Department of Primary Industries
and Regional Development

NSW Stock Status Summary – 2024/25

Silver Trevally (*Pseudocaranx georgianus*)

Assessment Authors and Year

Fowler, A. M. and Liggins, G. W. 2025. Stock assessment report 2024/25 - Silver Trevally (*Pseudocaranx georgianus*). NSW Department of Primary Industries and Regional Development - Fisheries: 61 pp.

Stock Status

Current stock status	On the basis of the evidence contained within this assessment, Silver Trevally are currently assessed as recovering.

Stock structure & distribution

Silver Trevally (*Pseudocaranx georgianus*), formerly known as *P. dentex*, have a relatively contiguous distribution from northern NSW to Western Australia, south of 25˚S latitude (Bearham et al. 2020). However, stock structure is poorly understood. Their continuous distribution, the dominance of the East Australian Current, and a recent genetic study, suggest Silver Trevally are likely genetically homogenous on Australia's east coast (Bearham et al. 2020). Tagging studies in Australia and New Zealand suggest that movement after settlement is limited, so there is potential for finer-scale population structure within the east coast population (Fowler et al. 2018).

Scope of this assessment

The assessment used an integrated age-structured population dynamics model (Fowler and Liggins 2025). The model used the same structure and data types as the previous assessment (Burch et al. 2023) but included an additional year of data (2023). The model assumed a single biological stock spanning the mainland jurisdictions of NSW, the Commonwealth and Victoria. This reflects likely stock structure (see above) and the fact that the two jurisdictions responsible for greatest catch historically (NSW and the Commonwealth) are primarily separated in an onshore-offshore direction.

The assessment presents results for a single base-case model and a range of alternative scenarios designed to examine the sensitivity of the base-case result to various uncertainties. While most of these scenarios resulted in minimal change to final estimates of biomass depletion, the result was sensitive to the value of natural mortality (*M*). The current stock status reflects the marginal biomass result of the base-case model combined with the uncertainty in that value identified from models that used a lower value of *M*.

The NSW stock status in the current report is based on depletion estimates at the start of the 2024 calendar year, which is the first year after the last data year in the model. All references to current or final biomass estimates in this report therefore refer to 2024.

Biology

Silver Trevally inhabit estuarine and coastal waters to depths of up to 200 m and are moderately long lived with a maximum observed age of 24 years (Rowling and Raines 2000). They are moderately fecund and mature at a relatively early age (2–4 years). The species is a broadcast spawner, with pelagic eggs and larvae distributed by currents prior to settlement on soft sediment habitat. Silver Trevally are fast swimmers but the majority of individuals may not move long distances in the adult phase (Fowler et al. 2018).

Fishery statistics

Catch information

Commercial

Commercial landings included in the assessment are shown in Figure 1. Six commercial catch fleets were included in the assessment: NSW fish trawl (NSWFTRL), NSW fish trap (NSWFTRP), NSW line (NSWLN), NSW estuary (NSWEST), Commonwealth trawl (CWTRL) and Victorian commercial (VICCOM).

Total reported commercial landings during 2023 (last model year) were 93.6 t, slightly higher than the preceding year (83.5 t). Landings comprised 21.2 t from NSWFTRL, 8.1 t from NSWFTRP, 1.7 t from NSWLN, 11.5 t from NSWEST, 21.3 t from CWTRL and 29.8 t from VICCOM.

Discarding was negligible prior to 2007 when a minimum legal length (MLL) was introduced in NSW. After that year, an average discard rate of 27% by weight was estimated for NSWFTRL from an onboard observer study (NSW DPI, unpublished).

