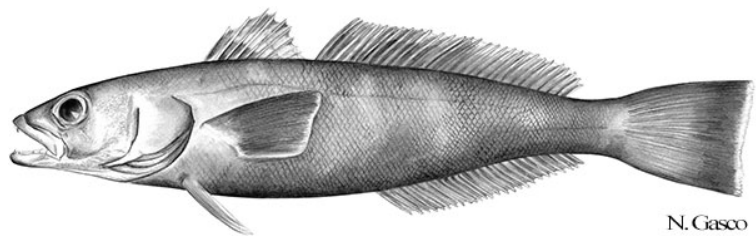


Stock Assessment Report 2020: *Dissostichus eleginoides* at Heard Island (Division 58.5.2)

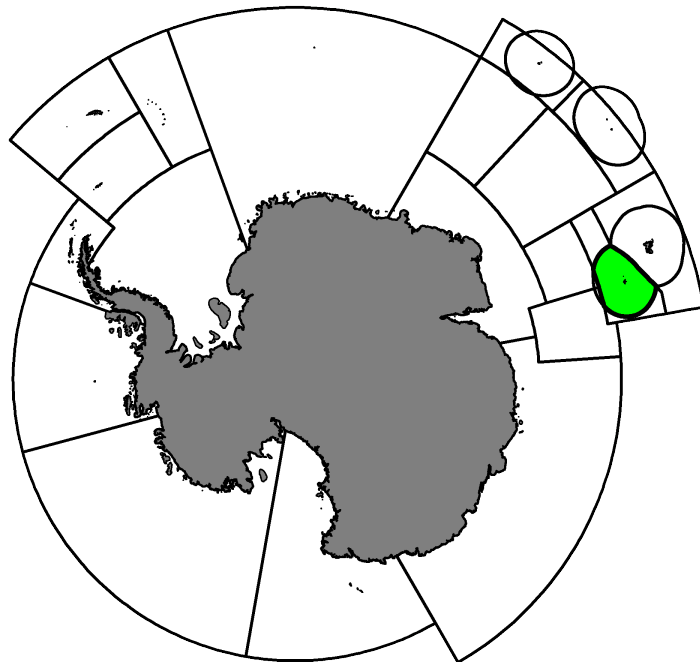
CCAMLR Secretariat

16 March 2021



N. Gasco

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.

Stock Assessment Report 2019:
***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 2019 with an integrated stock assessment using CASAL (WG-FSA-19/32).

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

Compared to the 2017 assessment, the 2019 stock assessment took into account (1) catch data to 2019 and observations to the end of 2018 including new ageing data from the RSTS and commercial fishery from 2017-2018, (2) inclusion of fishing-induced mortality from longline gear loss, (3) updated growth parameters, (4) updated length-weight relationship parameters, (5) updated maturity-at-age parameters, and (6) a simplification of the longline selectivity functions.

2. MPD estimates

The point estimate (maximum posterior density, MPD) for virgin spawning stock biomass B_0 was 71 210 tonnes and the estimated SSB status at the end of 2019 was 0.51.

The likelihood profile (Figure 1) indicated that tag-releases from 2014 - 2016 were in agreement with a B_0 of around 60 000 tonnes, while tag-releases from 2012, 2013 and 2017 were in diametrical disagreement indicating that either a much larger or much smaller B_0 was most likely. The survey abundance index indicated that a B_0 around 50 000 tonnes was most likely.

