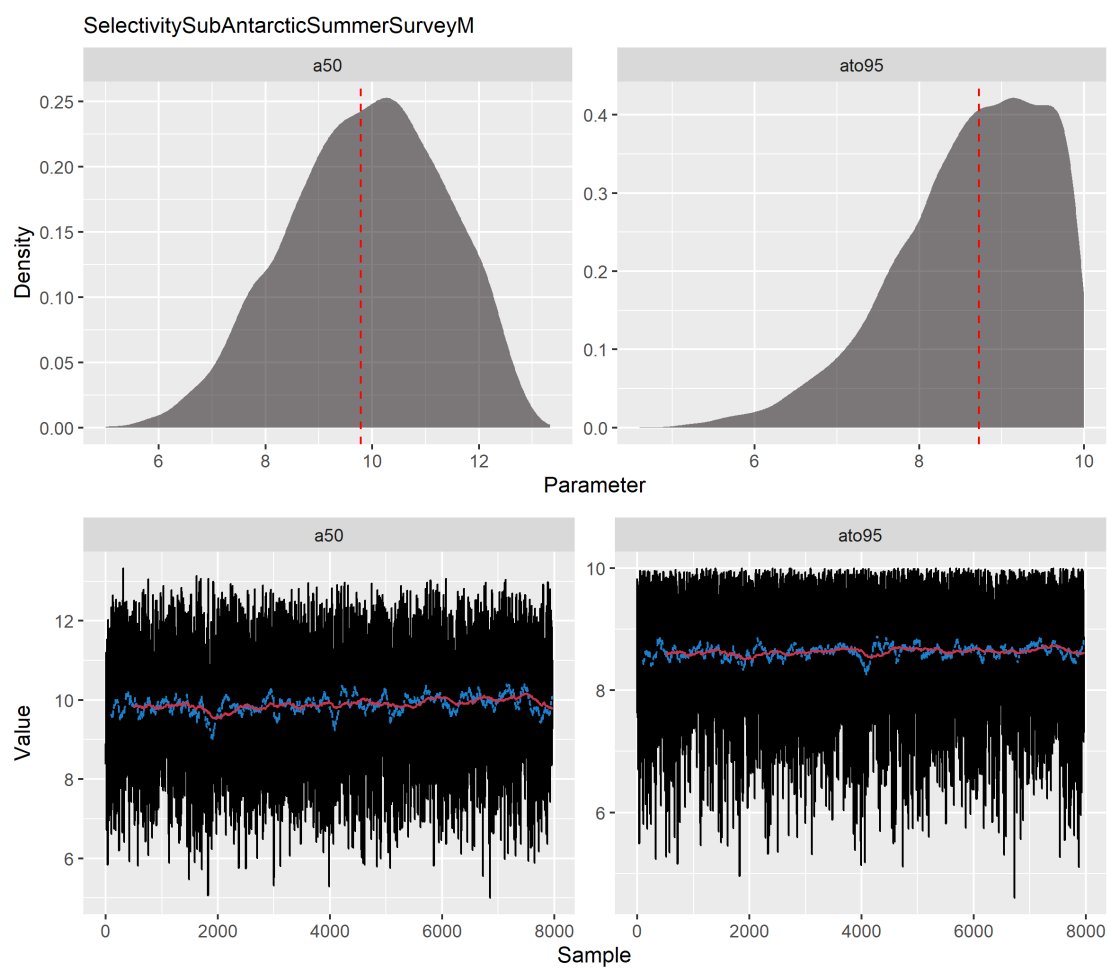


Figure 96: MCMC diagnostic plots for SubAntarcticSummerSurveyM selectivity parameters from the single stock model.

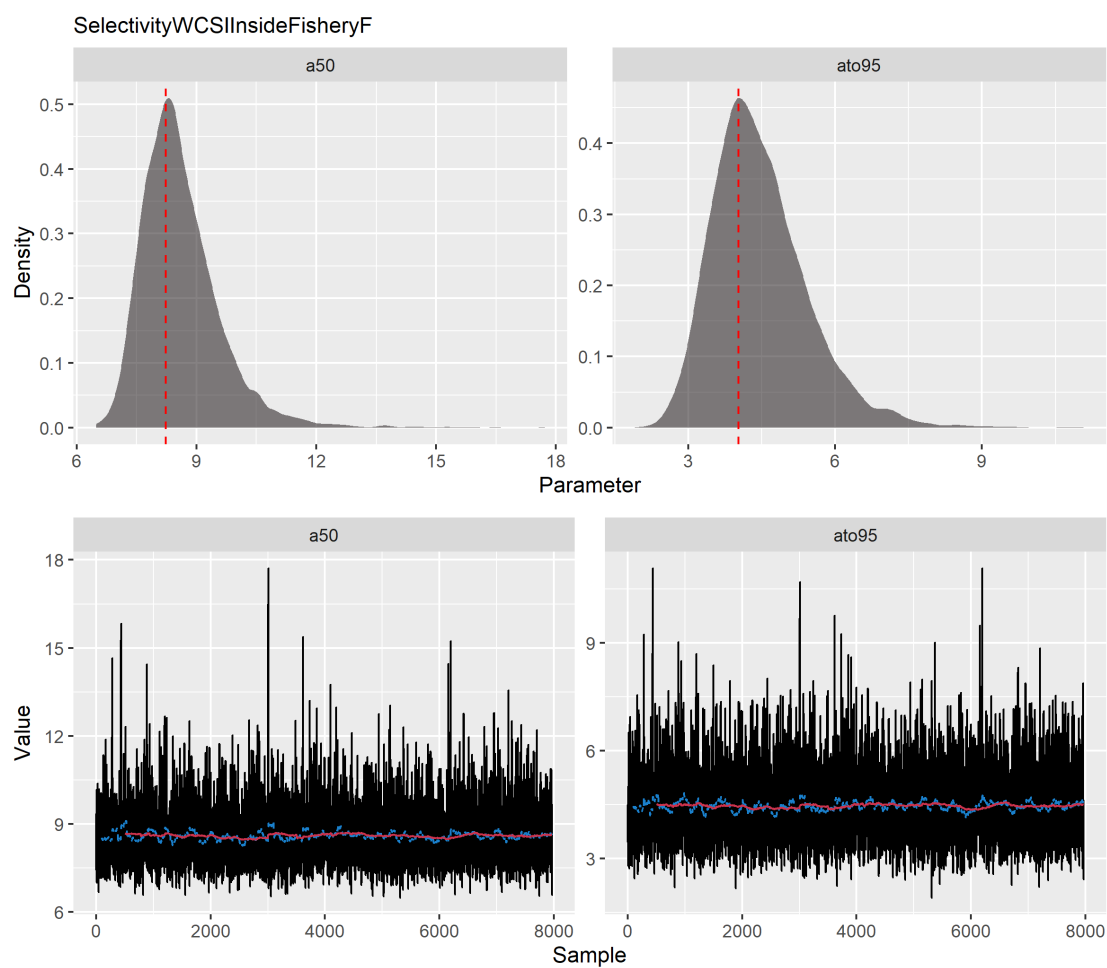


Figure 97: MCMC diagnostic plots for WCSIIInsideFisheryF selectivity parameters from the single stock model.

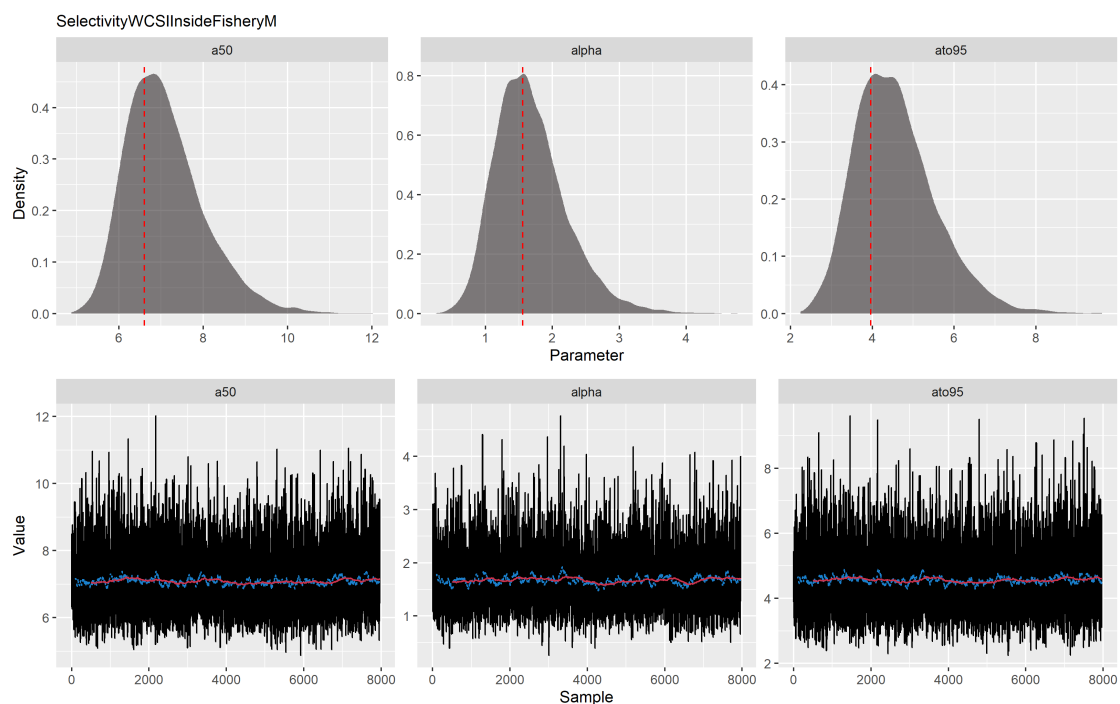


Figure 98: MCMC diagnostic plots for WCSInsideFisheryM selectivity parameters from the single stock model.

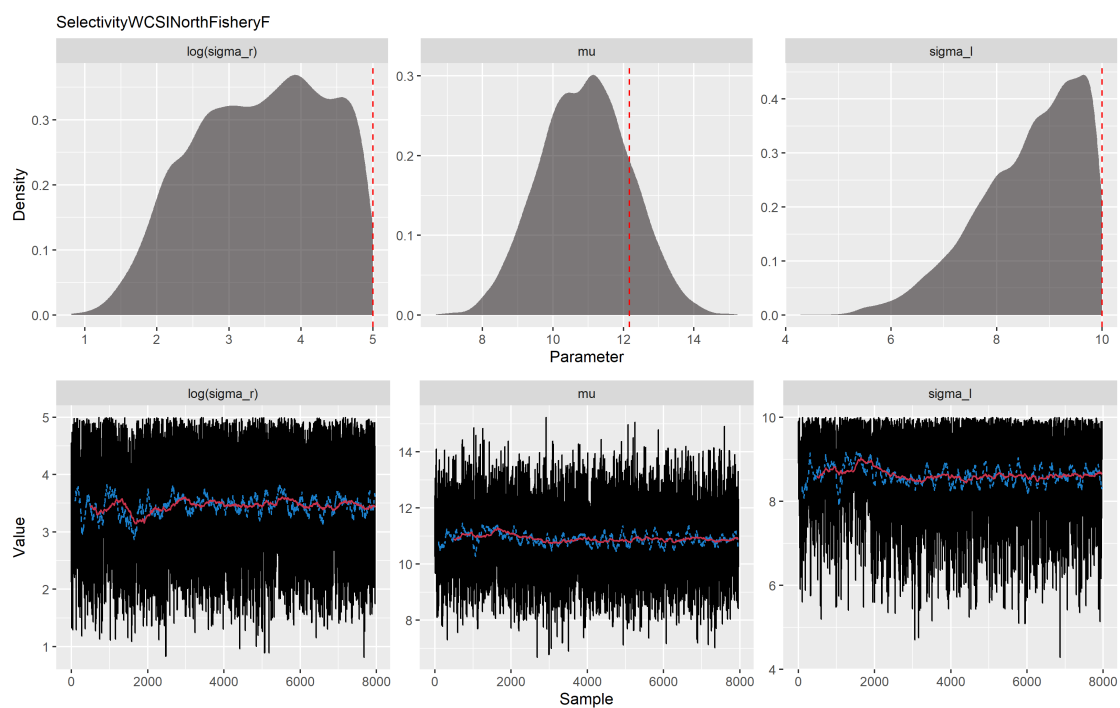


Figure 99: MCMC diagnostic plots for WCSNorthFisheryF selectivity parameters from the single stock model.

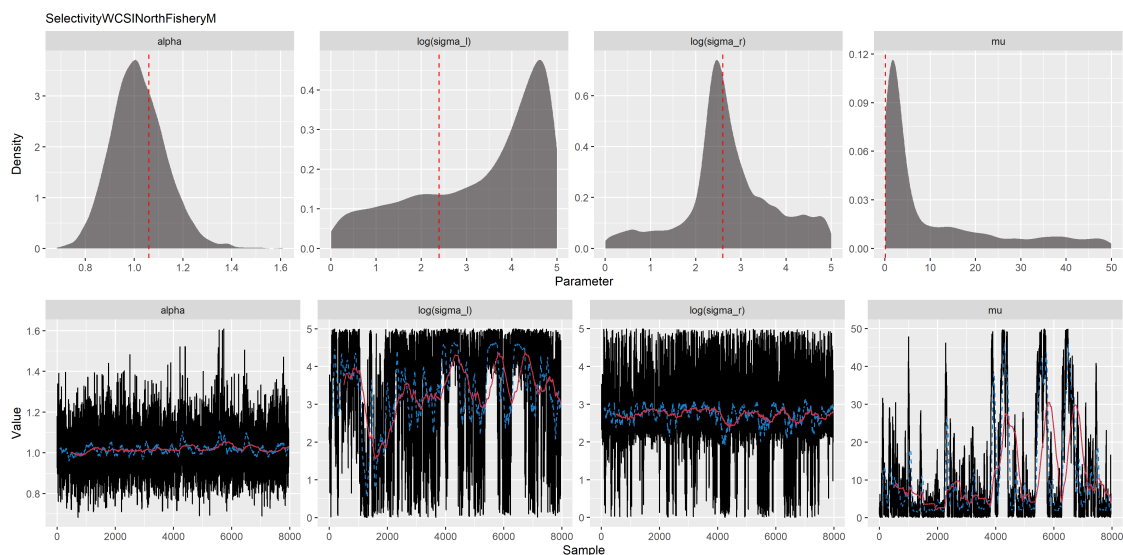


Figure 100: MCMC diagnostic plots for WCSINorthFisheryM selectivity parameters from the single stock model.

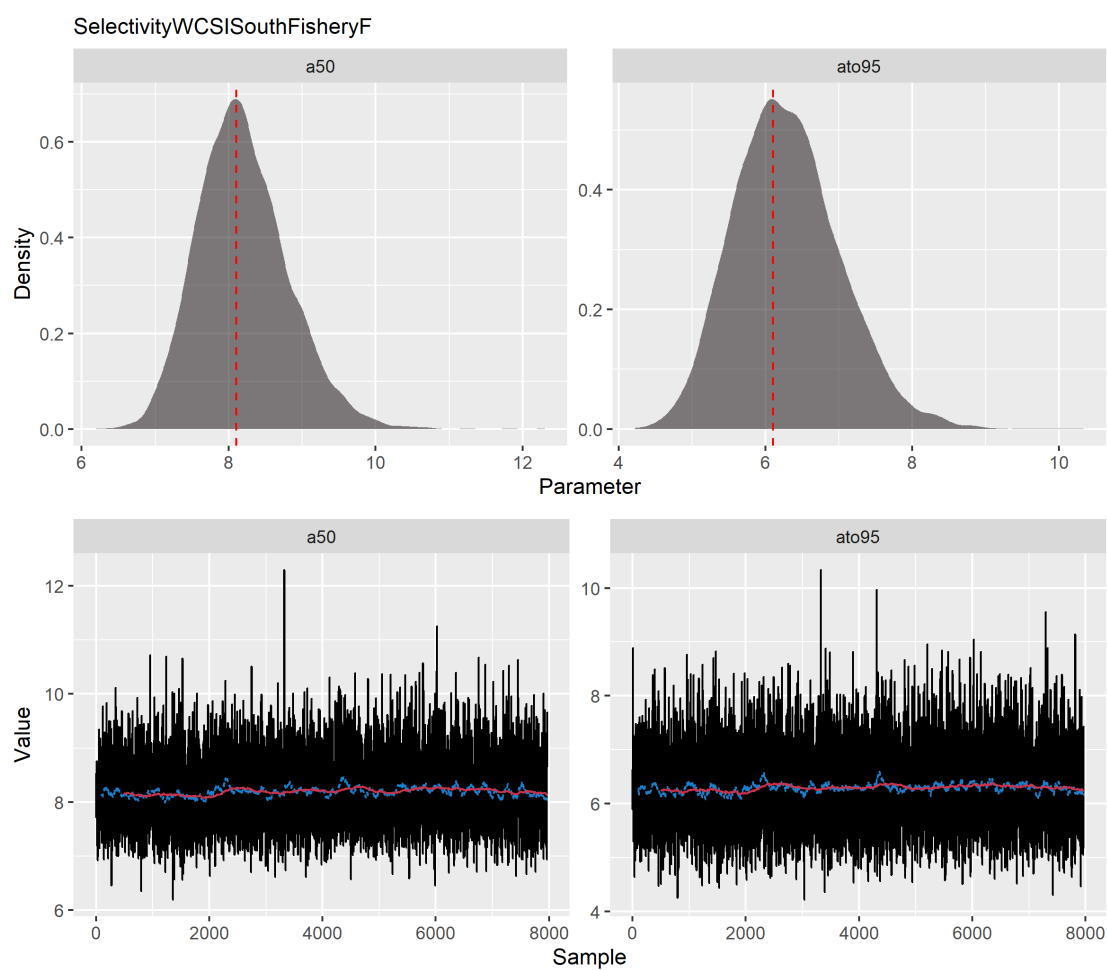


Figure 101: MCMC diagnostic plots for WCSISouthFisheryF selectivity parameters from the single stock model.

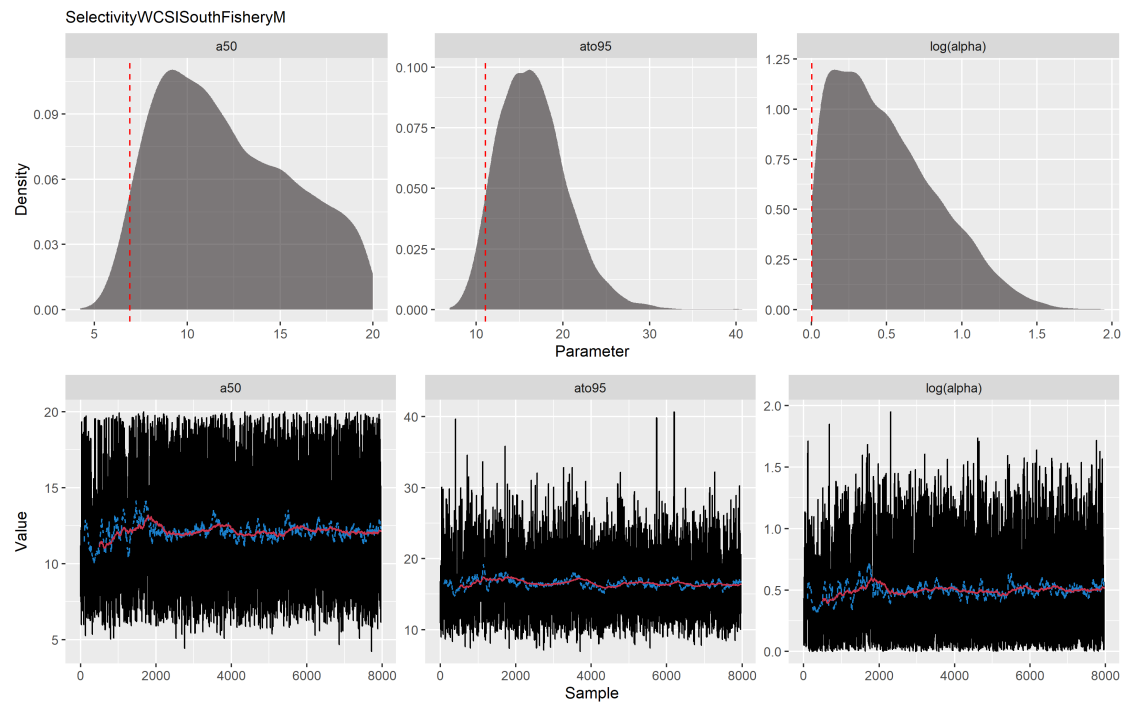


Figure 102: MCMC diagnostic plots for WCSISouthFisheryM selectivity parameters from the single stock model.

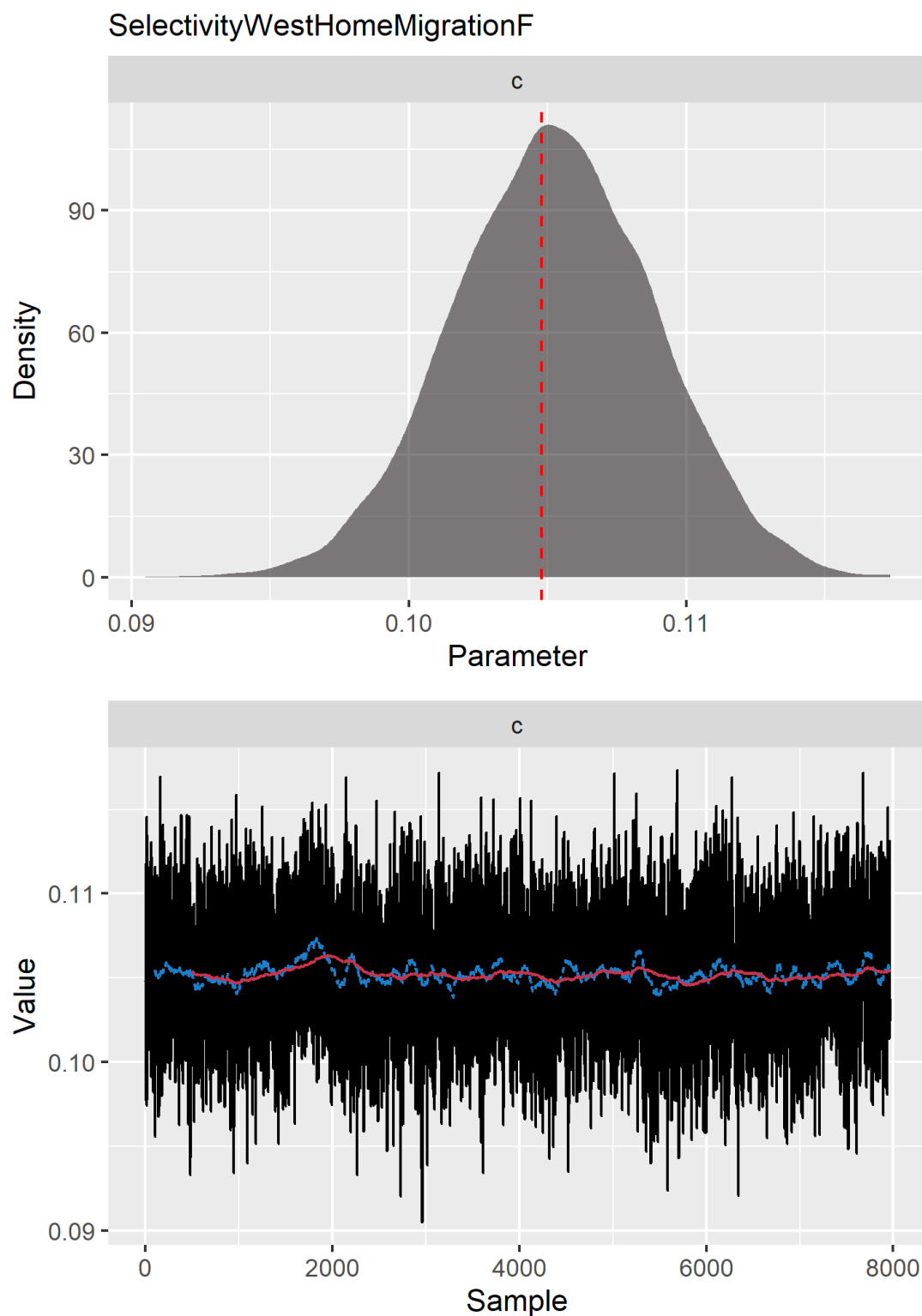


Figure 103: MCMC diagnostic plots for *WestHomeMigrationF* selectivity parameters from the single stock model.