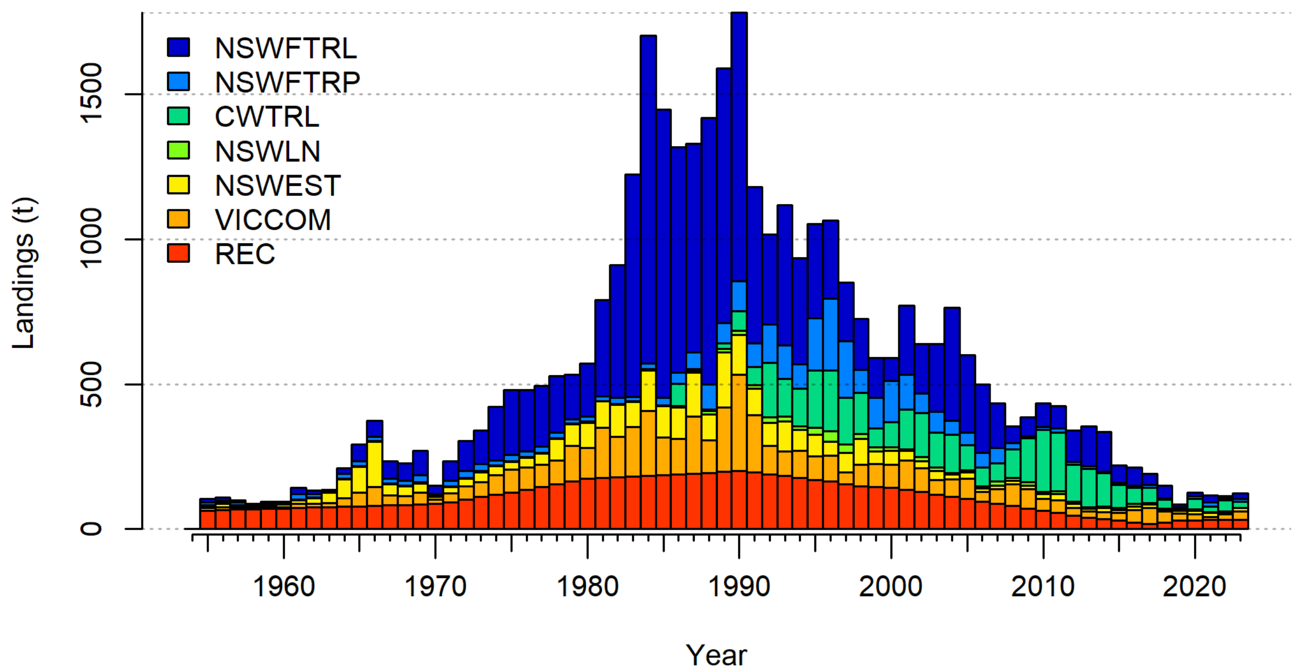

Figure 1. Landed catch of Silver Trevally by fleet. Note that the catches for the NSW and Victorian recreational (REC) and Victorian commercial (VICCOM) fleets have been imputed.

Recreational & Charter boat

Estimates of recreational harvest from NSW and Victoria were combined into a single fleet in the assessment (REC, Figure 1).

Five estimates of harvest by recreational fishers resident in NSW were used in the assessment: 100.0 t during 2000/01, 27.2 t during 2013/14, 12.5 t in 2017/18, 20.0 t in 2019/20 and 21.5 t in 2021/22. These weight estimates were made by converting estimates in numbers obtained from biennial offsite surveys (see Murphy et al. 2023) and included a scaling factor to account for catch by fishers that are not included in the sampling frame. Victorian recreational harvest was estimated at 42.9 t during 2000/01 using the ratio of NSW to Victorian catch in numbers during that year (Henry and Lyle 2003).

Indigenous

Aboriginal cultural catch of Silver Trevally has not been quantified but is assumed to be at a consistent or low level such that it would not substantially influence assessment outcomes.

Illegal, Unregulated and Unreported

The level of Illegal, Unregulated and Unreported (IUU) fishing has not been quantified but is assumed to be at a consistent or low level such that it would not substantially influence assessment outcomes.

Fishing effort information

Fishing effort was used in the calculation of standardised catch-per-unit-effort (CPUE) time-series included in the assessment. Effort in NSW prior to 2010 was reported in days, while effort from 2010 onward was reported in hours.

Catch rate information

Time-series of standardised CPUE for three catch fleets were included in the assessment: 1) NSWFTRL, 2) NSWFTRP, and 3) CWTRL (Figure 2). Management changes in NSW during 2007-2009, including the introduction of the MLL, necessitated a gap in the series from that jurisdiction. The resulting discontinuity was accommodated in the model by time-blocking catchability.

Patterns in CPUE were inconsistent among series during the earlier period and more consistent during the later period, noting that the series for CWTRL commences 12 years prior to those from NSW (Figure 2). From 2010 onward, all series show a decline to 2019 and a subsequent increase, although the most recent values for NSWFTRP are slightly lower. Best model fits were observed for NSWFTRP. CPUE values for NSWFTRL and CWTRL were underestimated by the model during intermediate years and overestimated during later years. The most recent observed CPUE value for NSWFTRL was considerably higher than preceding years.