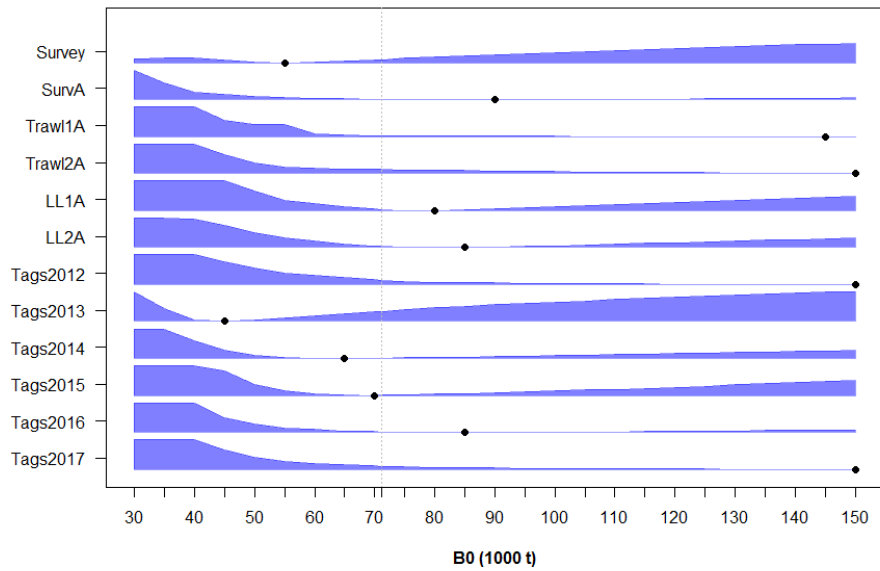


Figure 1: Likelihood profiles ($-2 \log$ -likelihood) across a range of B_0 values. To create these profiles, B_0 values were fixed while only the remaining parameters were estimated. The dotted grey line indicates the MPD estimate. ‘Survey’ is survey biomass index, ‘SurvA’ is survey catch-at-age, ‘Trawl1A’ 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 observations, tag-recaptures, median age by sub-fisheries, and the tag releases from the longline sub-fisheries are shown in Figures A7 to A14.

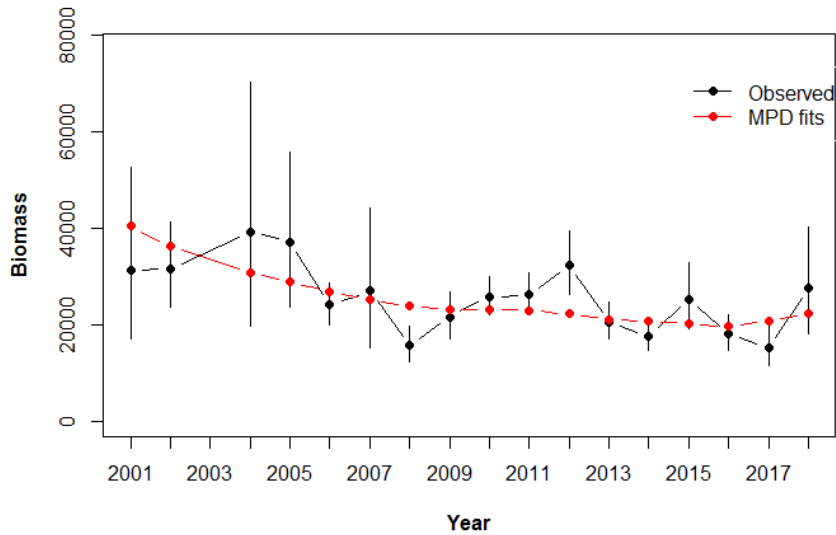


Figure 2: Observed (black line with 95% CI) and predicted (red line) survey biomass.