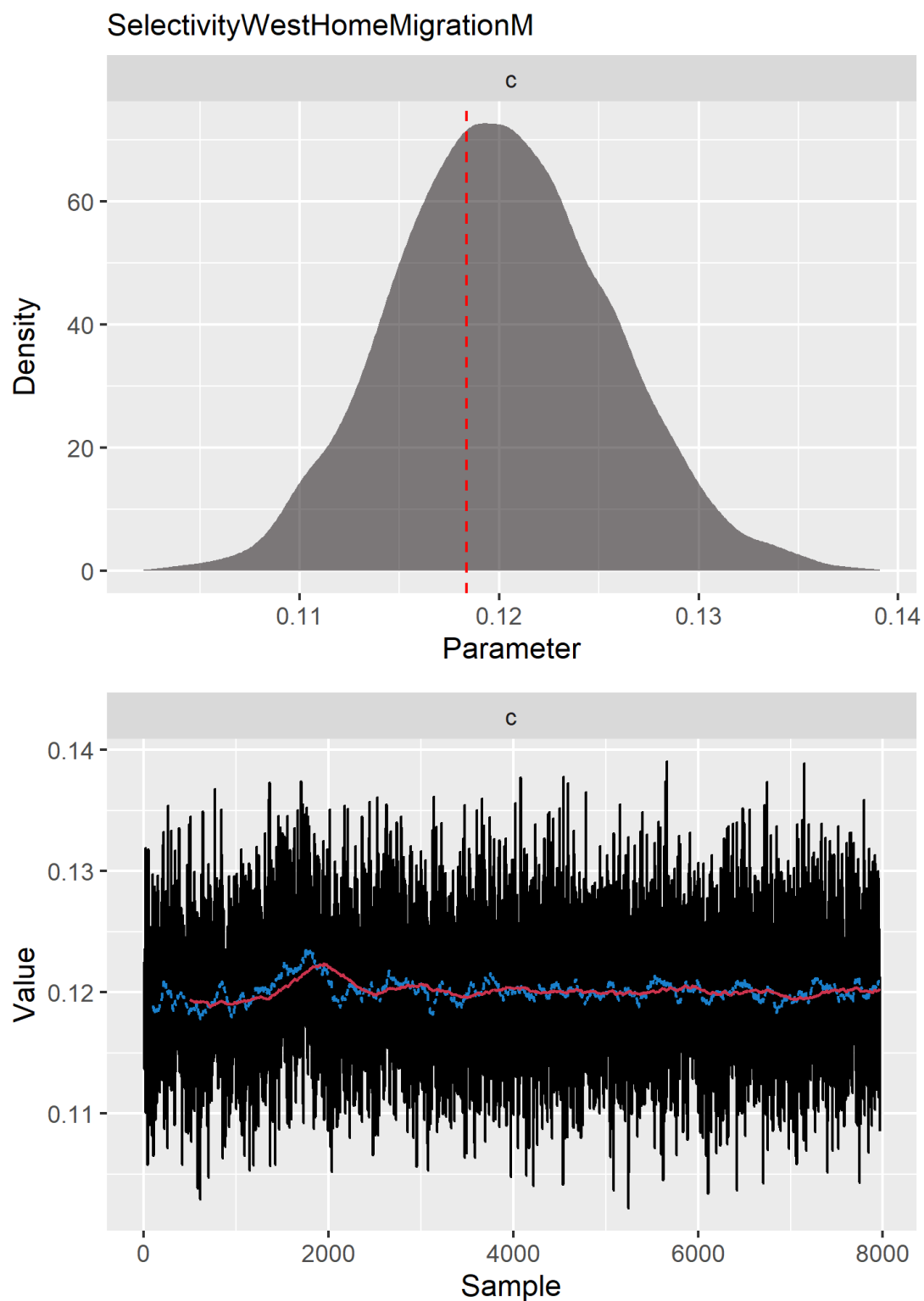


Figure 104: MCMC diagnostic plots for WestHomeMigrationM selectivity parameters from the single stock model.

Appendix B Model input files

B.1 Base model

B.1.1 Estimation

```

1  @minimiser adolc
2  type adolc
3  tolerance 1e-6
4  iterations 2500
5  covariance TRUE
6  active TRUE
7
8
9  @mcmc MCMC
10 type random_walk
11 start 1
12 length 5000000 # 8000000
13 keep 1000
14 step_size 0.3
15 adapt_stepsize_at 20000 40000 60000 80000 100000 200000 300000 400000 500000
16 proposal_distribution t
17 df 4
18 adapt_stepsize_method ratio
19 burn_in 1000000
20 max_correlation 0.8
21
22
23 @penalty PenaltyCatchMustBetaken
24 type process
25 log_scale TRUE
26 multiplier 10000
27
28
29 @estimate EastlogB0
30 parameter parameter_transformation[EastlogB0].log_parameter
31 lower_bound 13.1
32 upper_bound 13.8
33 estimation_phase 2
34 type uniform
35
36 @parameter_transformation EastlogB0
37 type log
38 parameters process[EastRecruitment].b0
39 prior_applies_to_restored_parameters true
40
41 @estimate WestlogB0
42 parameter parameter_transformation[WestlogB0].log_parameter
43 lower_bound 13.4
44 upper_bound 14.1
45 estimation_phase 2
46 type uniform
47
48 @parameter_transformation WestlogB0
49 type log
50 parameters process[WestRecruitment].b0
51 prior_applies_to_restored_parameters true
52
53 @parameter_transformation EastSimplexYCS
54 type simplex
55 sum_to_one false
56 parameters process[EastRecruitment].recruitment_multipliers{1977:2023}
57 prior_applies_to_restored_parameters true
58
59 @estimate EastSimplexYCS
60 type lognormal
61 mu 1*47
62 cv 1.1*47
63 parameter parameter_transformation[EastSimplexYCS].simplex
64 lower_bound -10*47
65 upper_bound 10*47
66
67 @parameter_transformation WestSimplexYCS

```

```

68 type simplex
69 sum_to_one false
70 parameters process[WestRecruitment].recruitment_multipliers{1977:2023}
71 prior_applies_to_restored_parameters true
72
73 @estimate WestSimplexYCS
74 type lognormal
75 mu 1*47
76 cv 1.1*47
77 parameter parameter_transformation[WestSimplexYCS].simplex
78 lower_bound -10*47
79 upper_bound 10*47
80
81 @estimate estimate_5
82 parameter selectivity[SelectivityWestHomeMigrationM].a50
83 type uniform
84 lower_bound -10
85 upper_bound 30
86
87 @estimate estimate_6
88 parameter selectivity[SelectivityWestHomeMigrationM].ato95
89 type uniform
90 lower_bound 0.1
91 upper_bound 30
92
93 @estimate estimate_7
94 parameter selectivity[SelectivityWestHomeMigrationF].a50
95 type uniform
96 lower_bound -10
97 upper_bound 30
98
99 @estimate estimate_8
100 parameter selectivity[SelectivityWestHomeMigrationF].ato95
101 type uniform
102 lower_bound 0.1
103 upper_bound 30
104
105 @ageing_error AgeingError
106 type data
107 table data
108 # 1 2 3 4 5 6 7 8 9 10 11 12 13 14
109 15 16 17 18
110 0.98 0.02 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
111 0.00 0.00 0.00
112 0.03 0.94 0.03 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
113 0.00 0.00 0.00
114 0.00 0.05 0.90 0.05 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
115 0.00 0.00 0.00
116 0.00 0.00 0.06 0.88 0.06 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
117 0.00 0.00 0.00
118 0.00 0.00 0.00 0.07 0.86 0.07 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
119 0.00 0.00 0.00
120 0.00 0.00 0.00 0.00 0.08 0.84 0.08 0.00 0.00 0.00 0.00 0.00 0.00 0.00
121 0.00 0.00 0.00
122 0.00 0.00 0.00 0.00 0.00 0.09 0.82 0.09 0.00 0.00 0.00 0.00 0.00 0.00
123 0.00 0.00 0.00
124 0.00 0.00 0.00 0.00 0.00 0.01 0.11 0.76 0.11 0.01 0.00 0.00 0.00 0.00
125 0.00 0.00 0.00
126 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.11 0.76 0.11 0.01 0.00 0.00 0.00
127 0.00 0.00 0.00
128 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.12 0.74 0.12 0.01 0.00 0.00
129 0.00 0.00 0.00
130 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.13 0.72 0.13 0.01 0.00
131 0.00 0.00 0.00
132 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.14 0.70 0.14 0.01
133 0.00 0.00 0.00
134 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.15 0.68 0.15 0.01

```

```

      0.00  0.00  0.00
122  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.02  0.15  0.66  0.15
      0.02  0.00  0.00
123  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  0.02  0.16  0.64
      0.16  0.02  0.00
124  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  0.02  0.16
      0.63  0.17  0.02
125  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  0.02
      0.17  0.63  0.18
126  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
      0.02  0.17  0.81
127  end_table
128

```

B.1.2 Estimation fishery

```

1  # ESTIMATION: Estimation of selectivities etc. for fisheries
2  # Fishery
3  @estimate
4  parameter selectivity[SelectivityChathamRiseDeepFisheryM].a50
5  same selectivity[SelectivityChathamRiseDeepFisheryF].a50
6  type uniform
7  lower_bound 1
8  upper_bound 10
9
10 @estimate
11 parameter selectivity[SelectivityChathamRiseDeepFisheryM].ato95
12 same selectivity[SelectivityChathamRiseDeepFisheryF].ato95
13 type uniform
14 lower_bound 1
15 upper_bound 15
16
17 @estimate
18 parameter selectivity[SelectivityChathamRiseShallowFisheryM].mu
19 same selectivity[SelectivityChathamRiseShallowFisheryF].mu
20 type uniform
21 lower_bound 1
22 upper_bound 10
23
24 /*
25 @estimate
26 parameter selectivity[SelectivityChathamRiseShallowFisheryM].sigma_1
27 same selectivity[SelectivityChathamRiseShallowFisheryF].sigma_1
28 type uniform
29 lower_bound 0.1
30 upper_bound 10
31 */
32 @estimate ChathamRiseShallowFisheryM_log_sigma_r
33 type uniform
34 parameter parameter_transformation[ChathamRiseShallowFisheryM_log_sigma_r].log_parameter
35 same parameter_transformation[ChathamRiseShallowFisheryF_log_sigma_r].log_parameter
36 lower_bound 0.001
37 upper_bound 5
38
39 @estimate ChathamRiseShallowFisheryM_log_sigma_1
40 parameter parameter_transformation[ChathamRiseShallowFisheryM_log_sigma_1].log_parameter
41 same parameter_transformation[ChathamRiseShallowFisheryF_log_sigma_1].log_parameter
42 type uniform
43 lower_bound 0.001
44 upper_bound 5
45
46 @estimate
47 parameter selectivity[SelectivityCookStraitSpawningFisheryM].a50
48 type uniform
49 lower_bound 1
50 upper_bound 10
51
52 @estimate
53 parameter selectivity[SelectivityCookStraitSpawningFisheryM].ato95
54 type uniform
55 lower_bound 1
56 upper_bound 10
57
58 @estimate
59 parameter selectivity[SelectivityCookStraitSpawningFisheryM].alpha
60 type uniform
61 lower_bound 0.1
62 upper_bound 10
63
64 @estimate
65 parameter selectivity[SelectivityCookStraitSpawningFisheryF].a50
66 type uniform
67 lower_bound 1

```

```

68 upper_bound 15
69
70 @estimate
71 parameter selectivity[SelectivityCookStraitSpawningFisheryF].ato95
72 type uniform
73 lower_bound 1
74 upper_bound 10
75
76
77 @estimate
78 parameter selectivity[SelectivityECSISpawningFisheryM].mu
79 type uniform
80 lower_bound 0.1
81 upper_bound 10
82
83 @estimate
84 parameter selectivity[SelectivityECSISpawningFisheryM].alpha
85 type uniform
86 lower_bound 0.1
87 upper_bound 10
88
89 @estimate
90 parameter selectivity[SelectivityECSISpawningFisheryM].sigma_1
91 type uniform
92 lower_bound 0.1
93 upper_bound 15
94
95 @estimate ECSISpawningFisheryM_log_sigma_r
96 parameter parameter_transformation[ECSISpawningFisheryM_log_sigma_r].log_parameter
97 type uniform
98 lower_bound 0.001
99 upper_bound 5
100
101
102 @estimate
103 parameter selectivity[SelectivityECSISpawningFisheryF].mu
104 type uniform
105 lower_bound 1
106 upper_bound 15
107
108 @estimate
109 parameter selectivity[SelectivityECSISpawningFisheryF].sigma_1
110 type uniform
111 lower_bound 0.1
112 upper_bound 10
113
114 @estimate ECSISpawningFisheryF_log_sigma_r
115 parameter parameter_transformation[ECSISpawningFisheryF_log_sigma_r].log_parameter
116 type uniform
117 lower_bound 0.001
118 upper_bound 5
119
120
121 @estimate
122 parameter selectivity[SelectivitySubAntarcticAucklandFisheryM].mu
123 same selectivity[SelectivitySubAntarcticAucklandFisheryF].mu
124 type uniform
125 lower_bound 1
126 upper_bound 10
127
128 @estimate
129 parameter selectivity[SelectivitySubAntarcticAucklandFisheryM].sigma_1
130 same selectivity[SelectivitySubAntarcticAucklandFisheryF].sigma_1
131 type uniform
132 lower_bound 0.1
133 upper_bound 10
134

```

```

135 @estimate SubaAntarcticAucklandFishery_log_sigma_r
136 parameter
137   parameter_transformation[SubAntarcticAucklandFisheryM_log_sigma_r].log_parameter
138   same parameter_transformation[SubAntarcticAucklandFisheryF_log_sigma_r].log_parameter
139   type uniform
140   lower_bound 0.001
141   upper_bound 5
142
143 @estimate
144 parameter selectivity[SelectivitySubAntarcticSnaresFisheryM].mu
145 same selectivity[SelectivitySubAntarcticSnaresFisheryF].mu
146 type uniform
147 lower_bound 1
148 upper_bound 10
149
150 @estimate
151 parameter selectivity[SelectivitySubAntarcticSnaresFisheryM].sigma_1
152 same selectivity[SelectivitySubAntarcticSnaresFisheryF].sigma_1
153 type uniform
154 lower_bound 0.1
155 upper_bound 10
156
157 @estimate SubaAntarcticSnaresFishery_log_sigma_r
158 parameter parameter_transformation[SubaAntarcticSnaresFisheryM_log_sigma_r].log_parameter
159 same parameter_transformation[SubaAntarcticSnaresFisheryF_log_sigma_r].log_parameter
160 type uniform
161 lower_bound 0.001
162 upper_bound 5
163
164 /*
165 @estimate
166 parameter selectivity[SelectivitySubAntarcticSnaresFisheryM].sigma_r
167 same selectivity[SelectivitySubAntarcticSnaresFisheryF].sigma_r
168 type uniform
169 lower_bound 1
170 upper_bound 100
171 */
172
173 @estimate
174 parameter selectivity[SelectivitySubAntarcticSubaFisheryM].a50
175 same selectivity[SelectivitySubAntarcticSubaFisheryF].a50
176 type uniform
177 lower_bound 1
178 upper_bound 15
179
180
181 @estimate
182 parameter selectivity[SelectivitySubAntarcticSubaFisheryM].ato95
183 same selectivity[SelectivitySubAntarcticSubaFisheryF].ato95
184 type uniform
185 lower_bound 1
186 upper_bound 10
187
188 @estimate
189 parameter selectivity[SelectivityWCSIInsideFisheryM].a50
190 type uniform
191 lower_bound 1
192 upper_bound 10
193
194 @estimate
195 parameter selectivity[SelectivityWCSIInsideFisheryM].ato95
196 type uniform
197 lower_bound 1
198 upper_bound 10
199
200 @estimate

```

```

201 parameter selectivity[SelectivityWCSInsideFisheryM].alpha
202 type uniform
203 lower_bound 0.1
204 upper_bound 10
205
206 @estimate
207 parameter selectivity[SelectivityWCSInsideFisheryF].a50
208 type uniform
209 lower_bound 1
210 upper_bound 10
211
212 @estimate
213 parameter selectivity[SelectivityWCSInsideFisheryF].ato95
214 type uniform
215 lower_bound 1
216 upper_bound 10
217
218 @estimate
219 parameter selectivity[SelectivityWCSNorthFisheryM].mu
220 type uniform
221 lower_bound 0.1
222 upper_bound 15
223
224 @estimate
225 parameter selectivity[SelectivityWCSNorthFisheryM].alpha
226 type uniform
227 lower_bound 0.1
228 upper_bound 10
229
230 @estimate WCSNorthFisheryM_log_sigma_l
231 parameter parameter_transformation[WCSNorthFisheryM_log_sigma_l].log_parameter
232 type uniform
233 lower_bound 0.001
234 upper_bound 5
235
236 @estimate WCSNorthFisheryM_log_sigma_r
237 parameter parameter_transformation[WCSNorthFisheryM_log_sigma_r].log_parameter
238 type uniform
239 lower_bound 0.001
240 upper_bound 5
241
242 @estimate
243 parameter selectivity[SelectivityWCSNorthFisheryF].mu
244 type uniform
245 lower_bound 1
246 upper_bound 20
247
248 @estimate
249 parameter selectivity[SelectivityWCSNorthFisheryF].sigma_l
250 type uniform
251 lower_bound 0.1
252 upper_bound 10
253
254 @estimate WCSNorthFisheryF_log_sigma_r
255 parameter parameter_transformation[WCSNorthFisheryF_log_sigma_r].log_parameter
256 type uniform
257 lower_bound 0.001
258 upper_bound 10
259
260 @estimate
261 parameter selectivity[SelectivityWCSISouthFisheryM].a50
262 type uniform
263 lower_bound 1
264 upper_bound 15
265
266 @estimate
267 parameter selectivity[SelectivityWCSISouthFisheryM].ato95

```

```

268 type uniform
269 lower_bound 1
270 upper_bound 15
271
272 @estimate
273 parameter selectivity[SelectivityWCSISouthFisheryM].alpha
274 type uniform
275 lower_bound 0.1
276 upper_bound 10
277
278 @estimate
279 parameter selectivity[SelectivityWCSISouthFisheryF].a50
280 type uniform
281 lower_bound 1
282 upper_bound 10
283
284 @estimate
285 parameter selectivity[SelectivityWCSISouthFisheryF].ato95
286 type uniform
287 lower_bound 1
288 upper_bound 15
289

```

B.1.3 Estimation survey

```

1  # ESTIMATION: Estimation of catchability constants and selectivities etc. for surveys
2  ## Define Catchabilities
3  @catchability CookStraitAcousticQ
4  type free
5  q 1.22472
6
7  @catchability ECSIAcousticQ
8  type free
9  q 1.22472
10
11 @catchability WCSIAcousticQ
12 type free
13 q 0.938112
14
15 @catchability ChathamRiseSummerQ
16 type free
17 q 0.0804276
18
19 @catchability SubAntarcticSummerQ
20 type free
21 q 0.109987
22
23 @catchability SubAntarcticAutumnQ
24 type free
25 q 0.0878128
26
27 # Estimate catchabilities
28 @estimate ECSIAcousticQ
29 parameter catchability[ECSIAcousticQ].q
30 type uniform
31 lower_bound 0.01
32 upper_bound 4.53
33
34 @estimate CookStraitAcousticQ
35 parameter catchability[CookStraitAcousticQ].q
36 type lognormal
37 mu 0.55
38 cv 0.90
39 lower_bound 0.01
40 upper_bound 4.53
41
42 @estimate WCSIAcousticQ
43 parameter catchability[WCSIAcousticQ].q
44 type lognormal
45 mu 0.39
46 cv 0.77
47 lower_bound 0.01
48 upper_bound 3.35
49
50 @estimate ChathamRiseSummerQ
51 parameter catchability[ChathamRiseSummerQ].q
52 type uniform
53 lower_bound 0.016
54 upper_bound 0.51
55
56 @estimate SubAntarcticSummerQ
57 parameter catchability[SubAntarcticSummerQ].q
58 type uniform
59 lower_bound 0.020
60 upper_bound 0.95
61
62 @estimate SubAntarcticAutumnQ
63 parameter catchability[SubAntarcticAutumnQ].q
64 type uniform
65 lower_bound 0.020
66 upper_bound 0.95
67 /*

```

```

68 # Process error
69 @estimate
70 parameter observation[CookStraitAcousticBiomass].process_error
71 lower_bound 0
72 upper_bound 10
73 type uniform
74 mcmc_fixed True
75
76 @estimate
77 parameter observation[WCSIAcousticBiomass].process_error
78 lower_bound 0
79 upper_bound 10
80 type uniform
81 mcmc_fixed True
82
83 @estimate
84 parameter observation[ChathamRiseSummerBiomass].process_error
85 lower_bound 0
86 upper_bound 10
87 type uniform
88 mcmc_fixed True
89
90 @estimate
91 parameter observation[SubAntarcticSummerBiomass].process_error
92 lower_bound 0
93 upper_bound 10
94 type uniform
95 mcmc_fixed True
96
97 @estimate
98 parameter observation[SubAntarcticAutumnBiomass].error_value_multiplier
99 lower_bound 0
100 upper_bound 10
101 type uniform
102 mcmc_fixed True
103
104 @estimate
105 parameter observation[SubAntarcticAEXAge].error_value_multiplier
106 lower_bound 0
107 upper_bound 10
108 type uniform
109 mcmc_fixed True
110
111 @estimate
112 parameter observation[SubAntarcticSHIAge].error_value_multiplier
113 lower_bound 0
114 upper_bound 10
115 type uniform
116 mcmc_fixed True
117
118 @estimate
119 parameter observation[ChathamRiseSHIAge].error_value_multiplier
120 lower_bound 0
121 upper_bound 10
122 type uniform
123 mcmc_fixed True
124 */
125
126 # Parameters
127 # Surveys
128
129 @estimate
130 parameter selectivity[SelectivitySubAntarcticSummerSurveyM].a50
131 same selectivity[SelectivitySubAntarcticSummerSurveyF].a50
132 type uniform
133 lower_bound 1
134 upper_bound 15

