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Rapid update for New Zealand rock lobster (*Jasus edwardsii*) in CRA 3 in 2025

New Zealand Fisheries Assessment Report 2026/18

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PLAIN LANGUAGE SUMMARY

The red rock lobster supports the most valuable inshore commercial fishery in New Zealand. This fishery has been managed with catch quotas in nine Quota Management Areas (QMAs), which are usually treated as independent populations or stocks.

To estimate those quotas, each population is fully assessed every five years, requiring a lot of time and effort by a team of at least four to five researchers. Instead of a full assessment, a rapid update assessment can be done for some of the stocks that were not assessed in that year. A rapid update repeats the previous full assessment model, only updating data inputs, which significantly speeds up the process.

This document describes the operation of the stock assessment rapid update completed in 2025 for CRA 3 which can be used to guide management decisions.

For the beginning of the 2025–26 fishing year, the red rock lobster population in CRA 3 was estimated to be below sustainable levels and is projected to remain below reference levels in five years under current catch settings.

EXECUTIVE SUMMARY

Pons, M.[1]; Webber, D.N.[2]; Rudd, M.B.[3]; Roberts, J.[4]; Starr, P.J.[5] (2026). Rapid update for New Zealand rock lobster (*Jasus edwardsii*) in CRA 3 in 2025.

***New Zealand Fisheries Assessment Report 2026/18*. 24 p.**

This document describes the 2025 operation of the stock assessment rapid update of New Zealand red rock lobster (*Jasus edwardsii*) for CRA 3, which can be used to guide management decisions in this QMA.

Full stock assessments for each rock lobster stock are generally done once every five years. Full stock assessments require significant time and effort, including: a review of the previous stock assessment and data inputs, updates to data processing code, the addition of new data, implementation of new structural changes to the model, review of prior specifications for model parameters, and multiple model runs to investigate sensitivity to key model assumptions. For red rock lobsters, the last few stock assessments have required four to five stock assessment scientists working for over five weeks to complete one or two stock assessments, working under the guidance of the Rock Lobster Working Group.

Rapid update assessments differ from a full stock assessment because they repeat the previous base case stock assessment model(s), with the same model settings and assumptions, only updating inputs with new covariates and data (e.g., additional years of catch, length frequencies, sex ratios, and tag-recapture growth increment data). This significantly speeds up the required process, with the result being that every stock can potentially have a rapid update done each year. Rapid updates do not aim to replace full stock assessments but complement them by providing inference about stock status in the interim years between full assessments.

This document presents a rapid update stock assessment for CRA 3. Rapids updates were not done for CRA 1 and CRA 2 this year because they received a full stock assessment in 2025. CRA 7 and CRA 8 used management procedures in 2025, resulting in no need to produce rapid updates for these stocks. Rapid updates were not done for CRA 4, CRA 5, or CRA 6 due to time restraints or because there was no new information on catch per unit of effort (CPUE) to contribute to reliable stock status estimates. There is no accepted stock assessment for CRA 9, so it cannot be included in the rapid update system.

For the beginning of the 2025–26 fishing year, the adjusted vulnerable biomass for CRA 3 was estimated to be at 72% (54–98%) of the reference level (B_R). Spawning stock biomass (SSB) indicators showed that the median SSB in 2025–26 was 21% (18–28%) of SSB_0, with a 38% probability of SSB being below the soft limit and a 0% probability of being below the hard limit at the beginning of the 2025–26 fishing year.

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1. INTRODUCTION

The red rock lobster (*Jasus edwardsii*) supports the most valuable inshore commercial fishery in New Zealand, with exports worth NZD$329 million in 2021 (Seafood New Zealand 2022) and it is also valuable to customary Māori, recreational fishers, and non-extractive stakeholders. Commercial red rock lobster fisheries have been managed with Individual Transferable Quotas (ITQs) in nine Quota Management Areas (QMAs) since April 1990, which are usually treated as independent stocks for stock assessment (Breen et al. 2016a, Figure 1).

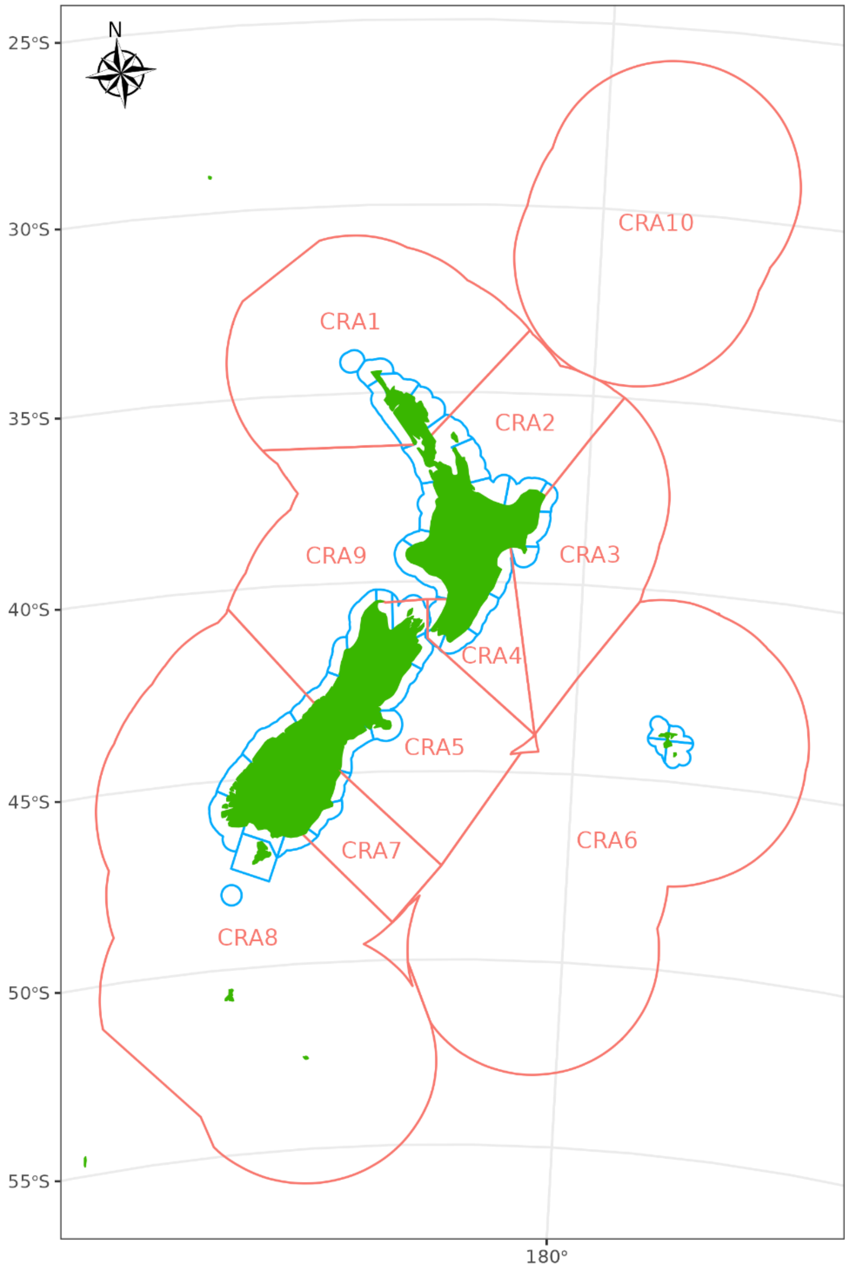

Figure 1: New Zealand red rock lobster (*Jasus edwardsii*) Quota Management Areas (QMAs) in red and statistical areas in blue. CRA 10 is not fished commercially.

Full stock assessments are generally done once every five years for eight of the ten rock lobster QMAs (except CRA 9, which is deemed to be data deficient for stock assessment and CRA 10 which is not fished commercially). Full stock assessments require significant time and effort, including: a review of the previous stock assessment and data inputs, updates to data processing code, the addition of new data, implementation of new structural changes to the model, review of prior specifications for model parameters, and multiple runs to investigate sensitivity to key model assumptions. The last few red rock lobster stock assessments have required four to five stock assessment scientists working for over five weeks to complete one or two stock assessments, under the guidance of the Rock Lobster Working Group (RLWG).

Up to the 2020–21 fishing year[6], management procedures (MPs), using standardised commercial fishery catch per unit effort (CPUE) as the input and a catch limit as the output, were used to manage New Zealand stocks of red rock lobsters (Bentley et al. 2003, Bentley & Stokes 2009, Breen et al. 2009, 2016a, 2016b, Webber & Starr 2020).

MPs, often referred to as harvest control rules, are simulation-tested decision rules or functions (Butterworth & Punt 1999) that specify one or more inputs and return an output value. MPs are an important fisheries management tool globally (Edwards & Dankel 2016). They are used to manage rock lobsters in South Africa (Johnston & Butterworth 2005, Johnston et al. 2014), South Australia (Punt et al. 2012), and Victoria (Punt et al. 2013).

The 2019–20 fishing year marked the transition of rock lobster catch and effort data collection from the paper-based Catch Effort Landing Return (CELR) system to an electronic reporting (ER) system dependent on a user interface operated from tablets or smart phones. Presently, there are three ER reporting 'platforms', each with different user interfaces and different underlying software. Preliminary analyses of the 2019–20 data indicated that the reported estimated catches using the new ER system differed from the equivalent estimates generated by the previous CELR forms (see appendix B of Starr 2025). Therefore, the RLWG agreed to temporarily suspend updating CPUE indices based on the statutory catch and effort data beginning with the 2019–20 spring/summer (SS) season. At the time, the RLWG concluded that, apart from CRA 7, there remained sufficient CELR data for each of the QMAs to ensure comparability with previous indices for the 2019–20 autumn/winter (AW) data. This meant that, after 2019–20 AW, statutory CPUE was no longer available to monitor the abundance of New Zealand rock lobster and was not available for use in MPs. This issue has since been reviewed several times by the RLWG without observing any reason to change the initial conclusion. An alternative CPUE series for CRA 3 was developed based on voluntary logbook data reported by the CRA 3 fleet since 2015, which was used in the 2024 CRA 3 stock assessment (Roberts et al. 2025). Logbook CPUE time series were also used in the past for the CRA 1, CRA 2, CRA 4, CRA 6, and CRA 8 stock assessments.