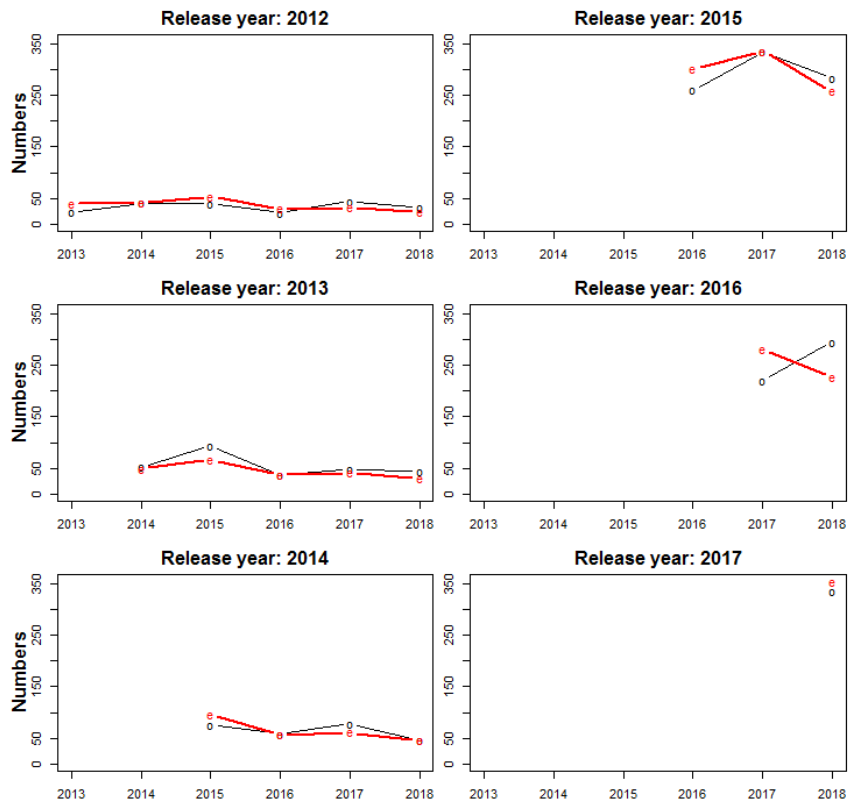


Figure 3: Observed (black lines) and expected (red lines) total tag recaptures by recapture year for tag releases in 2012–2017 and tag recaptures in 2013–2018.

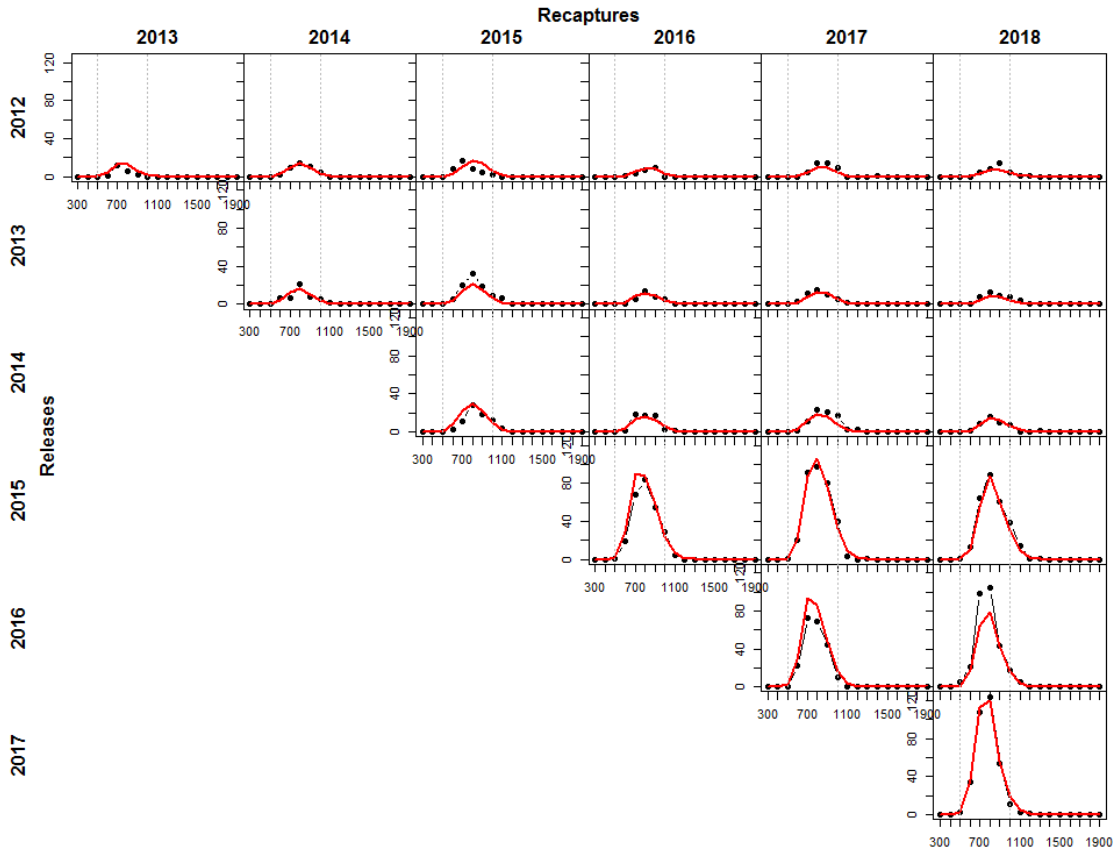


Figure 4: Observed (black lines) and expected (red lines) tag recaptures by 100 mm length for tag releases in 2012–2017 and tag recaptures in 2013–2018.