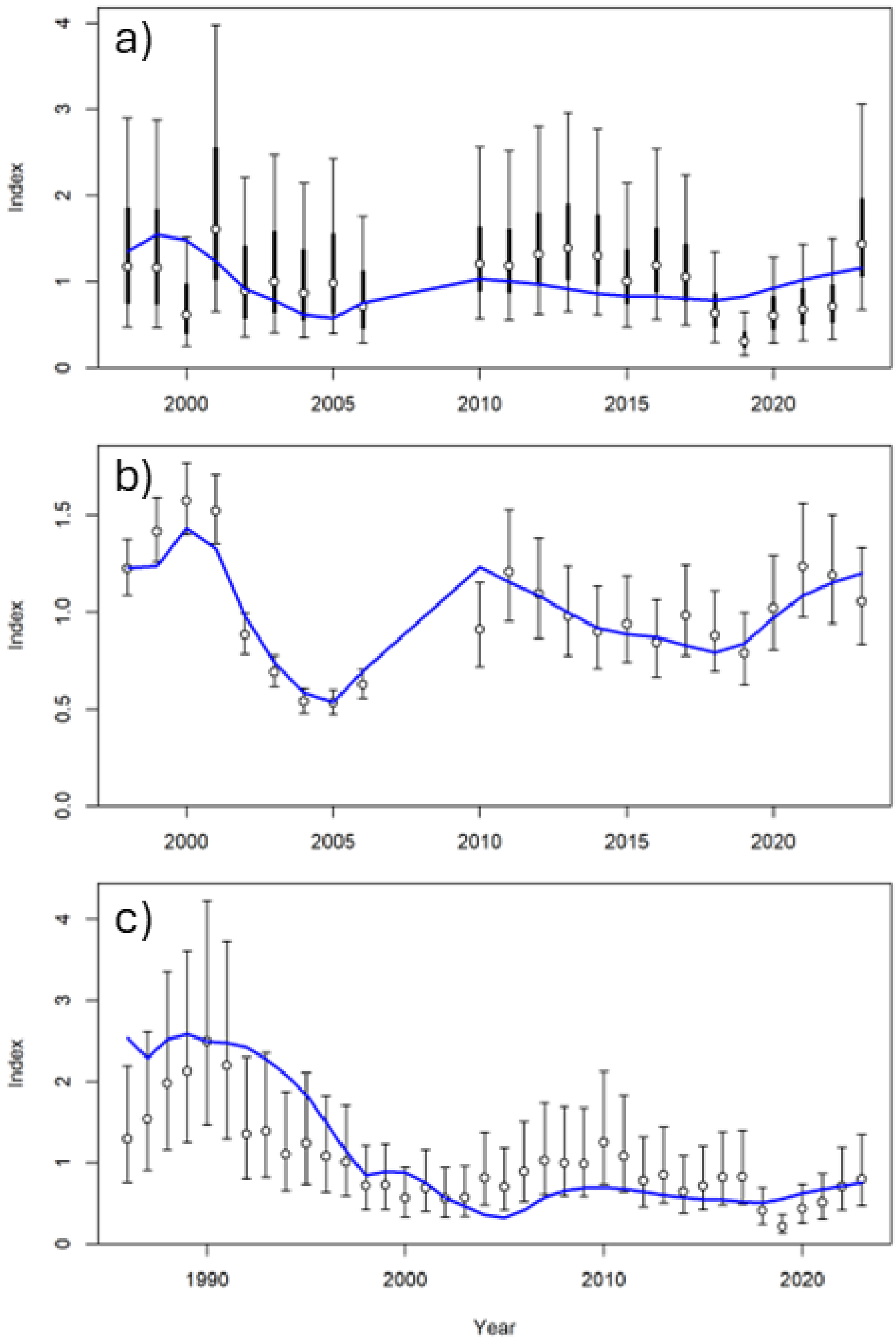

Figure 2. Standardised CPUE series for: a) NSW trawl (NSWFTRL), b) NSW trap (NSWFTRP) and c) Commonwealth trawl (CWTRL) fleets included the assessment. Observed values are indicated by open circles, model estimates are indicated by the blue line. Error bars indicate approximate 95% asymptotic intervals. Note the different time period for CWTRL.

