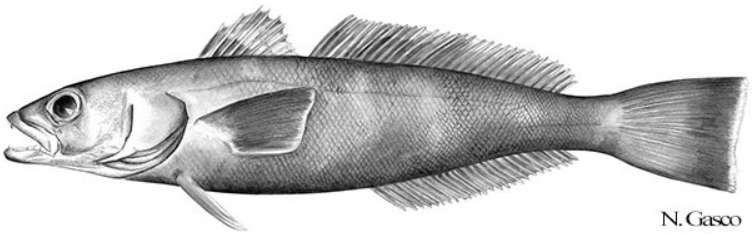
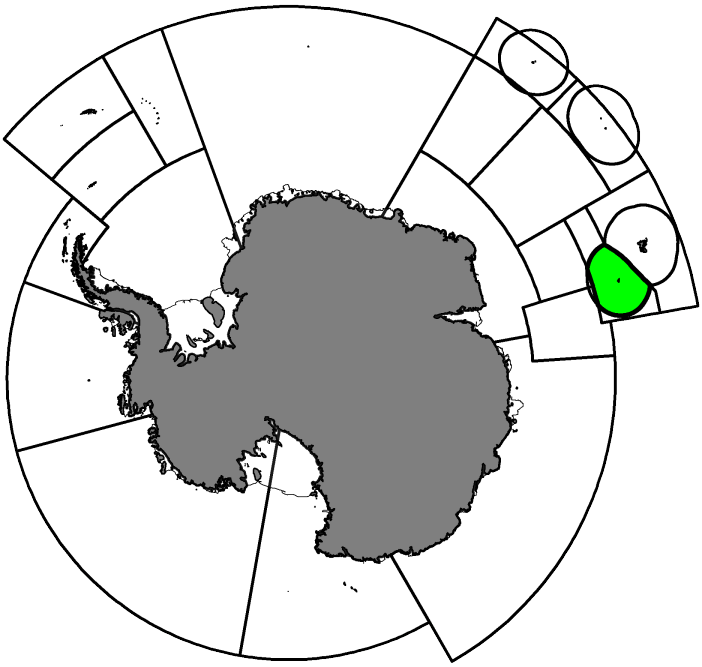
Stock Assessment Report 2024: *Dissostichus eleginoides* at Heard Island (Division 58.5.2)

CCAMLR Secretariat

14 March 2025



Patagonian toothfish *Dissostichus eleginoides* Smitt, 1898.



Map of the management areas within the CAMLR Convention Area. The region discussed in this report is shaded in green. Coastlines and ice shelves: UK Polar Data Centre/BAS and Natural Earth. Projection: EPSG 6932.

Stock Assessment Report 2024: *Dissostichus eleginoides*
Heard Island, Australian EEZ (Division 58.5.2)

1. Model configuration

The Heard Island and McDonald Islands fishery for Patagonian toothfish (*Dissostichus eleginoides*) in Division 58.5.2 was assessed in 2024 with an integrated stock assessment using Casal2 (WG-FSA-IMAF-2024/50 and WG-FSA-IMAF-2024/64).

The specification for the assessment model used for management advice are provided in the Stock Annex.

Compared to the 2023 assessment, the 2024 stock assessment took into account updated catch data to 2024 and observations to the end of 2023 including new ageing data from the RSTS and commercial fishery.

2. MPD estimates

The point estimate (maximum posterior density, MPD) for virgin spawing stock biomass B_0 was 64 609 tonnes and the estimated *SSB* status at the end of 2024 was 0.38.

The likelihood profile is shown in Figure 1. While tag-releases from 2013 to 2015 and in 2019 and 2021 indicated that B0 should be no more than 60 000 tonnes, tag-releases in other years were in disagreement indicating that a much larger B0 was most likely. The survey abundance index also indicated that a B0 should be at a substantially higher level.