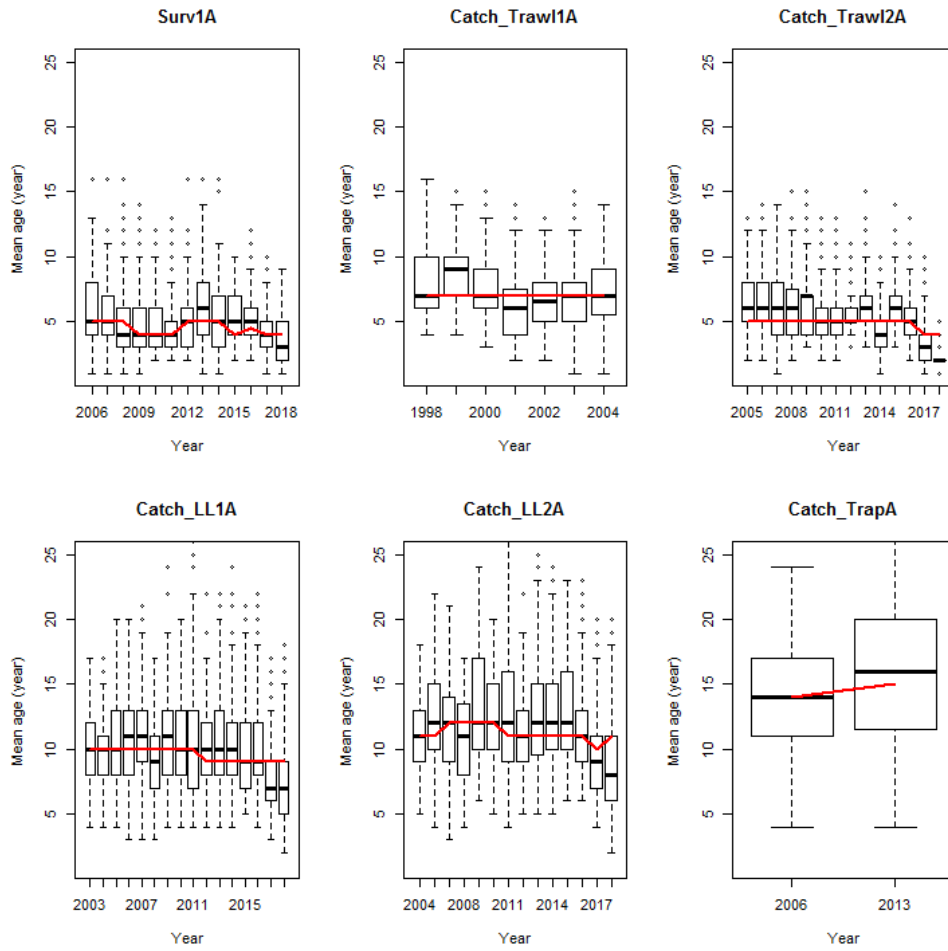


Figure 5: Boxplots of observed age by sub-fishery and expected median age (red line).