```

```

135
136 @estimate
137 parameter selectivity[SelectivitySubAntarcticSummerSurveyM].ato95
138 same selectivity[SelectivitySubAntarcticSummerSurveyF].ato95
139 type uniform
140 lower_bound 1
141 upper_bound 10
142 /*
143 @estimate
144 parameter selectivity[SelectivitySubAntarcticAutumnSurveyM].a50
145 same selectivity[SelectivitySubAntarcticAutumnSurveyF].a50
146 type uniform
147 lower_bound 1
148 upper_bound 10
149
150 @estimate
151 parameter selectivity[SelectivitySubAntarcticAutumnSurveyM].ato95
152 same selectivity[SelectivitySubAntarcticAutumnSurveyF].ato95
153 type uniform
154 lower_bound 1
155 upper_bound 50
156
157 @estimate
158 parameter selectivity[SelectivitySubAntarcticAEXSurveyM].a50
159 same selectivity[SelectivitySubAntarcticAEXSurveyF].a50
160 type uniform
161 lower_bound 1
162 upper_bound 10
163
164 @estimate
165 parameter selectivity[SelectivitySubAntarcticAEXSurveyM].ato95
166 same selectivity[SelectivitySubAntarcticAEXSurveyF].ato95
167 type uniform
168 lower_bound 1
169 upper_bound 50
170
171 @estimate
172 parameter selectivity[SelectivitySubAntarcticSHISurveyM].a50
173 same selectivity[SelectivitySubAntarcticSHISurveyF].a50
174 type uniform
175 lower_bound 1
176 upper_bound 10
177
178 @estimate
179 parameter selectivity[SelectivitySubAntarcticSHISurveyM].ato95
180 same selectivity[SelectivitySubAntarcticSHISurveyF].ato95
181 type uniform
182 lower_bound 1
183 upper_bound 50
184
185 @estimate
186 parameter selectivity[SelectivityChathamRiseSHISurveyM].e
187 same selectivity[SelectivityChathamRiseSHISurveyF].e
188 type uniform
189 lower_bound 0
190 upper_bound 10
191 */
192

```

B.1.4 Observations fishery


```

27 2011 0 0.0285917368492783 0.295362001375306 0.1203091219883 0.0248999904874632
0.00570900768428397 0 0 0 0 0 0 0 0 0 0 0 0.0958548915728862 0.271676383150468
0.072920942851894 0.0369861618899703 0.00936989978719414 0.00975027477791955
0.0116107212923911 0.00499040098782718 0 0.00519178701858852 0 0 0 0.0067766782862293 0 0
0
28 2012 0 0.109094196113803 0.149201572630631 0.0994717859748155 0.0807111961811361
0.0340790151342469 0 0 0 0 0 0 0 0 0 0 0 0.295824400182982 0.17018848588862
0.0180045364620121 0.0434248114317538 0 0 0 0 0 0 0 0 0 0 0
29 2013 0.00570302166298869 0 0.165096339233076 0.154541412343959 0.0449283852622419
0.0357314647191126 0.0140440194678146 0 0 0 0.0199237279674279 0 0 0 0 0 0 0
0.017466321803475 0.0879051549764596 0.343333440125845 0.0454584640718276
0.0410517565449272 0 0.0194186334800581 0.00539785834078744 0 0 0 0 0 0 0 0
30 2014 0 0.110796365999903 0.102668008957596 0.0676092190150807 0.0362181167645026
0.0217321713829919 0.0301812334129941 0.00973083281497126 0 0 0 0 0 0 0 0 0
0.183916925735685 0.101761607791086 0.0856235147388723 0.139079693118182
0.0506230433478215 0.0242813220891682 0.00495630146027226 0.00455011379968397
0.00741862191459053 0 0.0188529076565981 0 0 0 0 0 0
31 2015 0 0.00922699492575942 0.230825426948479 0.0753437042734111 0.0949027065635086
0.0452437483804001 0 0.0251732172432664 0.0110580488548273 0.00775582849241511 0 0 0 0 0
0 0 0 0.0198504683431099 0.213548895583108 0.038791678711807 0.0651582645632488
0.0315285523298253 0.0406934108761481 0.0304084407605101 0.0147190073568707
0.0155392906521851 0.00569205289719161 0.0127722052230951 0 0.0117680570208333 0 0 0 0
32 2016 0 0.0482066239562728 0.0190431751223616 0.184851011422726 0.106278124470617
0.0253944198950544 0.0247294479325465 0.0106690450215422 0.0198116176834401
0.0223562333841859 0.00438370563052096 0 0 0 0 0 0 0.0136229412145843
0.0130950724387997 0.0611128116556686 0.148708210031629 0.146558705048151
0.0253188105633088 0.0416593289358222 0.0282734607280306 0.0131289896516698
0.00281329463456466 0.00511921842211283 0.0166756694252021 0 0.00909504136559454
0.00909504136559454 0 0
33 2017 0.0148244406693199 0.150578410740195 0.155955520754185 0.0507970128027308
0.0309138712508268 0.00430099979814877 0 0.00848543504383143 0 0 0 0 0 0 0 0
0.272900868355853 0.179894596686248 0.0278486741235871 0.0229206962865683
0.0350220509610268 0.0305716640511563 0 0.0149857584763219 0 0 0 0 0 0 0
34 2018 0.0348748395298024 0.136316527605053 0.129841336421824 0.0656750805736937
0.0297062980483228 0.0379854078408467 0.00304977035981174 0 0.0162902201009416 0 0 0 0 0
0 0 0 0.0312002032783462 0.24805895908201 0.147303560883911 0.0198450632116508
0.0248920306918151 0.0443829687385369 0 0.00876330642767421 0 0.0181384973781477
0.00367592982761166 0 0 0 0 0 0
35 2019 0 0.0347461515177616 0.208666389002659 0.108249656539488 0.0799811171632861
0.00938941536465216 0.0177561713270063 0 0.016626645979608 0 0 0 0 0 0 0 0
0.325992154900624 0.130330891829169 0.032173769975097 0.0226943207599776 0 0
0.0133933156406707 0 0 0 0 0 0
36 2021 0.0625752809660902 0.114376590252786 0.109380123157328 0.100068789578106
0.0831688741645662 0.0294275363870971 0.00153592830480832 0.00153592830480832 0 0 0 0
0.00153592830480832 0 0 0 0 0.0506449491894964 0.0776178502038734 0.0814898201893649
0.139030098364637 0.077655816603729 0.0216540618702037 0.0053648042399142
0.00913901122922249 0 0.00118177886546642 0.0318064599233387 0 0 0 0
0.000810369900355787 0
37 2022 0.0842901146213864 0.10021084340894 0.163738718839876 0.040306125121042
0.0219007535539244 0.0451610267028669 0 0 0 0 0 0 0 0.152234193317855
0.167625208793697 0.0434604163886524 0.0297381218752083 0.0699300089585675
0.0793912539315657 0.00201321448641897 0 0 0 0 0 0 0 0
38 2023 0.0342066076912775 0.0964266374909309 0.122334312902214 0.0419042072098485
0.0264868224510351 0.030211393484512 0.0392479680487427 0.0254611445130809
0.00576175158307959 0.00587867174644618 0 0.00228563019224632 0 0 0 0
0.046960342298104 0.133180729031274 0.140007066786718 0.0795338807417801
0.0516964554582567 0.0459548094978937 0.0297575624512156 0.0237581416362324
0.00849287880803709 0.00680292416767049 0 0.00365006180940456 0 0 0 0
39 2024 0.0507099919494053 0.121967992117203 0.125852502785089 0.0705103999218438
0.0127093661790805 0.0079580604314024 0.00732926472734825 0.00195447197485608
0.00244331562799006 0 0 0 0 0 0 0.157861770530371 0.166414876669226
0.166047006223324 0.0780649170484656 0.0169278564414357 0.00327712852846604
0.00430058509691632 0.0041023587401778 0 0.00112430671202647 0.00044382829537224 0 0 0 0
0 0
40 end_table
41
42 table error_values

```

```

43 2001 85
44 2002 63
45 2003 46
46 2004 63
47 2005 133
48 2006 147
49 2007 39
50 2008 11
51 2009 17
52 2010 61
53 2011 66
54 2012 27
55 2013 68
56 2014 64
57 2015 135
58 2016 73
59 2017 57
60 2018 45
61 2019 38
62 2021 105
63 2022 37
64 2023 143
65 2024 137
66 end_table
67
68 @observation FisheryChathamRiseDeepAge
69 type process_removals_by_age
70 mortality_process Mortality
71 method_of_removal FisheryChathamRiseDeep
72 categories East.ChathamRise.Immature.M + East.ChathamRise.Mature.M +
West.ChathamRise.Immature.M + West.ChathamRise.Mature.M East.ChathamRise.Immature.F +
East.ChathamRise.Mature.F + West.ChathamRise.Immature.F + West.ChathamRise.Mature.F
73 time_step OctNov
74 min_age 1
75 max_age 18
76 plus_group TRUE
77 sum_to_one TRUE
78 ageing_error AgeingError
79 likelihood multinomial
80 process_errors 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
81 error_value_multiplier 0.0540792468307907
82 likelihood_multiplier 1.0
83 years 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016
2017 2018 2019 2020 2021 2022 2023 2024
84 table obs
85 2001 0.000754896625947443 0.0366444930358286 0.148738688050782 0.0771286787540796
0.0469143675262126 0.0299053817854768 0.0212967116809056 0.0134411207145523
0.00184956777713068 0.0025742707604128 0.000908600485040365 0.0020728460924249
0.00097592694800373 0 0 0 0 0.00188170508134664 0.000820675207824281 0.0155878960201522
0.17141431269709 0.147128227748533 0.0558395658484922 0.0661388264339352
0.0336125166637748 0.0469794326037012 0.0252969777134306 0.00719580620373303
0.0136128682973662 0.0142917899656121 0.00856359397145125 0.00433459298633612
0.00142305492185255 0.000200159386577138 0.000590742930646992 0.00188170508134664
86 2002 0.0480663636170083 0.0231705507307879 0.0685734443306294 0.139967510679053
0.0576140631241263 0.0169443486466107 0.00588722222160583 0.00146492255863357
0.00293350160543746 0.000846193065376369 0 0.000229589662002795 0.000665370089678791 0 0
0 0 0.00237135365828253 0.072269961798939 0.0115517975871003 0.0750363129248782
0.168090863542033 0.089738215938097 0.0508804336906258 0.0522516368112074
0.029503257384091 0.0338625445238919 0.0130492392140873 0.0102327476283106
0.00895322703151085 0.00582891466932301 0.00580635194939214 0.0010644246318725
0.000386568611336223 0.000387714415787732 0.00237135365828253
87 2003 0 0.14855802106511 0.0447380756634628 0.0619943449031239 0.0800516499882087
0.0147576337095688 0.0045708600088338 0.0069922135721085 0.00827850648837004
0.00215558684329943 0 0.000119148587175573 0 0.000225291571576022 0.00309950535404761
0.00314658534087701 0 0.00353066180200179 0.00278972805641627 0.201120145448029
0.0633498452069288 0.081335792161846 0.100529462968556 0.0773705675204676
0.0122757500557484 0.0252486328000416 0.00591652030029908 0.0194778652944764

```

0.00810961605086968 0.00273518117821726 0.00859891706520713 0.00285997768059283
0.00253325151253819 0 0 0.00353066180200179
88 2004 0.0464887728904547 0.0353457971267965 0.107548085706035 0.0320908888909042
0.0254929955328756 0.0517009927157964 0.00184972133541245 0.00144483116694414
0.0201042625537132 0 0.0167780437964627 0 0.00224709893393296 0.00706799182851016
0.00100585244887381 0 0 0.0692393027315869 0.0333419063246116 0.198156558670049
0.0622131874291576 0.0685685286948638 0.0907158271131524 0.037456660949574
0.00287875671944005 0.0454973364840489 0.00715823369639644 0.0289339894347691
0.00104833095561649 0 0.00373573135144408 0 0 0.00189031451857772 0
89 2005 0.0152514569008844 0.182467461018456 0.0764861176818267 0.0869508861748385
0.014313398762006 0.022907103309392 0.0249809058269471 0.00275195756340318
0.0010166885584436 0.00222054712159871 0.00110054865561348 0.000201033462990489 0 0 0 0
0.00120156332038642 0.0167198478590649 0.207784051181444 0.0741408507043788
0.126950754636959 0.015727433953143 0.038423738192259 0.0286123124149945
0.00875518322854885 0.00189830335840883 0.0183663805405564 0.00274411977003752
0.00925138450545838 0.00684605545554445 0.00355409806465008 0.000320417264373658
0.00540494417009904 0.0014488930229062 0.00120156332038642
90 2006 0.0156860795888675 0.0479626791149141 0.142373214310268 0.0981428640889389
0.113911132695744 0.0109303785023672 0.00879011336124506 0.0122858582922735
0.000571044511386675 0 0.00150495076888885 0 0 0 0 0.000730700115448837
0.00784165780408319 0.0457997956832508 0.156794656115915 0.105407431629633
0.11673823143244 0.0139223779971374 0.0267485919900301 0.0323764557737118
0.00778591015278379 0.00385203063183547 0.0177082663158843 0.00211830433544555
0.0048945256811443 0.00337534976225467 0 0 0.00101669922866034 0.000730700115448837
91 2007 0.0222067125245923 0.0836918224543534 0.143112793960037 0.109634138404844
0.0223929834519021 0.0350253224821653 0.00211921741040086 0.00224327293636506
0.0032607120675841 0 0 0.0003735364018023 0 0 0 0.000962615068801253
0.0241351642684476 0.0697489532825782 0.186881670023416 0.152949739775833
0.0241084881775721 0.0904984886472938 0.00451231013853944 0.00583304186918309
0.00742662233159099 0.00177450513520554 0.000318800509600115 0.00418195436237255 0
0.000303784756903955 0.00134073448981468 0 0 0.000962615068801253
92 2008 0.0132457864806928 0.0741968946867452 0.136212978950668 0.119610226802611
0.0602297317913179 0.0050102313584874 0.0153074699024889 0.00152145018641097
0.00158605244043575 0 0.000486460002964217 0 0.000620824904183759 0 0 0
0.000827477586131868 0.010765670081599 0.0811642907601311 0.153757086564053
0.117753742576633 0.103338519892304 0.0286026456924692 0.0484087364763648
0.00595752456689649 0.00508801624375626 0.00888252410352598 0.00277740401558475
9.0047610711998e-05 0.00262849088957028 0.000693745832407089 0 0 0.000408492014722735
0.000827477586131868
93 2009 0.0333222146872613 0.194780585914773 0.127610043971436 0.0667008720259503
0.0111973394031045 0.00798574856780342 0.0044379703526568 0.00290918254565354
0.000755054765672628 0.000642162785318959 0.00100526181960126 0.000354397299182211 0 0 0
0 0 0.0234116748544081 0.215614772287804 0.186338715870707 0.0682211916703573
0.0177454919204067 0.0121677466743982 0.00537960161609343 0.0075551712451083
0.000599445076812743 0.00403285177936698 0.00491619343128298 0.000422927990253014
0.00123305804324487 0.000660323401342608 0 0 0
94 2010 0.00788267321966815 0.0166113702800437 0.196896660159694 0.0679870518889976
0.0629775281742455 0.03985581708059 0.0268254025920446 0.00238535165812272
0.00386344394385619 0 0.00210100680315949 0.00184071850715727 0.00133188012340561 0 0 0
0.00145977539374728 0.00545874722497902 0.0218035114035116 0.175762701143331
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256 mortality_process Mortality
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383 mortality_process Mortality
384 method_of_removal FisherySubAntarcticSuba
385 categories West.SubAntarctic.Immature.M + West.SubAntarctic.Mature.M
West.SubAntarctic.Immature.F + West.SubAntarctic.Mature.F
386 time_step OctNov
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388 max_age 18
389 plus_group TRUE
390 ageing_error AgeingError
391 likelihood multinomial
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394 likelihood_multiplier 1.0
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396 table obs
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647 end_table
648
649 table error_values
650 1988 791
651 1989 599
652 1990 590
653 1991 736
654 1992 676
655 1993 725
656 1994 448
657 1995 896
658 1996 1008
659 1997 605
660 1998 701
661 1999 776
662 2000 774
663 2001 825
664 2002 877
665 2003 723
666 2004 854
667 2005 1140
668 2006 1024
669 2007 511
670 2008 574
671 2009 573
672 2010 511
673 2011 670
674 2012 664
675 2013 867
676 2014 870
677 2015 1031
678 2016 834
679 2017 729
680 2018 976
681 2019 1081
682 2020 833
683 2021 776
684 2022 743
685 2023 952
686 2024 1026
687 end_table
688
689

```

B.1.5 Observations survey

```

1  @observation CookStraitAcousticBiomass
2  type biomass
3  time_step JulSep
4  time_step_proportion 0.5
5  categories East.CookStrait.Mature.M + East.CookStrait.Mature.F
6  selectivities SelectivityCookStraitSpawningFisheryM SelectivityCookStraitSpawningFisheryF
7  catchability CookStraitAcousticQ
8  likelihood lognormal
9  process_error 0.0
10 error_value_multiplier 1.0
11 likelihood_multiplier 1.0
12 years 1991 1993 1994 1995 1996 1997 1998 1999 2001 2002 2003 2005 2006 2007 2008 2009
    2011 2013 2015 2017 2019 2021 2023
13 table obs
14 1991 88247.565 0.41
15 1993 282537.285 0.52
16 1994 277977.2016 0.91
17 1995 193889.0408 0.61
18 1996 92408.95769 0.57
19 1997 140626.4634 0.40
20 1998 79550.3042 0.44
21 1999 114409.8282 0.36
22 2001 102034.0909 0.30
23 2002 145075.0048 0.35
24 2003 104148.7844 0.34
25 2005 59139.10151 0.32
26 2006 59669.34895 0.34
27 2007 104427.6999 0.46
28 2008 82252.28529 0.30
29 2009 165538.3474 0.39
30 2011 140964.7624 0.35
31 2013 167829.5328 0.30
32 2015 203533.5384 0.33
33 2017 101733.8644 0.36
34 2019 91116.11374 0.36
35 2021 158893.5 0.41
36 2023 58675.29 0.38
37 end_table
38
39 @observation ECSIAcousticBiomass
40 type biomass
41 time_step JulSep
42 time_step_proportion 0.5
43 categories East.CookStrait.Mature.M + East.CookStrait.Mature.F
44 selectivities SelectivityECSISpawningFisheryM SelectivityECSISpawningFisheryF
45 catchability ECSIAcousticQ
46 likelihood lognormal
47 process_error 0.0
48 error_value_multiplier 1.0
49 likelihood_multiplier 1.0
50 years 2002 2003 2006 2008 2013 2019 2021 2023
51 table obs
52 2002 60000 0.33
53 2003 45000 0.47
54 2006 17000 0.63
55 2008 20000 1.07
56 2013 64000 0.74
57 2019 55000 0.92
58 2021 102000 0.30
59 2023 103000 0.53
60 end_table
61
62 @observation WCSIAcousticBiomass
63 type biomass
64 time_step JulSep
65 time_step_proportion 0.5
66 catchability WCSIAcousticQ

```

```

67 categories West.WCSI.Mature.M + West.WCSI.Mature.F
68 selectivities SelectivityOne SelectivityOne
69 likelihood lognormal
70 process_error 0.0
71 error_value_multiplier 1.0
72 likelihood_multiplier 1.0
73 years 1988 1989 1990 1991 1992 1993 1997 2000 2012 2013 2018 2024
74 table obs
75 1988 266265.4393 0.60
76 1989 165189.2979 0.38
77 1990 169048.7622 0.40
78 1991 227139.9065 0.73
79 1992 228885.0556 0.49
80 1993 379902.3464 0.38
81 1997 445491.0422 0.60
82 2000 262870.8502 0.60
83 2012 283102.407 0.50
84 2013 233385.3339 0.53
85 2018 123206.777 0.51
86 2024 116401 0.53
87 end_table
88
89 @observation ChathamRiseSummerBiomass
90 type biomass
91 time_step DecMar
92 time_step_proportion 0.6
93 categories East.ChathamRise.Immature.M + East.ChathamRise.Mature.M +
West.ChathamRise.Immature.M + West.ChathamRise.Mature.M + East.ChathamRise.Immature.F +
East.ChathamRise.Mature.F + West.ChathamRise.Immature.F + West.ChathamRise.Mature.F
94 selectivities SelectivityChathamRiseSummerSurveyM SelectivityChathamRiseSummerSurveyM
SelectivityChathamRiseSummerSurveyM SelectivityChathamRiseSummerSurveyM
SelectivityChathamRiseSummerSurveyF SelectivityChathamRiseSummerSurveyF
SelectivityChathamRiseSummerSurveyF SelectivityChathamRiseSummerSurveyF
95 catchability ChathamRiseSummerQ
96 likelihood lognormal
97 process_error 0.1
98 error_value_multiplier 1.0
99 likelihood_multiplier 1.0
100 years 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007
2008 2009 2010 2011 2012 2013 2014 2016 2018 2020 2022 2024
101 table obs
102 1992 117243.0 0.077
103 1993 145595.0 0.103
104 1994 125776.0 0.098
105 1995 112002.0 0.076
106 1996 111434.0 0.098
107 1997 153617.0 0.084
108 1999 81332.9 0.109
109 1998 81716.1 0.116
110 2000 53052.3 0.123
111 2001 59845.2 0.097
112 2002 49782.6 0.114
113 2003 47281.2 0.087
114 2004 35977.2 0.127
115 2005 61423.2 0.115
116 2006 68664.1 0.106
117 2007 59158.6 0.084
118 2008 57219.4 0.110
119 2009 114284.0 0.106
120 2010 74446.4 0.146
121 2011 62029.5 0.140
122 2012 84330.4 0.098
123 2013 65681.3 0.153
124 2014 94778.8 0.098
125 2016 59100.3 0.142
126 2018 85348.0 0.160
127 2020 61200.0 0.144

```