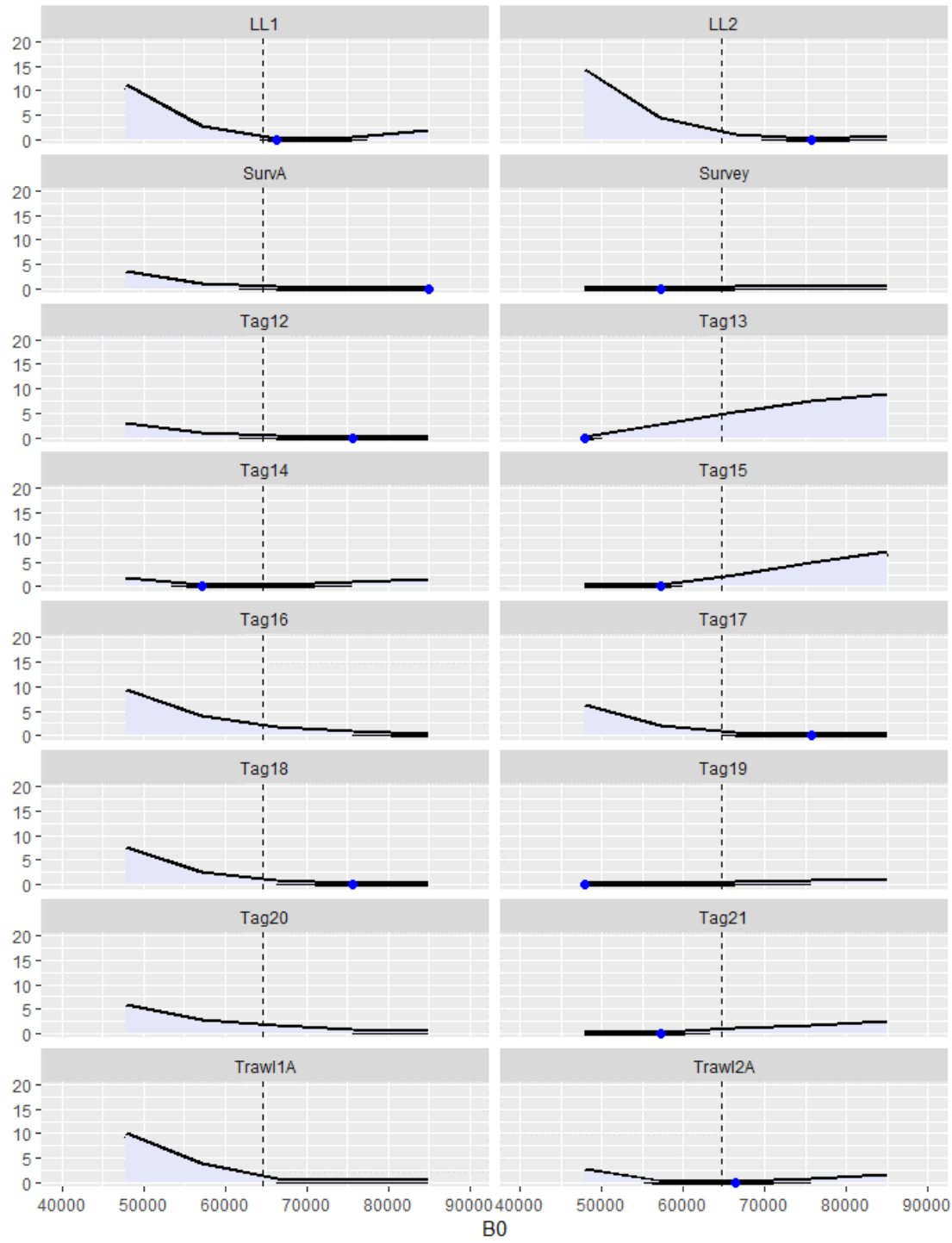


Figure 1: Likelihood profiles (–2 log-likelihood) across a range of B_0 values. To create these profiles, B_0 values were fixed while only the remaining parameters were estimated. 'Survey' is survey biomass index, 'SurvA' is survey catch-at-age, 'Trawl1A' is Trawl1 catch-at-age and so on, tag-release data are denoted by their release year.

MPD fits

The MPD model fits to the survey biomass, tag-recaptures, and median age by sub-fisheries are shown in Figures 2 to 6. Fits to biomass observations from the survey showed clear deviation between observed values and MPD fits particularly between 2019 and 2021, however the most recent year of data was well aligned with model predictions. At this stage, the model does not consider this signal strong enough to represent a recruitment pulse, maybe due to conflicting information from the tagging and the longline catch-at-age data.

The model fits to tagging data were generally good for cohorts released in the earlier years but fluctuate more for recent release cohorts (Figures 3 and 4). Tags released in 2019 in particular stood out with much higher than expected recapture numbers in 2020 and lower than expected recapture numbers in 2021 and 2022. These exaggerated values likely reflect changes in fishing effort during this time-frame where regularly fished areas were omitted from the fishing footprint on particular years.

Generally good fits were obtained for the proportions-at-age datasets of the longline sub-fisheries, while the fits to the data from the two trawl sub-fisheries were variable, despite the split into two trawl periods (Figure 5 and 6).