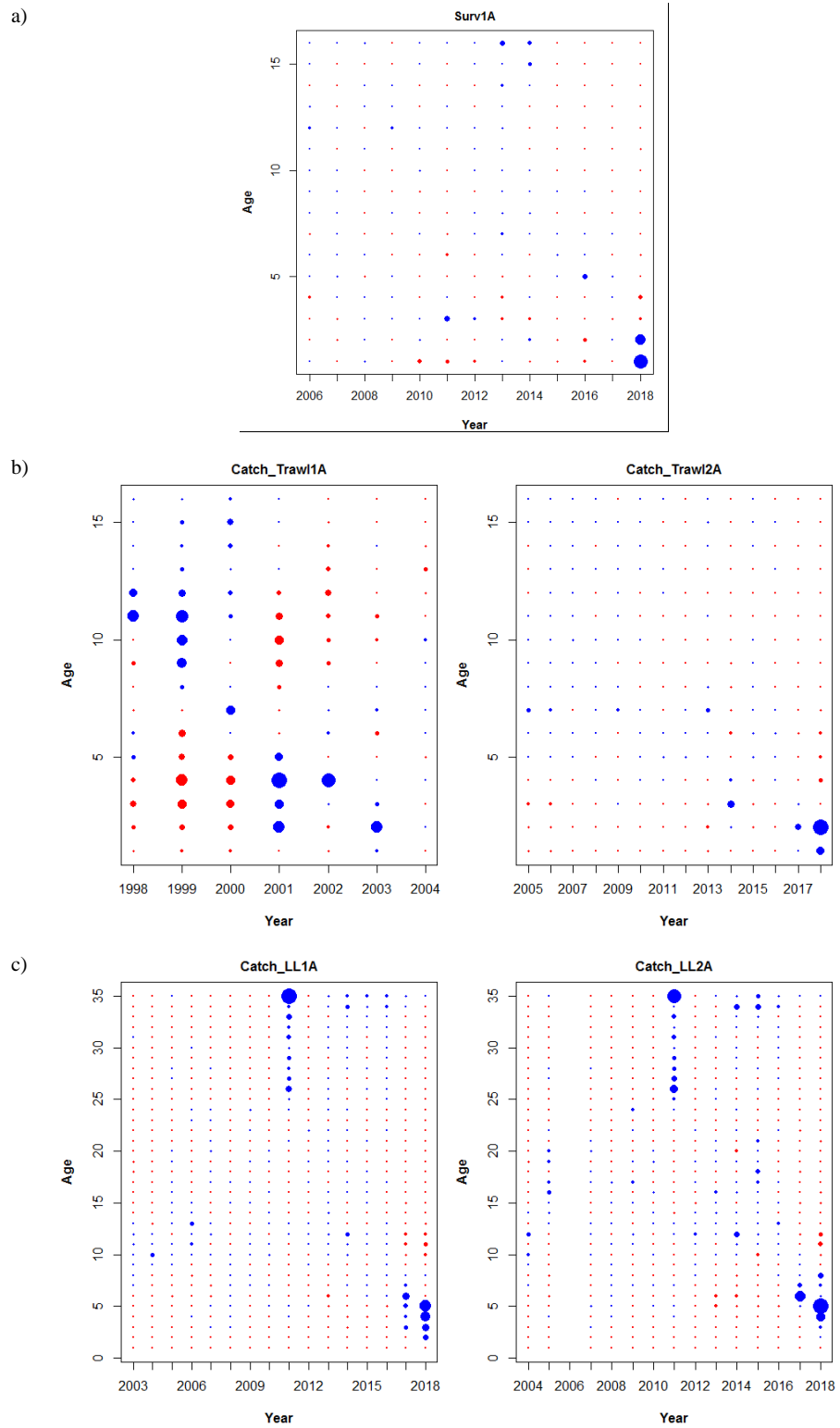


Figure 6: Pearson's residuals of MPD fits by age and year for the (a) survey, (b) commercial trawl and (c) longline sub-fisheries.

3. MCMC estimates

The 2019 assessment model estimated a virgin SSB (B_0) of 70 519 tonnes (95% CI: 65 634 - 76 626 tonnes) and an estimated SSB status in 2019 of 0.51 (0.49–0.53) (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 trace plots of the MCMCs for all free parameters showed little evidence of non-convergence (Figures 9 and 10).

Table 2: MCMC estimates of median SSB_0 and SSB status in 2019 with 95% confidence intervals.

B_0 (95% CI)	SSB status 2019 (95% CI)
70 519 (65 634 - 76 626)	0.51 (0.49 - 0.53)

