SARDI

TO:	**PIRSA FISHERIES AND AQUACULTURE**
FROM:	**SARDI AQUATIC AND LIVESTOCK SCIENCES AND THE COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISTION (CSIRO)**
SUBJECT:	**SUMMARY OF KEY RESULTS FOR SNAPPER PRIOR TO THE HARMFUL ALGAL BLOOM**
DATE:	**21 NOVEMBER 2025**

KEY POINTS

- This Advice Note summarises the key findings and results for Snapper using data to 30 June 2025, including data obtained through the Snapper Science Program. This Advice Note did not consider the potential impact of the harmful algal bloom (HAB). The key findings and results presented in this Advice Note have not yet been peer-reviewed and evaluation of the fishery model is ongoing, including weightings on and fits to data and contrasting inferences among datasets. Consequently, assessment of stock status was based on the best available current information, and some of the outputs from the fishery model may change for delivery of the Snapper Stock Assessment Report in 2026.
- The Snapper Science Program concludes in 2026 with the delivery of the Snapper Stock Assessment Report and three FRDC Final Reports. The Snapper Stock Assessment Report will include some data collected after the onset of the HAB, sensitivity analyses for DEPM parameters and integrated model outputs, and model diagnostics. All four of these documents will be peer-reviewed by suitably qualified reviewers both within and external to PIRSA.
- There are three stocks of Snapper in South Australian (SA) waters: the Spencer Gulf / West Coast (SG/WC) stock, the Gulf St Vincent (GSV) stock, and the Western Victorian Stock (WVS) that extends into the South-East (SE) Region of SA. For each stock, this Advice Note provides a summary of key data sources, key findings, and results that were considered in a weight-of-evidence approach to assign stock status.
- The SG/WC stock has been classified as 'depleted' since 2018. There is evidence of recovery from the regional age structures, the estimate of spawning biomass from the DEPM survey in 2024, and the model estimate of relative biomass. The SG/WC stock is classified as '**recovering**'. This means that (i) biomass remains depleted (i.e., < 20% of unfished levels), (ii) recruitment remains impaired, (iii) management measures are in place to promote stock recovery, and (iv) recovery is occurring.
- The GSV stock has been classified as 'depleted' since 2020. Compared with the SG/WC stock, there is weaker evidence of recovery from the regional age structures and the increased estimate of spawning biomass from the DEPM. Model estimated relative biomass has increased, albeit at a slow rate, since 2020. The GSV stock is

classified as '**recovering**'. This means that (i) biomass remains depleted (i.e., < 20% of unfished levels), (ii) recruitment remains impaired, (iii) management measures are in place to promote stock recovery, and (iv) recovery is occurring.

- Since 2020, model estimated relative biomass for the SE Region has been stable at a moderate to high level (i.e., above 30% of unfished levels) following strong recruitment in 2014 and 2018. The WVS is classified as 'sustainable' (Bell et al. 2024).

BACKGROUND

There are three recognised stocks of Snapper throughout the coastal waters of SA: the Spencer Gulf / West Coast (SG/WC) stock, the Gulf St Vincent (GSV) stock, and the Western Victorian Stock (WVS) that extends into the South-East (SE) Region of SA (Fowler et al. 2017, Bertram et al. 2023). The SG/WC and GSV stocks experienced significant declines in fishable biomass during the 2010s that related to extended periods of poor juvenile recruitment and the concurrent exploitation of the remaining populations (Drew et al. 2022, Fowler 2025). The declines in biomass and stock status for the SG/WC and GSV stocks prompted a suite of management actions from 2012 that culminated in the complete closure of the two stocks to commercial and recreational fishing from 1 November 2019. The most recent stock assessment was delivered in November 2022 and indicated that the closures had arrested the decline in biomass for the two stocks, but there was not yet evidence of recovery (Drew et al. 2022). Consequently, the SG/WC and GSV stocks remained classified as depleted, and the fishery closures were extended to 30 June 2026. The WVS has been classified as sustainable since 2012 (Bell et al. 2024), and the SE Region has been managed by a total allowable catch (TAC) for all sectors since 1 July 2021 (Rogers et al. 2024).

This Advice Note summarises the key findings and results for Snapper using data to 30 June 2025. As almost all data included in this Advice Note were collected prior to the onset of the HAB, the impact of the HAB was not considered. The key findings and results presented in this Advice Note have not yet been peer-reviewed, and evaluation of the model outputs, including weightings on and fits to data, are ongoing. Consequently, assessment of stock status was based on the best available current information and some of the outputs the fishery model may change for delivery of the Snapper Stock Assessment Report in 2026.