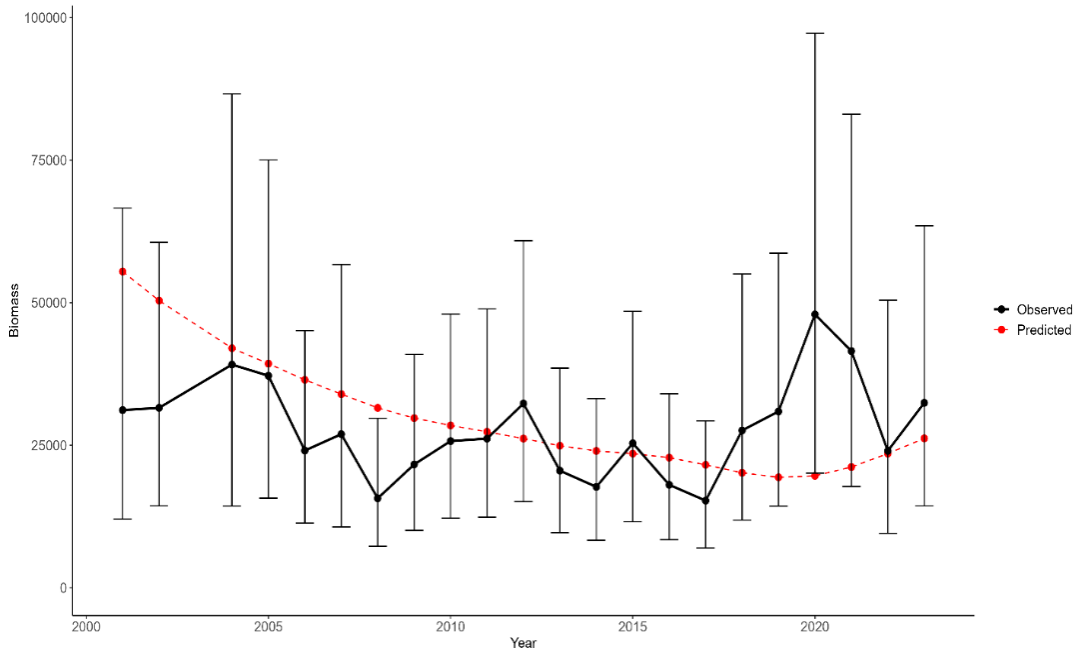


Figure 2: Observed (black line with 95% CI) and predicted (red line) survey biomass.

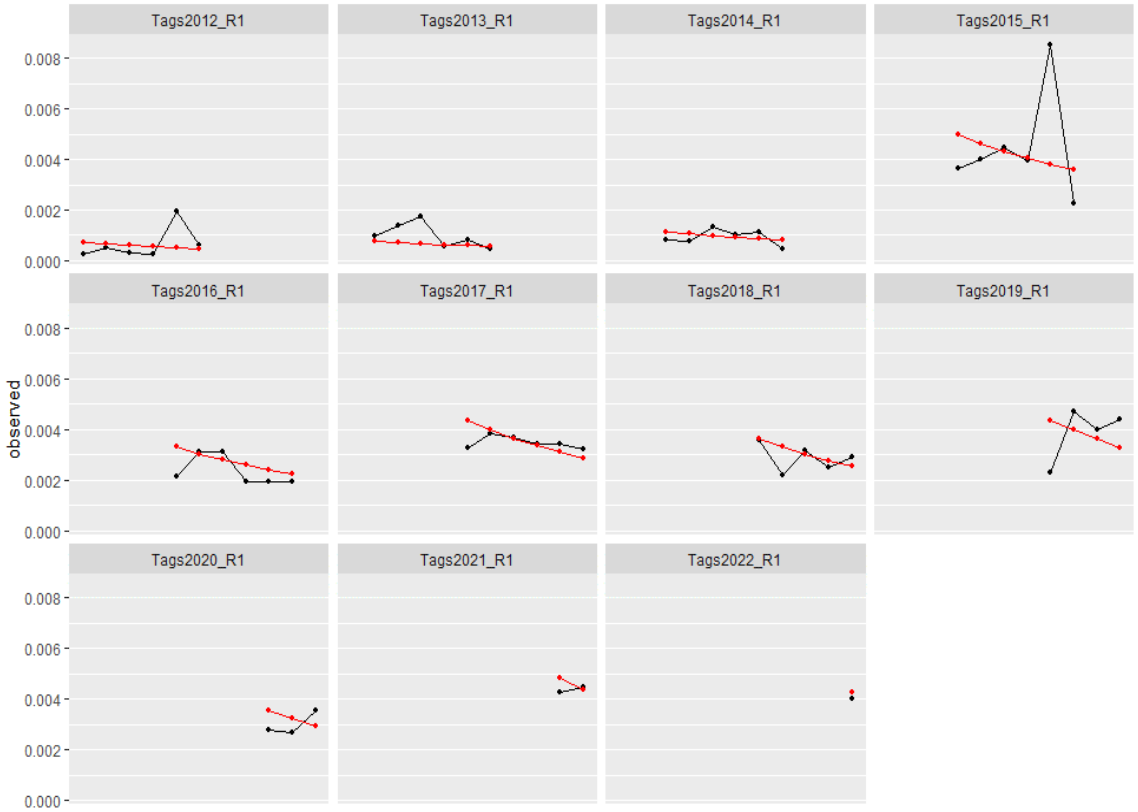


Figure 3: Observed (black lines) and expected (red lines) total tag recaptures by recapture year for tag releases in 2012–2022 and tag recaptures in 2013–2023.