With the loss of MPs, the status of the New Zealand rock lobster stocks are now monitored using current estimates of vulnerable biomass relative to a B_{MSY} proxy vulnerable biomass reference level (B_R) and estimates of female spawning stock biomass (SSB) relative to the Harvest Strategy Standard (HSS) default hard (10% SSB_0) and soft (20% SSB_0) limits. While this evaluation is straight-forward for years when a full stock assessment is done, this evaluation can also be made based on the stock status estimates generated by the rapid updates in the years between full stock assessments. The reference level (B_R) is estimated for each stock using the procedure developed by Rudd et al. (2021) and remains unchanged until the next full stock assessment.

Rapid updates differ from full stock assessments because they repeat the previous base case stock assessment model(s) with identical model settings and assumptions, only updating inputs, including additional years of catch, length frequencies (LFs), sex ratios, and tag-recapture data. This speeds up the assessment process somewhat. The rapid update system was initially designed to provide fishery advice even in the absence of a recently updated CPUE series (the main abundance index) and serves to temporarily replace the MPs previously used to manage these stocks (Webber & Starr 2020). However, retrospective analyses for some QMAs have shown systematic biases in stock status estimates when

[6] Most years in this document refer to the 1 April to 31 March statutory fishing year, for example, 1 April 2020 to 31 March 2021 is designated the 2020–21 fishing year. Two seasons are defined per fishing year: 1 April to 30 September is referred to as autumn/winter (AW) and 1 October to 31 March is referred to as spring/summer (SS). Sometimes specific seasons within a fishing year are referred to, for example, 2020–21 AW refers to 1 April 2020 to 30 September 2020 or 2020–21 SS refers to 1 October 2020 to 31 March 2021. Calendar years are simply referred as usual (e.g., 2020).

missing more than 4–5 years of CPUE data (Pons et al. 2022). Rapid updates do not aim to replace full stock assessments but complement them by providing inference about stock status in the interim years between full assessments.

The rapid update framework for New Zealand rock lobster stocks is described in Webber et al. (2021), Rudd et al. (2022), and Pons et al. (2023, 2024, and 2025). This document provides a 2025 rapid update for CRA 3 only. CRA 1 and CRA 2 were not included in the rapid updates because they received a full stock assessment in 2025. CRA 7 and CRA 8 had management procedures established in 2024, resulting in no need to run a rapid update for these stocks. Rapid updates were not done for CRA 4, CRA 5, or CRA 6 due largely to time constraints, and there is no accepted stock assessment for CRA 9.

The CRA 3 QMA for red rock lobster extends from East Cape south to the Wairoa River in northern Hawke Bay and includes East Cape (Statistical Area 909), Gisborne (910), and the Mahia Peninsula (911) (Figure 1, Figure 2).

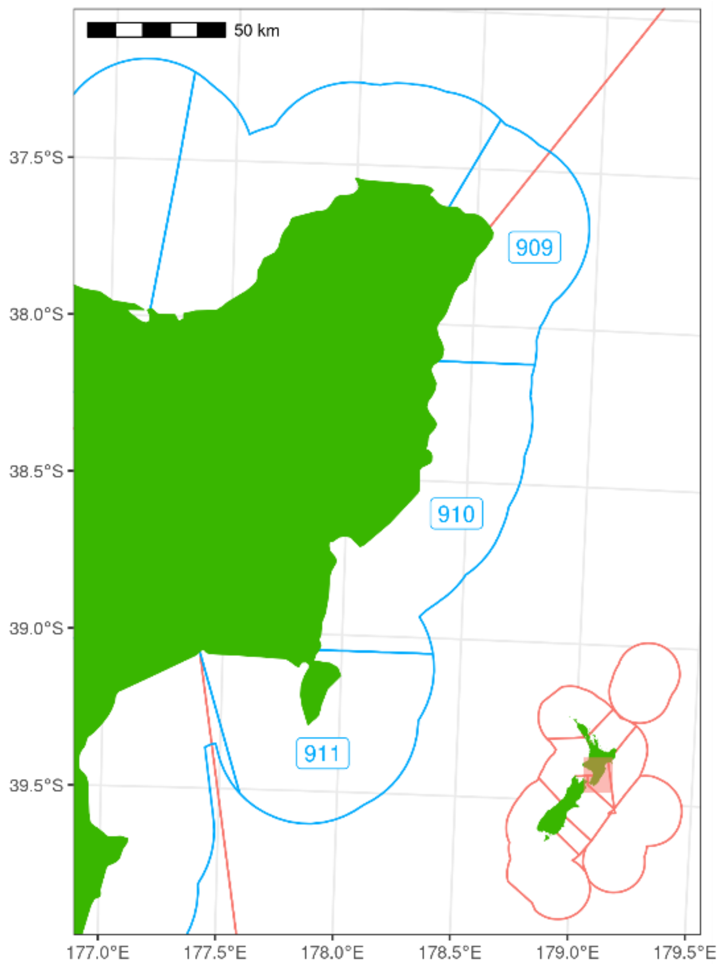

Figure 2: The extent of the CRA 3 QMA (bounded by red lines) and of the statistical areas included in this QMA (bounded by blue lines).

The CRA 3 stock assessment was last done in 2024 as a two-region model: Region 1 included Statistical Areas 909 and 910, and Region 2 consisted of Statistical Area 911 (Figure 2, Roberts et al. 2025). This assessment was conducted using the LSD model (Webber et al. 2023), starting in 1945 from an assumed unfished population in equilibrium with average recruitment. It was fitted to three standardised CPUE index series (FSU, CELR, and logbook series), LFs, sex ratio, and tag-recapture data. The model estimated three catchability coefficients (for FSU, CELR, and logbook CPUE) and used standardised LFs and sex ratio inputs (Webber 2022). Region-specific recruitment deviates were estimated up to three years before the last assessment year, in accordance with an agreement made at the 2022 November Plenary (Webber et al. 2023). The stock assessment reconstruction showed long-term cycles of abundance for the vulnerable biomass, with both regions declining to a low point in 1992, recovering through the mid-2010s, and then declining again into the early 2020s. The Region 2 mid-2010s peak was more pronounced than the equivalent peak for Region 1. Spawning stock biomass fell steeply after 2010, especially in Region 1, and by 2024 was near to or below the soft limit (20% of unfished SSB) in both regions (Roberts et al. 2025).

2. METHODS

The additional covariates and data that were used in the CRA 3 rapid update included: commercial and non-commercial catch data, standardised length frequency (LF) series, standardised sex-ratio series, tag-recapture data, and an updated logbook CPUE index series. The following data requests were submitted to Fisheries New Zealand in support of this update: monthly harvest returns (MHRs) (replog 16681) and tag-recapture data (replog 16686). Observer catch sampling data were extracted from the Fisheries New Zealand Rock Lobster Catch Sampling (*rlcs*) database (Mackay & George 2018). The voluntary logbook data extract came directly from FishServe (John Olver, May 2025). Although the standardisation of CPUE indices based on statutory commercial catch and effort data has been temporarily discontinued[7], commercial catch and effort data were requested from Fisheries New Zealand (replog 16681) because these data were used to scale the LF data (e.g., see section 5 of Starr et al. 2020).

All CPUE standardisations were done using the *R* package *brms* (Bürkner 2017). All CELR CPUE standardisations had been done for all QMAs in 2020, up to the 2019–20 AW season, for either full assessments or rapid updates (Webber et al. 2021; Rudd et al. 2022; Pons et al. 2023; Pons et al. 2024). Therefore, no revisions were made to the CELR based CPUE indices. In addition, for CRA 3, a CPUE series was developed for the 2024 stock assessment using voluntary logbook data reported by the CRA 3 fleet since 2015 (Roberts et al. 2025).

Commercial catches were updated by season for each fishing year using the MHR data extract.

Non-commercial catches were updated using the procedures developed for the 2024 base case model. The recreational catch series relied on the three National Panel Surveys (NPS) conducted over the months of October to September in 2011–2012, 2017–2018, and 2022–2023. These surveys used a population-based diary and interview design and were considered plausible for CRA 3, although estimates were associated with relatively high uncertainty (CVs ranging from 0.26 to 0.51). The 2022–23 NPS estimate was excluded from scaling. This survey was considered potentially biased relative to the previous two surveys because it coincided with Cyclone Gabrielle, which hit the north-east New Zealand in February 2023, causing considerable damage and limiting fishing opportunities (Roberts et al. 2025).

A catch vector was developed assuming that recreational catch was proportional to CRA 3 spring/summer (SS) abundance, as reflected in standardised SS CPUE. A SS CPUE series was constructed by combining FSU data (1979–1988), CELR data (1989–2013), and a composite of CELR, catch sampling, and logbook CPUE from 2014 onwards. A catchability parameter (q) was estimated by fitting the SS CPUE to the 2011–12 and 2017–18 NPS survey estimates using a lognormal likelihood weighted by survey CVs and then using the q to scale the SS CPUE in the years without survey estimates.

The annual recreational catch trajectory was constructed as follows:

1. Recreational catch from 1979 onwards was scaled to SS CPUE using the estimated catchability coefficient.

[7] Offset year standardised CPUE, incorporating ERS data, was developed and reviewed by the RLWG for CRA 7 in September 2023 for use in a management procedure.