For each stock (i.e., SG/WC, GSV, SE Region), a summary of key data sources, findings, and results including fishery statistics, regional length and age structures, estimates of spawning biomass, a hydroacoustic survey, and outputs from the integrated fishery assessment model are provided (see Methods in Appendix 1). These data were obtained prior to, and during, the Snapper Science Program – a program co-funded by the SA Government and the Fisheries Research and Development Corporation (FRDC). Results were considered in a weight-of-evidence approach to assign stock status using the National Fishery Status Reporting Framework (Roelofs et al. 2024).

The Snapper Science Program concludes in 2026 with the delivery of the Snapper Stock Assessment Report and three FRDC Final Reports. The Snapper Stock Assessment Report will include some data collected after the onset of the HAB, sensitivity analyses for DEPM parameters and integrated model outputs, and model diagnostics. All four of these documents will be peer-reviewed by suitably qualified reviewers both within and external to PIRSA.

RESULTS / DISCUSSION

SPENCER GULF / WEST COAST STOCK

Fishery statistics

Total annual commercial catch for the SG/WC stock varied cyclically from 1983/84 to 2011/12, with peaks in 1990/91, 2001/02, and 2007/08 (Figure 1a). The highest reported annual commercial catch was 592 t in 2001/02. Total catch decreased by 86% from 545 t in 2008/09 to 74 t in 2013/14 and subsequently remained low (~75 t) until the closure of the fishery in 2019 (Figure 1a). Handline was the dominate gear type used in the SG/WC stock, which contributed to ~70% of the total annual catch (Figure 1a).

Targeted HL effort varied annually from 1983/84 to 2002/03, when it peaked at 5,227 fisher-days and then decreased to 1,018 fisher-days in 2012/13 (Figure 1b). Targeted HL effort then remained < 1,000 fisher-days until the closure in 2019 (Figure 1b). Long-term trends in targeted HL CPUE reflect the general trend in HL catch, with a fluctuating but increasing trajectory until its peak of 132.6 kg.fisher-day^{-1} in 2006/07 (Figure 1c). High targeted HL catch rates (i.e., > 100 kg.fisher-day^{-1}) persisted through to 2011/12 and then decreased to ~55 kg.fisher-day^{-1} until the fishery closure in 2019 (Figure 1c).

Targeted LL catch for the SG/WC stock was relatively stable from 1983/84 until its peak in 2005/06 at 168 t. High catches persisted until 2008/09 and then decreased to ~30 t per year until the closure in 2019 (Figure 1a). Targeted LL effort maintained a consistent high level of ~2,000 fisher-days from 1984/85 to 1997/98, reaching a peak of 2,441 fisher-days in 1996/97 (Figure 1b). Targeted LL effort then decreased to ~1,200 fisher-days per year, with a moderate increase in effort between 2005/06 and 2009/10, before declining to ~700 fisher-days per year until 2019 (Figure 1b). Targeted LL CPUE peaked at 97.3 kg.fisher-day^{-1} in 2005/06, high catch rates persisted until 2008/09, then decreased to ~45 kg.fisher-day^{-1} until 2019 (Figure 1d).