```

128 2022 88999.0 0.101
129 2024 93643 0.134
130 end_table
131
132 @observation SubAntarcticSummerBiomass
133 type biomass
134 time_step DecMar
135 time_step_proportion 0.5
136 categories West.SubAntarctic.Immature.M + West.SubAntarctic.Mature.M +
West.SubAntarctic.Immature.F + West.SubAntarctic.Mature.F
137 selectivities SelectivitySubAntarcticSummerSurveyM SelectivitySubAntarcticSummerSurveyM
SelectivitySubAntarcticSummerSurveyF SelectivitySubAntarcticSummerSurveyF
138 catchability SubAntarcticSummerQ
139 likelihood lognormal
140 process_error 0.1
141 error_value_multiplier 1.0
142 likelihood_multiplier 1.0
143 years 1992 1993 1994 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2012 2013 2015
2017 2019 2021 2023 2025
144 table obs
145 1992 78433.74 0.066
146 1993 87420.74 0.0611
147 1994 95608.1 0.0896
148 2001 55523.15 0.1263
149 2002 37582.2 0.1568
150 2003 37424.65 0.1417
151 2004 12429.37 0.1429
152 2005 13537.54 0.0928
153 2006 18392.99 0.1383
154 2007 13111.88 0.1141
155 2008 42894.7 0.1692
156 2009 44439.29 0.1452
157 2010 53365.81 0.1251
158 2012 44221.17 0.1524
159 2013 54532.85 0.1536
160 2015 29071.84 0.1267
161 2017 30698.88 0.1295
162 2019 30075.57 0.1144
163 2021 31219.83 0.1237
164 2023 48455.7 0.0912
165 2025 79719.02 0.2224
166 end_table
167
168 @observation SubAntarcticAutumnBiomass
169 type biomass
170 time_step AprJun
171 time_step_proportion 0.1
172 categories West.SubAntarctic.Immature.M + West.SubAntarctic.Mature.M +
West.SubAntarctic.Immature.F + West.SubAntarctic.Mature.F
173 selectivities SelectivitySubAntarcticAutumnSurveyM SelectivitySubAntarcticAutumnSurveyM
SelectivitySubAntarcticAutumnSurveyF SelectivitySubAntarcticAutumnSurveyF
174 catchability SubAntarcticAutumnQ
175 likelihood lognormal
176 process_error 0.1
177 error_value_multiplier 1.0
178 likelihood_multiplier 1.0
179 years 1992 1996 1998
180 table obs
181 1992 67832 0.083
182 1996 89029 0.092
183 1998 67709 0.110
184 end_table
185
186 @observation SubAntarcticAEXAge
187 type proportions_at_age
188 time_step DecMar
189 time_step_proportion 0.6

```

```

190 categories West.SubAntarctic.Immature.M + West.SubAntarctic.Mature.M
    West.SubAntarctic.Immature.F + West.SubAntarctic.Mature.F
191 selectivities SelectivitySubAntarcticAEXSurveyM SelectivitySubAntarcticAEXSurveyF
192 min_age 2
193 max_age 6
194 plus_group TRUE
195 ageing_error AgeingError
196 likelihood multinomial
197 process_errors 0.0 0.0
198 error_value_multiplier 1
199 likelihood_multiplier 1.0
200 years 1990 1991
201 table obs
202 1990 0.021505376 0.008602151 0.019354839 0.255913978 0.120430108 0.021505376 0.006451613
    0.019354839 0.268817204 0.258064516
203 1991 0.03218391 0.07586207 0.02758621 0.13333333 0.09655172 0.02528736 0.07356322
    0.04137931 0.12413793 0.37011494
204 end_table
205
206 table error_values
207 1990 5
208 1991 5
209 end_table
210
211 @observation SubAntarcticSHIAge
212 type proportions_at_age
213 time_step DecMar
214 time_step_proportion 0.6
215 categories West.SubAntarctic.Immature.M + West.SubAntarctic.Mature.M
    West.SubAntarctic.Immature.F + West.SubAntarctic.Mature.F
216 selectivities SelectivitySubAntarcticSHISurveyM SelectivitySubAntarcticSHISurveyF
217 min_age 2
218 max_age 10
219 plus_group TRUE
220 sum_to_one TRUE
221 ageing_error AgeingError
222 likelihood multinomial
223 process_errors 0.0
224 error_value_multiplier 1
225 likelihood_multiplier 1.0
226 years 1984
227 table obs
228 1984 2.668759e-05 4.430140e-04 2.668759e-04 2.722134e-02 7.419150e-02 9.714283e-02
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244 sum_to_one TRUE
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246 likelihood multinomial
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0.0471599656943282 0.0391139768057837 0.0477983175524947 0.0336122104310827
0.010482288606223 0.00320668478391904
362 2008 0.0623410867313306 0.074265180451974 0.112816649402015 0.0247898957000682
0.0683071530781227 0.00816070595963517 0.0214858778213924 0.0089990559948918
0.00939066881958018 0.00230259153519118 0.00327415883632421 0.00182599528227131
0.00730512955379106 0.0484313666943054 0.056310708601012 0.122391066174528
0.029507624391622 0.105119907023536 0.0261151778105972 0.0279825163822784
0.0269167782552673 0.0260428270541298 0.012864653554719 0.0399215396240976
0.022929447676622 0.0502022375906968
363 2009 0.0506951116328875 0.0274983547992855 0.0720930392532279 0.0971287521467863
0.0288775718442528 0.0341513859812848 0.00805173840964695 0.0190189788520053
0.00488859640876187 0.00330874513032053 0.00148469332770793 0.00339587771171497
0.00405510447884398 0.045192001229028 0.0406565210711804 0.0641204080556364
0.125483528502672 0.0462593753511099 0.117577393222461 0.0162777419820828
0.0387762916831951 0.0306935982775264 0.0393632901262735 0.00498031491549286
0.044082207297583 0.0318893783090317
364 2010 0.0826257917248257 0.0647924650053745 0.0863491198073117 0.0754517425278948

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0.0735176133432484 0.0123898141614144 0.0223882785905185 0.00250694888964421
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0.00335582628379766 0.0656137366306124 0.0541918497417998 0.0928985884825281
0.0739282491558673 0.114934893519373 0.0212046812482639 0.0635036206691293
0.00469815679731672 0.0128746404779939 0.0223675742638318 0.0106817072097642
0.00875447946734669 0.023827229295242
365 2012 0.0418425225241884 0.0734260804445205 0.079298086657452 0.0715434789643265
0.0588575879587469 0.0468015421383764 0.025457302274839 0.00690171641480564
0.00581191089250796 0.000115567923891588 0.00163644180230489 0.00168729168881719
0.000115567923891588 0.0313246857708149 0.0696516320502212 0.0770075304059208
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0.0183752998987625 0.0156698548004604 0.00508845568894662 0.0072553542619139
0.0030348136813931 0.0122224636307744
366 2013 0.0493004203068698 0.0321527131901139 0.0579637224856552 0.0650169494971056
0.0788723375059082 0.0362460040353525 0.0208801540955779 0.0214503890506757
0.0033278952637972 0.00451715533057872 0.00100426405639329 0.000101646159553977
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0.0582544305019796 0.0121924568384995 0.0239153084198596 0.00651653528900544
0.00863382479251478 0.0170003201854026
367 2015 0.154610264278513 0.0176271044378581 0.0196736273279489 0.0373542812839778
0.0655411178811154 0.0414973842224494 0.0365009813531265 0.0160741684109064
0.00903007853153252 0.0063875262218021 0.000901028849220854 0.000752021494310946
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0.0556193234600439 0.0253417274143266 0.0175025436021131 0.0096831498292236
0.0024725907955363 0.00367978319429861
368 2017 0.0253058373805109 0.0186907525513374 0.0824605182707077 0.0372025510888855
0.0608418792159826 0.0177972252185973 0.0359150763785673 0.0240494310753645
0.0218274187374794 0.0114766688704522 0.00478577713265961 0.00163295537582828
0.000124273620687084 0.0222897166064354 0.0337067341389578 0.102510824232362
0.0417845194836183 0.0996251907600078 0.0668492660399962 0.0653430697572688
0.0635435877297198 0.0722091873002302 0.048541276240375 0.0261123731787701
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369 2019 0.135209046786075 0.0557390254588146 0.0574871966810455 0.0260072604807257
0.0237374229685276 0.0120293889863071 0.0181137103970127 0.0114755871959312
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0.0478947498090616 0.0421060750021156 0.0347020557079611 0.0684486158704382
0.0457363153649468 0.0450582563063242 0.0340732710832984 0.0211858642360802
0.00883512024568661 0.0177880706595383
370 2021 0.0774445968243599 0.0230643414185423 0.0518655865038897 0.0686790422642108
0.0445190065256499 0.0215555400773855 0.0123802409951076 0.00859742960968592
0.00618507674903989 0.0068263533458066 0.00582240721304073 0.00236960108752825
0.00172880484776286 0.0734518694293599 0.0212658848055875 0.0541664965402287
0.110944213739651 0.0932358528858648 0.0585862613094052 0.0382777280074551
0.0423996714358111 0.0284784451804581 0.0139894369495409 0.0198373030836518
0.0187584212586795 0.0955703879122964
371 2023 0.114350602924598 0.0758388255689737 0.0494588195171588 0.0418174280009563
0.0466853496483427 0.02412116335275 0.00923514755896201 0.00711339016986876
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0.0203939475163875
372 2025 0.0304419897487094 0.0434640894314373 0.0792145181959822 0.0684576154871589
0.0395330479720247 0.0325509527732112 0.0230532956965749 0.0143483306207214
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0.032649380161335 0.0811336569719595 0.138641420822783 0.0865114248028425
0.0861315810133568 0.0569300888229061 0.0688571838127567 0.043172713115801
0.0205715194103106 0.0166178240282346 0.0126865872763853 0.0103686613445572
0.00625990376769886
373 end_table
374
375 table error_values
376 1992 729
377 1993 719

```

```

378 1994 499
379 2001 484
380 2002 355
381 2003 397
382 2004 397
383 2005 385
384 2006 376
385 2007 443
386 2008 422
387 2009 431
388 2010 397
389 2012 448
390 2013 341
391 2015 420
392 2017 424
393 2019 477
394 2021 361
395 2023 522
396 2025 284
397 end_table
398
399 @observation SubAntarcticAutumnAge
400 type proportions_at_age
401 time_step AprJun
402 time_step_proportion 0.1
403 categories West.SubAntarctic.Immature.M + West.SubAntarctic.Mature.M
West.SubAntarctic.Immature.F + West.SubAntarctic.Mature.F
404 selectivities SelectivitySubAntarcticAutumnSurveyM SelectivitySubAntarcticAutumnSurveyF
405 min_age 2
406 max_age 15
407 plus_group TRUE
408 ageing_error AgeingError
409 sum_to_one TRUE
410 likelihood multinomial
411 process_errors 0 0 0
412 error_value_multiplier 0.809079535234383
413 likelihood_multiplier 1.0
414 years 1992 1996 1998
415 table obs
416 1992 0.013118 0.059901 0.13316 0.008441 0.028278 0.065237 0.064278 0.015269 0.008562
0.004832 0.001474 0.001256 0.001256 0.006192 1e-04 0.036813 0.17361 0.012739 0.052545
0.13831 0.079153 0.023387 0.021406 0.017684 0.009491 0.011604 0.008741 0.003163
417 1996 0.096951 0.174331 0.107319 0.003837 0.0079 0.032796 0.035954 0.00251 0.005663
0.008163 0.001266 0.00096 0.000569 0.00011 0.088084 0.15215 0.077643 0.007186 0.010082
0.05615 0.07618 0.006404 0.018146 0.017132 0.006386 0.002375 0.00231 0.001443
418 1998 0.014676 0.092163 0.057829 0.118981 0.071411 0.014817 0.01053 0.015554 0.015091
0.004496 0.005704 0.00091 0.002671 1e-04 0.020344 0.089263 0.054525 0.134439 0.091695
0.025744 0.020915 0.057038 0.038373 0.00852 0.010801 0.012873 0.003755 0.006783
419 end_table
420
421 table error_values
422 1992 21.4417473194557
423 1996 25.191123899907
424 1998 32.4555410245313
425 end_table
426

```

B.1.6 Population

```

1  @model
2  min_age 1
3  max_age 18
4  age_plus TRUE
5  start_year 1972
6  final_year 2025
7  projection_final_year 2029
8  type age
9  base_weight_units tonnes
10 initialisation_phases phase1
11 time_steps OctNov DecMar AprJun EndJun JulSep
12 length_bins 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
13 length_plus FALSE
14 threads 1
15
16 @initialisation_phase phase1
17 type derived
18
19 @categories
20 format stock.area.maturity.sex
21 names East.ChathamRise.Immature.M East.ChathamRise.Mature.M East.ChathamRise.Immature.F
East.ChathamRise.Mature.F East.CookStrait.Mature.M East.CookStrait.Mature.F
West.ChathamRise.Immature.M West.ChathamRise.Mature.M West.ChathamRise.Immature.F
West.ChathamRise.Mature.F West.SubAntarctic.Immature.M West.SubAntarctic.Mature.M
West.SubAntarctic.Immature.F West.SubAntarctic.Mature.F West.WCSI.Mature.M
West.WCSI.Mature.F
22 age_lengths AgeLengthEastM AgeLengthEastM AgeLengthEastF AgeLengthEastF AgeLengthEastM
AgeLengthEastF AgeLengthWestM AgeLengthWestM AgeLengthWestF AgeLengthWestF AgeLengthWestM
AgeLengthWestM AgeLengthWestF AgeLengthWestF AgeLengthWestM AgeLengthWestF
23
24 @time_step OctNov
25 processes WestReturnMigration EastReturnMigration Mortality
26
27 @time_step DecMar
28 processes WestRecruitment EastRecruitment Mortality
29
30 @time_step AprJun
31 processes EastMaturation WestMaturation WestHomeMigration Mortality
32
33 @time_step EndJun
34 processes EastSpawningMigration WestSpawningMigration
35
36 @time_step JulSep
37 processes Ageing Mortality
38
39 @process None
40 type null_process
41
42 @process Ageing
43 type ageing
44 categories *
45
46 @process EastMaturation
47 type transition_category
48 from East.ChathamRise.Immature.M East.ChathamRise.Immature.F
49 to East.ChathamRise.Mature.M East.ChathamRise.Mature.F
50 selectivities SelectivityEastMaturationM SelectivityEastMaturationF
51 proportions 1.0 1.0
52
53 @process WestMaturation
54 type transition_category
55 from West.ChathamRise.Immature.M West.ChathamRise.Immature.F West.SubAntarctic.Immature.M
West.SubAntarctic.Immature.F
56 to West.ChathamRise.Mature.M West.ChathamRise.Mature.F West.SubAntarctic.Mature.M
West.SubAntarctic.Mature.F
57 selectivities SelectivityWestMaturationM SelectivityWestMaturationF
SelectivityWestMaturationM SelectivityWestMaturationF

```

```

58 proportions 1.0 1.0 1.0 1.0
59
60 @process WestHomeMigration
61 type transition_category
62 from West.ChathamRise.Immature.M West.ChathamRise.Mature.M West.ChathamRise.Immature.F
  West.ChathamRise.Mature.F
63 to West.SubAntarctic.Immature.M West.SubAntarctic.Mature.M West.SubAntarctic.Immature.F
  West.SubAntarctic.Mature.F
64 selectivities SelectivityWestHomeMigrationM SelectivityWestHomeMigrationM
  SelectivityWestHomeMigrationF SelectivityWestHomeMigrationF
65 proportions 1.0 1.0 1.0 1.0
66
67 @process WestSpawningMigration
68 type transition_category
69 from West.SubAntarctic.Mature.M West.SubAntarctic.Mature.F
70 to West.WCSI.Mature.M West.WCSI.Mature.F
71 selectivities SelectivityOne SelectivityOne
72 proportions 1.0 1.0
73
74 @process WestReturnMigration
75 type transition_category
76 from West.WCSI.Mature.M West.WCSI.Mature.F
77 to West.SubAntarctic.Mature.M West.SubAntarctic.Mature.F
78 selectivities SelectivityOne SelectivityOne
79 proportions 1.0 1.0
80
81 @process EastSpawningMigration
82 type transition_category
83 from East.ChathamRise.Mature.M East.ChathamRise.Mature.F
84 to East.CookStrait.Mature.M East.CookStrait.Mature.F
85 selectivities SelectivityOne SelectivityOne
86 proportions 1.0 1.0
87
88 @process EastReturnMigration
89 type transition_category
90 from East.CookStrait.Mature.M East.CookStrait.Mature.F
91 to East.ChathamRise.Mature.M East.ChathamRise.Mature.F
92 selectivities SelectivityOne SelectivityOne
93 proportions 1.0 1.0
94
95 @derived_quantity EastSSB
96 type biomass
97 time_step JulSep
98 categories East.CookStrait.Mature.M East.CookStrait.Mature.F
99 selectivities SelectivityOne SelectivityOne
100 time_step_proportion 0.5
101 time_step_proportion_method weighted_sum
102
103 @derived_quantity WestSSB
104 type biomass
105 time_step JulSep
106 categories West.WCSI.Mature.M West.WCSI.Mature.F
107 selectivities SelectivityOne SelectivityOne
108 time_step_proportion 0.5
109 time_step_proportion_method weighted_sum
110
111 @derived_quantity TotalSSB
112 type biomass
113 time_step JulSep
114 categories West.WCSI.Mature.M West.WCSI.Mature.F East.CookStrait.Mature.M
  East.CookStrait.Mature.F
115 selectivities SelectivityOne SelectivityOne SelectivityOne SelectivityOne
116 time_step_proportion 0.5
117 time_step_proportion_method weighted_sum
118
119 @derived_quantity WestRecruitApprox
120 type abundance

```



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243 2014 30944.7 7060.7 14595.7 3627.2 5784.2 7405.5 7114.8 10355.2 44435.4 15019
244 2015 36885.9 7261.7 16161.6 4250.5 4574.6 9369.5 3012.9 13388 51146 15477.4
245 2016 29847.5 9536.6 15431.9 5311.4 2406.2 2716.1 1643.9 16171.5 38320.6 15333.3
246 2017 34799.8 8354.1 12738.9 5441.7 2493.7 6046.1 4922.5 16764.3 33299.4 16705.8
247 2018 31289 9020.5 18059.5 4948.1 3692.5 4916.9 7007.6 17087.4 19351.8 20045.3
248 2019 29886.7 6181.4 18971.6 10624.7 2440.5 4367.2 2494.4 14990.4 15368.6 17134.3
249 2020 25815.6 4766.6 15101.1 9738 3013.2 3906.3 1211.2 13727.6 18206.7 12250.3
250 2021 31250.7 4126.3 11043.8 9665.4 4104.5 3702 1538.5 9985.1 12421.6 12980.8
251 2022 28777.9 4346 8335.1 9694 3052.4 2703.6 2624.7 9747.7 10700.8 11682.4
252 2023 34371.6 4891.6 12014.1 10908.2 5065.1 2581.5 5285 10320.8 7851.2 12266.6
253 2024 34327.3 6048.4 10702.6 15508.2 2495.4 1543.6 3746.3 10089.1 7123.1 15451.4
254 2025 34327.3 6048.4 10702.6 15508.2 2495.4 1543.6 3746.3 10089.1 7123.1 15451.4
255 end_table
256
257 table method
258 method category selectivity u_max time_step penalty
259 FisheryChathamRiseDeep East.ChathamRise.Immature.M SelectivityChathamRiseDeepFisheryM
0.95 OctNov PenaltyCatchMustBetaken
260 FisheryChathamRiseDeep East.ChathamRise.Immature.F SelectivityChathamRiseDeepFisheryF
0.95 OctNov PenaltyCatchMustBetaken
261 FisheryChathamRiseDeep East.ChathamRise.Mature.M SelectivityChathamRiseDeepFisheryM 0.95
OctNov PenaltyCatchMustBetaken
262 FisheryChathamRiseDeep East.ChathamRise.Mature.F SelectivityChathamRiseDeepFisheryF 0.95
OctNov PenaltyCatchMustBetaken
263 FisheryChathamRiseDeep West.ChathamRise.Immature.M SelectivityChathamRiseDeepFisheryM
0.95 OctNov PenaltyCatchMustBetaken
264 FisheryChathamRiseDeep West.ChathamRise.Immature.F SelectivityChathamRiseDeepFisheryF
0.95 OctNov PenaltyCatchMustBetaken
265 FisheryChathamRiseDeep West.ChathamRise.Mature.M SelectivityChathamRiseDeepFisheryM 0.95
OctNov PenaltyCatchMustBetaken
266 FisheryChathamRiseDeep West.ChathamRise.Mature.F SelectivityChathamRiseDeepFisheryF 0.95
OctNov PenaltyCatchMustBetaken
267 FisheryChathamRiseShallow East.ChathamRise.Immature.M
SelectivityChathamRiseShallowFisheryM 0.95 OctNov PenaltyCatchMustBetaken
268 FisheryChathamRiseShallow East.ChathamRise.Immature.F
SelectivityChathamRiseShallowFisheryF 0.95 OctNov PenaltyCatchMustBetaken
269 FisheryChathamRiseShallow East.ChathamRise.Mature.M SelectivityChathamRiseShallowFisheryM
0.95 OctNov PenaltyCatchMustBetaken
270 FisheryChathamRiseShallow East.ChathamRise.Mature.F SelectivityChathamRiseShallowFisheryF
0.95 OctNov PenaltyCatchMustBetaken
271 FisheryChathamRiseShallow West.ChathamRise.Immature.M
SelectivityChathamRiseShallowFisheryM 0.95 OctNov PenaltyCatchMustBetaken
272 FisheryChathamRiseShallow West.ChathamRise.Immature.F
SelectivityChathamRiseShallowFisheryF 0.95 OctNov PenaltyCatchMustBetaken
273 FisheryChathamRiseShallow West.ChathamRise.Mature.M SelectivityChathamRiseShallowFisheryM
0.95 OctNov PenaltyCatchMustBetaken
274 FisheryChathamRiseShallow West.ChathamRise.Mature.F SelectivityChathamRiseShallowFisheryF
0.95 OctNov PenaltyCatchMustBetaken
275 FisheryCookStraitSpawning East.CookStrait.Mature.M SelectivityCookStraitSpawningFisheryM
0.95 JulSep PenaltyCatchMustBetaken
276 FisheryCookStraitSpawning East.CookStrait.Mature.F SelectivityCookStraitSpawningFisheryF
0.95 JulSep PenaltyCatchMustBetaken
277 FisheryECSISpawning East.CookStrait.Mature.M SelectivityECSISpawningFisheryM 0.95 JulSep
PenaltyCatchMustBetaken
278 FisheryECSISpawning East.CookStrait.Mature.F SelectivityECSISpawningFisheryF 0.95 JulSep
PenaltyCatchMustBetaken
279 FisherySubAntarcticAuckland West.SubAntarctic.Immature.M
SelectivitySubAntarcticAucklandFisheryM 0.95 OctNov PenaltyCatchMustBetaken
280 FisherySubAntarcticAuckland West.SubAntarctic.Immature.F
SelectivitySubAntarcticAucklandFisheryF 0.95 OctNov PenaltyCatchMustBetaken
281 FisherySubAntarcticAuckland West.SubAntarctic.Mature.M
SelectivitySubAntarcticAucklandFisheryM 0.95 OctNov PenaltyCatchMustBetaken
282 FisherySubAntarcticAuckland West.SubAntarctic.Mature.F
SelectivitySubAntarcticAucklandFisheryF 0.95 OctNov PenaltyCatchMustBetaken
283 FisherySubAntarcticSnares West.SubAntarctic.Immature.M
SelectivitySubAntarcticSnaresFisheryM 0.95 OctNov PenaltyCatchMustBetaken
284 FisherySubAntarcticSnares West.SubAntarctic.Immature.F

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285 SelectivitySubAntarcticSnaresFisheryF 0.95 OctNov PenaltyCatchMustBetaken
FisherySubAntarcticSnares West.SubAntarctic.Mature.M
286 SelectivitySubAntarcticSnaresFisheryM 0.95 OctNov PenaltyCatchMustBetaken
FisherySubAntarcticSnares West.SubAntarctic.Mature.F
287 SelectivitySubAntarcticSnaresFisheryF 0.95 OctNov PenaltyCatchMustBetaken
FisherySubAntarcticSuba West.SubAntarctic.Immature.M SelectivitySubAntarcticSubaFisheryM
0.95 OctNov PenaltyCatchMustBetaken
288 FisherySubAntarcticSuba West.SubAntarctic.Immature.F SelectivitySubAntarcticSubaFisheryF
0.95 OctNov PenaltyCatchMustBetaken
289 FisherySubAntarcticSuba West.SubAntarctic.Mature.M SelectivitySubAntarcticSubaFisheryM
0.95 OctNov PenaltyCatchMustBetaken
290 FisherySubAntarcticSuba West.SubAntarctic.Mature.F SelectivitySubAntarcticSubaFisheryF
0.95 OctNov PenaltyCatchMustBetaken
291 FisheryWCSIIInside West.WCSI.Mature.M SelectivityWCSIIInsideFisheryM 0.95 JulSep
PenaltyCatchMustBetaken
292 FisheryWCSIIInside West.WCSI.Mature.F SelectivityWCSIIInsideFisheryF 0.95 JulSep
PenaltyCatchMustBetaken
293 FisheryWCSINorth West.WCSI.Mature.M SelectivityWCSINorthFisheryM 0.95 JulSep
PenaltyCatchMustBetaken
294 FisheryWCSINorth West.WCSI.Mature.F SelectivityWCSINorthFisheryF 0.95 JulSep
PenaltyCatchMustBetaken
295 FisheryWCSISouth West.WCSI.Mature.M SelectivityWCSISouthFisheryM 0.95 JulSep
PenaltyCatchMustBetaken
296 FisheryWCSISouth West.WCSI.Mature.F SelectivityWCSISouthFisheryF 0.95 JulSep
PenaltyCatchMustBetaken
297 end_table
298
299 @selectivity SelectivityOne
300 type constant
301 c 1.0
302
303 @selectivity Select2yrs
304 type all_values
305 v 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0
306
307 @selectivity SelectivityEastMaturationM
308 type logistic
309 a50 2.0
310 ato95 2.0
311 alpha 1.0
312
313 @selectivity SelectivityEastMaturationF
314 type logistic
315 a50 3.0
316 ato95 3.0
317 alpha 1.0
318
319 @selectivity SelectivityWestMaturationM
320 type logistic
321 a50 2.0
322 ato95 2.0
323 alpha 1.0
324
325 @selectivity SelectivityWestMaturationF
326 type logistic
327 a50 3.0
328 ato95 3.0
329 alpha 1.0
330
331 @selectivity SelectivityWestHomeMigrationM
332 type logistic_producing
333 l 1
334 h 8
335 a50 3.0
336 ato95 2.0
337 alpha 1.0
338

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```

339 @selectivity SelectivityWestHomeMigrationF
340 type logistic_producing
341 l 1
342 h 8
343 a50 3.0
344 ato95 2.0
345 alpha 1.0
346
347 @selectivity SelectivityChathamRiseSummerSurveyM
348 type knife_edge
349 e 2.0
350 alpha 1.0
351
352 @selectivity SelectivityChathamRiseSummerSurveyF
353 type knife_edge
354 e 2.0
355 alpha 1.0
356
357 @selectivity SelectivitySubAntarcticSummerSurveyM
358 type logistic
359 a50 7.0
360 ato95 3.0
361 alpha 1.0
362
363 @selectivity SelectivitySubAntarcticSummerSurveyF
364 type logistic
365 a50 7.0
366 ato95 3.0
367 alpha 1.0
368
369 @selectivity SelectivitySubAntarcticAutumnSurveyM
370 type logistic
371 a50 5
372 ato95 7
373 alpha 1.0
374
375 @selectivity SelectivitySubAntarcticAutumnSurveyF
376 type logistic
377 a50 5
378 ato95 7
379 alpha 1.0
380
381 @selectivity SelectivitySubAntarcticAEXSurveyM
382 type logistic
383 a50 3.5
384 ato95 1.5
385 alpha 1.0
386
387 @selectivity SelectivitySubAntarcticAEXSurveyF
388 type logistic
389 a50 3.5
390 ato95 1.5
391 alpha 1.0
392
393 @selectivity SelectivitySubAntarcticSHISurveyM
394 type logistic
395 a50 5.5
396 ato95 2
397 alpha 1.0
398
399 @selectivity SelectivitySubAntarcticSHISurveyF
400 type logistic
401 a50 5.5
402 ato95 2
403 alpha 1.0
404
405 @selectivity SelectivityChathamRiseSHISurveyM