2. Recreational catch in 1945 was assumed to be 20% of the 1979 level and was interpolated linearly between 1945 and 1979.
3. Recreational landings by commercial vessels under Section 111 (destination code ‘F’) were added when available; otherwise, the maximum observed annual value (3.05 t) was applied.
4. Charter vessel catches were added in years where Amateur Fishing Charter Vessel – Activity Catch Returns (ACV–ACR) data were available.
5. In NPS survey years (2011, 2017, and 2022), modelled recreational catches were replaced with the sum of NPS survey estimates, declared Section 111 catches, and charter vessel catches, with charter catches excluded from NPS estimates to avoid double counting. The 2022 NPS estimate replaced the modelled recreational catches because it was the best available information on potential recreational catch during the fishing year affected by Cyclone Gabrielle. It was excluded from scaling the modelled recreational catches because it was not representative of the scale of catch in other years.

Annual recreational catches were split seasonally assuming that 90% of catch occurred in the SS and 10% in the autumn/winter (AW). Seasonal recreational catches were then allocated spatially between regions using the same proportional split as observed in commercial catches, which averaged 59.9% from Region 1 and 40.1% from Region 2 over years from 1979–2024, and 61.5% from Region 1 and 38.3% from Region 2 when including Regional split data prior to 1979.

The customary catch was assumed to be a constant catch of 10 t, split between seasons with 90% assumed taken in the SS. The customary catch estimates for each region by year and season were based on the observed commercial catch regional distribution in the same fishing year and season.

The illegal catch assumptions reflect the changes in approach adopted by the RLWG over the past seven years, transitioning from using a poorly documented ‘export discrepancy’ procedure for the early years and uncertain fisheries compliance estimates from 1990–91 onwards, to using assumed fixed proportions of the commercial catches. The approach adopted by the RLWG used to set the illegal catches in CRA 3 was:

1) 1979–80 to 1989–90: 20% of total commercial catch from the period, distributed evenly across years during this period (45.2 tonnes annually).
2) 1990–91 to 2024–25: 15% of total commercial catch, distributed evenly across years during this period (32.2 tonnes annually).

The RLWG agreed not to scale illegal catch by annual standardised CPUE, as this produced unrealistically high estimates in years of high CPUE. Illegal catch was therefore assumed to be a constant proportion of commercial catch within each period.

For use in the stock assessment model, annual illegal catches were allocated seasonally and regionally in proportion to the commercial catch in each year. On average from 1979–2024, commercial catch was distributed as 36.7% in Region 1 AW, 23.3% in Region 1 SS, 18.8% in Region 2 AW, and 21.2% in Region 2 SS.

LF data were derived from individual lobster tail-width (TW) measurements and came from both the observer catch sampling and the voluntary logbook programmes. The LF standardisation followed the procedure documented by Webber (2022), repeating the procedure used for the 2024 stock assessment. Similarly, the sex ratios were estimated based on the observed proportions in the observer and logbook data using the same procedure as was used in the 2024 assessment (Roberts et al. 2025).

Tag-recapture growth increment data were extracted from the Fisheries New Zealand tag database and processed up to 2024–25 for the CRA 3 2025 rapid update, although this did not result in any additional data to those used by the 2024 assessment of CRA 3 (Roberts et al. 2025).

No data re-weighting was done for CRA 3 rapid update compared to the 2024 full assessment. All other model specifications remained as they were in the original base case stock assessment model. Fixed values and assumptions were continued from the previous full stock assessment, including priors and bounds for estimated model parameters; the reference level B_R (Rudd et al. 2021), and all structural assumptions which applied to growth, maturity, selectivity, and vulnerability. Recruitment deviations were estimated from the first model year through to three years prior to the final model year as in the 2024 full assessment (Roberts et al. 2025). The rapid update model was run using the lobster stock dynamics (LSD) model coded in Stan (Stan Development Team 2017, Webber et al. 2018, Webber et al. 2023). Lists of parameter and derived quantity definitions are provided in Table 1 and Table 2.

Table 1: Definitions of parameters. CR = historical catch rate; FSU= Fisheries Statistics Unit.

Parameter	Definition
R_0	initial numbers recruiting
M	instantaneous rate of natural mortality
Rdevs	annual recruitment deviations
sigmaR	standard deviation of *Rdevs*
qCR	catchability coefficient (relationship between vulnerable biomass and CR series)
qFSU	catchability coefficient (relationship between vulnerable biomass and FSU CPUE series)
qCELR	catchability coefficient (relationship between vulnerable biomass and CELR CPUE series)
qLB	catchability coefficient (relationship between vulnerable biomass and logbook CPUE series)
mat50	TW at which 50% of immature females become mature
mat95	difference between *mat50* and the TW at which 95% of immature females become mature
Galpha	annual growth increment at 50 mm TW
Gbeta	annual growth increment at 80 mm TW
Gdiff	the ratio of *Gbeta* to *Galpha*
Gshape	parameter for shape of growth curve: 1 implies von Bertalanffy straight line; >1 implies a concave upwards curve
GCV	coefficient of variation of process error for tag recaptures
Gobs	standard deviation of observation error for tag recaptures
selL	shape of the left-hand limb of the selectivity curve (as if it were a standard deviation)
selM	TW at maximum selectivity
vuln	relative vulnerability by sex and season
qdrift	additive change in catchability coefficient each year
U_0	initial exploitation rate (first year is in equilibrium using this estimate)

Table 2: Definitions of derived quantities including reference points and performance indicators. The 'YEAR' subscript is replaced with the relevant fishing year in the text and tables (e.g., B_{2022} is the beginning of season AW adjusted vulnerable biomass[8] for the 2022–23 fishing year).

Variable	Description
Reference points	
B_0	beginning of season AW adjusted vulnerable biomass (tonnes) before fishing
B_{0now}	equilibrium vulnerable reference biomass using mean 2009–2018 recruitment
B_{YEAR}	beginning of season AW adjusted vulnerable biomass (tonnes) for the specified fishing year
B_R	reference level in terms of AW adjusted vulnerable biomass (Rudd et al. 2021)
SSB_0	mature female spawning stock biomass (tonnes) in the AW season before fishing
SSB_{0now}	equilibrium female spawning biomass using mean 2009–2018 recruitment
SSB_{YEAR}	mature female spawning stock biomass (tonnes) in the AW season at beginning of the specified fishing year
T_0	equilibrium total biomass
T_{0now}	equilibrium total biomass using mean 2009–2018 recruitment
T_{YEAR}	beginning of season AW total biomass for the specified fishing year
H_{YEAR}	handling mortality (tonnes)
U_{YEAR}	exploitation rate weighted by seasonal vulnerable biomass for the specified fishing year
Performance indicators	
B_{YEAR} / B_0	ratio of B_{YEAR} to B_0
B_{YEAR} / B_{0now}	ratio of B_{YEAR} to B_{0now}
B_{YEAR} / B_R	ratio of B_{YEAR} to B_R
SSB_{YEAR} / SSB_0	ratio of SSB_{YEAR} to SSB_0
SSB_{YEAR} / SSB_{0now}	ratio of SSB_{YEAR} to SSB_{0now}
T_{YEAR} / T_0	ratio of T_{YEAR} to T_0
T_{YEAR} / T_{0now}	ratio of T_{YEAR} to T_{0now}
F_{YEAR} / F_{MSY}	ratio of F_{YEAR} to F_{MSY}

The 5-year projections provided by the 2024 full assessment have also been updated for a further year here, which are informed by a fully updated logbook CPUE time series. Recruitment estimation was also extended to 2021, three years before the model end year. Projected catches were 156 tonnes for the commercial catch (equal to the TACC) and the non-commercial catches were updated to match the 2024–25 catches.

3. RESULTS

The 2025 rapid update for CRA 3 incorporated one additional year of data to the 2024 stock assessment. This update included catch data through 2024–25 (Table 3), updated CRA 3 logbook CPUE series including the 2023–24 and 2024–25 AW and SS indices for each region, and LF data extended to include 2024–25.

[8] Adjusted vulnerable biomass is calculated by applying the MLS and selectivity from the final model year to all previous years, including those years where earlier regulations were active.

Table 3: Comparison of recent CRA 3 catch (tonnes) for the 2024 stock assessment and the following rapid update. The table shows the last five fishing years and the five projection years in the 2024 base case model (starting in 2018–19), compared with catch for 2018–19 onwards for the 2025 rapid update including also the five projection years. All projection years are highlighted in grey.

	Commercial			Recreational			Customary			Illegal		
Fishing year	AW	SS	Total	AW	SS	Total	AW	SS	Total	AW	SS	Total
2024/base												
2018–19	134.41	54.58	188.99	1.63	14.63	16.25	1.00	9.00	10.00	23.16	9.41	32.57
2019–20	104.30	111.09	215.39	1.28	11.54	12.82	1.00	9.00	10.00	15.77	16.80	32.57
2020–21	103.24	66.79	170.02	1.34	12.05	13.39	1.00	9.00	10.00	19.78	12.79	32.57
2021–22	83.15	74.50	157.64	0.80	7.21	8.01	1.00	9.00	10.00	17.18	15.39	32.57
2022–23	63.77	59.90	123.67	0.82	7.34	8.15	1.00	9.00	10.00	16.79	15.78	32.57
2023–24	94.33	40.67	135.00	0.82	7.34	8.15	1.00	9.00	10.00	16.79	15.78	32.57
2024–25	109.00	47.00	156.00	0.82	7.34	8.15	1.00	9.00	10.00	16.79	15.78	32.57
2025–26	109.00	47.00	156.00	0.82	7.34	8.15	1.00	9.00	10.00	16.79	15.78	32.57
2026–27	109.00	47.00	156.00	0.82	7.34	8.15	1.00	9.00	10.00	16.79	15.78	32.57
2027–28	109.00	47.00	156.00	0.82	7.34	8.15	1.00	9.00	10.00	16.79	15.78	32.57
2023/base												
2018–19	134.24	54.75	188.99	1.63	14.63	16.25	1.00	9.00	10.00	22.89	9.34	32.23
2019–20	104.42	110.97	215.39	1.28	11.54	12.82	1.00	9.00	10.00	15.62	16.60	32.23
2020–21	103.24	66.79	170.02	1.34	12.05	13.39	1.00	9.00	10.00	19.57	12.66	32.23
2021–22	83.24	74.40	157.64	0.80	7.21	8.01	1.00	9.00	10.00	17.02	15.21	32.23
2022–23	63.71	59.96	123.67	0.82	7.34	8.15	1.00	9.00	10.00	16.60	15.62	32.23
2023–24	65.51	71.51	137.02	0.68	6.14	6.82	1.00	9.00	10.00	15.41	16.82	32.23
2024–25	109.00	47.00	156.00	0.68	6.14	6.82	1.00	9.00	10.00	15.41	16.82	32.23
2025–26	109.00	47.00	156.00	0.68	6.14	6.82	1.00	9.00	10.00	15.41	16.82	32.23
2026–27	109.00	47.00	156.00	0.68	6.14	6.82	1.00	9.00	10.00	15.41	16.82	32.23
2027–28	109.00	47.00	156.00	0.68	6.14	6.82	1.00	9.00	10.00	15.41	16.82	32.23
2028–29	109.00	47.00	156.00	0.68	6.14	6.82	1.00	9.00	10.00	15.41	16.82	32.23

MCMC trace plots for the 2025 rapid update suggested that mixing was adequate with no evidence of non-convergence (Appendix A).