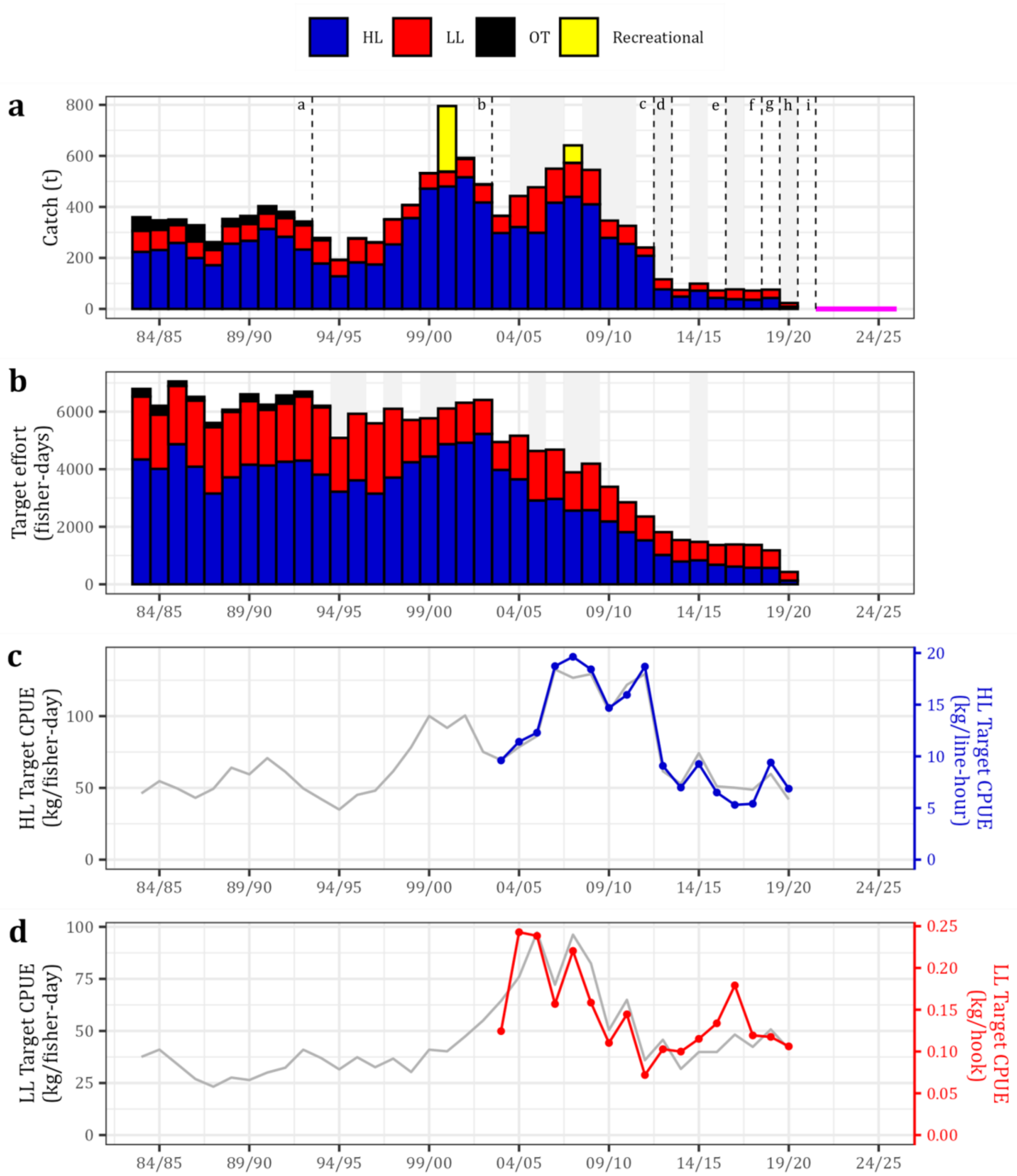

Figure 1. Key commercial fishery statistics for Snapper in the Spencer Gulf / West Coast (SG/WC) stock, grouped by key gear types – handline (HL, blue), longline (LL, red), and all other gears combined (OT). Long-term trends in annual estimates of: (a) total catch; (b) targeted effort; (c) HL catch per unit targeted effort; (d) LL catch per unit of targeted effort. Grey shading identifies years when data for one or more gear types were confidential (i.e., < 5 fishers). Letters in plot 'a' correspond to management changes described in Table A1 and the pink line shows annual total allowable commercial catch since 2021/22.

Age structures

For the WC, annual age structures from 2020/21 to 2024/25 were characterised by a broad range of year classes ranging from the late 1990s to early 2020s (Figure 2). The 2009, 2010, 2012, and 2014 year classes were consistently the highest represented in the annual age structures. The 2014 year class accounted for 27% and 38% of fish in 2023/24 and 2024/25 and was the dominant year class sampled (Figure 2).

For NSG, annual age structures from 2020/21 to 2024/25 generally involved a high proportion of fish < 10 years of age from multiple different year classes (Figure 2). The 2014 and 2016 year classes were well represented and have persisted over the past four years of sampling. The 2020 year class was first detected in the age structure for 2022/23 and accounted for 28% of the fish sampled in 2024/25 (Figure 2).