```

```

406 type knife_edge
407 e 2
408 alpha 1.0
409
410 @selectivity SelectivityChathamRiseSHISurveyF
411 type knife_edge
412 e 2
413 alpha 1.0
414
415 @selectivity SelectivityChathamRiseDeepFisheryM
416 type logistic
417 a50 7
418 ato95 3
419 alpha 1
420
421 @selectivity SelectivityChathamRiseDeepFisheryF
422 type logistic
423 a50 7
424 ato95 3
425 alpha 1
426
427 @selectivity SelectivityChathamRiseShallowFisheryM
428 type double_normal
429 mu 4
430 sigma_l 2
431 sigma_r 20
432 alpha 1
433
434 @parameter_transformation ChathamRiseShallowFisheryM_log_sigma_r
435 type log
436 parameters selectivity[SelectivityChathamRiseShallowFisheryM].sigma_r
437
438 @parameter_transformation ChathamRiseShallowFisheryM_log_sigma_l
439 type log
440 parameters selectivity[SelectivityChathamRiseShallowFisheryM].sigma_l
441
442 @selectivity SelectivityChathamRiseShallowFisheryF
443 type double_normal
444 mu 4
445 sigma_l 2
446 sigma_r 20
447 alpha 1
448
449 @parameter_transformation ChathamRiseShallowFisheryF_log_sigma_l
450 type log
451 parameters selectivity[SelectivityChathamRiseShallowFisheryF].sigma_l
452
453 @parameter_transformation ChathamRiseShallowFisheryF_log_sigma_r
454 type log
455 parameters selectivity[SelectivityChathamRiseShallowFisheryF].sigma_r
456
457 @selectivity SelectivityCookStraitSpawningFisheryM
458 type logistic
459 a50 7
460 ato95 3
461 alpha 1
462
463 @selectivity SelectivityCookStraitSpawningFisheryF
464 type logistic
465 a50 7
466 ato95 3
467 alpha 1
468
469 @selectivity SelectivityECSISpawningFisheryM
470 type double_normal
471 mu 4
472 sigma_l 2

```

```

473 sigma_r 20
474 alpha 1
475
476 @selectivity SelectivityECSISpawningFisheryF
477 type double_normal
478 mu 4
479 sigma_l 2
480 sigma_r 20
481 alpha 1
482
483 @parameter_transformation ECSISpawningFisheryF_log_sigma_r
484 type log
485 parameters selectivity[SelectivityECSISpawningFisheryF].sigma_r
486
487 @parameter_transformation ECSISpawningFisheryM_log_sigma_r
488 type log
489 parameters selectivity[SelectivityECSISpawningFisheryM].sigma_r
490
491 @selectivity SelectivitySubAntarcticAucklandFisheryM
492 type double_normal
493 mu 7
494 sigma_l 2
495 sigma_r 10
496 alpha 1
497
498 @selectivity SelectivitySubAntarcticAucklandFisheryF
499 type double_normal
500 mu 7
501 sigma_l 2
502 sigma_r 10
503 alpha 1
504
505 @parameter_transformation SubAntarcticAucklandFisheryM_log_sigma_r
506 type log
507 parameters Selectivity[SelectivitySubAntarcticAucklandFisheryM].sigma_r
508
509 @parameter_transformation SubAntarcticAucklandFisheryF_log_sigma_r
510 type log
511 parameters Selectivity[SelectivitySubAntarcticAucklandFisheryF].sigma_r
512
513 @selectivity SelectivitySubAntarcticSnaresFisheryM
514 type double_normal
515 mu 4
516 sigma_l 2
517 sigma_r 20
518 alpha 1
519
520 @parameter_transformation SubAntarcticSnaresFisheryM_log_sigma_r
521 type log
522 parameters Selectivity[SelectivitySubAntarcticSnaresFisheryM].sigma_r
523
524 @selectivity SelectivitySubAntarcticSnaresFisheryF
525 type double_normal
526 mu 4
527 sigma_l 2
528 sigma_r 20
529 alpha 1
530
531 @parameter_transformation SubAntarcticSnaresFisheryF_log_sigma_r
532 type log
533 parameters Selectivity[SelectivitySubAntarcticSnaresFisheryF].sigma_r
534
535 @selectivity SelectivitySubAntarcticSubaFisheryM
536 type logistic
537 a50 7
538 ato95 3
539 alpha 1

```

```

540
541 @selectivity SelectivitySubAntarcticSubaFisheryF
542 type logistic
543 a50 7
544 ato95 3
545 alpha 1
546
547 @selectivity SelectivityWCSInsideFisheryM
548 type logistic
549 a50 7
550 ato95 3
551 alpha 1
552
553 @selectivity SelectivityWCSInsideFisheryF
554 type logistic
555 a50 7
556 ato95 3
557 alpha 1
558
559 @selectivity SelectivityWCSNorthFisheryF
560 type double_normal
561 mu 4
562 sigma_l 2
563 sigma_r 20
564 alpha 1
565
566 @parameter_transformation WCSNorthFisheryF_log_sigma_r
567 type log
568 parameters Selectivity[SelectivityWCSNorthFisheryF].sigma_r
569
570 @selectivity SelectivityWCSNorthFisheryM
571 type double_normal
572 mu 4
573 sigma_l 2
574 sigma_r 20
575 alpha 1
576
577 @parameter_transformation WCSNorthFisheryM_log_sigma_r
578 type log
579 parameters Selectivity[SelectivityWCSNorthFisheryM].sigma_r
580
581 @parameter_transformation WCSNorthFisheryM_log_sigma_l
582 type log
583 parameters Selectivity[SelectivityWCSNorthFisheryM].sigma_l
584
585 @selectivity SelectivityWCSISouthFisheryM
586 type logistic
587 a50 8.2
588 ato95 3
589 alpha 1
590
591 @selectivity SelectivityWCSISouthFisheryF
592 type logistic
593 a50 7
594 ato95 3
595 alpha 1
596
597 @time_varying ChathamRiseSummerSurveyShiftM
598 type exogenous
599 parameter selectivity[SelectivityChathamRiseSummerSurveyM].e
600 years 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007
2008 2009 2010 2011 2012 2013 2014 2015 2016 2017
601 exogenous_variable -0.846349 -0.571551 -0.577387 0 0 0 0 0 -0.0386661 -0.0163429
0.0559784 0.723787 0.522114 0.679399 0.0981645 -0.180663 0.0214547 -0.273193 0 -0.115074
0.032279 0 0.507732 0 -0.053837
602 a 0.0
603

```

```

604 @time_varying ChathamRiseSummerSurveyShiftF
605 type exogenous
606 parameter selectivity[SelectivityChathamRiseSummerSurveyF].e
607 years 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007
      2008 2009 2010 2011 2012 2013 2014 2015 2016 2017
608 exogenous_variable -0.846349 -0.571551 -0.577387 0 0 0 0 0 -0.0386661 -0.0163429
      0.0559784 0.723787 0.522114 0.679399 0.0981645 -0.180663 0.0214547 -0.273193 0 -0.115074
      0.032279 0 0.507732 0 -0.053837
609 a 0.0
610
611 @selectivity SelectivityChathamRiseDeepFishery
612 type double_normal
613 mu 14
614 sigma_l 10.7575
615 sigma_r 44
616 alpha 1.0
617 length_based FALSE
618
619 @age_length AgeLengthEastM
620 type von_bertalanffy
621 length_weight LengthWeightEastM
622 k 0.232
623 t0 -1.23
624 Linf 89.5
625 cv_first 0.05
626 cv_last 0.05
627 time_step_proportions 0.25 0.60 0.90 0.90 0.0
628 by_length TRUE
629 distribution normal
630 compatibility_option casal
631
632 @age_length AgeLengthEastF
633 type von_bertalanffy
634 length_weight LengthWeightEastF
635 k 0.161
636 t0 -2.18
637 Linf 101.8
638 cv_first 0.05
639 cv_last 0.05
640 time_step_proportions 0.25 0.60 0.90 0.90 0.0
641 by_length TRUE
642 distribution normal
643 compatibility_option casal
644
645 @age_length AgeLengthWestM
646 type von_bertalanffy
647 length_weight LengthWeightWestM
648 k 0.261
649 t0 -0.50
650 Linf 92.6
651 cv_first 0.05
652 cv_last 0.05
653 time_step_proportions 0.25 0.60 0.90 0.90 0.0
654 by_length TRUE
655 distribution normal
656 compatibility_option casal
657
658 @age_length AgeLengthWestF
659 type von_bertalanffy
660 length_weight LengthWeightWestF
661 k 0.213
662 t0 -0.60
663 Linf 104.0
664 cv_first 0.05
665 cv_last 0.05
666 time_step_proportions 0.25 0.60 0.90 0.90 0.0
667 by_length TRUE

```

```

668 distribution normal
669 compatibility_option casal
670
671 @length_weight LengthWeightEastM
672 type basic
673 units tonnes
674 a 4.79e-09
675 b 2.89
676
677 @length_weight LengthWeightEastF
678 type basic
679 units tonnes
680 a 4.79e-09
681 b 2.89
682
683 @length_weight LengthWeightWestM
684 type basic
685 units tonnes
686 a 4.79e-09
687 b 2.89
688
689 @length_weight LengthWeightWestF
690 type basic
691 units tonnes
692 a 4.79e-09
693 b 2.89
694

```

B.2 Single stock model

B.2.1 Estimation

```

1  @minimiser adolc
2  type adolc
3  tolerance 1e-6
4  iterations 2500
5  covariance TRUE
6  active TRUE
7
8
9  @mcmc MCMC
10 type random_walk
11 start 1
12 length 8000000
13 keep 1000
14 step_size 0
15 adapt_stepsize_at 20000 40000 60000 80000 100000
16 proposal_distribution t
17 df 4
18 adapt_stepsize_method double_half
19 burn_in 1000000
20 max_correlation 0.8
21
22
23 @penalty PenaltyCatchMustBetaken
24 type process
25 log_scale TRUE
26 multiplier 10000
27
28 @estimate logB0
29 parameter parameter_transformation[logB0].log_parameter
30 lower_bound 13.8
31 upper_bound 15.2
32 estimation_phase 2
33 type uniform
34
35 @parameter_transformation logB0
36 type log
37 parameters process[Recruitment].b0
38 prior_applies_to_restored_parameters true
39
40 @parameter_transformation SimplexYCS
41 type simplex
42 sum_to_one false
43 parameters process[Recruitment].recruitment_multipliers{1977:2023}
44 prior_applies_to_restored_parameters true
45
46 @estimate SimplexYCS
47 type lognormal
48 mu 1*47
49 cv 1.1*47
50 parameter parameter_transformation[SimplexYCS].simplex
51 lower_bound -10*47
52 upper_bound 10*47
53
54
55 @estimate estimate_3
56 parameter selectivity[SelectivityWestHomeMigrationM].c
57 type uniform
58 lower_bound 0
59 upper_bound 1
60
61 @estimate estimate_5
62 parameter selectivity[SelectivityWestHomeMigrationF].c
63 type uniform
64 lower_bound 0
65 upper_bound 1
66
67

```

```

68 @ageing_error AgeingError
69 type data
70 table data
71 # 1 2 3 4 5 6 7 8 9 10 11 12 13 14
    15 16 17 18
72 0.98 0.02 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
73 0.03 0.94 0.03 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
74 0.00 0.05 0.90 0.05 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
75 0.00 0.00 0.06 0.88 0.06 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
76 0.00 0.00 0.00 0.07 0.86 0.07 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
    0.00 0.00 0.00
77 0.00 0.00 0.00 0.00 0.08 0.84 0.08 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
    0.00 0.00 0.00
78 0.00 0.00 0.00 0.00 0.00 0.09 0.82 0.09 0.00 0.00 0.00 0.00 0.00 0.00 0.00
    0.00 0.00 0.00
79 0.00 0.00 0.00 0.00 0.00 0.01 0.11 0.76 0.11 0.01 0.00 0.00 0.00 0.00 0.00
    0.00 0.00 0.00
80 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.11 0.76 0.11 0.01 0.00 0.00 0.00 0.00
    0.00 0.00 0.00
81 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.12 0.74 0.12 0.01 0.00 0.00 0.00
    0.00 0.00 0.00
82 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.13 0.72 0.13 0.01 0.00 0.00
    0.00 0.00 0.00
83 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.14 0.70 0.14 0.01 0.00
    0.00 0.00 0.00
84 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.15 0.68 0.15 0.01
    0.00 0.00 0.00
85 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.02 0.15 0.66 0.15
    0.02 0.00 0.00
86 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.02 0.16 0.64
    0.16 0.02 0.00
87 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 0.02 0.16
    0.63 0.17 0.02
88 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 0.02
    0.17 0.63 0.18
89 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
    0.02 0.17 0.81
90 end_table
91

```

B.2.2 Estimation fishery

```

1  # ESTIMATION: Estimation of selectivities etc. for fisheries
2
3  # Fishery
4  @estimate
5  parameter selectivity[SelectivityChathamRiseDeepFisheryM].a50
6  same selectivity[SelectivityChathamRiseDeepFisheryF].a50
7  type uniform
8  lower_bound 1
9  upper_bound 10
10
11 @estimate
12 parameter selectivity[SelectivityChathamRiseDeepFisheryM].ato95
13 same selectivity[SelectivityChathamRiseDeepFisheryF].ato95
14 type uniform
15 lower_bound 1
16 upper_bound 50
17
18 @estimate
19 parameter selectivity[SelectivityChathamRiseShallowFisheryM].mu
20 same selectivity[SelectivityChathamRiseShallowFisheryF].mu
21 type uniform
22 lower_bound 1
23 upper_bound 10
24
25 /*
26 @estimate
27 parameter selectivity[SelectivityChathamRiseShallowFisheryM].sigma_1
28 same selectivity[SelectivityChathamRiseShallowFisheryF].sigma_1
29 type uniform
30 lower_bound 0.1
31 upper_bound 10
32 */
33 @estimate ChathamRiseShallowFisheryM_log_sigma_r
34 type uniform
35 parameter parameter_transformation[ChathamRiseShallowFisheryM_log_sigma_r].log_parameter
36 same parameter_transformation[ChathamRiseShallowFisheryF_log_sigma_r].log_parameter
37 lower_bound 0.001
38 upper_bound 5
39
40 @estimate ChathamRiseShallowFisheryM_log_sigma_l
41 parameter parameter_transformation[ChathamRiseShallowFisheryM_log_sigma_l].log_parameter
42 same parameter_transformation[ChathamRiseShallowFisheryF_log_sigma_l].log_parameter
43 type uniform
44 lower_bound 0.001
45 upper_bound 5
46
47 @estimate
48 parameter selectivity[SelectivityCookStraitSpawningFisheryM].a50
49 type uniform
50 lower_bound 1
51 upper_bound 20
52
53 @estimate
54 parameter selectivity[SelectivityCookStraitSpawningFisheryM].ato95
55 type uniform
56 lower_bound 1
57 upper_bound 10
58
59 @estimate
60 parameter selectivity[SelectivityCookStraitSpawningFisheryM].alpha
61 type uniform
62 lower_bound 0.1
63 upper_bound 10
64
65 @estimate
66 parameter selectivity[SelectivityCookStraitSpawningFisheryF].a50
67 type uniform

```

```

68 lower_bound 1
69 upper_bound 20
70
71 @estimate
72 parameter selectivity[SelectivityCookStraitSpawningFisheryF].ato95
73 type uniform
74 lower_bound 1
75 upper_bound 10
76
77
78 @estimate
79 parameter selectivity[SelectivityECSISpawningFisheryM].mu
80 type uniform
81 lower_bound 0.1
82 upper_bound 50
83
84 @estimate
85 parameter selectivity[SelectivityECSISpawningFisheryM].alpha
86 type uniform
87 lower_bound 0.1
88 upper_bound 10
89
90 @estimate
91 parameter selectivity[SelectivityECSISpawningFisheryM].sigma_1
92 type uniform
93 lower_bound 0.1
94 upper_bound 10
95
96 @estimate ECSISpawningFisheryM_log_sigma_r
97 parameter parameter_transformation[ECSISpawningFisheryM_log_sigma_r].log_parameter
98 type uniform
99 lower_bound 0.001
100 upper_bound 5
101
102
103 @estimate
104 parameter selectivity[SelectivityECSISpawningFisheryF].mu
105 type uniform
106 lower_bound 1
107 upper_bound 10
108
109 @estimate
110 parameter selectivity[SelectivityECSISpawningFisheryF].sigma_1
111 type uniform
112 lower_bound 0.1
113 upper_bound 10
114
115 @estimate ECSISpawningFisheryF_log_sigma_r
116 parameter parameter_transformation[ECSISpawningFisheryF_log_sigma_r].log_parameter
117 type uniform
118 lower_bound 0.001
119 upper_bound 5
120
121
122 /*
123 @estimate
124 parameter selectivity[SelectivitySubAntarcticAucklandFisheryM].mu
125 same selectivity[SelectivitySubAntarcticAucklandFisheryF].mu
126 type uniform
127 lower_bound 1
128 upper_bound 15
129 */
130 @estimate SubaAntarcticAucklandFishery_log_mu
131 parameter parameter_transformation[SubAntarcticAucklandFisheryM_log_mu].log_parameter
132 same parameter_transformation[SubAntarcticAucklandFisheryF_log_mu].log_parameter
133 type uniform
134 lower_bound 0.001