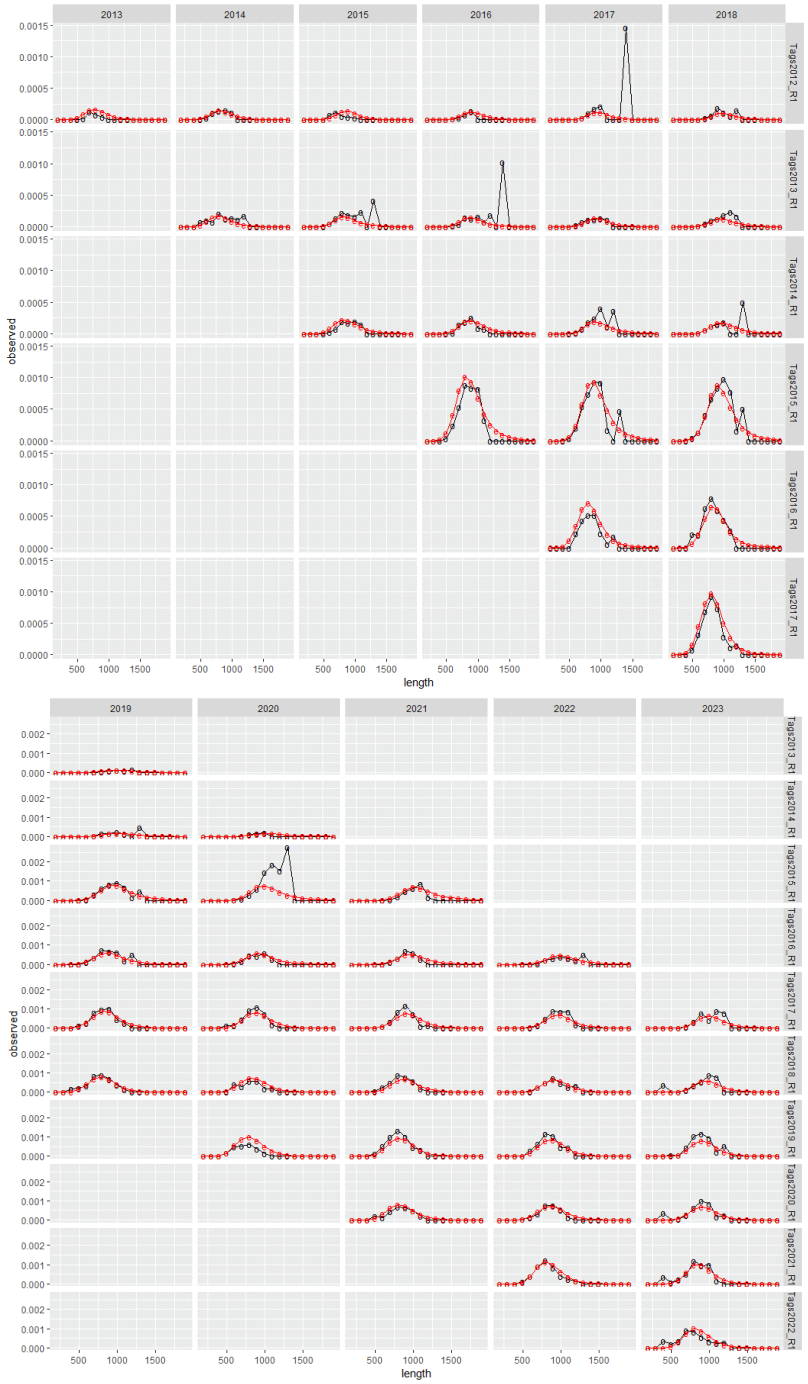


Figure 4: Observed (black lines) and expected (red lines) tag recaptures by 100 mm length for tag releases in 2012–2022 and tag recaptures in 2013–2023.