For SSG, annual age structures for fish sampled in 2023/24 and 2024/25 involved fish of up to 20 years of age but were characterised by several distinct year classes (Figure 2). The 2014, 2016, and 2020 year classes were well represented in both 2023/24 and 2024/25, and the 2022 year class emerged in samples from 2024/25. These age structures indicate that the 2014, 2016, and 2020 year classes were years of comparatively stronger recruitment for the regional populations of the WC, NSG, and SSG.

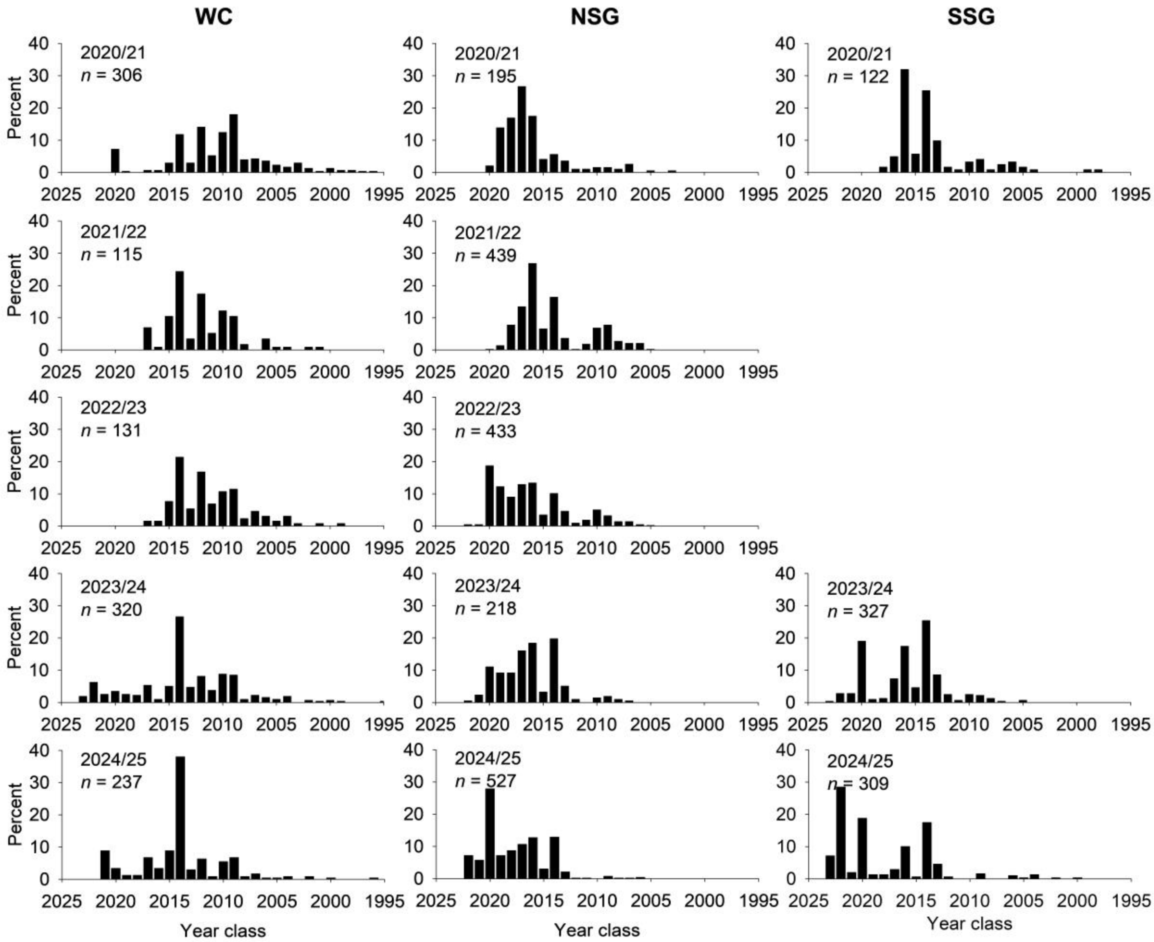

Figure 2. Annual age structures for Snapper sampled from the West Coast (WC) of Eyre Peninsula (left), northern Spencer Gulf (NSG, middle), and southern Spencer Gulf (SSG, right) between 2020/21 and 2024/25. For each year, data were presented as the relative percentage of fish accounted for by each year class, i.e., the year that they were spawned.