```

```

135 upper_bound 2.5
136
137 @estimate
138 parameter selectivity[SelectivitySubAntarcticAucklandFisheryM].sigma_1
139 same selectivity[SelectivitySubAntarcticAucklandFisheryF].sigma_1
140 type uniform
141 lower_bound 0.1
142 upper_bound 10
143
144 @estimate SubaAntarcticAucklandFishery_log_sigma_r
145 parameter
146   parameter_transformation[SubaAntarcticAucklandFisheryM_log_sigma_r].log_parameter
147 same parameter_transformation[SubaAntarcticAucklandFisheryF_log_sigma_r].log_parameter
148 type uniform
149 lower_bound 0.001
150 upper_bound 5
151
152 @estimate
153 parameter selectivity[SelectivitySubAntarcticSnaresFisheryM].mu
154 same selectivity[SelectivitySubAntarcticSnaresFisheryF].mu
155 type uniform
156 lower_bound 1
157 upper_bound 10
158
159 @estimate
160 parameter selectivity[SelectivitySubAntarcticSnaresFisheryM].sigma_1
161 same selectivity[SelectivitySubAntarcticSnaresFisheryF].sigma_1
162 type uniform
163 lower_bound 0.1
164 upper_bound 10
165
166 /*
167 @estimate
168 parameter selectivity[SelectivitySubAntarcticSnaresFisheryM].sigma_r
169 same selectivity[SelectivitySubAntarcticSnaresFisheryF].sigma_r
170 type uniform
171 lower_bound 1
172 upper_bound 100
173 */
174
175 @estimate SubaAntarcticSnaresFishery_log_sigma_r
176 parameter parameter_transformation[SubaAntarcticSnaresFisheryM_log_sigma_r].log_parameter
177 same parameter_transformation[SubaAntarcticSnaresFisheryF_log_sigma_r].log_parameter
178 type uniform
179 lower_bound 0.001
180 upper_bound 5
181
182 @estimate
183 parameter selectivity[SelectivitySubAntarcticSubaFisheryM].a50
184 same selectivity[SelectivitySubAntarcticSubaFisheryF].a50
185 type uniform
186 lower_bound 1
187 upper_bound 20
188
189 @estimate
190 parameter selectivity[SelectivitySubAntarcticSubaFisheryM].ato95
191 same selectivity[SelectivitySubAntarcticSubaFisheryF].ato95
192 type uniform
193 lower_bound 1
194 upper_bound 10
195
196 @estimate
197 parameter selectivity[SelectivityWCSIInsideFisheryM].a50
198 type uniform
199 lower_bound 1
200 upper_bound 20

```

```

201
202 @estimate
203 parameter selectivity[SelectivityWCSInsideFisheryM].ato95
204 type uniform
205 lower_bound 1
206 upper_bound 10
207
208 @estimate
209 parameter selectivity[SelectivityWCSInsideFisheryM].alpha
210 type uniform
211 lower_bound 0.1
212 upper_bound 10
213
214 @estimate
215 parameter selectivity[SelectivityWCSInsideFisheryF].a50
216 type uniform
217 lower_bound 1
218 upper_bound 20
219
220 @estimate
221 parameter selectivity[SelectivityWCSInsideFisheryF].ato95
222 type uniform
223 lower_bound 1
224 upper_bound 50
225
226
227 @estimate
228 parameter selectivity[SelectivityWCSNorthFisheryM].mu
229 type uniform
230 lower_bound 0.1
231 upper_bound 50
232
233 @estimate
234 parameter selectivity[SelectivityWCSNorthFisheryM].alpha
235 type uniform
236 lower_bound 0.1
237 upper_bound 10
238
239 @estimate WCSNorthFisheryM_log_sigma_l
240 parameter parameter_transformation[WCSNorthFisheryM_log_sigma_l].log_parameter
241 type uniform
242 lower_bound 0.001
243 upper_bound 5
244
245 @estimate WCSNorthFisheryM_log_sigma_r
246 parameter parameter_transformation[WCSNorthFisheryM_log_sigma_r].log_parameter
247 type uniform
248 lower_bound 0.001
249 upper_bound 5
250
251 @estimate
252 parameter selectivity[SelectivityWCSNorthFisheryF].mu
253 type uniform
254 lower_bound 1
255 upper_bound 50
256
257 @estimate
258 parameter selectivity[SelectivityWCSNorthFisheryF].sigma_l
259 type uniform
260 lower_bound 0.1
261 upper_bound 10
262
263 @estimate WCSNorthFisheryF_log_sigma_r
264 parameter parameter_transformation[WCSNorthFisheryF_log_sigma_r].log_parameter
265 type uniform
266 lower_bound 0.001
267 upper_bound 5

```

```

268
269
270 @estimate
271 parameter selectivity[SelectivityWCSISouthFisheryM].a50
272 type uniform
273 lower_bound 1
274 upper_bound 20
275
276 @estimate
277 parameter selectivity[SelectivityWCSISouthFisheryM].ato95
278 type uniform
279 lower_bound 1
280 upper_bound 50
281 /*
282 @estimate
283 parameter selectivity[SelectivityWCSISouthFisheryM].alpha
284 type uniform
285 lower_bound 0.1
286 upper_bound 10
287 */
288 @estimate WCSISouthFisheryM_log_alpha
289 parameter parameter_transformation[WCSISouthFisheryM_log_alpha].log_parameter
290 type uniform
291 lower_bound 0.001
292 upper_bound 10
293
294 @estimate
295 parameter selectivity[SelectivityWCSISouthFisheryF].a50
296 type uniform
297 lower_bound 1
298 upper_bound 20
299
300 @estimate
301 parameter selectivity[SelectivityWCSISouthFisheryF].ato95
302 type uniform
303 lower_bound 1
304 upper_bound 50
305

```

B.2.3 Estimation survey

```

1  # ESTIMATION: Estimation of catchability constants and selectivities etc. for surveys
2
3  ## Define Catchabilities
4  @catchability CookStraitAcousticQ
5  type free
6  q 1.22472
7
8
9  @catchability ECSIAcousticQ
10 type free
11 q 1.22472
12
13
14 @catchability WCSIAcousticQ
15 type free
16 q 0.938112
17
18 @catchability ChathamRiseSummerQ
19 type free
20 q 0.0804276
21
22 @catchability SubAntarcticSummerQ
23 type free
24 q 0.109987
25
26 @catchability SubAntarcticAutumnQ
27 type free
28 q 0.0878128
29
30 # Estimate catchabilities
31 @estimate ECSIAcousticQ
32 parameter catchability[ECSIAcousticQ].q
33 type uniform
34 lower_bound 0.01
35 upper_bound 4.53
36
37 @estimate CookStraitAcousticQ
38 parameter catchability[CookStraitAcousticQ].q
39 type lognormal
40 mu 0.55
41 cv 0.90
42 lower_bound 0.01
43 upper_bound 4.53
44
45 @estimate WCSIAcousticQ
46 parameter catchability[WCSIAcousticQ].q
47 type lognormal
48 mu 0.39
49 cv 0.77
50 lower_bound 0.01
51 upper_bound 3.35
52
53 @estimate ChathamRiseSummerQ
54 parameter catchability[ChathamRiseSummerQ].q
55 type uniform
56 lower_bound 0.016
57 upper_bound 0.51
58
59 @estimate SubAntarcticSummerQ
60 parameter catchability[SubAntarcticSummerQ].q
61 type uniform
62 lower_bound 0.020
63 upper_bound 0.95
64
65 @estimate SubAntarcticAutumnQ
66 parameter catchability[SubAntarcticAutumnQ].q
67 type uniform

```

```

68   lower_bound 0.020
69   upper_bound 0.51
70   /*
71   # Process error
72   @estimate
73   parameter observation[CookStraitAcousticBiomass].process_error
74   lower_bound 0
75   upper_bound 10
76   type uniform
77   mcmc_fixed True
78
79   @estimate
80   parameter observation[WCSIAcousticBiomass].process_error
81   lower_bound 0
82   upper_bound 10
83   type uniform
84   mcmc_fixed True
85
86   @estimate
87   parameter observation[ChathamRiseSummerBiomass].process_error
88   lower_bound 0
89   upper_bound 10
90   type uniform
91   mcmc_fixed True
92
93   @estimate
94   parameter observation[SubAntarcticSummerBiomass].process_error
95   lower_bound 0
96   upper_bound 10
97   type uniform
98   mcmc_fixed True
99
100  @estimate
101  parameter observation[SubAntarcticAutumnBiomass].error_value_multiplier
102  lower_bound 0
103  upper_bound 10
104  type uniform
105  mcmc_fixed True
106
107  @estimate
108  parameter observation[SubAntarcticAEXAge].error_value_multiplier
109  lower_bound 0
110  upper_bound 10
111  type uniform
112  mcmc_fixed True
113
114  @estimate
115  parameter observation[SubAntarcticSHIAge].error_value_multiplier
116  lower_bound 0
117  upper_bound 10
118  type uniform
119  mcmc_fixed True
120
121  @estimate
122  parameter observation[ChathamRiseSHIAge].error_value_multiplier
123  lower_bound 0
124  upper_bound 10
125  type uniform
126  mcmc_fixed True
127  */
128
129  # Parameters
130  # Surveys
131  /*
132  @estimate
133  parameter selectivity[SelectivityChathamRiseSummerSurveyM].e
134  same selectivity[SelectivityChathamRiseSummerSurveyF].2

```

```

135 type uniform
136 lower_bound 0
137 upper_bound 18
138 */
139 @estimate
140 parameter selectivity[SelectivitySubAntarcticSummerSurveyM].a50
141 same selectivity[SelectivitySubAntarcticSummerSurveyF].a50
142 type normal_by_stdev
143 mu 7
144 sigma 5
145 lower_bound 1
146 upper_bound 20
147
148 @estimate
149 parameter selectivity[SelectivitySubAntarcticSummerSurveyM].ato95
150 same selectivity[SelectivitySubAntarcticSummerSurveyF].ato95
151 type normal_by_stdev
152 mu 3
153 sigma 5
154 lower_bound 1
155 upper_bound 10
156 /*
157 @estimate
158 parameter selectivity[SelectivitySubAntarcticAutumnSurveyM].a50
159 same selectivity[SelectivitySubAntarcticAutumnSurveyF].a50
160 type uniform
161 lower_bound 1
162 upper_bound 10
163
164 @estimate
165 parameter selectivity[SelectivitySubAntarcticAutumnSurveyM].ato95
166 same selectivity[SelectivitySubAntarcticAutumnSurveyF].ato95
167 type uniform
168 lower_bound 1
169 upper_bound 50
170
171 @estimate
172 parameter selectivity[SelectivitySubAntarcticAEXSurveyM].a50
173 same selectivity[SelectivitySubAntarcticAEXSurveyF].a50
174 type uniform
175 lower_bound 1
176 upper_bound 10
177
178 @estimate
179 parameter selectivity[SelectivitySubAntarcticAEXSurveyM].ato95
180 same selectivity[SelectivitySubAntarcticAEXSurveyF].ato95
181 type uniform
182 lower_bound 1
183 upper_bound 10
184
185 @estimate
186 parameter selectivity[SelectivitySubAntarcticSHISurveyM].a50
187 same selectivity[SelectivitySubAntarcticSHISurveyF].a50
188 type uniform
189 lower_bound 1
190 upper_bound 10
191
192 @estimate
193 parameter selectivity[SelectivitySubAntarcticSHISurveyM].ato95
194 same selectivity[SelectivitySubAntarcticSHISurveyF].ato95
195 type uniform
196 lower_bound 1
197 upper_bound 10
198
199 @estimate
200 parameter selectivity[SelectivityChathamRiseSHISurveyM].e
201 same selectivity[SelectivityChathamRiseSHISurveyF].e

```

```
202  type uniform
203  lower_bound 0
204  upper_bound 10
205  */
206
```

B.2.4 Observations fishery


```

0.00570900768428397 0 0 0 0 0 0 0 0 0 0 0 0.0958548915728862 0.271676383150468
0.072920942851894 0.0369861618899703 0.00936989978719414 0.00975027477791955
0.0116107212923911 0.00499040098782718 0 0.00519178701858852 0 0 0 0.0067766782862293 0 0
0
28 2012 0 0.109094196113803 0.149201572630631 0.0994717859748155 0.0807111961811361
0.0340790151342469 0 0 0 0 0 0 0 0 0 0 0 0.295824400182982 0.17018848588862
0.0180045364620121 0.0434248114317538 0 0 0 0 0 0 0 0 0 0
29 2013 0.00570302166298869 0 0.165096339233076 0.154541412343959 0.0449283852622419
0.0357314647191126 0.0140440194678146 0 0 0 0.0199237279674279 0 0 0 0 0 0
0.017466321803475 0.0879051549764596 0.343333440125845 0.0454584640718276
0.0410517565449272 0 0.0194186334800581 0.00539785834078744 0 0 0 0 0 0 0
30 2014 0 0.110796365999903 0.102668008957596 0.0676092190150807 0.0362181167645026
0.0217321713829919 0.0301812334129941 0.00973083281497126 0 0 0 0 0 0 0 0
0.183916925735685 0.101761607791086 0.0856235147388723 0.139079693118182
0.0506230433478215 0.0242813220891682 0.00495630146027226 0.00455011379968397
0.00741862191459053 0 0.0188529076565981 0 0 0 0 0 0
31 2015 0 0.00922699492575942 0.230825426948479 0.0753437042734111 0.0949027065635086
0.0452437483804001 0 0.0251732172432664 0.0110580488548273 0.00775582849241511 0 0 0 0
0 0 0 0 0.0198504683431099 0.213548895583108 0.038791678711807 0.0651582645632488
0.0315285523298253 0.0406934108761481 0.0304084407605101 0.0147190073568707
0.0155392906521851 0.00569205289719161 0.0127722052230951 0 0.0117680570208333 0 0 0 0
32 2016 0 0.0482066239562728 0.0190431751223616 0.184851011422726 0.106278124470617
0.0253944198950544 0.0247294479325465 0.0106690450215422 0.0198116176834401
0.0223562333841859 0.00438370563052096 0 0 0 0 0 0.0136229412145843
0.0130950724387997 0.0611128116556686 0.148708210031629 0.146558705048151
0.0253188105633088 0.0416593289358222 0.0282734607280306 0.0131289896516698
0.00281329463456466 0.00511921842211283 0.0166756694252021 0 0.00909504136559454
0.00909504136559454 0 0 0
33 2017 0.0148244406693199 0.150578410740195 0.155955520754185 0.0507970128027308
0.0309138712508268 0.00430099979814877 0 0.00848543504383143 0 0 0 0 0 0 0
0.272900868355853 0.179894596686248 0.0278486741235871 0.0229206962865683
0.0350220509610268 0.0305716640511563 0 0.0149857584763219 0 0 0 0 0 0 0
34 2018 0.0348748395298024 0.136316527605053 0.129841336421824 0.0656750805736937
0.0297062980483228 0.0379854078408467 0.00304977035981174 0 0.0162902201009416 0 0 0 0
0 0 0 0 0.0312002032783462 0.24805895908201 0.147303560883911 0.0198450632116508
0.0248920306918151 0.0443829687385369 0 0.00876330642767421 0 0.0181384973781477
0.00367592982761166 0 0 0 0 0 0
35 2019 0 0.0347461515177616 0.208666389002659 0.108249656539488 0.0799811171632861
0.00938941536465216 0.0177561713270063 0 0.016626645979608 0 0 0 0 0 0 0
0.325992154900624 0.130330891829169 0.032173769975097 0.0226943207599776 0 0
0.0133933156406707 0 0 0 0 0 0 0 0
36 2021 0.0625752809660902 0.114376590252786 0.109380123157328 0.100068789578106
0.0831688741645662 0.0294275363870971 0.00153592830480832 0.00153592830480832 0 0 0
0.00153592830480832 0 0 0 0 0.0506449491894964 0.0776178502038734 0.0814898201893649
0.139030098364637 0.077655816603729 0.0216540618702037 0.0053648042399142
0.00913901122922249 0 0.00118177886546642 0.0318064599233387 0 0 0 0
0.000810369900355787 0
37 2022 0.0842901146213864 0.10021084340894 0.163738718839876 0.040306125121042
0.0219007535539244 0.0451610267028669 0 0 0 0 0 0 0 0.152234193317855
0.167625208793697 0.0434604163886524 0.0297381218752083 0.0699300089585675
0.0793912539315657 0.00201321448641897 0 0 0 0 0 0 0 0
38 2023 0.0342066076912775 0.0964266374909309 0.122334312902214 0.0419042072098485
0.0264868224510351 0.030211393484512 0.0392479680487427 0.0254611445130809
0.00576175158307959 0.00587867174644618 0 0.00228563019224632 0 0 0 0
0.046960342298104 0.133180729031274 0.140007066786718 0.0795338807417801
0.0516964554582567 0.0459548094978937 0.0297575624512156 0.0237581416362324
0.00849287880803709 0.00680292416767049 0 0 0.00365006180940456 0 0 0 0
39 2024 0.0507099919494053 0.121967992117203 0.125852502785089 0.0705103999218438
0.0127093661790805 0.0079580604314024 0.00732926472734825 0.00195447197485608
0.00244331562799006 0 0 0 0 0 0 0 0.157861770530371 0.166414876669226
0.166047006223324 0.0780649170484656 0.0169278564414357 0.00327712852846604
0.00430058509691632 0.0041023587401778 0 0.00112430671202647 0.00044382829537224 0 0 0 0
0 0 0
40 end_table
41
42 table error_values
43 2001 85

```

```

44 2002 63
45 2003 46
46 2004 63
47 2005 133
48 2006 147
49 2007 39
50 2008 11
51 2009 17
52 2010 61
53 2011 66
54 2012 27
55 2013 68
56 2014 64
57 2015 135
58 2016 73
59 2017 57
60 2018 45
61 2019 38
62 2021 105
63 2022 37
64 2023 143
65 2024 137
66 end_table
67
68
69
70
71 @observation FisheryChathamRiseDeepAge
72 type process_removals_by_age
73 mortality_process Mortality
74 method_of_removal FisheryChathamRiseDeep
75 categories ChathamRise.Immature.M + ChathamRise.Mature.M ChathamRise.Immature.F +
ChathamRise.Mature.F
76 time_step DecMar
77 min_age 1
78 max_age 18
79 plus_group TRUE
80 sum_to_one TRUE
81 ageing_error AgeingError
82 likelihood multinomial
83 process_errors 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
84 error_value_multiplier 0.0422089418277348
85 likelihood_multiplier 1.0
86 years 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016
2017 2018 2019 2020 2021 2022 2023 2024
87 table obs
88 2001 0.000754896625947443 0.0366444930358286 0.148738688050782 0.0771286787540796
0.0469143675262126 0.0299053817854768 0.0212967116809056 0.0134411207145523
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0.00097592694800373 0 0 0 0.00188170508134664 0.000820675207824281 0.0155878960201522
0.17141431269709 0.147128227748533 0.0558395658484922 0.0661388264339352
0.0336125166637748 0.0469794326037012 0.0252969777134306 0.00719580620373303
0.0136128682973662 0.0142917899656121 0.00856359397145125 0.00433459298633612
0.00142305492185255 0.000200159386577138 0.000590742930646992 0.00188170508134664
89 2002 0.0480663636170083 0.02317055607307879 0.0685734443306294 0.139967510679053
0.0576140631241263 0.0169443486466107 0.00588722222160583 0.00146492255863357
0.00293350160543746 0.000846193065376369 0 0.000229589662002795 0.000665370089678791 0 0
0 0 0.00237135365828253 0.072269961798939 0.0115517975871003 0.0750363129248782
0.168090863542033 0.089738215938097 0.0508804336906258 0.0522516368112074
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90 2003 0 0.14855802106511 0.0447380756634628 0.0619943449031239 0.0800516499882087
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0.0633498452069288 0.081335792161846 0.100529462968556 0.0773705675204676

```

0.0122757500557484 0.0252486328000416 0.00591652030029908 0.0194778652944764
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91 2004 0.0464887728904547 0.0353457971267965 0.107548085706035 0.0320908888909042
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92 2005 0.0152514569008844 0.182467461018456 0.0764861176818267 0.0869508861748385
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0.00540494417009904 0.0014488930229062 0.00120156332038642
93 2006 0.0156860795888675 0.0479626791149141 0.142373214310268 0.0981428640889389
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94 2007 0.0222067125245923 0.0836918224543534 0.143112793960037 0.109634138404844
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95 2008 0.0132457864806928 0.0741968946867452 0.136212978950668 0.119610226802611
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0 0 0.0234116748544081 0.215614772287804 0.186338715870707 0.0682211916703573
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97 2010 0.00788267321966815 0.0166113702800437 0.196896660159694 0.0679870518889976
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98 2011 0.00653102505347002 0.0259605579876231 0.125926217898998 0.165480516860454
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99 2012 0 0.0203805756637215 0.114150145568748 0.128434617460382 0.0808296789129046
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0.00123829478387999 0.000477175298954095 0 0 0 0.000477814614854924
100 2013 0.00456765741841345 0.0516881464428582 0.0943201602552125 0.118131176306331
0.0776969369890102 0.0265237654577581 0.0249794109604905 0.00737089550979656
0.00528132500015216 0.0017768429111091 0 0 0 0 0 0 0.00651725443649537
0.0524597949201663 0.0593924524156356 0.187301017267825 0.0855742321861503
0.0667383408652613 0.0650349411893187 0.0293696765626162 0.0215559717912082
0.00203060171902808 0.00508480827430626 0.00147624788393452 0.00333411219820127
0.000411367333919957 0 0.000508665573740045 0.000874198131061622 0
101 2014 0.00354149186616066 0.14989269400907 0.0326672681794556 0.0720096415823204
0.05606942712984 0.0197183411184355 0.0263208541974652 0.0169756059096681
0.00586111399990569 0.00245465058551852 0.00228022253317425 0.000985364382724812
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0.000996737202838828 0.000355115594113409 0.000554315117385959 0 0.00100722431062735
102 2015 0.00217132934034051 0.0335642798110072 0.198523978870301 0.0468358851695952
0.0708755411654654 0.0203770743053682 0.0148869335311259 0.00682174680677222
0.003914276700802 0.00865481021279107 0.0017253536714113 0.00185269247991361
0.00263659485155911 0.00177771602880675 0 0 0 0.00187980835128138 0.0283786125518011
0.249589360267698 0.0978310966985838 0.118689274373432 0.0315361278075976
0.0112809886686594 0.01331951838353 0.0122632469205138 0.00745280753343215
0.00560430960304066 0.00415975889981303 0 0.0015781286431773 0.000457825482962104
0.000960954699779969 0.000399968473708706 0
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0.0650152757294911 0.0574640825987312 0.0602958773362226 0.0415172683265365
0.0126921075569885 0.00754834643252247 0.00845153722979962 0.00188338897642204
0.00131801457265208 0.000906025191514337 0.000242033107272757 0.00111165859189433
0.000498257201004506 0.00909870974571269 0.019728434204965 0.0143363772371038
0.00866829903912425 0.0599274765537545 0.0713994176592748 0.109460531467398
0.10457757711748 0.10174631368909 0.0583140686618783 0.0337938930164137
0.0175229880222527 0.00932673083380268 0.0038852095478845 0.00480022225230165
0.00400118817269521 0.00137609169087732

667 2018 0.00907949585503297 0.0781211180649679 0.111232711908741 0.0179003290352703
0.0234620521961106 0.0574885282866355 0.0074919899060329 0.0321564106733701
0.0203886986124435 0.00529707722765288 0.00393993216276947 0.00151108531573351
0.00385001929994944 0.00178813536621997 0 0 9.78322543407763e-05 0.0025301210151609
0.0390126413230524 0.0457866066998732 0.0344620199740354 0.0429237398700861
0.13425758488194 0.0520918339743826 0.121532346721144 0.060266024057709
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0.00683828449852769 0.0014333065806056 0.000408130883940402 0.000263545136860082