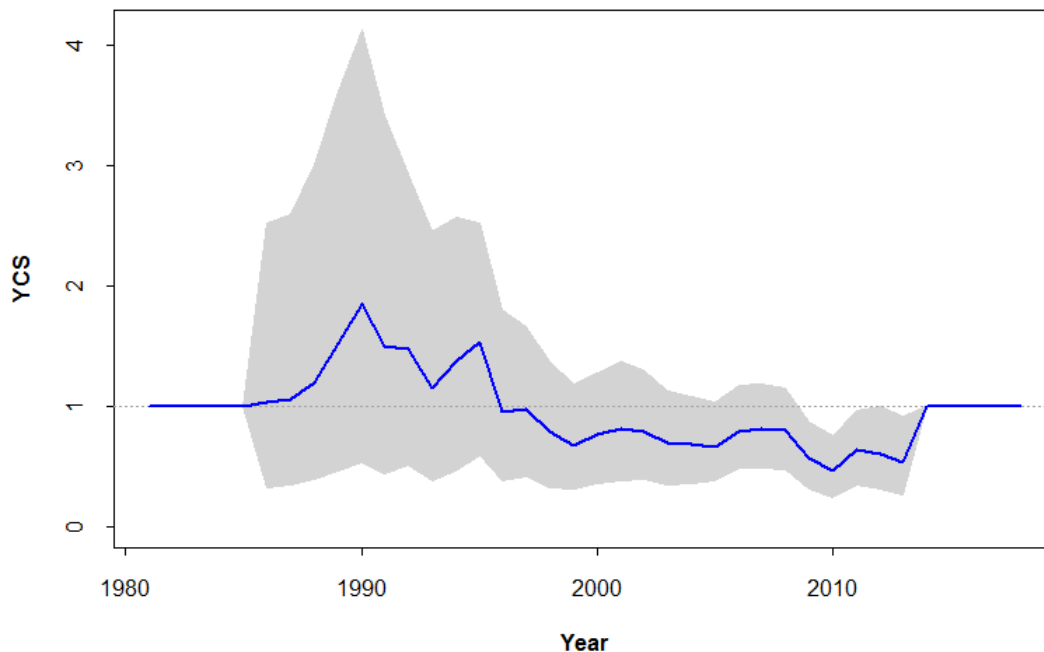


Figure 7: Year-class strength (YCS) estimates with 95% confidence bounds obtained from the MCMC samples.

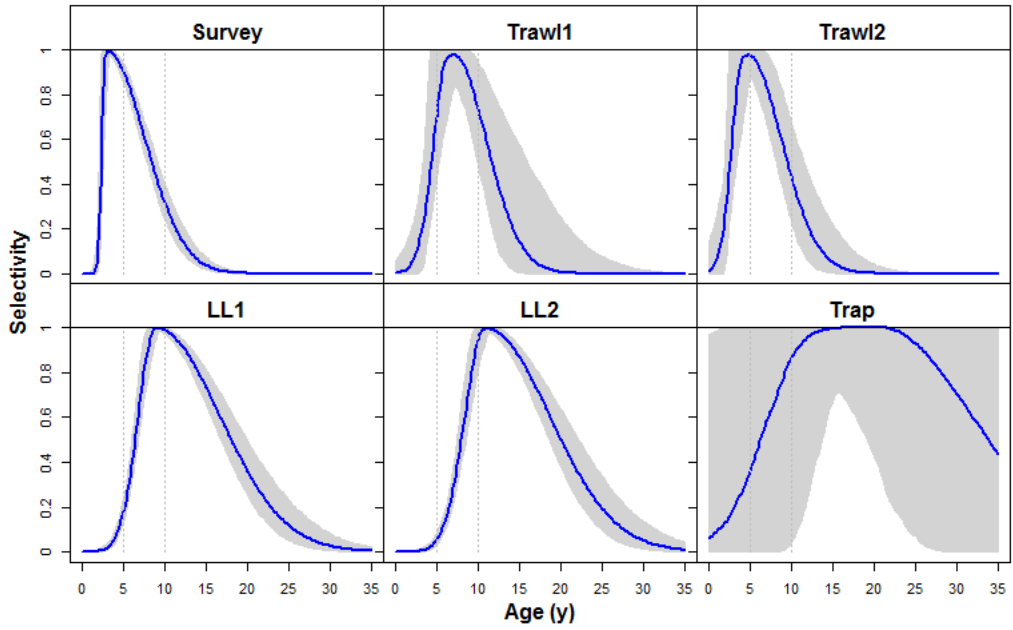


Figure 8: Estimated double-normal-plateau and double-normal fishing selectivity functions for the survey (Surv1) and commercial sub-fisheries, showing 95% confidence bounds obtained from the MCMC samples. Trawl1 is trawl from 1997 to 2004, Trawl2 is trawl from 2005 to 2019, LL1 and LL2 are longline in <1 500 m and >1 500 m depth respectively. Vertical reference lines are shown at ages 5 and 10.