There were differences between the SS logbook CPUE series used in the 2025 rapid update for both Region 1 and Region 2 relative to the series used in 2024 for both regions (Figure 3). These differences stemmed from a fisher in Region 1 who did not turn in his 2023 data in time for the 2024 stock assessment. This shift in the data resulted small changes to the index values in both regions and seasons and notably caused a rise in the 2024 SS Region 1 index value (Figure 3). Nevertheless, the 2025 fits to the logbook CPUE series were similar to the fits obtained by the 2024 assessment, except for 2023 where the fitted line was slightly higher in Region 1 SS and lower in Region 2 for both seasons compared to the 2024 fits (Figure 3). Consequently, the 2025 model estimated slightly higher recruitment in Region 1 and lower recruitment in Region 2 for 2020 (the last year of estimated recruitment in the 2024 assessment) than did the 2024 stock assessment (Figure 4). Mean projected recruitment in Region 1 by the 2025 model was slightly lower than for the 2024 model so that it could fit to the 2024 CPUE index value, which was slightly lower than the 2023 index value (Figure 4). The fits to the LF data were almost indistinguishable from the 2024 assessment in the overlapping years with minor differences in 2023 where the new LF data were included (Figure 5). Since recruitment was predicted to be lower in the last few years, the estimated 2024 adjusted vulnerable biomass and SSB levels were lower for the 2025 model compared to the 2024 model as were the five -year projections (Figure 6, Figure 7).

All parameter estimates by the 2025 model were similar to those estimated by the 2024 stock assessment (Table 4).

The CRA 3 rapid update predicted that the posterior median stock size at the beginning of 2025–26 was 16% B_0, 21% SSB_0, and 72% of B_R (Table 5). At the beginning of 2029–30, the posterior median stock size was projected to be 94% of B_R, 21% B_0, and 23% SSB_0. Exploitation rates (U) at the beginning of 2025–26 were above U_R in both regions, and under current catches is projected to be below U_R only in Region 2 by 2029–30. The probabilities of being greater than B_R at the beginning of 2025–26 were 0.037 and 0.637 for 2029–30. The probabilities of being below 20% SSB_0 were 0.381 in 2025–26 and 0.000 in 2029–30.

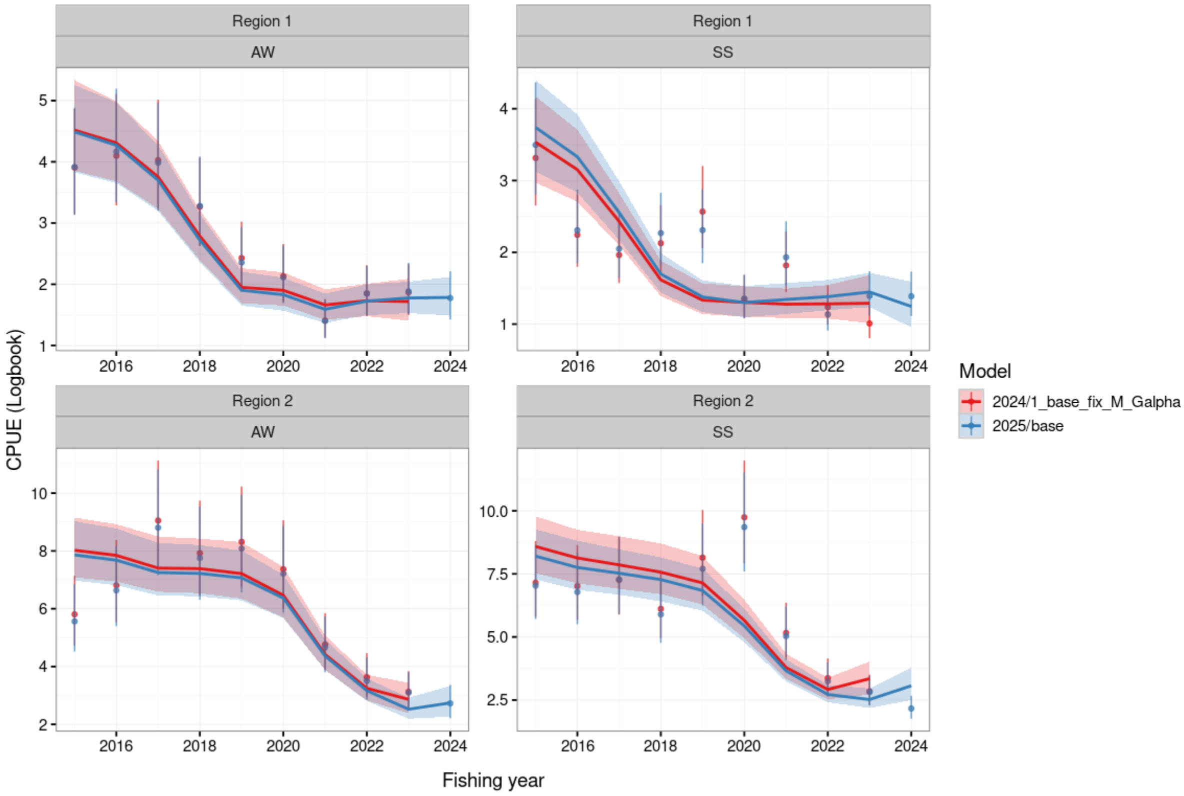

Figure 3: CRA 3 Logbook CPUE observations (points) and posterior distribution showing the median (line) and 90% credible interval (shaded region) by season (AW = autumn/winter, SS = spring/summer), by region (Region 1= Statistical Areas 909+910, Region 2= Statistical Area 911), and fishing year (labelled using the first year in the pair) for the 2024 stock assessment (1_base_fix_M_Galpha) and the 2025 rapid update.