668 2019 0.0017204803846089 0.0203569301874541 0.0997748860761569 0.117622008215334
0.0516136206060821 0.036806312438007 0.0376619414338816 0.0129505546993818

```

0.0142644547465421 0.00879451090591982 0.00457307308657259 0.00242088584960839
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0.0420898321208333 0.0393831355112042 0.024068935589521 0.00590638495763153
0.00388818554626426 0.00148755291586059 0.00178294240016796 0.000716631933106333
669 2020 0.0237988543363961 0.0020999810597395 0.0186497847828718 0.0919776860432853
0.126308860448271 0.0789225142476765 0.0312980139939515 0.0263618141444215
0.00904145066594458 0.0046677940112849 0.00213604461636989 0.0011300566830305
0.00105188635602546 0 0 0 5.9096344333713e-05 0.00873687126457779 0.00269960358546529
0.00930199746901065 0.0520555974407255 0.107551472173013 0.10066448435313
0.108475985298641 0.0645895641950552 0.0422486501753488 0.0360160095389857
0.026555761303252 0.0100158767368636 0.00594028624209073 0.00456068197647103
0.00226231635319898 0.000474142264171948 0.000346861896396418
670 2021 0.0135586153851526 0.0294087879814158 0.015434976726646 0.0412614855193011
0.0674923934643424 0.0776046251208111 0.0552331958702308 0.0146712163653221
0.0208516050240588 0.00312775784719361 0 0.000996846730342754 0.00259485000094453
0.00104363347900428 0 0 1.35039319847138e-05 0.00760325427375049 0.00956529976574046
0.00687685289163043 0.0171127763574275 0.0570140391365075 0.146469553089394
0.120755127078311 0.0649677966358978 0.075426041895266 0.0687121785261008
0.0350191479560945 0.00997920119808205 0.0135272026358717 0.0134461629730717 0
0.0054909590934299 0.00474091304667275
671 2022 0.012681573896399 0.0626291478785896 0.0542197835010659 0.0453285075301676
0.0428885188096602 0.0985291038727767 0.0537219402740224 0.0275252386109701
0.00869764759770387 0.00925151170398736 0.00585717780169676 0 0.000924363206561632
0.00135568153788193 0 6.76110695637874e-05 0.00576445140108076 0.0101611351412891
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0.00194232272841705 0.00171408638512587 0.00271858092857629
672 2023 0.00163745116753704 0.0418253656709447 0.104359160576815 0.0678280329289036
0.0429134642834975 0.0513374616093918 0.0488777798758877 0.0283769834343689
0.0105062485235756 0.00366955335680623 0.00179101389790867 0.00381286239536054 0 0 0 0
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0.0129597241535393 0.00288000717782245 0.00141068499710777 0.00441050614699893 0
0.00128589006498959
673 2024 0.000113659362434591 0.00224378870518093 0.0307748537064066 0.0957655833612727
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0.0282883296146595 0.0201270825708131 0.017451387806911 0.0058031814912644
0.00504789626862104 0.00483684640692305 0.00277270971675318 0.000152505546299921
674 end_table
675
676 table error_values
677 1988 791
678 1989 599
679 1990 590
680 1991 736
681 1992 676
682 1993 725
683 1994 448
684 1995 896
685 1996 1008
686 1997 605
687 1998 701
688 1999 776
689 2000 774
690 2001 825
691 2002 877
692 2003 723
693 2004 854
694 2005 1140

```

695	2006	1024
696	2007	511
697	2008	574
698	2009	573
699	2010	511
700	2011	670
701	2012	664
702	2013	867
703	2014	870
704	2015	1031
705	2016	834
706	2017	729
707	2018	976
708	2019	1081
709	2020	833
710	2021	776
711	2022	743
712	2023	952
713	2024	1026
714	end_table	
715		
716		
717		
718		
719		

B.2.5 Observations survey

```

1  @observation CookStraitAcousticBiomass
2  type biomass
3  time_step JulSep
4  time_step_proportion 0.5
5  categories CookStrait.Mature.M + CookStrait.Mature.F
6  selectivities SelectivityOne SelectivityOne
7  catchability CookStraitAcousticQ
8  likelihood lognormal
9  process_error 0.0
10 error_value_multiplier 1.0
11 likelihood_multiplier 1.0
12 years 1991 1993 1994 1995 1996 1997 1998 1999 2001 2002 2003 2005 2006 2007 2008 2009
    2011 2013 2015 2017 2019 2021 2023
13 table obs
14 1991 88247.565 0.41
15 1993 282537.285 0.52
16 1994 277977.2016 0.91
17 1995 193889.0408 0.61
18 1996 92408.95769 0.57
19 1997 140626.4634 0.40
20 1998 79550.3042 0.44
21 1999 114409.8282 0.36
22 2001 102034.0909 0.30
23 2002 145075.0048 0.35
24 2003 104148.7844 0.34
25 2005 59139.10151 0.32
26 2006 59669.34895 0.34
27 2007 104427.6999 0.46
28 2008 82252.28529 0.30
29 2009 165538.3474 0.39
30 2011 140964.7624 0.35
31 2013 167829.5328 0.30
32 2015 203533.5384 0.33
33 2017 101733.8644 0.36
34 2019 91116.11374 0.36
35 2021 158893.5 0.41
36 2023 58675.29 0.38
37 end_table
38
39
40
41
42 @observation ECSIAcousticBiomass
43 type biomass
44 time_step JulSep
45 time_step_proportion 0.5
46 categories CookStrait.Mature.M + CookStrait.Mature.F
47 selectivities SelectivityECSISpawningFisheryM SelectivityECSISpawningFisheryF
48 catchability ECSIAcousticQ
49 likelihood lognormal
50 process_error 0.0
51 error_value_multiplier 1.0
52 likelihood_multiplier 1.0
53 years 2002 2003 2006 2008 2013 2019 2021 2023
54 table obs
55 2002 60000 0.33
56 2003 45000 0.47
57 2006 17000 0.63
58 2008 20000 1.07
59 2013 64000 0.74
60 2019 55000 0.92
61 2021 102000 0.30
62 2023 103000 0.53
63 end_table
64
65
66

```

```

67
68 @observation WCSIAcousticBiomass
69 type biomass
70 time_step JulSep
71 time_step_proportion 0.5
72 catchability WCSIAcousticQ
73 categories WCSI.Mature.M + WCSI.Mature.F
74 selectivities SelectivityOne SelectivityOne
75 likelihood lognormal
76 process_error 0.0
77 error_value_multiplier 1.0
78 likelihood_multiplier 1.0
79 years 1988 1989 1990 1991 1992 1993 1997 2000 2012 2013 2018 2024
80 table obs
81 1988 266265.4393 0.60
82 1989 165189.2979 0.38
83 1990 169048.7622 0.40
84 1991 227139.9065 0.73
85 1992 228885.0556 0.49
86 1993 379902.3464 0.38
87 1997 445491.0422 0.60
88 2000 262870.8502 0.60
89 2012 283102.407 0.50
90 2013 233385.3339 0.53
91 2018 123206.777 0.51
92 2024 116401 0.53
93 end_table
94
95
96
97
98 @observation ChathamRiseSummerBiomass
99 type biomass
100 time_step DecMar
101 time_step_proportion 0.6
102 categories ChathamRise.Immature.M + ChathamRise.Mature.M + ChathamRise.Immature.F +
ChathamRise.Mature.F
103 selectivities SelectivityChathamRiseSummerSurveyM SelectivityChathamRiseSummerSurveyM
SelectivityChathamRiseSummerSurveyF SelectivityChathamRiseSummerSurveyF
104 catchability ChathamRiseSummerQ
105 likelihood lognormal
106 process_error 0.1
107 error_value_multiplier 1.0
108 likelihood_multiplier 1.0
109 years 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007
2008 2009 2010 2011 2012 2013 2014 2016 2018 2020 2022 2024
110 table obs
111 1992 117243.0 0.077
112 1993 145595.0 0.103
113 1994 125776.0 0.098
114 1995 112002.0 0.076
115 1996 111434.0 0.098
116 1997 153617.0 0.084
117 1999 81332.9 0.109
118 1998 81716.1 0.116
119 2000 53052.3 0.123
120 2001 59845.2 0.097
121 2002 49782.6 0.114
122 2003 47281.2 0.087
123 2004 35977.2 0.127
124 2005 61423.2 0.115
125 2006 68664.1 0.106
126 2007 59158.6 0.084
127 2008 57219.4 0.110
128 2009 114284.0 0.106
129 2010 74446.4 0.146
130 2011 62029.5 0.140

```

```

131 2012 84330.4 0.098
132 2013 65681.3 0.153
133 2014 94778.8 0.098
134 2016 59100.3 0.142
135 2018 85348.0 0.160
136 2020 61200.0 0.144
137 2022 88999.0 0.101
138 2024 93643 0.134
139 end_table
140
141
142
143
144 @observation SubAntarcticSummerBiomass
145 type biomass
146 time_step DecMar
147 time_step_proportion 0.5
148 categories SubAntarctic.Immature.M + SubAntarctic.Mature.M + SubAntarctic.Immature.F +
SubAntarctic.Mature.F
149 selectivities SelectivitySubAntarcticSummerSurveyM SelectivitySubAntarcticSummerSurveyM
SelectivitySubAntarcticSummerSurveyF SelectivitySubAntarcticSummerSurveyF
150 catchability SubAntarcticSummerQ
151 likelihood lognormal
152 process_error 0.1
153 error_value_multiplier 1.0
154 likelihood_multiplier 1.0
155 years 1992 1993 1994 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2012 2013 2015
2017 2019 2021 2023 2025
156 table obs
157 1992 78433.74 0.066
158 1993 87420.74 0.0611
159 1994 95608.1 0.0896
160 2001 55523.15 0.1263
161 2002 37582.2 0.1568
162 2003 37424.65 0.1417
163 2004 12429.37 0.1429
164 2005 13537.54 0.0928
165 2006 18392.99 0.1383
166 2007 13111.88 0.1141
167 2008 42894.7 0.1692
168 2009 44439.29 0.1452
169 2010 53365.81 0.1251
170 2012 44221.17 0.1524
171 2013 54532.85 0.1536
172 2015 29071.84 0.1267
173 2017 30698.88 0.1295
174 2019 30075.57 0.1144
175 2021 31219.83 0.1237
176 2023 48455.7 0.0912
177 2025 79719.02 0.2224
178 end_table
179
180
181
182
183 @observation SubAntarcticAutumnBiomass
184 type biomass
185 time_step AprJun
186 time_step_proportion 0.1
187 categories SubAntarctic.Immature.M + SubAntarctic.Mature.M + SubAntarctic.Immature.F +
SubAntarctic.Mature.F
188 selectivities SelectivitySubAntarcticAutumnSurveyM SelectivitySubAntarcticAutumnSurveyM
SelectivitySubAntarcticAutumnSurveyF SelectivitySubAntarcticAutumnSurveyF
189 catchability SubAntarcticAutumnQ
190 likelihood lognormal
191 process_error 0.1
192 error_value_multiplier 1.0

```

```

193 likelihood_multiplier 1.0
194 years 1992 1996 1998
195 table obs
196 1992 67832 0.083
197 1996 89029 0.092
198 1998 67709 0.110
199 end_table
200
201
202
203
204 @observation SubAntarcticAEXAge
205 type proportions_at_age
206 time_step DecMar
207 time_step_proportion 0.6
208 categories SubAntarctic.Immature.M + SubAntarctic.Mature.M SubAntarctic.Immature.F +
SubAntarctic.Mature.F
209 selectivities SelectivitySubAntarcticAEXSurveyM SelectivitySubAntarcticAEXSurveyF
210 min_age 2
211 max_age 6
212 plus_group TRUE
213 ageing_error AgeingError
214 likelihood multinomial
215 process_errors 0.0 0.0
216 error_value_multiplier 1
217 likelihood_multiplier 1.0
218 years 1990 1991
219 table obs
220 1990 0.021505376 0.008602151 0.019354839 0.255913978 0.120430108 0.021505376 0.006451613
0.019354839 0.268817204 0.258064516
221 1991 0.03218391 0.07586207 0.02758621 0.13333333 0.09655172 0.02528736 0.07356322
0.04137931 0.12413793 0.37011494
222 end_table
223
224 table error_values
225 1990 5
226 1991 5
227 end_table
228
229
230
231
232 @observation SubAntarcticSHIAge
233 type proportions_at_age
234 time_step DecMar
235 time_step_proportion 0.6
236 categories SubAntarctic.Immature.M + SubAntarctic.Mature.M SubAntarctic.Immature.F +
SubAntarctic.Mature.F
237 selectivities SelectivitySubAntarcticSHISurveyM SelectivitySubAntarcticSHISurveyF
238 min_age 2
239 max_age 10
240 plus_group TRUE
241 sum_to_one TRUE
242 ageing_error AgeingError
243 likelihood multinomial
244 process_errors 0.0
245 error_value_multiplier 1
246 likelihood_multiplier 1.0
247 years 1984
248 table obs
249 1984 2.668759e-05 4.430140e-04 2.668759e-04 2.722134e-02 7.419150e-02 9.714283e-02
7.152274e-02 7.312400e-02 0.08646779 5.604394e-04 5.871270e-04 4.483515e-02 7.472525e-02
1.003453e-01 1.158241e-01 7.899527e-02 3.949763e-02 1.142229e-01
250 end_table
251
252 table error_values
253 1984 5

```

```

254 end_table
255
256
257
258
259 @observation ChathamRiseSHIAge
260 type proportions_at_age
261 time_step DecMar
262 time_step_proportion 0.6
263 categories ChathamRise.Immature.M + ChathamRise.Mature.M ChathamRise.Immature.F +
ChathamRise.Mature.F
264 selectivities SelectivityChathamRiseSHISurveyM SelectivityChathamRiseSHISurveyF
265 min_age 2
266 max_age 9
267 plus_group TRUE
268 sum_to_one TRUE
269 ageing_error AgeingError
270 likelihood multinomial
271 process_errors 0.0
272 error_value_multiplier 1
273 likelihood_multiplier 1.0
274 years 1983
275 table obs
276 1983 0.1173777529 0.2111396632 0.0635991012 0.0332024719 0.0056116854 0.0009118989
0.0030396629 0.0004419202 0.1365510114 0.1896282025 0.1498787642 0.0339039326
0.0194070787 0.0102880899 0.0114571910 0.0135615730
277 end_table
278
279 table error_values
280 1983 5
281 end_table
282
283
284
285
286 @observation ChathamRiseSummerAge
287 type proportions_at_age
288 time_step DecMar
289 time_step_proportion 0.6
290 categories ChathamRise.Immature.M + ChathamRise.Mature.M ChathamRise.Immature.F +
ChathamRise.Mature.F
291 selectivities SelectivityChathamRiseSummerSurveyM SelectivityChathamRiseSummerSurveyF
292 ageing_error AgeingError
293 min_age 2
294 max_age 13
295 plus_group TRUE
296 likelihood multinomial
297 process_errors 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
298 error_value_multiplier 0.0335029770140805
299 likelihood_multiplier 1.0
300 years 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007
2008 2009 2010 2011 2012 2013 2014 2016 2018 2020 2022 2024
301 table obs
302 1992 0.024381653310976 0.247836745453897 0.147479453268408 0.0231586271423216
0.00515356433258101 0.0085989975939229 0.00494072320605722 0.00131918281972357
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0.00268266252364751 0.00376847639246175 0.00282203564710725 0.00855578112153228
303 1993 0.00977431855392742 0.0552746764519553 0.222676336769703 0.127057913660186
0.0119052516393375 0.0122322963889323 0.00956451626173453 0.00197872357930938
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0.0055494763170236 0.00188822062973598 0.00282616028895124 0.00736981973457953
304 1994 0.274074786546116 0.0121635419287057 0.0309741191790349 0.0818775063259296
0.0402654670829696 0.0061957116855828 0.00468784681631868 0.00299057399488007

```

0.00276417230204649 0.000147974962636322 0.000147974962636322 0.00219446869589665
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0.00678909128575445 0.00422172568401426 0.00281004454046375 0.00782195652495598
305 1995 0.2718444905259413 0.11236772136988 0.0121328531797355 0.0189649452615283
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306 0.00446658236733673 0.00392208241782017 0.000983225074402973 0.00351941689223949
1996 0.138868675560531 0.228574390231261 0.0470317504742358 0.00661960589192607
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307 1997 0.323579027795961 0.0373005874260352 0.0449519349431568 0.0370162105547817
0.00521321826622397 0.0090077153698724 0.00944882396749733 0.00352305384273637
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308 1998 0.0686836310106784 0.286179817297933 0.034265838037407 0.0337268728742632
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309 1999 0.134272437689558 0.0890052356020942 0.161767820532371 0.0130678256154798
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436 categories SubAntarctic.Immature.M + SubAntarctic.Mature.M SubAntarctic.Immature.F +
SubAntarctic.Mature.F
437 selectivities SelectivitySubAntarcticAutumnSurveyM SelectivitySubAntarcticAutumnSurveyF
438 min_age 2
439 max_age 15
440 plus_group TRUE
441 ageing_error AgeingError
442 sum_to_one TRUE
443 likelihood multinomial
444 process_errors 0 0 0
445 error_value_multiplier 0.54760215217137
446 likelihood_multiplier 1.0
447 years 1992 1996 1998
448 table obs

```

```

449 1992 0.013118 0.059901 0.13316 0.008441 0.028278 0.065237 0.064278 0.015269 0.008562
    0.004832 0.001474 0.001256 0.001256 0.006192 1e-04 0.036813 0.17361 0.012739 0.052545
    0.13831 0.079153 0.023387 0.021406 0.017684 0.009491 0.011604 0.008741 0.003163
450 1996 0.096951 0.174331 0.107319 0.003837 0.0079 0.032796 0.035954 0.00251 0.005663
    0.008163 0.001266 0.00096 0.000569 0.00011 0.088084 0.15215 0.077643 0.007186 0.010082
    0.05615 0.07618 0.006404 0.018146 0.017132 0.006386 0.002375 0.00231 0.001443
451 1998 0.014676 0.092163 0.057829 0.118981 0.071411 0.014817 0.01053 0.015554 0.015091
    0.004496 0.005704 0.00091 0.002671 1e-04 0.020344 0.089263 0.054525 0.134439 0.091695
    0.025744 0.020915 0.057038 0.038373 0.00852 0.010801 0.012873 0.003755 0.006783
452 end_table
453
454 table error_values
455 1992 21.4417473194557
456 1996 25.191123899907
457 1998 32.4555410245313
458 end_table
459
460
461
462
463

```

B.2.6 Population

```

1  @model
2  min_age 1
3  max_age 18
4  age_plus TRUE
5  start_year 1972
6  final_year 2025
7  projection_final_year 2029
8  type age
9  base_weight_units tonnes
10 initialisation_phases phase1
11 time_steps OctNov DecMar AprJun EndJun JulSep
12 length_bins 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
13 length_plus FALSE
14 threads 1
15
16
17 @initialisation_phase phase1
18 type derived
19
20
21 @categories
22 format area.maturity.sex
23 names ChathamRise.Immature.M ChathamRise.Mature.M ChathamRise.Immature.F
    ChathamRise.Mature.F CookStrait.Mature.M CookStrait.Mature.F SubAntarctic.Immature.M
    SubAntarctic.Mature.M SubAntarctic.Immature.F SubAntarctic.Mature.F WCSI.Mature.M
    WCSI.Mature.F
24 age_lengths AgeLengthEastM AgeLengthEastM AgeLengthEastF AgeLengthEastF AgeLengthEastM
    AgeLengthEastF AgeLengthWestM AgeLengthWestM AgeLengthWestF AgeLengthWestF AgeLengthWestM
    AgeLengthWestF
25
26
27 @time_step OctNov
28 processes WestReturnMigration EastReturnMigration Mortality
29
30
31 @time_step DecMar
32 processes Recruitment Mortality
33
34
35 @time_step AprJun
36 processes EastMaturation WestMaturation WestHomeMigration Mortality
37
38
39 @time_step EndJun
40 processes EastSpawningMigration WestSpawningMigration
41
42
43 @time_step JulSep
44 processes Ageing Mortality
45
46
47 @process None
48 type null_process
49
50
51 @process Ageing
52 type ageing
53 categories *
54
55
56 @process EastMaturation
57 type transition_category
58 from ChathamRise.Immature.M ChathamRise.Immature.F
59 to ChathamRise.Mature.M ChathamRise.Mature.F
60 selectivities SelectivityEastMaturationM SelectivityEastMaturationF
61 proportions 1.0 1.0
62

```

```

63
64 @process WestMaturation
65 type transition_category
66 from SubAntarctic.Immature.M SubAntarctic.Immature.F
67 to SubAntarctic.Mature.M SubAntarctic.Mature.F
68 selectivities SelectivityWestMaturationM SelectivityWestMaturationF
69 proportions 1.0 1.0
70
71
72 @process WestHomeMigration
73 type transition_category
74 from ChathamRise.Immature.M ChathamRise.Mature.M ChathamRise.Immature.F
75 ChathamRise.Mature.F
76 to SubAntarctic.Immature.M SubAntarctic.Mature.M SubAntarctic.Immature.F
77 SubAntarctic.Mature.F
78 selectivities SelectivityWestHomeMigrationM SelectivityWestHomeMigrationM
79 SelectivityWestHomeMigrationF SelectivityWestHomeMigrationF
80 proportions 1.0 1.0 1.0 1.0
81
82
83 @process WestSpawningMigration
84 type transition_category
85 from SubAntarctic.Mature.M SubAntarctic.Mature.F
86 to WCSI.Mature.M WCSI.Mature.F
87 selectivities SelectivityOne SelectivityOne
88 proportions 1.0 1.0
89
90
91 @process WestReturnMigration
92 type transition_category
93 from WCSI.Mature.M WCSI.Mature.F
94 to SubAntarctic.Mature.M SubAntarctic.Mature.F
95 selectivities SelectivityOne SelectivityOne
96 proportions 1.0 1.0
97
98
99 @process EastSpawningMigration
100 type transition_category
101 from ChathamRise.Mature.M ChathamRise.Mature.F
102 to CookStrait.Mature.M CookStrait.Mature.F
103 selectivities SelectivityOne SelectivityOne
104 proportions 1.0 1.0
105
106
107 @process EastReturnMigration
108 type transition_category
109 from CookStrait.Mature.M CookStrait.Mature.F
110 to ChathamRise.Mature.M ChathamRise.Mature.F
111 selectivities SelectivityOne SelectivityOne
112 proportions 1.0 1.0
113
114
115 @derived_quantity TotalSSB
116 type biomass
117 time_step JulSep
118 categories CookStrait.Mature.M CookStrait.Mature.F WCSI.Mature.M WCSI.Mature.F
119 selectivities SelectivityOne SelectivityOne SelectivityOne SelectivityOne
120 time_step_proportion 0.5
121 time_step_proportion_method weighted_sum
122
123
124 @derived_quantity EastSSB
125 type biomass
126 time_step JulSep
127 categories CookStrait.Mature.M CookStrait.Mature.F
128 selectivities SelectivityOne SelectivityOne
129 time_step_proportion 0.5

```