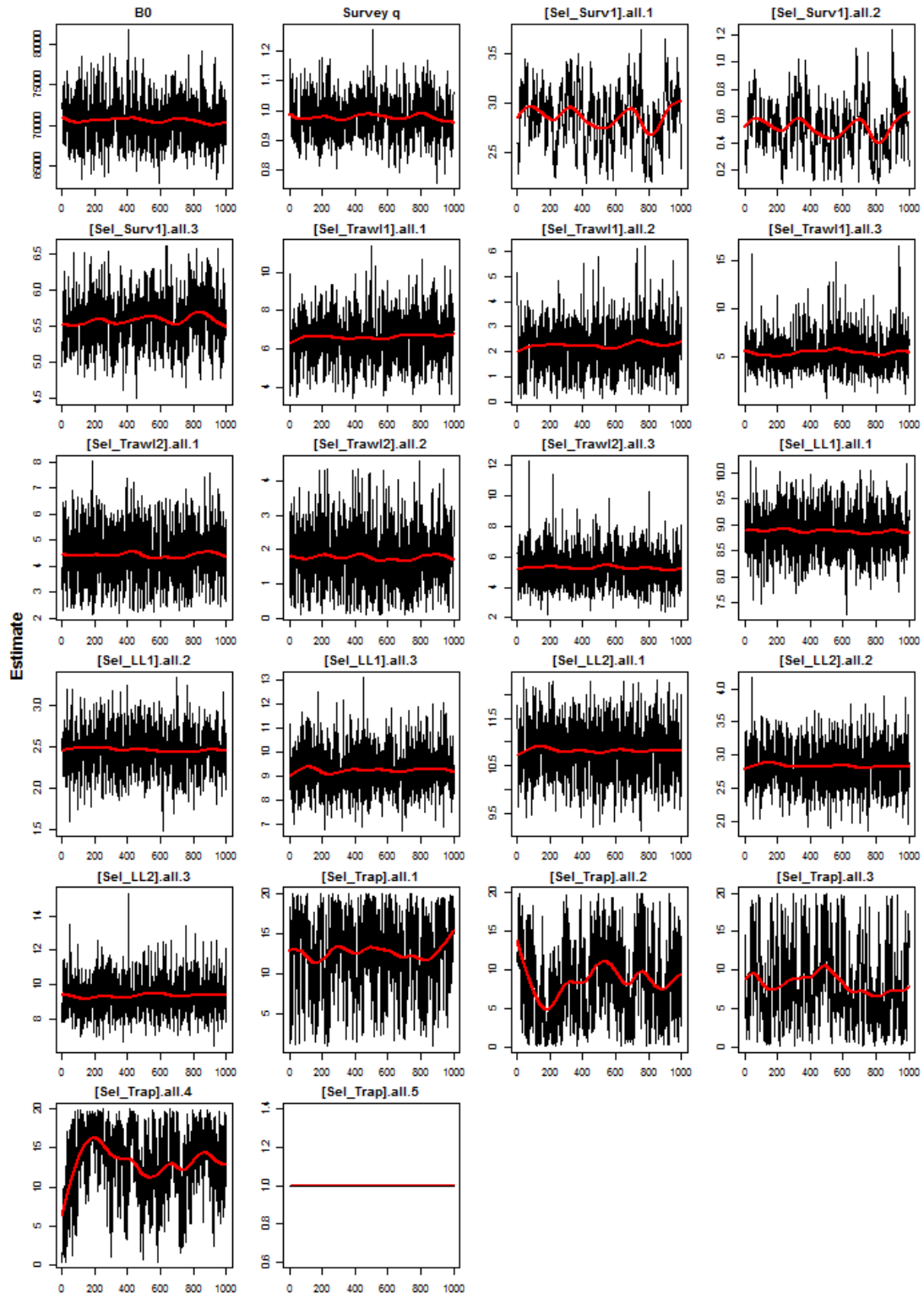


Figure 9: MCMC posterior trace plots for B_0 , survey catchability q and all selectivity parameters.