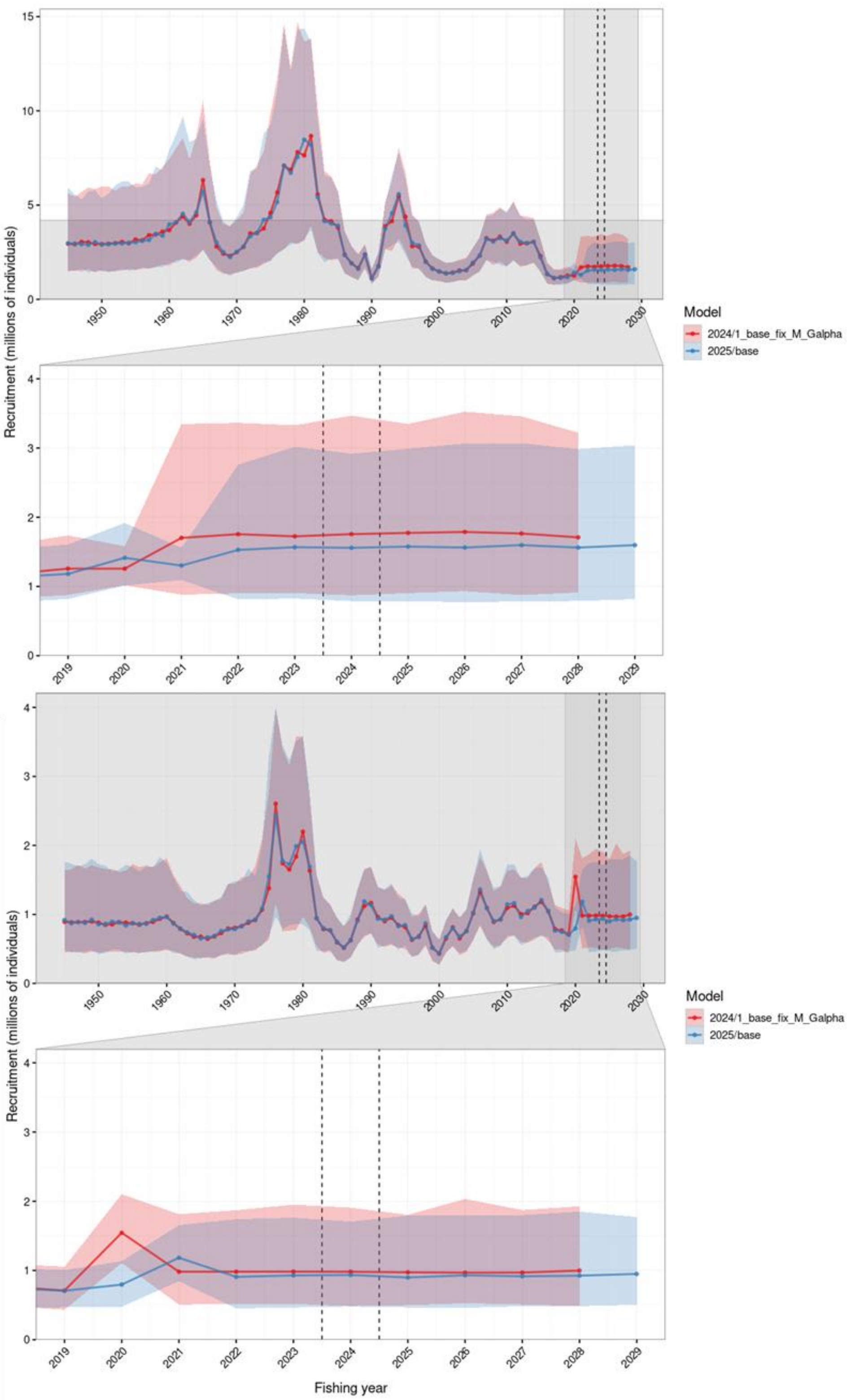

Figure 4: CRA 3 posterior distribution of recruitment showing the median (line and points) and 90% credible interval (shaded region) for the 2024 stock assessment (1_base_fix_M_Galpha) and 2025 rapid update with 5-year projections. The vertical dashed lines indicate the transition between the final model year and the 5-year projections for each base case. Region 1 and Region 2 are presented top and bottom, respectively. For each region, the top panel shows the recruitment for all model years, and the lower panel shows the recruitment for the last ten years.

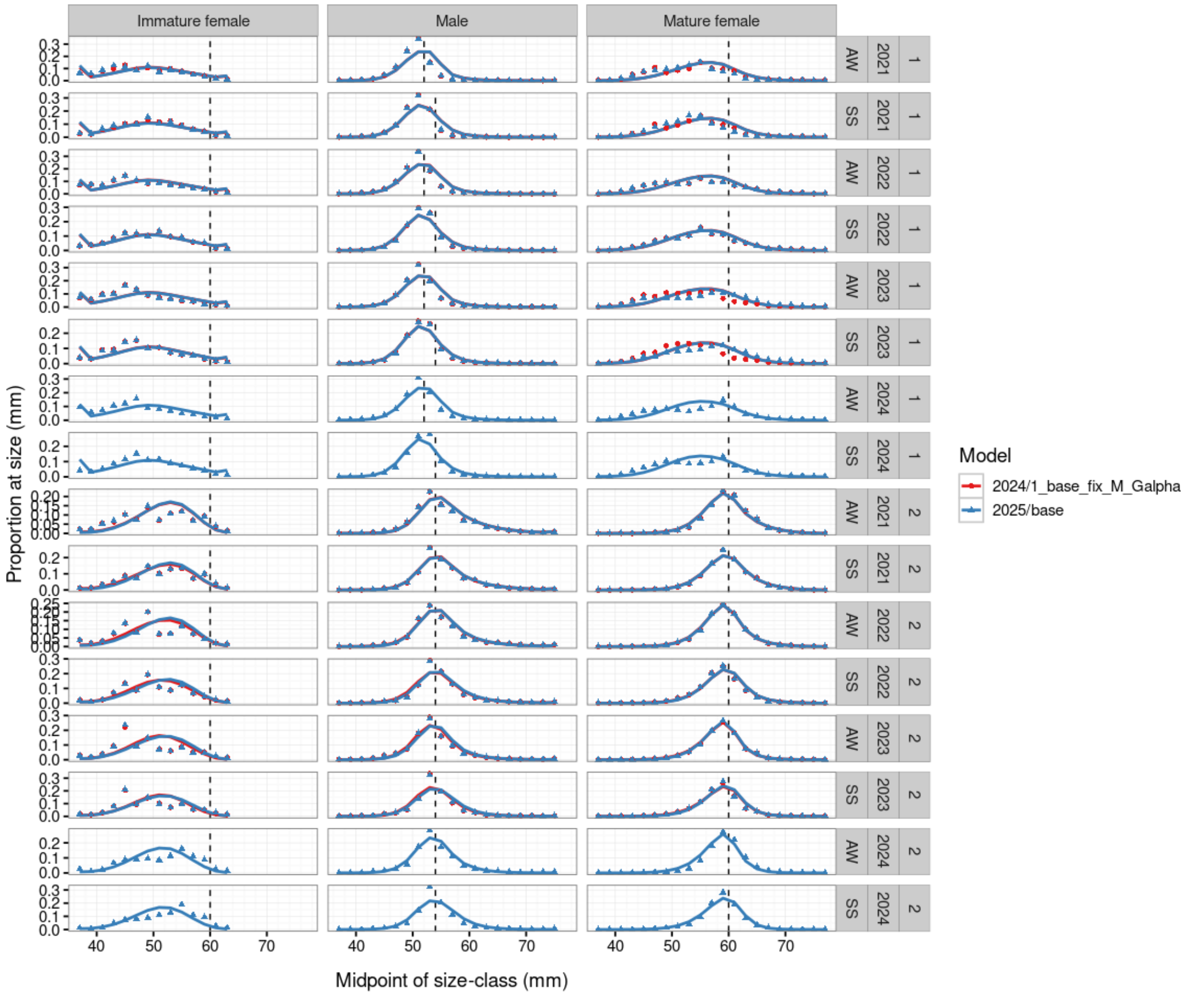

Figure 5: 2021–2024 CRA 3 length frequency observations (points) and median of the posterior distribution (line) by year, region (Region 1= Statistical Areas 909+910, Region 2= Statistical Area 911), and season (AW = autumn/winter, SS = spring/summer) for the 2024 stock assessment (1_base_fix_M_Galpha) and the 2025 rapid update. Dashed vertical lines represent the minimum legal size (MLS) for the respective sexes.

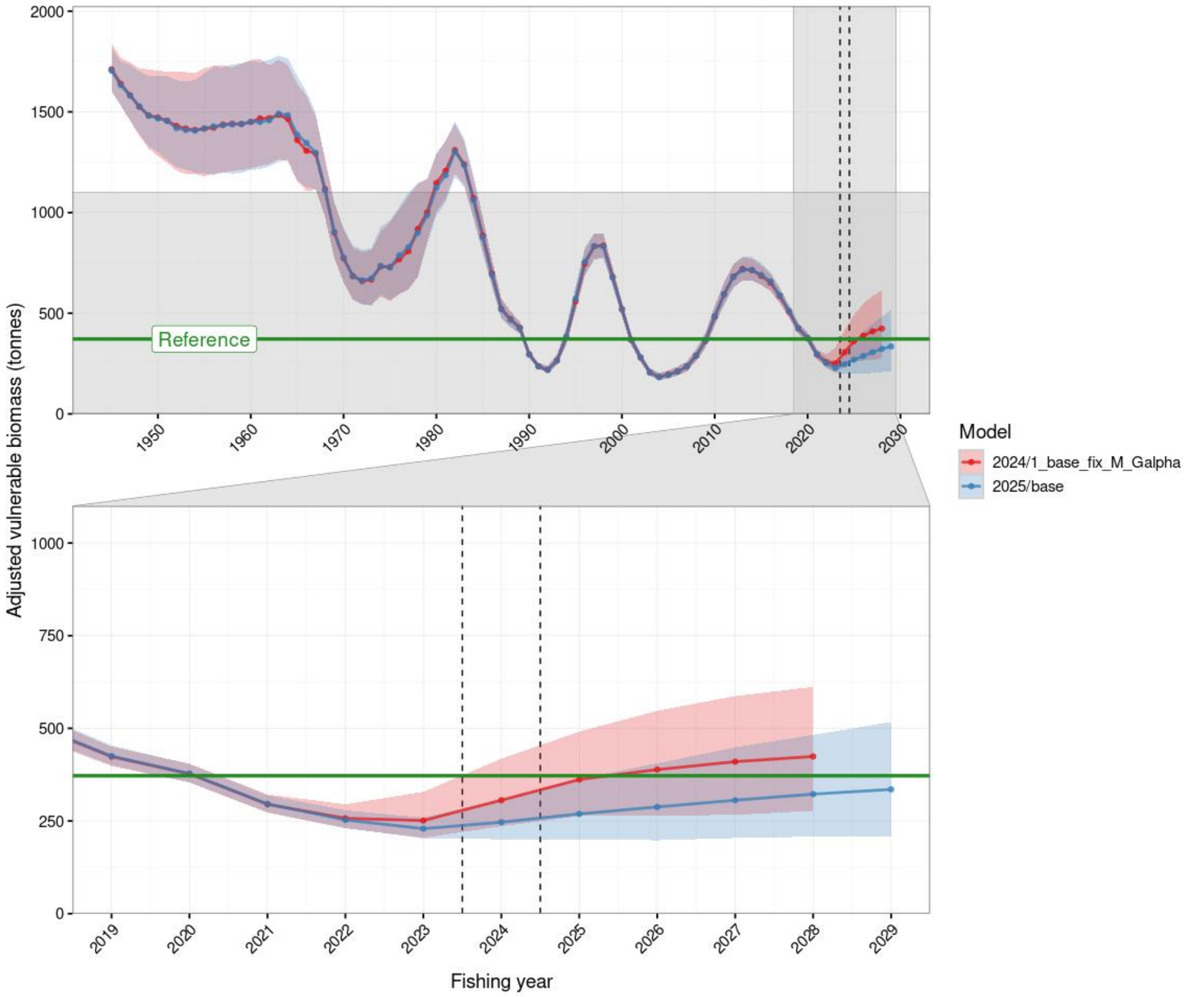

Figure 6: RA 3 posterior distribution of adjusted vulnerable biomass (tonnes) showing the median (line and points) and 90% credible interval (shaded region) for the 2024 stock assessment (1_base_fix_M_Galpha) and the 2025 rapid update with 5-year projections. The vertical dashed lines indicate the transition between the final model year and the 5-year projections for each base case. The top panel shows the adjusted vulnerable biomass for all model years, and the lower panel shows adjusted vulnerable biomass for the last ten years. The interim target (BR) is shown as green solid line in both panels. Note that this is for both regions combined.