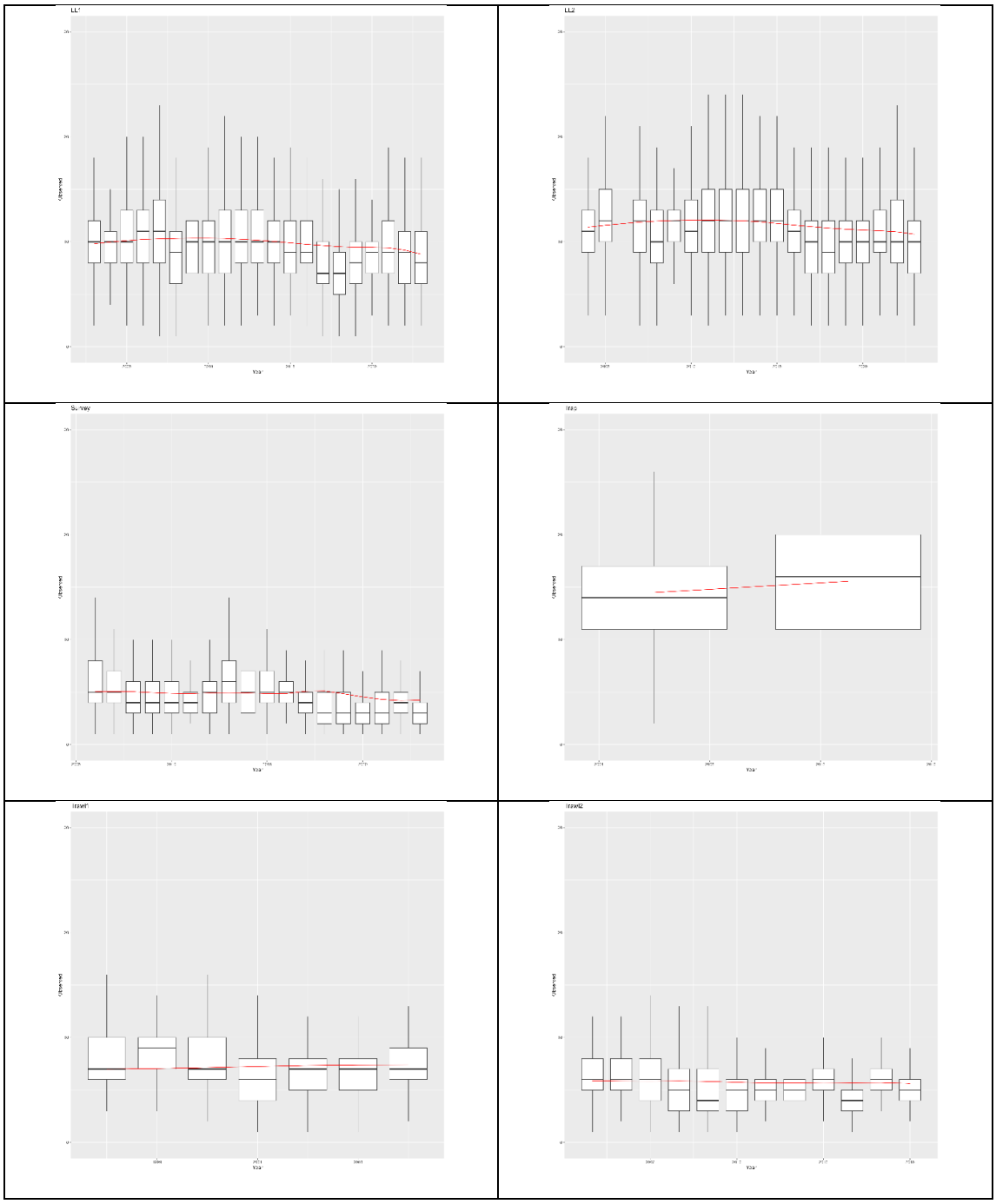


Figure 5: Boxplots of observed age by sub-fishery and expected median age (red line) for shallow (<1500m) longline (LL1), deep (> 1500m) longline (LL2), RSTS (Survey), trap (Trap) and Trawl1 and Trawl2.