Daily egg production method (DEPM) estimate of spawning biomass

A total of 505 Snapper eggs were sampled in SG from 149 stations (i.e., 30% of stations sampled). The distribution and abundance of Snapper eggs varied spatially throughout the survey area. The majority of Snapper eggs were sampled from the southern half of the survey area, with the highest egg densities sampled from the waters adjacent to Cowell and Lucky Bay (Figure 3). Other patches of moderate to high egg densities were sampled near Murninnie, *Jurassic Park*, and the *Illusion* (Figure 3).

A total of 259 adult Snapper were processed from 15 samples throughout the survey area. There was latitudinal variation in the estimates of spawning fraction among samples, with the lowest spawning fractions from samples in the north of the survey area and higher estimates in the central and southern regions (Figure 3). The overall estimate of spawning fraction for 2024 was 0.44, which was lower than the estimate of 0.72 in 2021 (Table 1). There was a relationship between the distribution of adult samples with high estimates of spawning fraction and areas of high egg density.

The estimated spawning biomass of Snapper for SG in 2024 was 440 ± 104 t, which was substantially higher than the previous surveys in 2021 (i.e., 65 ± 15 t) and 2019 (i.e., 61 ± 11 t) (Table 1). The increased estimate of spawning biomass between the 2024 and 2021 surveys was primarily driven by three parameters: mean daily egg production (P_0), spawning area (A), and spawning fraction (S). Mean daily egg production was approximately three times higher in 2024 than 2021 (5.17 to 1.76 eggs.m^{-2}, respectively) and spawning area was 53% higher, both of which reflected the increased number of Snapper eggs sampled in 2024 compared to 2021 (i.e., 505 and 223 Snapper eggs, respectively).

Table 1. Summary of parameters and the estimated spawning biomass (SB) (t) of Snapper for DEPM surveys in Spencer Gulf from 2013 to 2024. P_0 – mean daily egg production (eggs.m^{-2}); A – spawning area (km^2); W – mean female weight (kg); R – sex ratio by female weight; F – batch fecundity of W; S – spawning fraction; SE – standard error. *Estimates of spawning biomass from previous DEPM surveys (2013 to 2022) were re-analysed using the same analytical methods and survey area applied in 2024/25 to produce estimates of spawning biomass that are comparable between years.

Year	P_0	A	W	R	F	S	SB (t)*	SE
2013	3.70	734	4.48	0.50	273,796	0.60	161	53
2018	2.17	3,080	1.82	0.50	119,465	0.72	300	68
2019	0.54	1,304	1.79	0.50	117,245	0.37	61	11
2021	1.76	756	4.30	0.50	263,823	0.72	65	15
2024	5.17	1,154	3.71	0.50	229,860	0.44	440	104