Stock Assessment

Stock Assessment Methodology

Year of most recent assessment:

2024 (using data to 2023)

Assessment method:

An integrated age- and length-structured population model including multiple catch fleets and abundance (CPUE) indices was used for the assessment and was undertaken using Stock Synthesis 3.30.23 (Methot and Wetzel 2013). A single base-case model was developed and the potential effects of various uncertainties on the base case result were explored using a range of alternative (sensitivity) scenarios.

The current stock status determination for NSW is based on the base-case model, taking into account the uncertainty in the final biomass estimate indicated by the sensitivity scenarios.

Main data inputs:

- Landings (t) from seven fleets across NSW, Vic and the Commonwealth zones 10, 20 and 60 (the areas off NSW and Victoria) from 1955–2023 were included. Fleets were NSW fish trawl (NSWFTRL), NSW fish trap (NSWFTRP), NSW line (NSWLN), NSW estuary (NSWEST), Commonwealth trawl (CWTRL, 1986-2023), Victorian commercial (VICCOM) and recreational (REC). The REC fleet included both NSW and Victorian harvest estimates. Annual estimates of recreational harvest were produced by interpolating between recent offsite survey estimates (since 2000) and imputation in prior years. Victorian recreational harvest was imputed from NSW estimates using a catch ratio from the single year where estimates for both jurisdictions were available (2000/01, Henry and Lyle 2003). Victorian commercial catch prior to 1979 was imputed based on the mean ratio of Victorian to NSW commercial landings during 1979-1985.

- Estimated discards by the NSW trawl fleet after the introduction of the MLL in 2007.

- Three standardised CPUE indices from NSWFTRL (1998-2023), NSWFTRP (1998-2023), and CWTRL (1986-2023). General linear models were used to standardise CPUE values for a range of potential confounding variables, including vessel, month, ocean zone and depth.

- Length data from NSWFTRL, NSWFTRP, NSWLN, NSWEST, CWTRL and REC fisheries, and from the fishery-independent *RV Kapala* surveys. Years of data included for each fleet were: NSWFTRL (20 years between 1987 and 2023), NSWFTRP (13 years between 2005 and 2023), NSWLN (11 years between 2005 and 2023), NSWEST (5 years between 2019 and 2023), CWTRL (22 years between 1993 and 2022), REC (1 year, 1994) and *RV Kapala* (2 years, 1993-94).

- Age-at-length data for 1998 from NSWFTRL, NSWFTRP, NSWLN and NSWEST fisheries.

- Biological parameters, including those for growth and maturity, were obtained from Rowling and Raines (2000). Natural mortality (*M*) was estimated outside of the model using a longevity-based empirical estimator (Hamel and Cope 2022).

Key model structure & assumptions:

An integrated age- and length-structured population model was used for the base case and all sensitivity scenarios.

The base case included seven catch fleets, one ‘length-only’ fleet (*RV Kapala*), three indices of abundance (CPUE), numerous years of length data and one year of age-at-length data (see ‘Main data inputs’).

Logistic selectivity was applied for all fleets except NSWFTRP and NSWEST, where double-normal plateau selectivity was applied.

Selectivity parameters were estimated for all catch fleets with available length data, except NSWFTRL.

The retention function for NSWFTRL was time-blocked before and after 2007.

The catchability parameters (*q*) for NSWFTRL and NSWFTRP CPUE were time-blocked before and after 2007.

Recruitment deviations were estimated between 1955 and 2021, after which recruitment was fixed at the average value for the preceding 10-year period.

Natural mortality (*M*) was fixed at 0.18 yr^{-1} for the base-case model. *M* is assumed to be age- and time-invariant.

Steepness (*h*) of the Beverton-Holt stock-recruitment relationship was fixed at 0.7.

Recruitment variability (σR) was tuned to a value of 0.89.

Growth parameters:

- Asymptotic length (L_{inf}): 43.97 cm FL
- Growth rate (*K*): 0.12 yr^{-1}
- Length at time zero (t_0): -3.89 cm FL

Length at 50% maturity (m_1): 19 cm FL

Length at 95% maturity (m_2): 22.5 cm FL

Relative weighting of data types, and years of data within data types, was achieved via sample numbers and CV values.