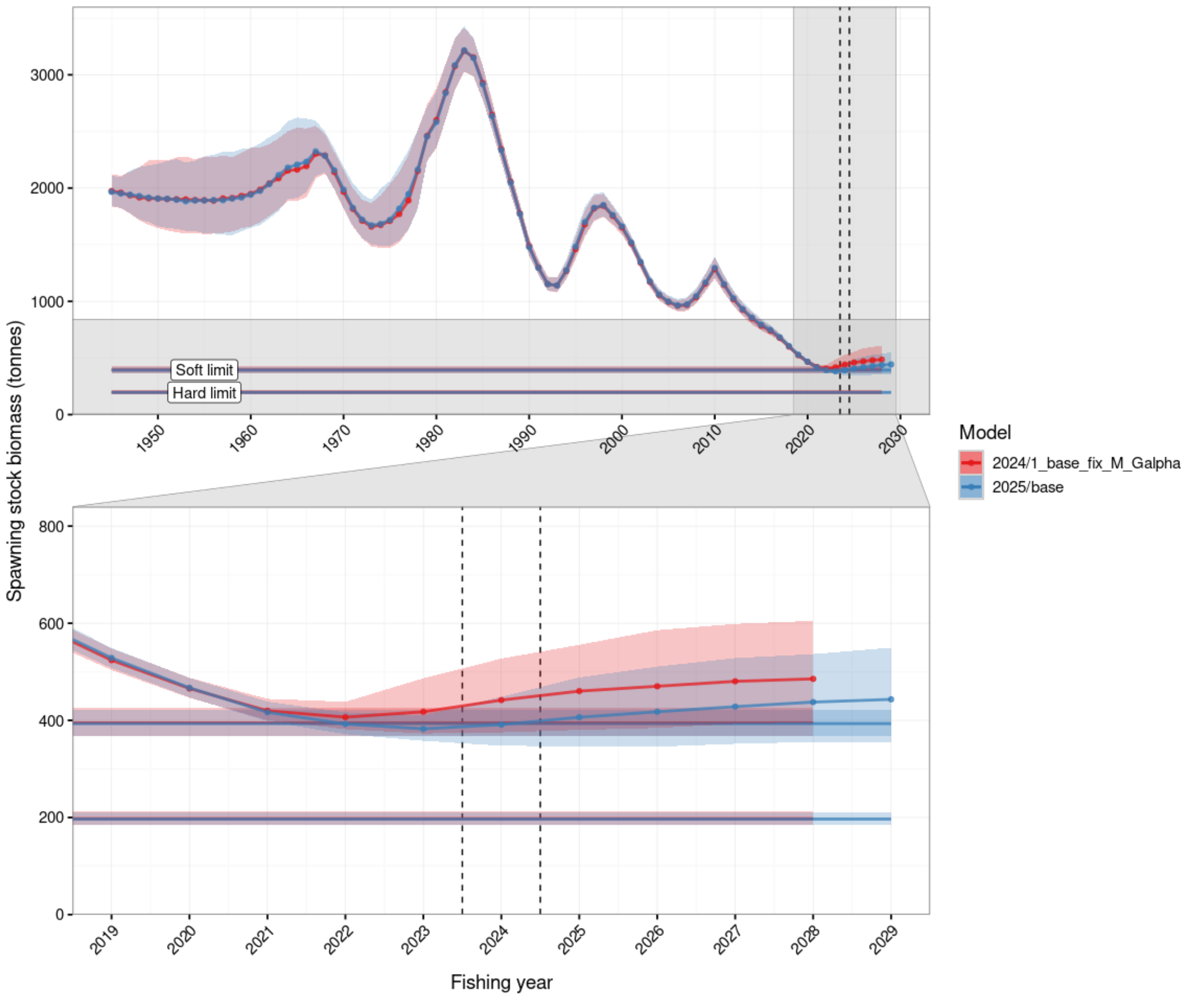

Figure 7: CRA 3 posterior distribution of spawning stock biomass (tonnes) showing the median (line and points) and 90% credible interval (shaded region) for the 2024 stock assessment (1_base_fix_M_Galpha) and the 2025 rapid update with 5-year projections. The vertical dashed lines indicate the transition between the final model year and the 5-year projections for each base case. The top panel shows the spawning stock biomass for all model years, and the lower panel shows spawning stock biomass for the last ten years. Note that this is for both regions combined. The horizontal lines and shaded regions represent the soft limit (top horizontal line and shaded region) and the hard limit (lower horizontal line and shaded region).

Table 4: Summary of the posterior distribution for the model parameter estimates for the base model for CRA 3 in 2024 and rapid update in 2025 showing the mean, median, 90% credible interval (i.e., 5% and 95%). Growth increment values in mm TW, biomass values in tonnes, and R_0 in numbers. '–': not applicable. M = male, F = female, IF = immature female, and MF = mature female.

			2024 assessment			2025 rapid update		
Parameter	**Region**	**Season**	**5%**	**Median**	**95%**	**5%**	**Median**	**95%**
R₀	909+910		2 867 990	3 178 880	3 524 450	2 840 023	3 140 975	3 466 433
R₀	911		880 013	969 944	1 071 770	888 939	978 754	1 073 324
qCR	909+910		0.331	0.436	0.563	0.307	0.422	0.545
	911		0.252	0.339	0.456	0.256	0.340	0.465
qFSU	909+910	AW	1.10E-03	1.26E-03	1.46E-03	1.10E-03	1.28E-03	1.48E-03
		SS	1.17E-03	1.36E-03	1.58E-03	1.17E-03	1.36E-03	1.56E-03
	911	AW	2.08E-03	2.59E-03	3.31E-03	2.02E-03	2.59E-03	3.34E-03
		SS	1.83E-03	2.25E-03	2.85E-03	1.78E-03	2.26E-03	2.88E-03
qCELR	909+910	AW	2.24E-03	2.48E-03	2.78E-03	2.22E-03	2.49E-03	2.78E-03
		SS	3.82E-03	4.32E-03	4.85E-03	3.77E-03	4.32E-03	4.85E-03
	911	AW	3.82E-03	4.25E-03	4.70E-03	3.77E-03	4.20E-03	4.65E-03
		SS	4.09E-03	4.53E-03	5.03E-03	4.04E-03	4.49E-03	4.99E-03
qLB	909+910	AW	4.085E-06	4.910E-06	5.778E-06	4.08E-06	4.84E-06	5.73E-06
		SS	5.827E-06	7.098E-06	8.756E-06	6.12E-06	7.46E-06	9.10E-06
	911	AW	1.169E-05	1.339E-05	1.545E-05	1.14E-05	1.29E-05	1.47E-05
		SS	1.062E-05	1.214E-05	1.402E-05	1.00E-05	1.14E-05	1.29E-05
Gdiff [M]	909+910		0.034	0.049	0.063	0.035	0.048	0.062
Gdiff [F]			0.064	0.087	0.108	0.058	0.083	0.106
Gdiff [M]	911		0.236	0.316	0.400	0.249	0.327	0.409
Gdiff [F]			0.062	0.079	0.101	0.063	0.081	0.102
Gshape [M]	909+910		7.408	7.680	7.967	7.423	7.704	7.948
Gshape [F]			5.824	6.152	6.515	5.800	6.129	6.499
Gshape [M]	911		1.947	2.362	2.897	2.011	2.463	2.993
Gshape [F]			3.100	3.327	3.561	3.151	3.362	3.593
GCV [M]	909+910		0.636	0.653	0.671	0.636	0.655	0.672
GCV [F]			1.555	1.642	1.742	1.577	1.675	1.783
GCV [M]	911		0.488	0.539	0.590	0.496	0.539	0.595
GCV [F]			0.876	0.990	1.131	0.887	0.993	1.118
vuln [F]	909+910	AW	0.179	0.242	0.326	0.182	0.241	0.328
		SS	0.494	0.658	0.864	0.519	0.668	0.885
	911	AW	0.374	0.418	0.467	0.358	0.402	0.448
		SS	1.005	1.098	1.198	1.004	1.093	1.189
selL [M]	909+910		5.270	5.596	5.964	5.324	5.641	5.988
selL [F] < 1993			7.460	8.641	10.071	7.643	8.807	10.286
selL [F] ≥ 1993			11.354	12.303	13.381	11.675	12.674	13.898
selL [M]	911		4.364	4.639	4.903	4.402	4.655	4.897
selL [F]			6.177	6.454	6.727	6.166	6.403	6.679
selM [M]	909+910		47.880	48.161	48.454	47.906	48.194	48.439
selM [F] < 1993			52.335	53.795	55.445	52.240	53.738	55.471
selM [F] ≥ 1993			59.326	61.089	63.283	59.609	61.332	63.459
selM [M]	911		51.266	51.517	51.780	51.206	51.460	51.713
selM [F]			58.373	58.720	59.068	58.390	58.719	59.049

Table 5: CRA 3 rapid update indicators, summarising the mean, median, and 90% credible intervals.