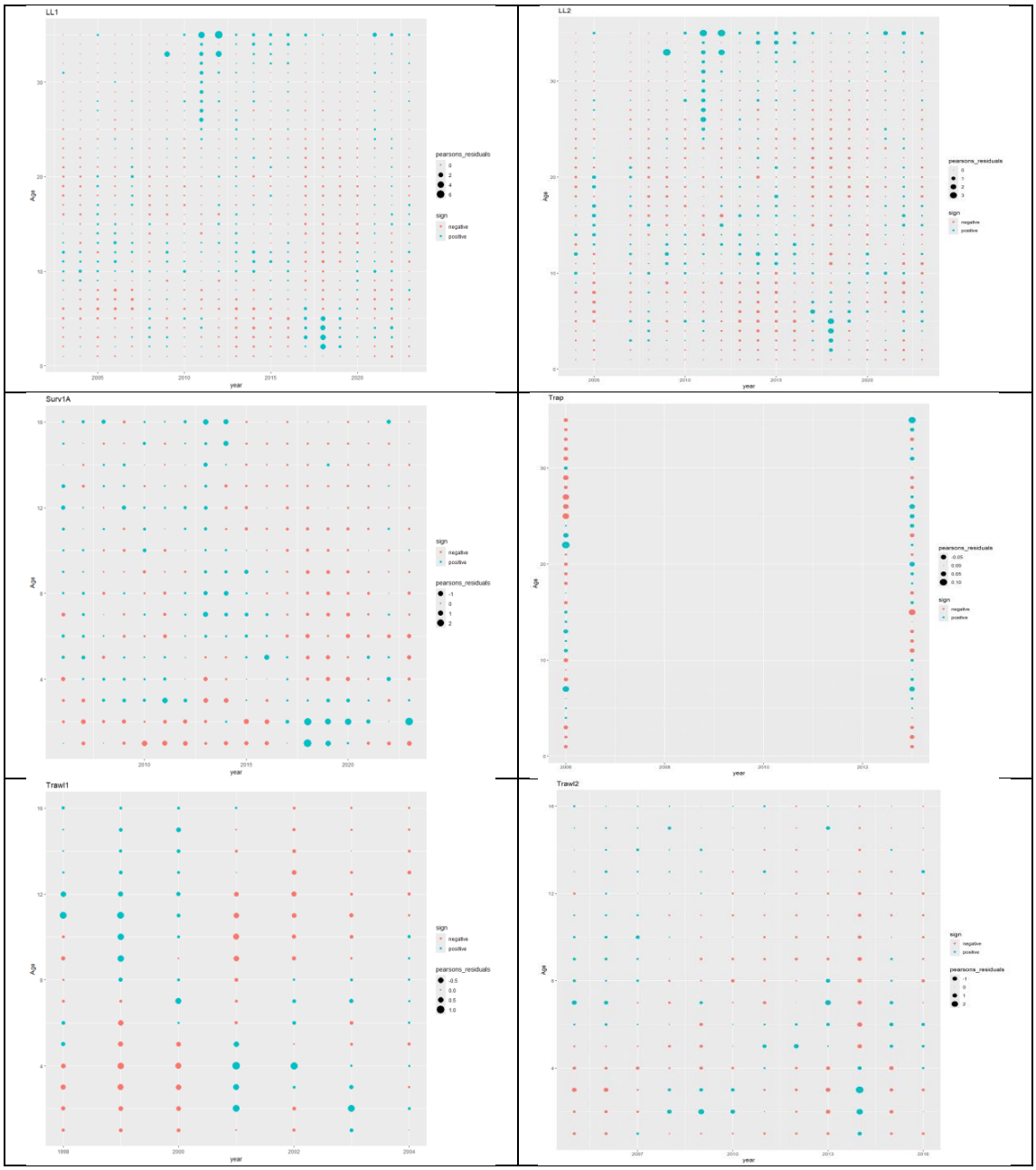


Figure 6: Pearson's residuals of MPD fits by age and year for the surveyand commercial sub-fisheries.

3. MCMC estimates

The 2023 assessment model estimated a virgin SSB (B_0) of 64 083 tonnes (95% CI: 60 139 – 68 635 tonnes) and an estimated SSB status in 2023 of 0.38 (95% CI: 0.38-0.38) (Table 2).

The estimated YCS showed large uncertainty for the earlier years 1986-1995, with an indication of a decline and increasingly higher confidence over time (Figure 7).

The estimated selectivity functions differed distinctly between the survey and the trawl, longline and trap sub-fisheries (Figure 8). The trawl surveys and the commercial trawl sub-fisheries observed predominantly young fish, while the longline and trap sub-fisheries concentrated on older fish, with LL2 in waters deeper than 1500 m catching older fish compared to LL1 in waters shallower than 1500 m. Trap was estimated to catch mainly fish older than 15 years

The posterior distribution and trace plots of the MCMCs for B_0, survey q, all estimated *YCS*, and selectivity parameters showed acceptable mixing behaviour (Figures 9 and 10) and passed the Heidelberger & Welch (1983) stationary and half-width tests.

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Table 2: MCMC estimates of median SSB_0 (tonnes) and SSB status in 2023 with 95% confidence intervals.

B_0 (95% CI) (tonnes)	SSB status 2023 (95% CI)
64 086 (60 139 – 668 635)	0.38 (0.38 – 0.38)

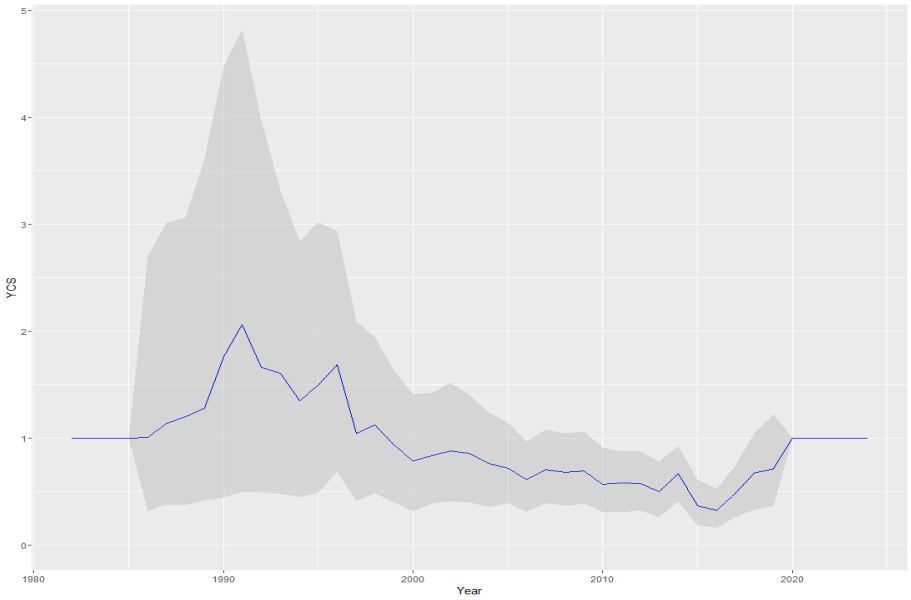

Figure 7: Year-class strength (YCS) estimates with 95% confidence bounds obtained from the MCMC samples.