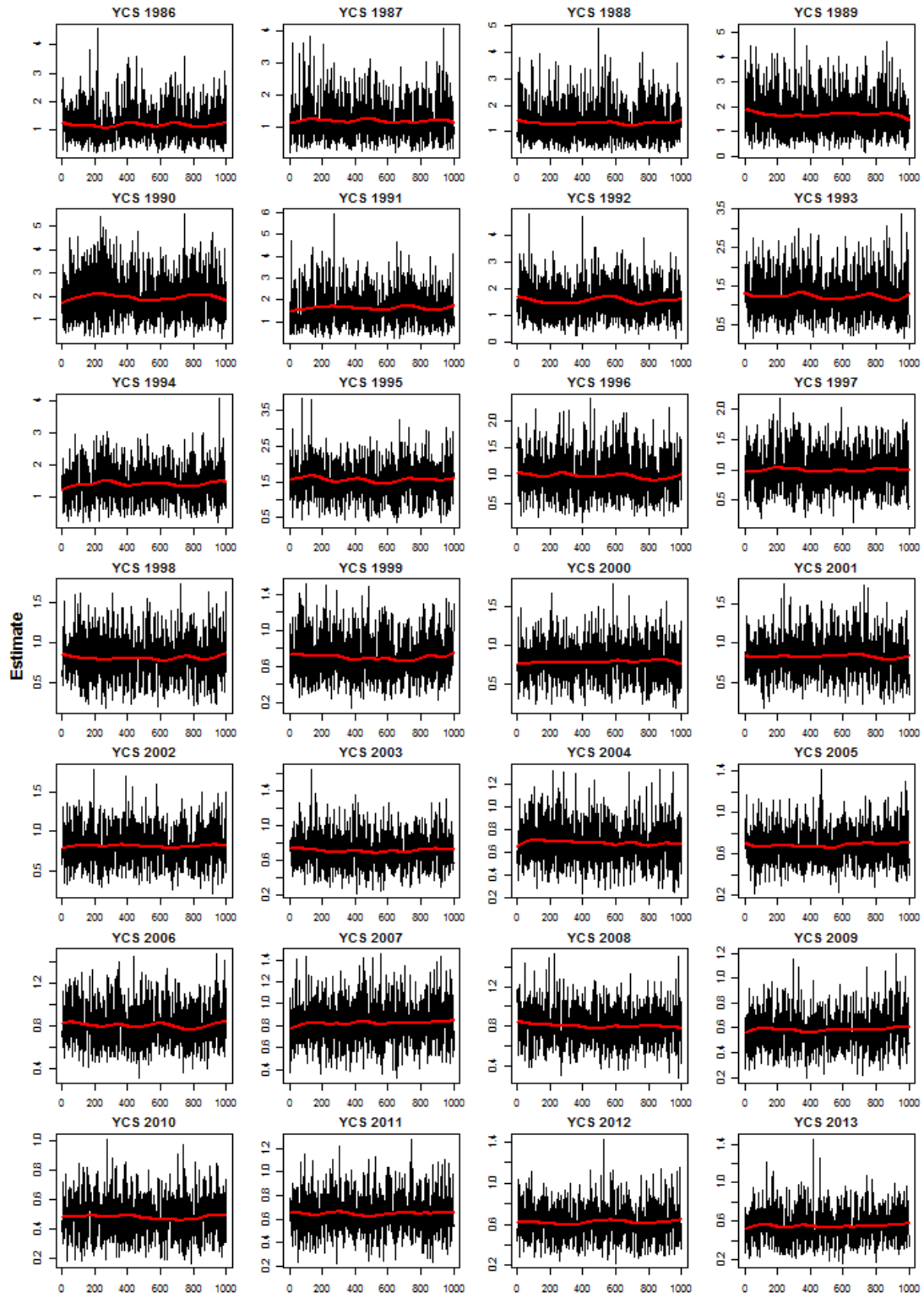


Figure 10: MCMC posterior trace plots for all estimated YCS parameters.

4. Yield estimates

The median CV estimated for the YCS period from 1986 to 2013 was used to generate the random recruitment from 2012 to 2018 and the 35-year projection period from 2019 to 2054 ($\sigma_R = 0.47$).

The estimated long-term yield from this projection was 3 030 tonnes with a depletion probability of 0.0 and an escapement probability of 0.501 (Table 3, Figure 11).

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	Target	Depletion
2019 Assessment	3030	0.501	0.00

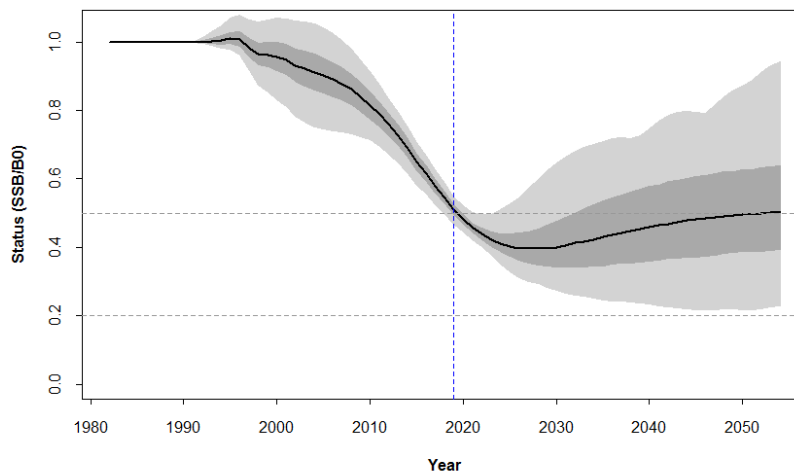


Figure 11: Projected SSB status relative to B0 for the assessment Model 6 and a constant future catch of 3030 tonnes using MCMC samples. The YCS period from 1986-2013 was used to generate random lognormal recruitment from 2014-2054. Shown are median (black line), 100% confidence bounds (light grey) and 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](#)