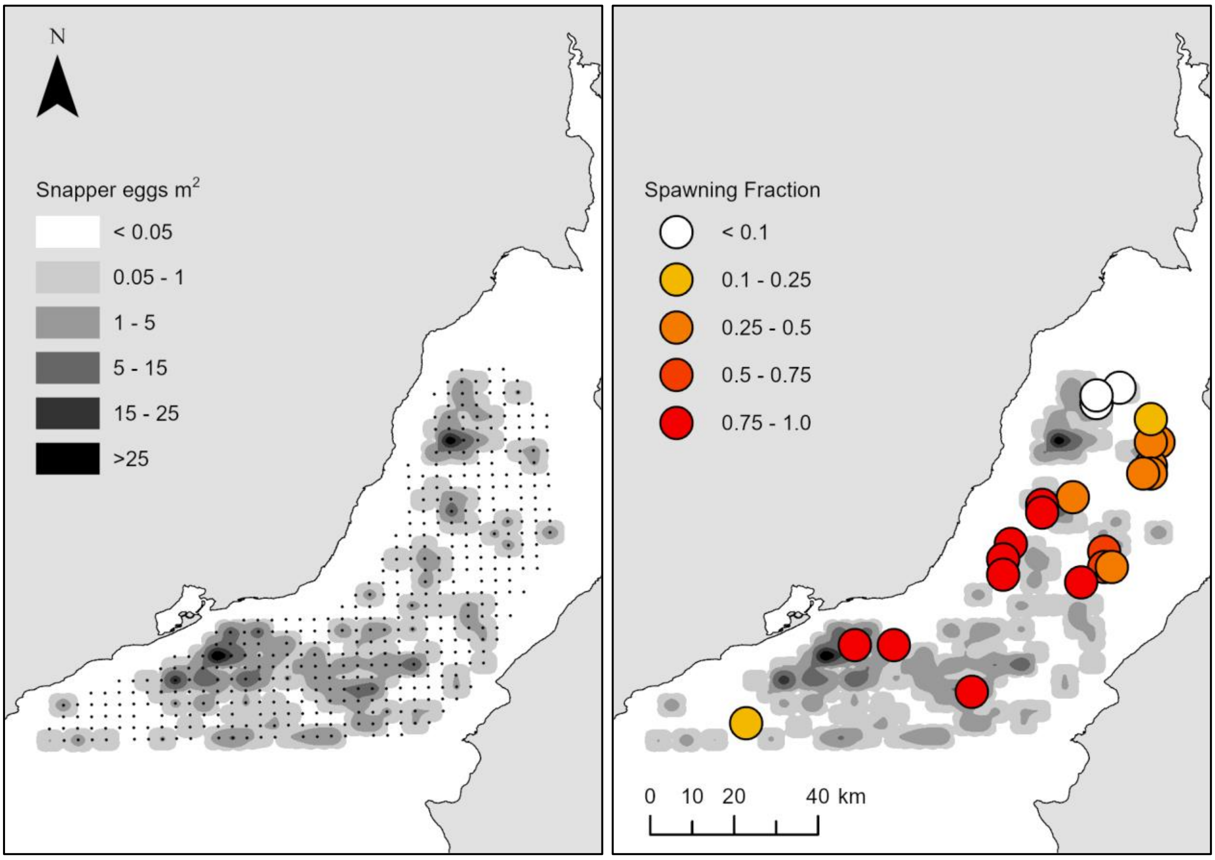

Figure 3. (Left) Spatial distribution of Snapper egg density (eggs.m^{-2}) from the DEPM survey in Spencer Gulf in December 2024. Symbols (●) identify the stations sampled. (Right) Spatial distribution of adult samples collected during the survey colour-coded by spawning fraction.

Standardised CPUE

Standardised CPUE for the SG/WC stock was relatively stable between 1983 and 1996. By 2000, CPUE peaked at levels that were > 50% above the time-series average (Figure 4). Thereafter, standardised CPUE declined, but remained near and/or above the long-term average until 2010. After 2010, standardised CPUE declined to its lowest level on record by 2012/13 and remained relatively stable thereafter. The most recent estimates of standardised CPUE in 2018/19 were approximately 30-40% below the long-term average (Figure 4). The large peaks observed during the summer time-steps were less pronounced in the standardised CPUE compared with the nominal CPUE, because the months when Snapper aggregate to spawn were excluded from the standardisation.

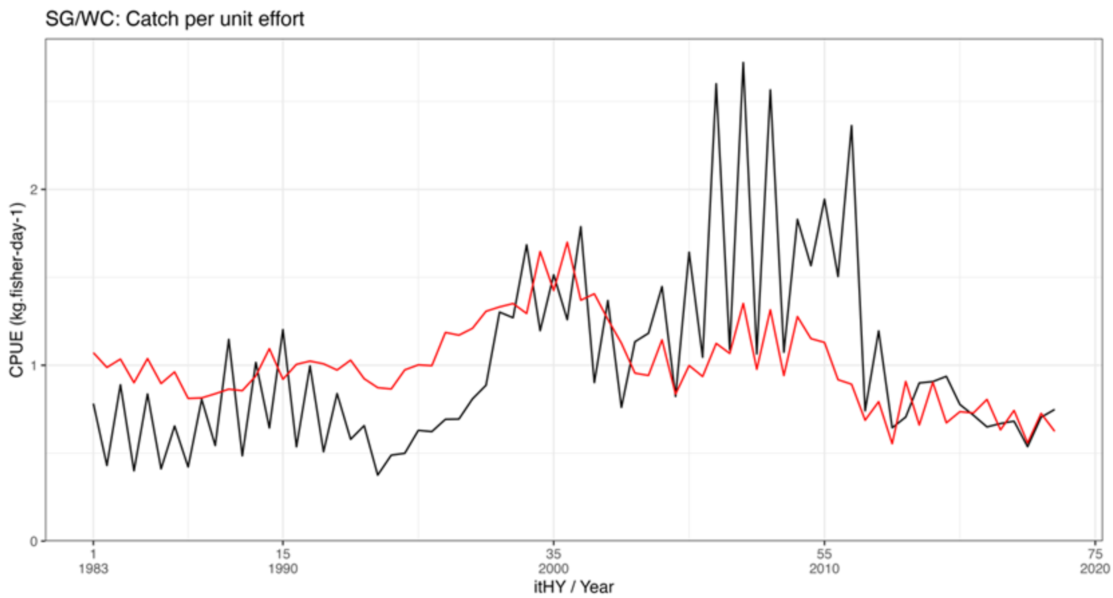

Figure 4. Catch rate standardisation for the Spencer Gulf / West Coast (SG/WC) stock showing nominal (black) and standardised (red) catch per unit effort (CPUE) for handline from 1983 to 2019.