Model tuning procedure: the Francis method was used to iteratively reweight the initial sample sizes of length compositions to match the effective sample sizes calculated by the model. Variance input factors were used to weight data with too few samples for the Francis method. Extra variance was estimated for the NSWFTRL CPUE series. The bias ramp was initially modelled and then pre-specified at plausible model values.

Model projections were made across a range of constant catch scenarios (50-175 t), which included catch in the most recent year of data (~125 t, 2023).

Key assumptions are:

- A single stock of Silver Trevally on Australia’s east coast.
- That the stock was not exploited prior to 1955 (and prior to 1945 for the relevant sensitivity scenario).
- Commercial catches reported for each fleet are accurate.
- CPUE is linearly related to abundance.
- Selectivity is time-invariant, except for NSWFTRL.
- Recruitment after 2021 is below the long-term average.

Sources of uncertainty evaluated:

Uncertainty was explored in two ways: 1) evaluation of model fits, and 2) modelling of alternative (sensitivity) scenarios to the base case.

Evaluation of model fits involved comparison of model estimations to observed values from CPUE series, length compositions and age-at-length data. Fits to length and age data were considered for each year and aggregated across years within fleets. The appropriateness of estimated selectivity and retention functions was also considered with respect to the length data used to inform them.

Sensitivity scenarios:

- Average recruitment
- Commonwealth CPUE shortened - 1992-2023
- Steepness of the stock recruitment relationship
    - Low h (0.6)
    - High h (0.8)
- Natural mortality (M)
    - Very low M (0.11 yr-1)
    - Low M (0.14 yr-1)
    - High M (0.22 yr-1)
- Length at 50% maturity
    - Low (17 cm)
    - High (21 cm)
- Likelihood weightings for age and length compositions
    - Half
    - Double
- Likelihood weightings for CPUE indices
    - Half
    - Double
- Alternative trawl catches 1992-2000
    - 'Low catch' scenario
    - 'High catch' scenario
- 1997 age data added
- Early catch data added - 1945-1954
- NSWFTRP CPUE removed

Status Indicators - Limit & Target Reference Levels

Biomass indicator or proxy	Depletion of spawning biomass (model estimated)
Biomass Limit Reference Point (LRP)	B_{20} (20% of pre-exploitation spawning biomass)
Biomass Target Reference Point (TRP)	B_{48} (48% of pre-exploitation spawning biomass)
Fishing mortality indicator or proxy	Fishing mortality (model estimated)
Fishing mortality LRP	N/A
Fishing Mortality TRP	F_{48} (Fishing mortality rate that achieves B_{48})

Stock Assessment Results

Female spawning biomass at the beginning of 2024 was estimated at 1,050 t (Figure 3a). Unfished female spawning biomass was estimated at 4,954 t, resulting in a relative biomass estimate of 21.2% in 2024 (Figure 3b).

Estimated biomass declined steadily from 1955 until the mid-1980s (Figure 3). A rapid decline was then observed from the late 1980s to the mid-2000s, where estimated biomass reached 10.7% of unfished biomass. Estimated biomass then remained at or below 20% of unfished biomass until 2024. Estimated biomass has been increasing consistently since 2018.

Sensitivity modelling indicated that the base case result was relatively insensitive to most variations, with final spawning biomass estimates typically within 3% of the base-case value (21.2%). Exceptions to this were the sensitivities for natural mortality; relative biomass estimates for these scenarios in 2024 ranged from 8.5% higher to 11.5% lower than the base-case value. Both the low-*M* and very low-*M* scenarios produced relative biomass estimates that were below B_{20}. Given the marginal biomass estimate from the base-case and the uncertainty in this estimate generated by alternative values of *M*, current biomass is not above the LRP with reasonable confidence.