```

127 time_step_proportion_method weighted_sum
128
129
130 @derived_quantity WestSSB
131 type biomass
132 time_step JulSep
133 categories WCSI.Mature.M WCSI.Mature.F
134 selectivities SelectivityOne SelectivityOne
135 time_step_proportion 0.5
136 time_step_proportion_method weighted_sum
137
138
139 @derived_quantity WestRecruitApprox
140 type abundance
141 time_step JulSep
142 categories WCSI.Mature.M WCSI.Mature.F
143 selectivities Select2yrs Select2yrs
144 time_step_proportion 0.5
145 time_step_proportion_method weighted_sum
146
147
148 @derived_quantity EastRecruitApprox
149 type abundance
150 time_step JulSep
151 categories CookStrait.Mature.M CookStrait.Mature.F
152 selectivities Select2yrs Select2yrs
153 time_step_proportion 0.5
154 time_step_proportion_method weighted_sum
155
156
157 @derived_quantity VulnerableBiomass_CookStraitFishery
158 type biomass
159 time_step JulSep
160 categories CookStrait.Mature.M CookStrait.Mature.F
161 selectivities SelectivityCookStraitSpawningFisheryM SelectivityCookStraitSpawningFisheryF
162 time_step_proportion 0.5
163 time_step_proportion_method weighted_sum
164
165
166 @derived_quantity VulnerableBiomass_WCSINorthFishery
167 type biomass
168 time_step JulSep
169 categories WCSI.Mature.M WCSI.Mature.F
170 selectivities SelectivityWCSINorthFisheryM SelectivityWCSINorthFisheryF
171 time_step_proportion 0.5
172 time_step_proportion_method weighted_sum
173
174
175 @derived_quantity VulnerableBiomass_ECISFishery
176 type biomass
177 time_step JulSep
178 categories CookStrait.Mature.M CookStrait.Mature.F
179 selectivities SelectivityECISpawningFisheryM SelectivityECISpawningFisheryF
180 time_step_proportion 0.5
181 time_step_proportion_method weighted_sum
182
183
184 @derived_quantity VulnerableBiomass_WCSISouthFishery
185 type biomass
186 time_step JulSep
187 categories WCSI.Mature.M WCSI.Mature.F
188 selectivities SelectivityWCSISouthFisheryM SelectivityWCSISouthFisheryF
189 time_step_proportion 0.5
190 time_step_proportion_method weighted_sum
191
192
193 @derived_quantity VulnerableBiomass_WCSIInsideFishery

```



```

253 2005 25070.5 6388.9 23032.1 4837 2654.3 2292.6 1399.3 7893.1 21241.6 9459.1
254 2006 23993.8 11231.8 19836.2 2155.9 1232.4 4842.6 883.2 5220.4 19001.4 15985.2
255 2007 32296.2 6534.5 17796.2 2973.2 1779.7 5388.1 650.7 3108.8 23936.3 6541
256 2008 31865.9 6588.4 15586.5 5312.9 2800.7 4556.8 1525.3 913.5 17085.2 3082
257 2009 32578.9 7292.1 14836.2 3480.3 2200.6 6393.8 1325.6 1151.4 16837.1 2705.1
258 2010 33637.2 6971.4 15697.4 1998.6 2527.2 8364.9 1549.6 2933 31172.7 2356.7
259 2011 32947.6 9845.2 11646.4 2157.3 3272.1 7804.7 1656.6 7509.1 36551.6 5410.8
260 2012 33790.8 7404 12875.5 4423.8 2973.3 11195.2 1988.4 8486.5 36478.9 10491.5
261 2013 31368.2 8183.8 15265.8 5476.6 4256.7 7818.8 2518 6858.2 35648.8 14180.5
262 2014 30944.7 7060.7 14595.7 3627.2 5784.2 7405.5 7114.8 10355.2 44435.4 15019
263 2015 36885.9 7261.7 16161.6 4250.5 4574.6 9369.5 3012.9 13388 51146 15477.4
264 2016 29847.5 9536.6 15431.9 5311.4 2406.2 2716.1 1643.9 16171.5 38320.6 15333.3
265 2017 34799.8 8354.1 12738.9 5441.7 2493.7 6046.1 4922.5 16764.3 33299.4 16705.8
266 2018 31289 9020.5 18059.5 4948.1 3692.5 4916.9 7007.6 17087.4 19351.8 20045.3
267 2019 29886.7 6181.4 18971.6 10624.7 2440.5 4367.2 2494.4 14990.4 15368.6 17134.3
268 2020 25815.6 4766.6 15101.1 9738 3013.2 3906.3 1211.2 13727.6 18206.7 12250.3
269 2021 31250.7 4126.3 11043.8 9665.4 4104.5 3702 1538.5 9985.1 12421.6 12980.8
270 2022 28777.9 4346 8335.1 9694 3052.4 2703.6 2624.7 9747.7 10700.8 11682.4
271 2023 34371.6 4891.6 12014.1 10908.2 5065.1 2581.5 5285 10320.8 7851.2 12266.6
272 2024 34327.3 6048.4 10702.6 15508.2 2495.4 1543.6 3746.3 10089.1 7123.1 15451.4
273 2025 34327.3 6048.4 10702.6 15508.2 2495.4 1543.6 3746.3 10089.1 7123.1 15451.4
274 end_table
275
276
277 table method
278 method category selectivity u_max time_step penalty
279 FisheryChathamRiseDeep ChathamRise.Immature.M SelectivityChathamRiseDeepFisheryM 0.95
DecMar PenaltyCatchMustBetaken
280 FisheryChathamRiseDeep ChathamRise.Immature.F SelectivityChathamRiseDeepFisheryF 0.95
DecMar PenaltyCatchMustBetaken
281 FisheryChathamRiseDeep ChathamRise.Mature.M SelectivityChathamRiseDeepFisheryM 0.95
DecMar PenaltyCatchMustBetaken
282 FisheryChathamRiseDeep ChathamRise.Mature.F SelectivityChathamRiseDeepFisheryF 0.95
DecMar PenaltyCatchMustBetaken
283 FisheryChathamRiseDeep ChathamRise.Immature.M SelectivityChathamRiseDeepFisheryM 0.95
DecMar PenaltyCatchMustBetaken
284 FisheryChathamRiseDeep ChathamRise.Immature.F SelectivityChathamRiseDeepFisheryF 0.95
DecMar PenaltyCatchMustBetaken
285 FisheryChathamRiseDeep ChathamRise.Mature.M SelectivityChathamRiseDeepFisheryM 0.95
DecMar PenaltyCatchMustBetaken
286 FisheryChathamRiseDeep ChathamRise.Mature.F SelectivityChathamRiseDeepFisheryF 0.95
DecMar PenaltyCatchMustBetaken
287 FisheryChathamRiseShallow ChathamRise.Immature.M SelectivityChathamRiseShallowFisheryM
0.95 DecMar PenaltyCatchMustBetaken
288 FisheryChathamRiseShallow ChathamRise.Immature.F SelectivityChathamRiseShallowFisheryF
0.95 DecMar PenaltyCatchMustBetaken
289 FisheryChathamRiseShallow ChathamRise.Mature.M SelectivityChathamRiseShallowFisheryM 0.95
DecMar PenaltyCatchMustBetaken
290 FisheryChathamRiseShallow ChathamRise.Mature.F SelectivityChathamRiseShallowFisheryF 0.95
DecMar PenaltyCatchMustBetaken
291 FisheryChathamRiseShallow ChathamRise.Immature.M SelectivityChathamRiseShallowFisheryM
0.95 DecMar PenaltyCatchMustBetaken
292 FisheryChathamRiseShallow ChathamRise.Immature.F SelectivityChathamRiseShallowFisheryF
0.95 DecMar PenaltyCatchMustBetaken
293 FisheryChathamRiseShallow ChathamRise.Mature.M SelectivityChathamRiseShallowFisheryM 0.95
DecMar PenaltyCatchMustBetaken
294 FisheryChathamRiseShallow ChathamRise.Mature.F SelectivityChathamRiseShallowFisheryF 0.95
DecMar PenaltyCatchMustBetaken
295 FisheryCookStraitSpawning CookStrait.Mature.M SelectivityCookStraitSpawningFisheryM 0.95
JulSep PenaltyCatchMustBetaken
296 FisheryCookStraitSpawning CookStrait.Mature.F SelectivityCookStraitSpawningFisheryF 0.95
JulSep PenaltyCatchMustBetaken
297 FisheryECSISpawning CookStrait.Mature.M SelectivityECSISpawningFisheryM 0.95 JulSep
PenaltyCatchMustBetaken
298 FisheryECSISpawning CookStrait.Mature.F SelectivityECSISpawningFisheryF 0.95 JulSep
PenaltyCatchMustBetaken
299 FisherySubAntarcticAuckland SubAntarctic.Immature.M

```

```

300 SelectivitySubAntarcticAucklandFisheryM 0.95 DecMar PenaltyCatchMustBetaken
FisherySubAntarcticAuckland SubAntarctic.Immature.F
301 SelectivitySubAntarcticAucklandFisheryF 0.95 DecMar PenaltyCatchMustBetaken
FisherySubAntarcticAuckland SubAntarctic.Mature.M SelectivitySubAntarcticAucklandFisheryM
0.95 DecMar PenaltyCatchMustBetaken
302 FisherySubAntarcticAuckland SubAntarctic.Mature.F SelectivitySubAntarcticAucklandFisheryF
0.95 DecMar PenaltyCatchMustBetaken
303 FisherySubAntarcticSnares SubAntarctic.Immature.M SelectivitySubAntarcticSnaresFisheryM
0.95 DecMar PenaltyCatchMustBetaken
304 FisherySubAntarcticSnares SubAntarctic.Immature.F SelectivitySubAntarcticSnaresFisheryF
0.95 DecMar PenaltyCatchMustBetaken
305 FisherySubAntarcticSnares SubAntarctic.Mature.M SelectivitySubAntarcticSnaresFisheryM
0.95 DecMar PenaltyCatchMustBetaken
306 FisherySubAntarcticSnares SubAntarctic.Mature.F SelectivitySubAntarcticSnaresFisheryF
0.95 DecMar PenaltyCatchMustBetaken
307 FisherySubAntarcticSuba SubAntarctic.Immature.M SelectivitySubAntarcticSubaFisheryM 0.95
DecMar PenaltyCatchMustBetaken
308 FisherySubAntarcticSuba SubAntarctic.Immature.F SelectivitySubAntarcticSubaFisheryF 0.95
DecMar PenaltyCatchMustBetaken
309 FisherySubAntarcticSuba SubAntarctic.Mature.M SelectivitySubAntarcticSubaFisheryM 0.95
DecMar PenaltyCatchMustBetaken
310 FisherySubAntarcticSuba SubAntarctic.Mature.F SelectivitySubAntarcticSubaFisheryF 0.95
DecMar PenaltyCatchMustBetaken
311 FisheryWCSIIInside WCSI.Mature.M SelectivityWCSIIInsideFisheryM 0.95 JulSep
PenaltyCatchMustBetaken
312 FisheryWCSIIInside WCSI.Mature.F SelectivityWCSIIInsideFisheryF 0.95 JulSep
PenaltyCatchMustBetaken
313 FisheryWCSINorth WCSI.Mature.M SelectivityWCSINorthFisheryM 0.95 JulSep
PenaltyCatchMustBetaken
314 FisheryWCSINorth WCSI.Mature.F SelectivityWCSINorthFisheryF 0.95 JulSep
PenaltyCatchMustBetaken
315 FisheryWCSISouth WCSI.Mature.M SelectivityWCSISouthFisheryM 0.95 JulSep
PenaltyCatchMustBetaken
316 FisheryWCSISouth WCSI.Mature.F SelectivityWCSISouthFisheryF 0.95 JulSep
PenaltyCatchMustBetaken
317 end_table
318
319
320
321
322
323 @selectivity SelectivityOne
324 type constant
325 c 1.0
326
327
328 @selectivity Select2yrs
329 type all_values
330 v 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0
331
332
333 @selectivity SelectivityEastMaturationM
334 type logistic
335 a50 2.0
336 ato95 2.0
337 alpha 1.0
338
339
340 @selectivity SelectivityEastMaturationF
341 type logistic
342 a50 3.0
343 ato95 3.0
344 alpha 1.0
345
346
347 @selectivity SelectivityWestMaturationM
348 type logistic

```

```

349 a50 2.0
350 ato95 2.0
351 alpha 1.0
352
353
354 @selectivity SelectivityWestMaturationF
355 type logistic
356 a50 3.0
357 ato95 3.0
358 alpha 1.0
359
360
361 @selectivity SelectivityWestHomeMigrationM
362 type constant
363 c 0.5
364
365
366 @selectivity SelectivityWestHomeMigrationF
367 type constant
368 c 0.5
369
370
371 @selectivity SelectivityChathamRiseSummerSurveyM
372 type knife_edge
373 e 2.0
374 alpha 1.0
375
376
377 @selectivity SelectivityChathamRiseSummerSurveyF
378 type knife_edge
379 e 2.0
380 alpha 1.0
381
382
383 @selectivity SelectivitySubAntarcticSummerSurveyM
384 type logistic
385 a50 5
386 ato95 3.0
387 alpha 1.0
388
389
390 @selectivity SelectivitySubAntarcticSummerSurveyF
391 type logistic
392 a50 5
393 ato95 3.0
394 alpha 1.0
395
396
397 @selectivity SelectivitySubAntarcticAutumnSurveyM
398 type logistic
399 a50 5
400 ato95 7
401 alpha 1.0
402
403
404 @selectivity SelectivitySubAntarcticAutumnSurveyF
405 type logistic
406 a50 5
407 ato95 7
408 alpha 1.0
409
410
411 @selectivity SelectivitySubAntarcticAEXSurveyM
412 type logistic
413 a50 3.5
414 ato95 1.5
415 alpha 1.0

```

```

416
417
418 @selectivity SelectivitySubAntarcticAEXSurveyF
419 type logistic
420 a50 3.5
421 ato95 1.5
422 alpha 1.0
423
424
425 @selectivity SelectivitySubAntarcticSHISurveyM
426 type logistic
427 a50 5.5
428 ato95 2
429 alpha 1.0
430
431
432 @selectivity SelectivitySubAntarcticSHISurveyF
433 type logistic
434 a50 5.5
435 ato95 2
436 alpha 1.0
437
438
439 @selectivity SelectivityChathamRiseSHISurveyM
440 type knife_edge
441 e 2
442 alpha 1.0
443
444
445 @selectivity SelectivityChathamRiseSHISurveyF
446 type knife_edge
447 e 2
448 alpha 1.0
449
450
451 @selectivity SelectivityChathamRiseDeepFisheryM
452 type logistic
453 a50 7
454 ato95 3
455 alpha 1
456
457
458 @selectivity SelectivityChathamRiseDeepFisheryF
459 type logistic
460 a50 7
461 ato95 3
462 alpha 1
463
464
465 @selectivity SelectivityChathamRiseShallowFisheryM
466 type double_normal
467 mu 4
468 sigma_l 2
469 sigma_r 20
470 alpha 1
471
472
473 @parameter_transformation ChathamRiseShallowFisheryM_log_sigma_r
474 type log
475 parameters selectivity[SelectivityChathamRiseShallowFisheryM].sigma_r
476
477
478 @parameter_transformation ChathamRiseShallowFisheryM_log_sigma_l
479 type log
480 parameters selectivity[SelectivityChathamRiseShallowFisheryM].sigma_l
481
482

```

```

483 @selectivity SelectivityChathamRiseShallowFisheryF
484 type double_normal
485 mu 4
486 sigma_l 2
487 sigma_r 20
488 alpha 1
489
490 @parameter_transformation ChathamRiseShallowFisheryF_log_sigma_l
491 type log
492 parameters selectivity[SelectivityChathamRiseShallowFisheryF].sigma_l
493
494 @parameter_transformation ChathamRiseShallowFisheryF_log_sigma_r
495 type log
496 parameters selectivity[SelectivityChathamRiseShallowFisheryF].sigma_r
497
498 @selectivity SelectivityCookStraitSpawningFisheryM
499 type logistic
500 a50 7
501 ato95 3
502 alpha 1
503
504 @selectivity SelectivityCookStraitSpawningFisheryF
505 type logistic
506 a50 7
507 ato95 3
508 alpha 1
509
510 @selectivity SelectivityECSISpawningFisheryM
511 type double_normal
512 mu 4
513 sigma_l 2
514 sigma_r 20
515 alpha 1
516
517 @selectivity SelectivityECSISpawningFisheryF
518 type double_normal
519 mu 4
520 sigma_l 2
521 sigma_r 20
522 alpha 1
523
524 @parameter_transformation ECSISpawningFisheryF_log_sigma_r
525 type log
526 parameters selectivity[SelectivityECSISpawningFisheryF].sigma_r
527
528 @parameter_transformation ECSISpawningFisheryM_log_sigma_r
529 type log
530 parameters selectivity[SelectivityECSISpawningFisheryM].sigma_r
531
532 @selectivity SelectivitySubAntarcticAucklandFisheryM
533 type double_normal
534 mu 4
535 sigma_l 2
536 sigma_r 20
537 alpha 1
538
539 @selectivity SelectivitySubAntarcticAucklandFisheryF

```

```

550 type double_normal
551 mu 4
552 sigma_l 2
553 sigma_r 20
554 alpha 1
555
556 @parameter_transformation SubaAntarcticAucklandFisheryM_log_sigma_r
557 type log
558 parameters Selectivity[SelectivitySubAntarcticAucklandFisheryM].sigma_r
559
560 @parameter_transformation SubaAntarcticAucklandFisheryF_log_sigma_r
561 type log
562 parameters Selectivity[SelectivitySubAntarcticAucklandFisheryF].sigma_r
563
564
565 @parameter_transformation SubAntarcticAucklandFisheryM_log_mu
566 type log
567 parameters Selectivity[SelectivitySubAntarcticAucklandFisheryM].mu
568
569 @parameter_transformation SubAntarcticAucklandFisheryF_log_mu
570 type log
571 parameters Selectivity[SelectivitySubAntarcticAucklandFisheryF].mu
572
573
574 @selectivity SelectivitySubAntarcticSnaresFisheryM
575 type double_normal
576 mu 4
577 sigma_l 2
578 sigma_r 20
579 alpha 1
580
581 @selectivity SelectivitySubAntarcticSnaresFisheryF
582 type double_normal
583 mu 4
584 sigma_l 2
585 sigma_r 20
586 alpha 1
587
588 @parameter_transformation SubaAntarcticSnaresFisheryM_log_sigma_r
589 type log
590 parameters Selectivity[SelectivitySubAntarcticSnaresFisheryM].sigma_r
591
592 @parameter_transformation SubaAntarcticSnaresFisheryF_log_sigma_r
593 type log
594 parameters Selectivity[SelectivitySubAntarcticSnaresFisheryF].sigma_r
595
596
597 @selectivity SelectivitySubAntarcticSubaFisheryM
598 type logistic
599 a50 7
600 ato95 3
601 alpha 1
602
603 @selectivity SelectivitySubAntarcticSubaFisheryF
604 type logistic
605 a50 7
606 ato95 3
607 alpha 1
608
609 @selectivity SelectivityWCSIIInsideFisheryM
610 type logistic
611 a50 7
612 ato95 3
613 alpha 1
614
615
616 @selectivity SelectivityWCSIIInsideFisheryF

```

```

617 type logistic
618 a50 7
619 ato95 3
620 alpha 1
621
622
623 @selectivity SelectivityWCSINorthFisheryF
624 type double_normal
625 mu 4
626 sigma_l 2
627 sigma_r 20
628 alpha 1
629
630
631 @parameter_transformation WCSINorthFisheryF_log_sigma_r
632 type log
633 parameters Selectivity[SelectivityWCSINorthFisheryF].sigma_r
634
635
636 @selectivity SelectivityWCSINorthFisheryM
637 type double_normal
638 mu 4
639 sigma_l 2
640 sigma_r 20
641 alpha 1
642
643
644 @parameter_transformation WCSINorthFisheryM_log_sigma_r
645 type log
646 parameters Selectivity[SelectivityWCSINorthFisheryM].sigma_r
647
648
649 @parameter_transformation WCSINorthFisheryM_log_sigma_l
650 type log
651 parameters Selectivity[SelectivityWCSINorthFisheryM].sigma_l
652
653
654 @selectivity SelectivityWCSISouthFisheryM
655 type logistic
656 a50 8.2
657 ato95 3
658 alpha 5
659
660 @parameter_transformation WCSISouthFisheryM_log_alpha
661 type log
662 parameters Selectivity[SelectivityWCSISouthFisheryM].alpha
663
664
665
666
667 @selectivity SelectivityWCSISouthFisheryF
668 type logistic
669 a50 7
670 ato95 3
671 alpha 1
672
673
674 @age_length AgeLengthEastM
675 type von_bertalanffy
676 length_weight LengthWeightEastM
677 k 0.232
678 t0 -1.23
679 Linf 89.5
680 cv_first 0.05
681 cv_last 0.05
682 time_step_proportions 0.25 0.60 0.90 0.90 0.0
683 by_length TRUE

```

```

684 distribution normal
685 compatibility_option casal
686
687
688 @age_length AgeLengthEastF
689 type von_bertalanffy
690 length_weight LengthWeightEastF
691 k 0.161
692 t0 -2.18
693 Linf 101.8
694 cv_first 0.05
695 cv_last 0.05
696 time_step_proportions 0.25 0.60 0.90 0.90 0.0
697 by_length TRUE
698 distribution normal
699 compatibility_option casal
700
701
702 @age_length AgeLengthWestM
703 type von_bertalanffy
704 length_weight LengthWeightWestM
705 k 0.261
706 t0 -0.50
707 Linf 92.6
708 cv_first 0.05
709 cv_last 0.05
710 time_step_proportions 0.25 0.60 0.90 0.90 0.0
711 by_length TRUE
712 distribution normal
713 compatibility_option casal
714
715
716 @age_length AgeLengthWestF
717 type von_bertalanffy
718 length_weight LengthWeightWestF
719 k 0.213
720 t0 -0.60
721 Linf 104.0
722 cv_first 0.05
723 cv_last 0.05
724 time_step_proportions 0.25 0.60 0.90 0.90 0.0
725 by_length TRUE
726 distribution normal
727 compatibility_option casal
728
729
730 @length_weight LengthWeightEastM
731 type basic
732 units tonnes
733 a 4.79e-09
734 b 2.89
735
736
737 @length_weight LengthWeightEastF
738 type basic
739 units tonnes
740 a 4.79e-09
741 b 2.89
742
743
744 @length_weight LengthWeightWestM
745 type basic
746 units tonnes
747 a 4.79e-09
748 b 2.89
749
750

```

```
751  @length_weight LengthWeightWestF
752  type basic
753  units tonnes
754  a 4.79e-09
755  b 2.89
756
757
758
```