SnapEst model outputs

Model estimated relative biomass for the SG/WC stock demonstrated a cyclic trend throughout the 40-year time series from 1984 to 2025. Estimated relative biomass declined during the late 1980s and early 1990s consistent with low modelled recruitment during the 1980s (Figure 5). Modelled biomass increased rapidly during the mid-1990s following the recruitment of the exceptionally strong 1991 year class to the fishable biomass. Estimated relative biomass then remained at a high level during the early 2000s as the strong 1997 and 1999 year classes recruited to the fishery. Thereafter, model estimated biomass declined considerably from 2005 to 2020, consistent with very low modelled recruitment during the 2000s and 2010s (Figure 5). Concurrently, estimated harvest fraction increased from 0.10 in 2005 to 0.40 in 2019.

Estimated relative biomass remained at a very low level in the early 2020s following the fishery closure (i.e., < 10% of unfished biomass) and then increased considerably from 2022 to 2025, but remained < 20% of unfished biomass (Figure 7). The increase in modelled relative biomass was driven by the increased estimate of spawning biomass from the DEPM survey in 2024 and was attributed to modelled recruitment in 2020 and strong recruitment in 2021 (Figure 5). Recent estimates of modelled recruitment are associated with high uncertainty due to the limited data for those year classes as the fish have just entered the fishable biomass. Furthermore, recent estimates of modelled recruitment were inconsistent with the regional age structures for 2023/24 and 2024/25, which identified the 2014, 2016, and 2020 year classes as the most prominent (Figure 2). The conflict between the age structures and modelled recruitment was likely due to the very low estimates of spawning biomass from DEPM surveys in 2019 and 2021 (Table 1). The low estimate of harvest fraction reflects the nominal estimate of mortality applied since the closure to account for incidental mortality from all fisheries and sectors, retained Traditional catches, and Snapper retained for research purposes.