Indicator	Mean	5%	50%	95%
Vulnerable biomass				
B_0	–	1 603	1 705	1 821
B_{0now}	–	1 421	1 500	1 587
B_{MIN}	–	155	171	189
B_R	372	–	–	–
B_{2025}	–	201	269	364
B_{2029}	–	221	349	530
B_R / B_0	–	0.204	0.218	0.232
B_R / B_{0now}	–	0.234	0.248	0.262
B_{2025} / B_0	–	0.118	0.158	0.217
B_{2029} / B_0	–	0.126	0.205	0.311
B_{2025} / B_{0now}	–	0.136	0.179	0.240
B_{2029} / B_{0now}	–	0.147	0.233	0.347
B_{2029} / B_{2025}	–	0.802	1.293	2.005
B_{2025} / B_R	–	0.540	0.724	0.979
B_{2029} / B_R	–	0.593	0.937	1.424
Exploitation				
U_R *Region 1*	0.349			
U_R *Region 2*	0.385			
U_{2025} *Region 1*	–	0.290	0.463	0.825
U_{2025} *Region 2*	–	0.310	0.403	0.527
U_{2029} *Region 1*	–	0.260	0.449	0.938
U_{2029} *Region 2*	–	0.163	0.271	0.556
U_{2025} / U_R *Region 1*	–	0.831	1.328	2.364
U_{2025} / U_R *Region 2*	–	0.805	1.045	1.369
U_{2029} / U_R *Region 1*	–	0.746	1.285	2.689
U_{2029} / U_R *Region 2*	–	0.423	0.705	1.443
Spawning stock biomass				
SSB_0	–	1 841	1 967	2 110
SSB_{0now}	–	489	517	546
SSB_{2025}	–	346	406	488
SSB_{2029}	–	356	443	550
SSB_{2025} / SSB_0	–	0.174	0.205	0.252
SSB_{2029} / SSB_0	–	0.181	0.225	0.284
SSB_{2025} / SSB_{0now}	–	0.673	0.784	0.931
SSB_{2029} / SSB_{0now}	–	0.697	0.858	1.054
SSB_{2029} / SSB_{2025}	–	0.876	1.083	1.358
Total mortality				
T_0	–	5318	5667	6081
T_{0now}	–	3299	3472	3653
T_{2025}	–	1598	2018	2557
T_{2029}	–	1647	2152	2762
T_{2025} / T_0	–	0.281	0.354	0.462
T_{2029} / T_0	–	0.288	0.379	0.486
T_{2025} / T_{0now}	–	0.463	0.580	0.728
T_{2029} / T_{0now}	–	0.480	0.619	0.791
T_{2029} / T_{2025}	–	0.794	1.053	1.426
Probabilities				
P($B_{2025} > B_{MIN}$)	0.998	–	–	–
P($B_{2025} > B_R$)	0.037	–	–	–
P($B_{2029} > B_R$)	0.637	–	–	–
P($B_{2029} > B_{2025}$)	0.805	–	–	–
P($SSB_{2025} < 20\% \ SSB_0$)	0.381	–	–	–
P($SSB_{2025} < 10\% \ SSB_0$)	0.000	–	–	–
P($SSB_{2029} < 20\% \ SSB_0$)	0.193	–	–	–
P($SSB_{2029} < 10\% \ SSB_0$)	0.000	–	–	–

Indicator	Mean	5%	50%	95%
P(SSB_{2025}< 20% SSB_{0now})	0.000	–	–	–
P(SSB_{2025}< 10% SSB_{0now})	0.000	–	–	–
P(SSB_{2029}< 20% SSB_{0now})	0.000	–	–	–
P(SSB_{2029}< 10% SSB_{0now})	0.000	–	–	–
P(SSB_{2029}> SSB_{2025})	0.725	–	–	–
P(T_{2029}> T_{2025})	0.609	–	–	–
P(U_{2025}> U_R) *Region 1*	0.852	–	–	–
P(U_{2025}> U_R) *Region 2*	0.598	–	–	–
P(U_{2029}> U_R) *Region 1*	0.506	–	–	–
P(U_{2029}> U_R) *Region 2*	0.116	–	–	–
P(U_{2029}>U_{2025}) *Region 1*	0.506	–	–	–
P(U_{2029}>U_{2025}) *Region 2*	0.116	–	–	–

4. DISCUSSION

Rapid updates provide an annual update of stock status for the red rock lobster stocks which have already been formally assessed and accepted. This provides a framework for managing these stocks that will be responsive to annual changes, much as the previous MPs were. Current CPUE indices based on statutory commercial catch and effort data are presently not available for most rock lobster stocks. An alternative CPUE series has been developed for CRA 3, based on catch and effort from logbook data, that has been accepted by the RLWG as an abundance series (Roberts et al. 2025). This information was updated and included for CRA 3 in the 2025 rapid update.

The CRA 3 vulnerable biomass showed high levels in the 1950s and mid-60s, followed by a period of sharp decline until the early 1970s. Then there were three pronounced cycles up until 2020, with biomass estimated to be below the reference level in the early 1990s, the mid-2000s, and the 2020s including 2024. While the vulnerable biomass was predicted to be have been below the reference level in the most recent assessment years, a modest increase was predicted over the next five years under current catch levels. The SSB shows a similar pattern of decline followed by fluctuations. In recent years, SSB has approached the soft limit but remained above the hard limit, with this rapid update also predicting a slight recovery over the next five years under current catch limits. This 2025 CRA 3 rapid update predicted the vulnerable biomass at the beginning of 2025–26 to be slightly lower than was projected by the 2024 assessment. The median 2025 adjusted vulnerable biomass is estimated to be 0.72 times the reference level and the median 2025 SSB to be at 21% of SSB_0. Both biomass series were projected by the 2025 CRA 3 rapid update to increase under current catch levels, but that rate of increase was slower than was predicted by the 2024 full assessment.

Projections made by this 2025 rapid update should be interpreted with caution. As noted in previous plenary discussions (see Fisheries New Zealand 2024), the assumption of mean future recruitment may not be appropriate for this stock because there appears to be a long-term decline in recruitment. This will introduce additional uncertainty into forward projections even when informed by up-to-date CPUE. Furthermore, five-year projections assume that future catches and regional commercial catch splits remain consistent with those reported in 2024. Given that regional catch splits have changed in recent years, partly in response to the January 2023 cyclone impacts and to apparent changes in relative abundance between regions, this assumption represents a key source of uncertainty in the projections. It is also likely that the full effects of the 2023 cyclone on stock dynamics have not yet been realised, reinforcing the need to treat these short-term projections cautiously. Continued annual rapid update assessments, informed by updated regional catch and CPUE data, will therefore be important to track stock status and its uncertainty in CRA 3.

5. POTENTIAL RESEARCH

Future research considerations for rapid assessment updates include:

- Construct performance criteria to identify changes in parameter estimates and model fits between the full assessment and the rapid update.
- Develop diagnostic procedures such as likelihood profiles to improve the understanding of contributions by model components.
- Explore how recent recruitment is informed in rapid updates (e.g., using likelihood profiles) and determine the range of years for which recruitment should be estimated in rock lobster stock assessment models.

6. FULFILMENT OF BROADER OUTCOMES

As required under Government Procurement rules[9], Fisheries New Zealand considered broader outcomes (secondary benefits such as environmental, social, economic or cultural benefits) that would be generated by this project.

Whakapapa links all people back to the land, sea, and sky, and our obligations to respect the physical world. This research aims to ensure the long-term sustainability of red rock lobster stocks, for the good of the wider community (including stakeholders and the public) and the marine ecosystems that lobsters inhabit. This project supports both Māori and regional businesses, and our research is inextricably linked to the moana from the work it carries out and the tangata whenua it supports.

To support the wider fisheries science community and enable more value to be extracted from the limited resources (time and money) available for fisheries research, we make as much code as possible open source (i.e., publicly available). Furthermore, this project has built capacity and capability in fisheries science and stock assessment by employing researchers with a range of experience so that those with a long history of working in fisheries science can pass on their knowledge. This approach has meant that rock lobster stock assessments have consisted of a team with some members that have been involved for many years and some newer team members. This approach further mitigates risk associated with team members not being able to participate any longer.

7. ACKNOWLEDGEMENTS

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APPENDIX A. MCMC DIAGNOSTICS