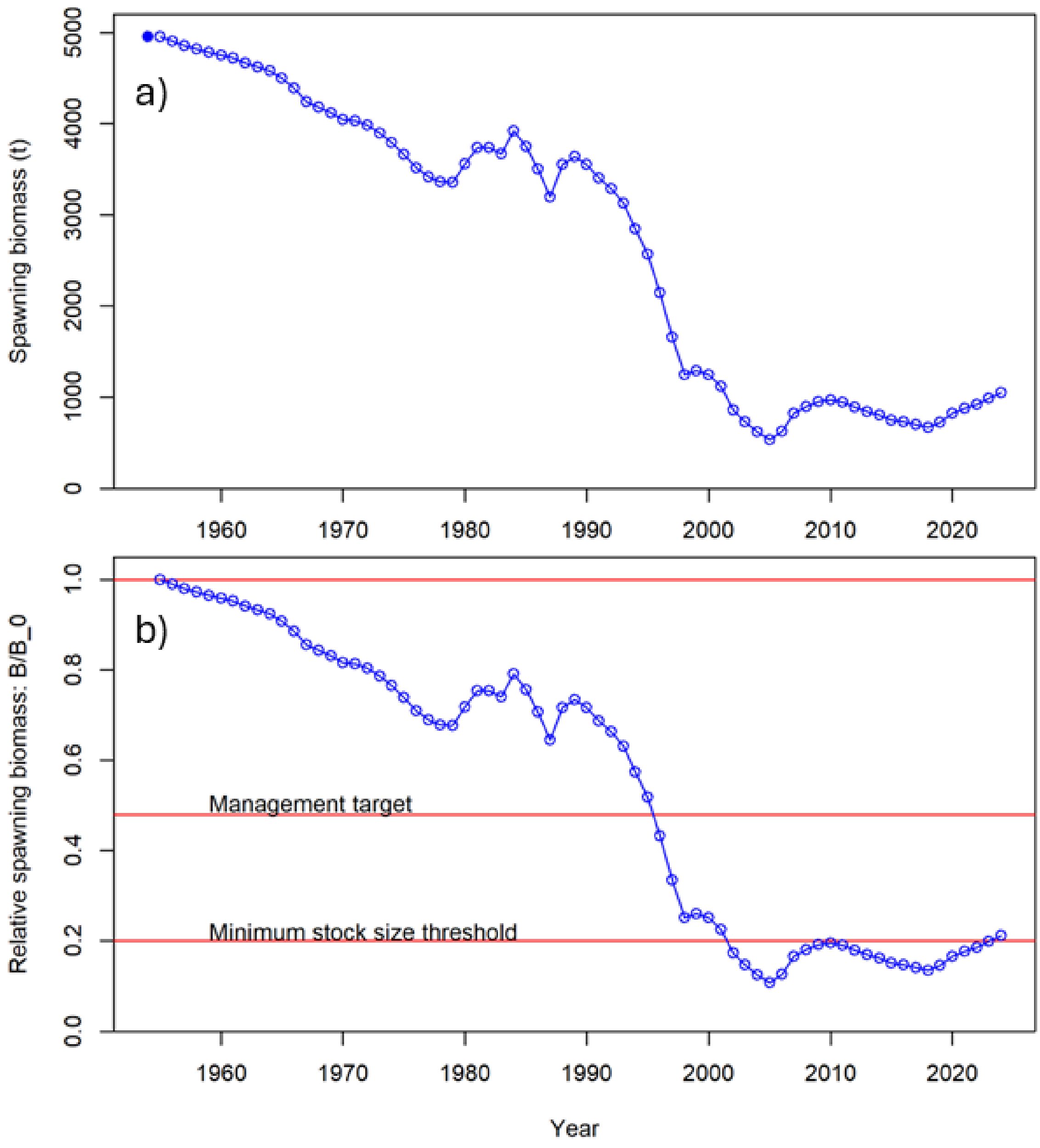

Figure 3. Depletion trajectories for a) absolute female spawning biomass and b) relative spawning biomass from 1955 to 2023. The management target (48%) and minimum stock size threshold (20%) represent values specified for the Commonwealth component of the stock and are not formalised for Silver Trevally in NSW.

The decline in biomass was associated with high fishing mortality (*F*), which increased to *F* = 2 during the mid-1980s and exceeded *F* = 5 during the mid-2000s. *F* then declined consistently to *F* < 1 by 2019 and remained below 1 until the end of the time series. Current fishing mortality is therefore at a level that should allow the stock to rebuild, assuming that productivity remains at least equal to that specified within the models.

Model projections predict that biomass will rebuild under all constant catch levels tested, which includes the current level of catch (~125 t, 2023). If current catch levels were maintained, a potential management target of B_{48} would be reached by 2052.