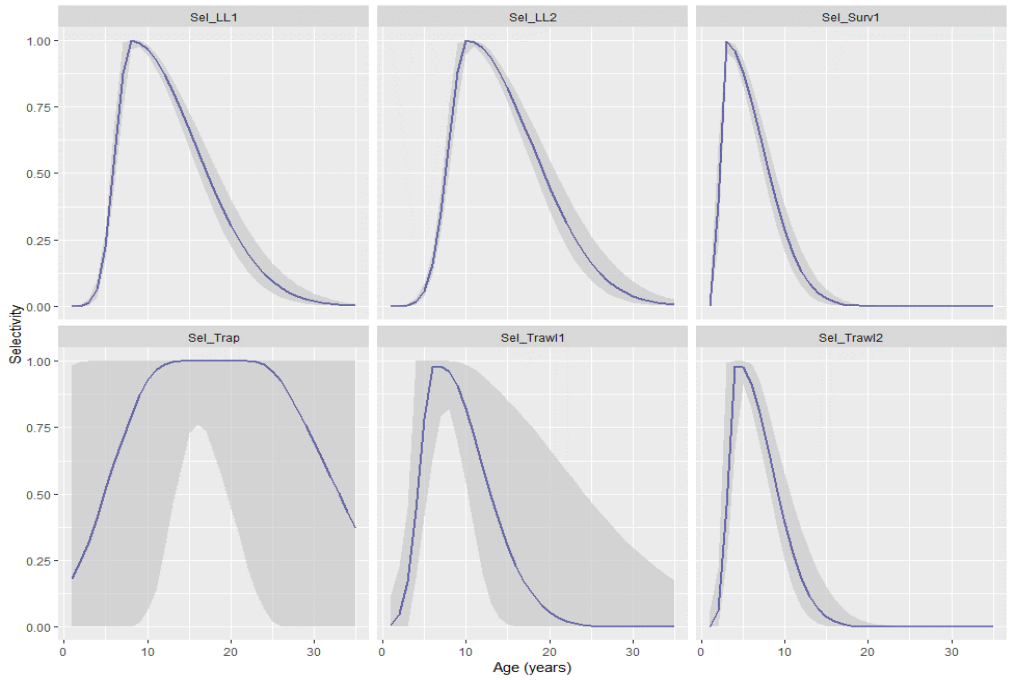

Figure 8: Estimated double-normal-plateau and double-normal fishing selectivity functions for the survey (Surv1) and commercial sub-fisheries, showing 95% confidence bounds obtained from the MCMC samples. Trawl1 is trawl from 1997 to 2004, Trawl2 is trawl from 2005 onwards, LL1 and LL2 are longline in <1 500 m and >1 500 m depth respectively. Vertical reference lines are shown at ages 5 and 10.

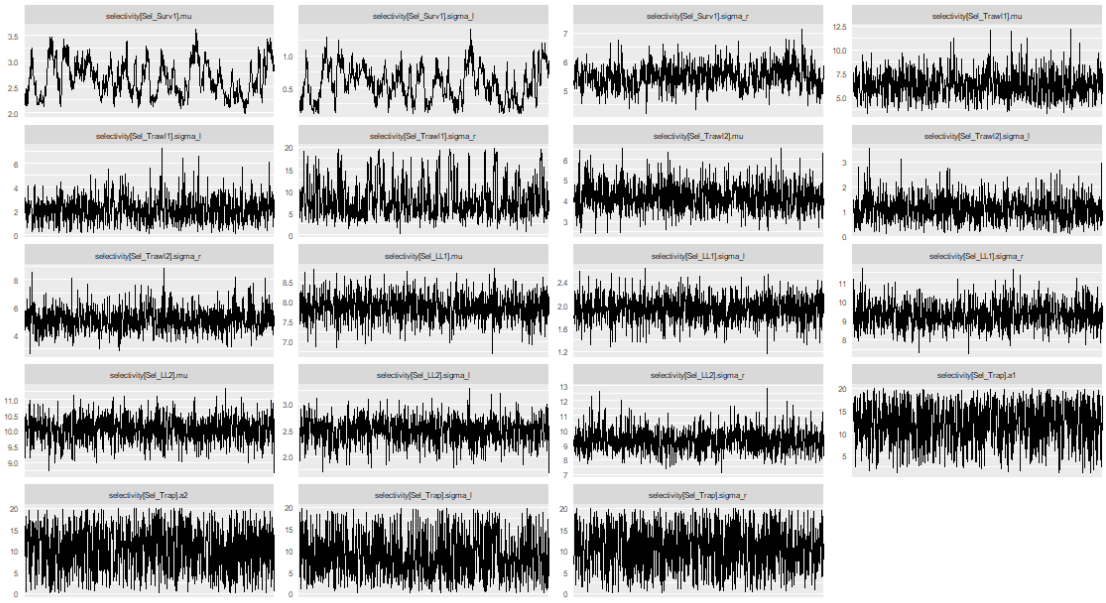

Figure 9: MCMC posterior trace plots for B_0, survey catchability q and all selectivity parameters.

Figure 10: MCMC posterior trace plots for all estimated YCS parameters.

4. Yield estimates

The median CV estimated for the YCS period from 1986 to 2019 was used to generate the random recruitment from 2020 to 2023 and the 35-year projection period from 2024 to 2059.

The estimated long-term yield from this projection using the CCAMLR Decision Rules was 2 640 tonnes with a depletion probability of 0.0 and an escapement probability of 0.502 (Table 3, Figure 11).

The Scientific Committee discussed the application of the CCAMLR decision rule to this stock and noted the uncertainty in estimated stock status caused by the spatial and temporal variability of tagging effort in the stock assessment (SC-CAMLR-43 para. 3.90). The Commission endosed a catch limit of 2 120 tonnes that was projected to return the spawning stock biomass to target level of 50%B0 after 20 years rather than after the 35-year projections period in the CCAMLR Decision Rules (Figure 12).

Table 3: Estimates of catch limits in tonnes based on MCMC sampling that satisfy the CCAMLR harvest control rules, with (i) a median escapement of the spawning biomass at the end of the 35-year projection period of at least 50% of the median pre-exploitation level ('Target'), and (ii) a less than 10% risk of the spawning biomass dropping below 20% of its median pre-exploitation level at any time over the 35-year projection period ('Depletion').