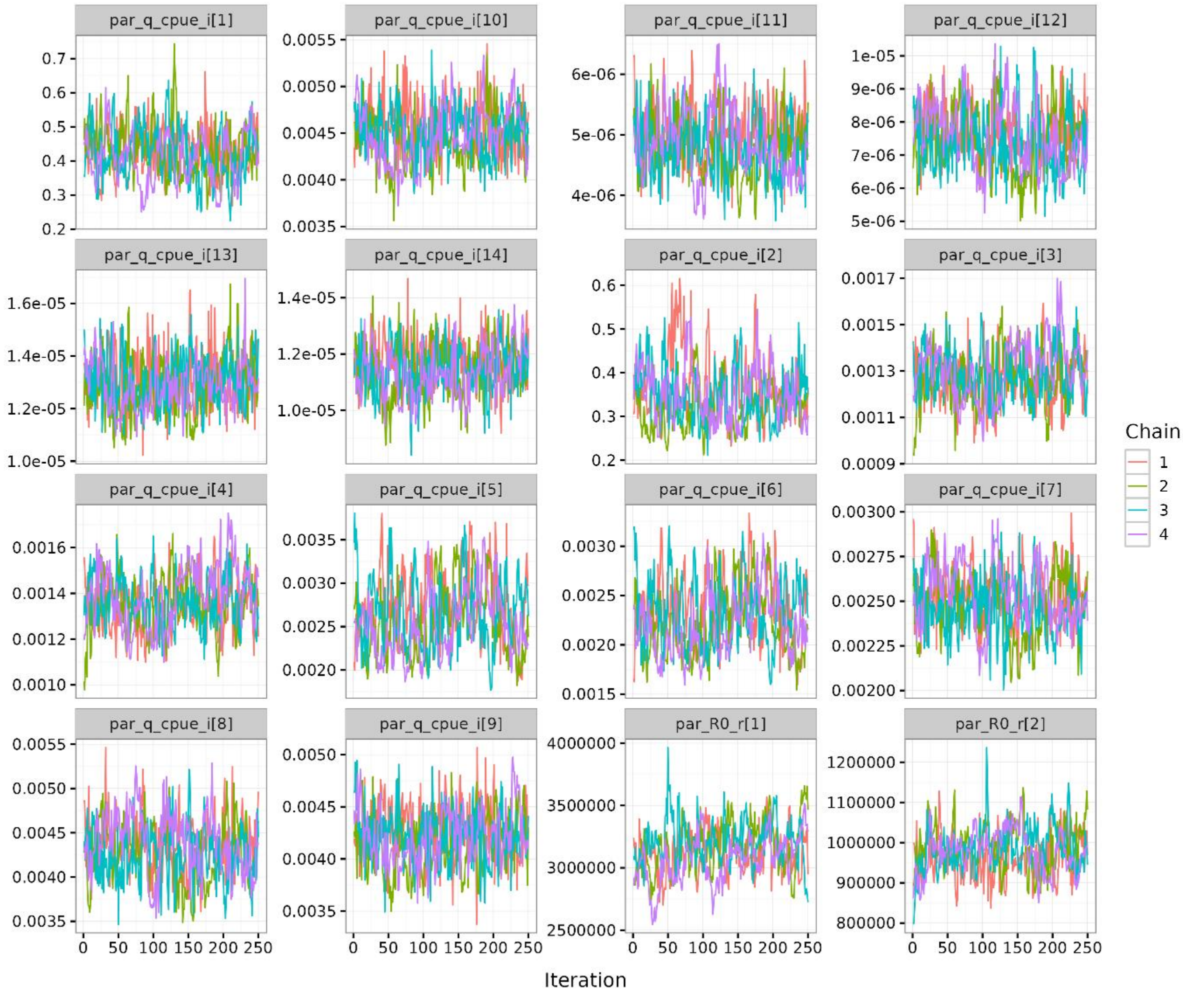

Figure A.1: MCMC trace plots by independent chain for *M, R_0*, maturation, and CPUE parameters in the CRA 3 rapid update (MCMC iteration on the x-axis and parameter value on y-axis).

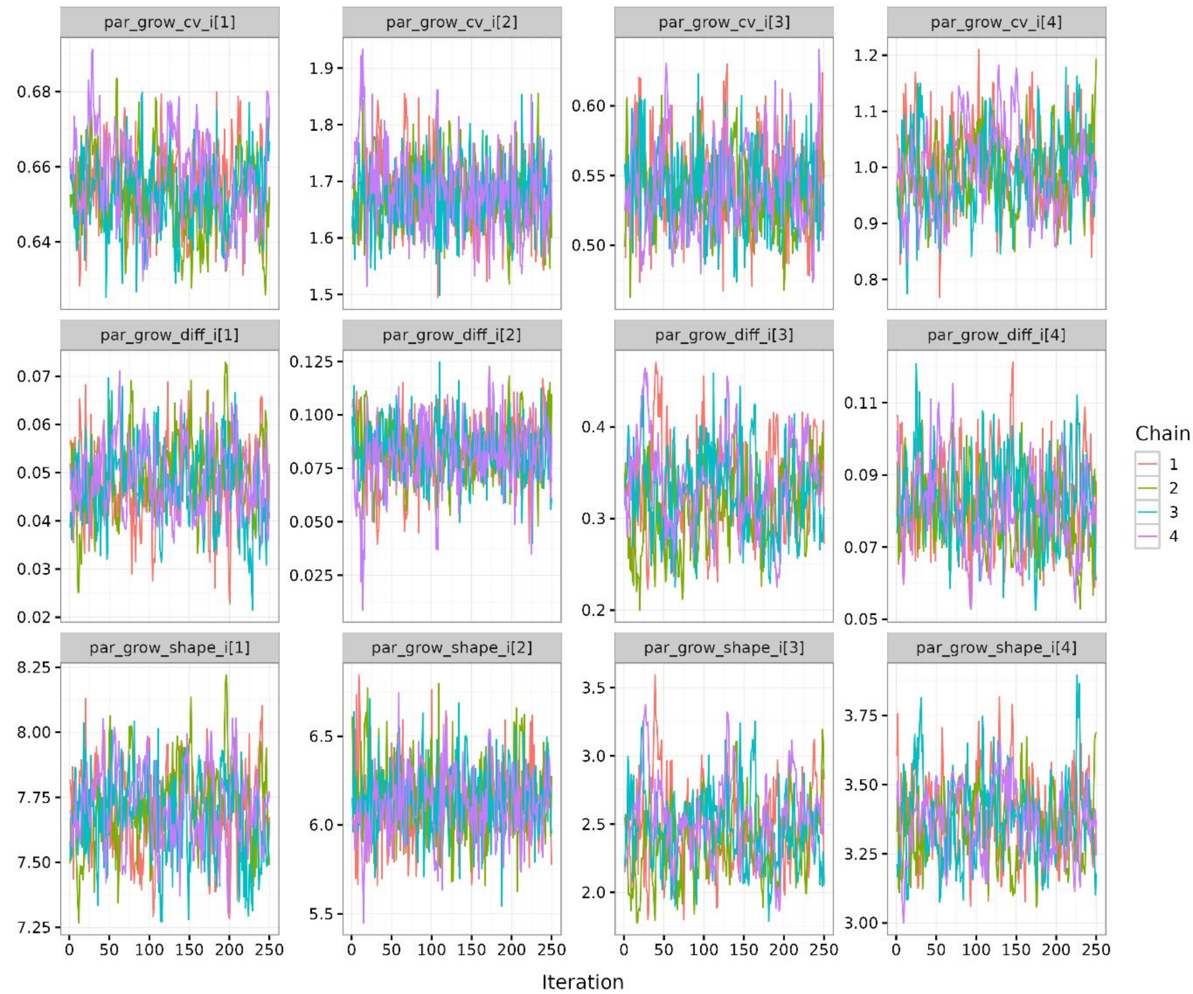

Figure A.2: MCMC trace plots by independent chain for estimated growth parameters in the CRA 3 rapid update (MCMC iteration on the x-axis and parameter value on y-axis).

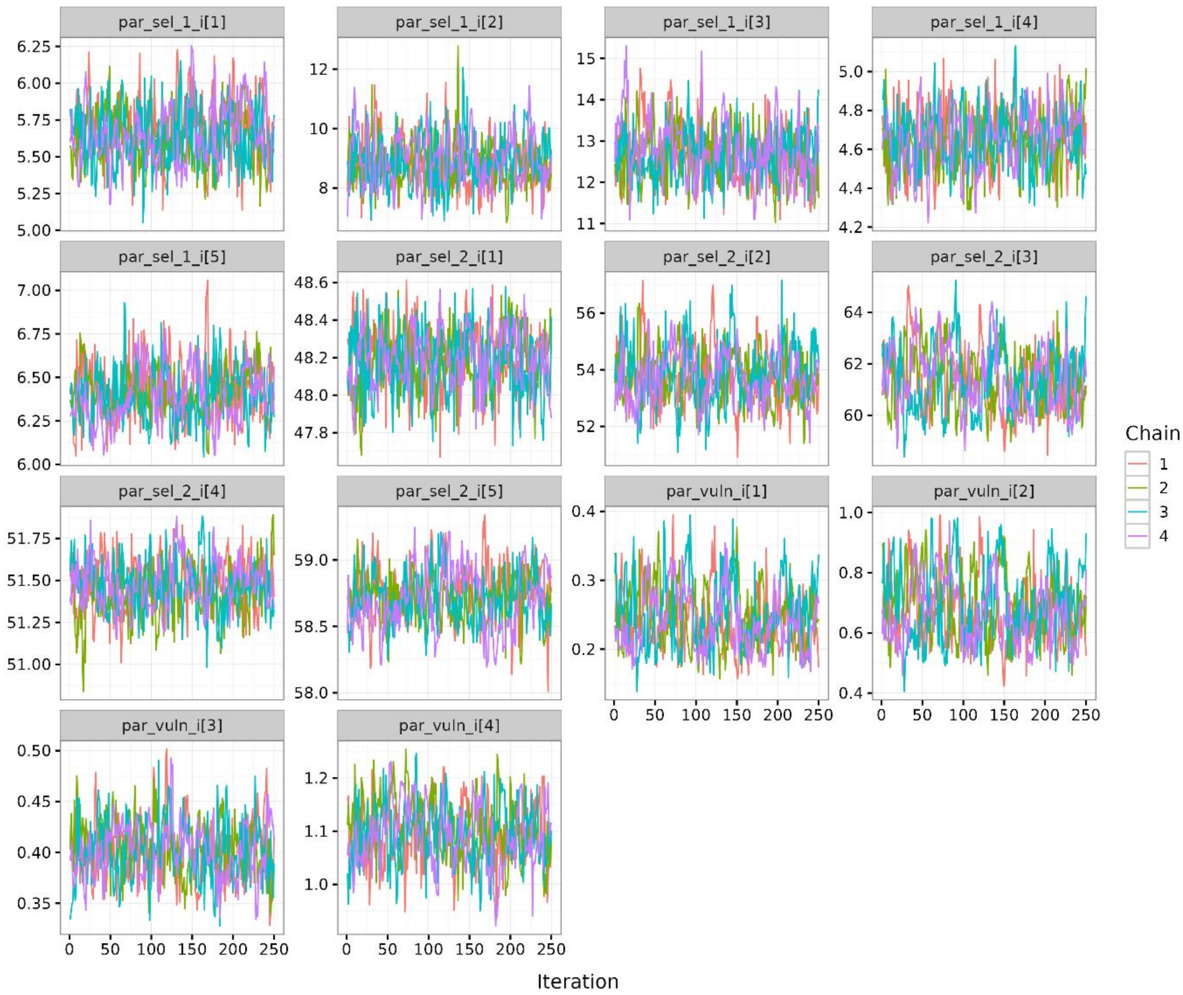

Figure A.3: MCMC trace plots by independent chain for estimated selectivity and vulnerability parameters in the CRA 3 rapid update (MCMC iteration on the x-axis and parameter value on y-axis).