Stock Assessment Result Summary

Biomass status in relation to Limit	B (2024) = 21.2%, above B_{20}
Biomass status in relation to Target	B (2024) = 21.2%, below B_{48}
Fishing mortality in relation to Limit	N/A
Fishing mortality in relation to Target	F (2024) < 1, below F_{48}
Current SAFS stock status	Recovering
Current Commonwealth stock status	Uncertain (biomass) Not subject to overfishing (fishing mortality)

Fishery interactions

On the east coast of Australia, Silver Trevally are caught in fisheries managed by NSW, the Commonwealth and Victoria. North of Barrenjoey Pt, and south of Barrenjoey Pt inside 3 nm, the stock is subject to numerous NSW fisheries (outlined in the fleet descriptions above). South of Barrenjoey Pt outside 3 nm the stock is fished by The Commonwealth Trawl Sector (CTS) of the Southern and Eastern Scalefish and Shark Fishery (SESSF).

Qualifying Comments

Conclusions regarding the current status of Silver Trevally depend on the assumptions outlined in the section 'Key model structure & assumptions' and the outcomes of the sensitivity scenarios.

A 'recovering' status has been applied to Silver Trevally in NSW, rather than 'sustainable', due to the uncertainty regarding current biomass relative to the LRP. Estimated biomass from the base-case model was only marginally above the LRP and estimates from numerous sensitivity scenarios were below the LRP, particularly those using lower values of *M*. Despite uncertainty regarding current biomass, models indicated a trend of increasing biomass since 2018 and projections suggest that biomass should rebuild at all catch levels examined (50-175 t).

In addition to model-based evidence of rebuilding, management measures have been applied to limit mortality of Silver Trevally. The TAC for the NSW Ocean Trawl – Fish Northern Zone (OTFN) has recently been reduced (12 t in 2023, down from 20 t in previous years), and although the Southern Fish Trawl (SFT) is not subject to catch quota, catches in this fishery have been <10 t since 2019.

The current assessment represents the second application of an integrated age-structured population dynamics model to this stock and extends the data included in the previous assessment by one year (Burch et al. 2023). A bridging analysis between the two models indicated minimal change in either the depletion trajectory or final biomass estimate compared to the previous base case. However, a retrospective analysis on the current model indicated a pattern of increasingly higher final biomass estimates as more years of data were removed.

References

Bearham, D., Robert, M., Chaplin, J. A., Moore, G. I., Fairclough, D. V., and Bertram, A. 2020. Molecular evidence of three species in the *Pseudocaranx dentex* complex (Carangidae) in Australian waters. Marine and Freshwater Research 71: 518-531.

Burch, P., Fowler, A., Liggins, G., Sporcic, M., Dowling, N., Chick, R.., Tuck, G. 2023. A joint Commonwealth and NSW assessment of Silver Trevally (*Pseudocaranx georgianus*). Prepared for the Australian Fisheries Management Authority. 83 pp.

Fowler, A. M., Chick, R. C. and Stewart, J. 2018. Patterns and drivers of movement for a coastal benthopelagic fish, *Pseudocaranx georgianus*, on Australia's southeast coast. Scientific Reports 8: 16738.

Fowler, A. M. and Liggins, G. W. 2025. Stock assessment report 2024/25 - Silver Trevally (*Pseudocaranx georgianus*). NSW Department of Primary Industries and Regional Development - Fisheries: 61 pp.

Hamel, O. S. and Cope, J. M. 2022. Development and considerations for application of a longevity-based prior for the natural mortality rate. Fisheries Research, 256, p.106477.

Henry, G. W. and Lyle, J. M. 2003. The National Recreational and Indigenous Fishing Survey. FRDC Project No. 99/158, New South Wales Fisheries and Tasmanian Aquaculture & Fisheries Institute University of Tasmania.

Methot Jr., R. D. and Wetzel, C. R. 2013. Stock Synthesis: a biological and statistical framework for fish stock assessment and fishery management. Fisheries Research, 142, 86–99.

Murphy, J. J., Ochwada-Doyle, F. A., Hughes, J. M., West, L. D., Miles, N. G., Fowler, A. M., Stark, K. E., and Taylor, M. D. 2023. Survey of recreational fishing in NSW, 2021/22 – Key Results. NSW DPI.

Rowling, K. R. and Raines, L. P. 2000. Description of the biology and an assessment of the fishery for silver trevally *Pseudocaranx dentex* off New South Wales. NSW Fisheries Final Report Series No. 24. NSW DPI Fisheries, Cronulla.