Model	Catch limit (tonnes)	Target	Depletion
2024 Assessment	2660	0.508	0.000

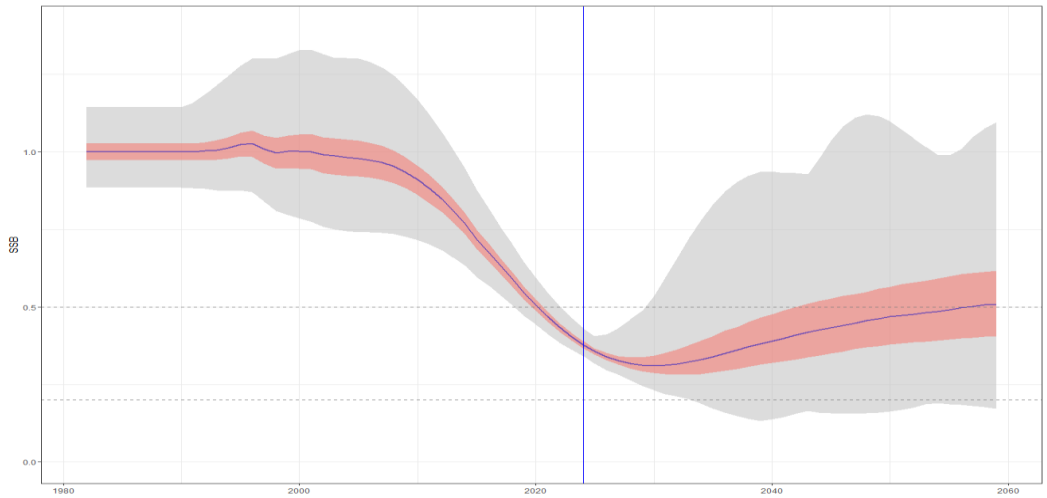

Figure 11: Projected SSB status relative to B0 for the assessment model and a constant future catch of 2640 tonnes using MCMC samples. The YCS period from 1986-2019 was used to generate random lognormal recruitment from 2020-2059. Shown are median (black line), 100% confidence bounds (light grey) and 80% confidence bounds (dark grey). Horizontal dotted lines show the 50% and 20% status levels used in the CCAMLR decision rules, the vertical blue line indicates the current year.

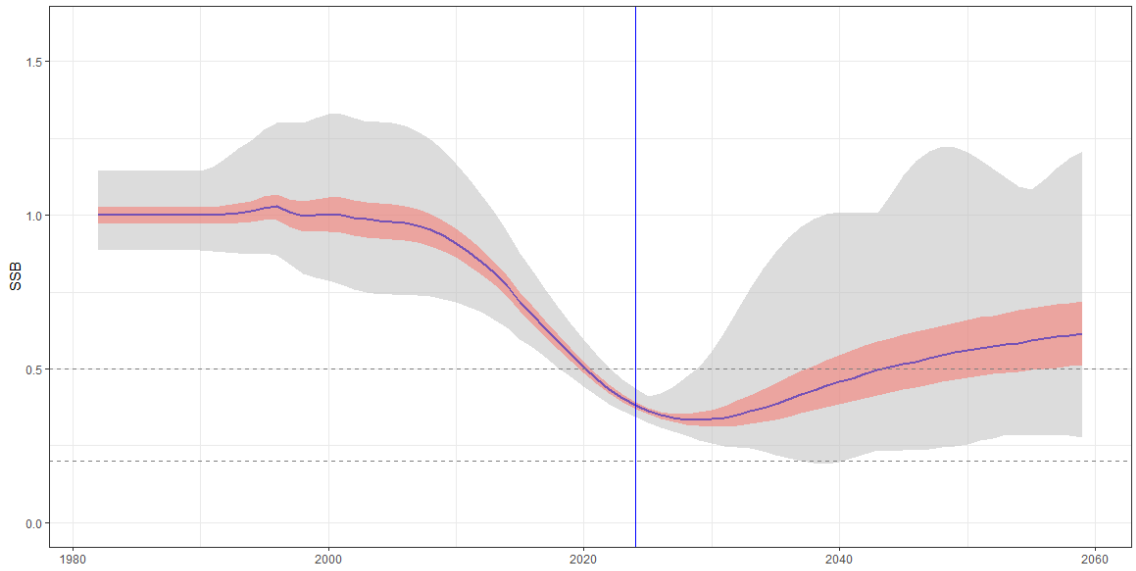

Figure 12: Projected SSB status relative to B0 for the assessment model and a constant future catch of 2120 tonnes using MCMC samples. The YCS period from 1986-2019 was used to generate random lognormal recruitment from 2020-2059. Shown are median (black line), 100% confidence bounds (light grey) and 80% confidence bounds (dark grey). Horizontal dotted lines show the 50% and 20% status levels used in the CCAMLR decision rules, the vertical blue line indicates the current year.

Additional Resources

- Fishery Summary: pdf, html
- Fishery Report: pdf, html
- Species Description: pdf, html
- Stock Annex: pdf
- Fisheries Documents Browser