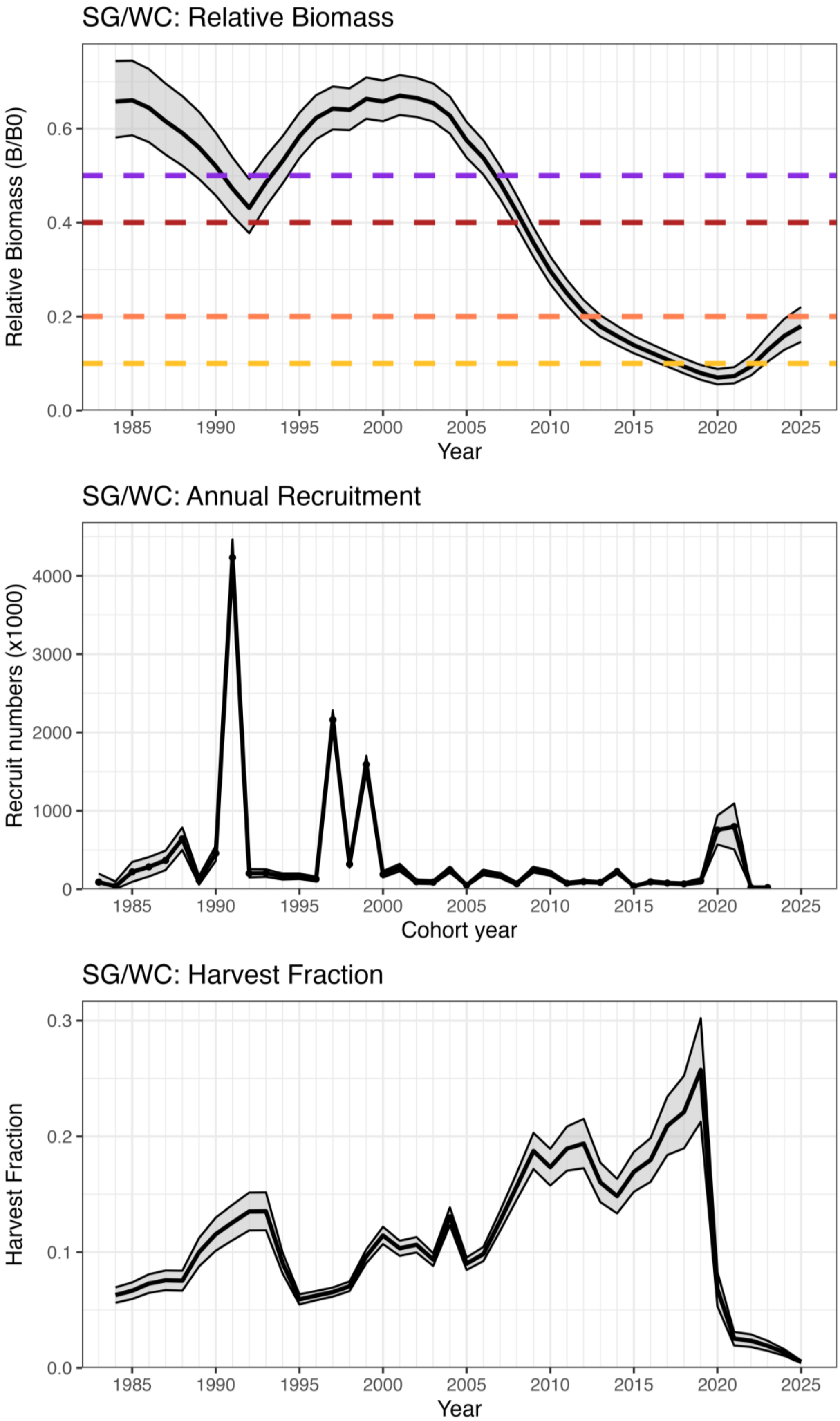

Figure 5. Time series of annual biological performance indicators from the SnapEst fishery assessment model for the Spencer Gulf / West Coast (SG/WC) stock from 1984 to 2025. Top – relative biomass (B/B_0); middle – recruitment; bottom – harvest fraction. Shading shows 95% confidence intervals.

Stock status

- The regional length and age structures for the WC, NSG, and SSG demonstrate the persistence of year classes that were in the population when the fishery closure was implemented (e.g., the 2014 year class), and the addition of new year classes to the fishable biomass during the closure (e.g., the 2016 and 2020 year classes). The 2014, 2016, and 2020 year classes were the highest represented in the samples collected in 2023/24 and 2024/25.
- The estimate of spawning biomass for Spencer Gulf using the DEPM was substantially higher for the survey in December 2024 (i.e., 440 ± 104 t) than in December 2021 (i.e., 65 ± 15 t). The increased estimate for 2024 was driven by a considerable increase in the number and density of Snapper eggs sampled and a lower estimate of spawning fraction.
- Model estimated relative biomass (i.e., $B/B_{est}0$) increased in recent years from < 10% of unfished levels in 2022 to < 20% of unfished levels in 2025.
- The SG/WC stock has been classified as 'depleted' since 2018 (Fowler et al. 2019). On the basis of the evidence provided above, the SG/WC stock is classified as '**recovering**'. This means that (i) biomass remains depleted (i.e., < 20% of unfished levels), (ii) recruitment remains impaired, (iii) management measures are in place to promote stock recovery, and (iv) recovery is occurring.

GULF ST VINCENT STOCK

Fishery statistics

Total commercial catch for the GSV stock was relatively low from 1983/84 to 2008/09, catch then increased exponentially, peaking at 501 t in 2011/12 (Figure 6a). Total catch remained at high levels (i.e., > 350 t) from 2009/10 to 2015/16, followed by incremental annual declines in catch to 184 t in 2018/19, prior to closure in 2019 (Figure 6a).

Handline catch has been relatively low for this stock through time (i.e., ~30 t per year) (Figure 6a). Handline was the preferred gear type for targeting Snapper in the GSV stock until 2008/09, when effort shifted to LL (Figure 6b). Targeted HL CPUE was consistent but low from 1983/84 to 2000/01, after which CPUE increased to its peak in 2007/08 at 76.9 kg.fisher-day^{-1}. Catch rates then varied annually and declined to ~40 kg.fisher-day^{-1} by 2018/19 (Figure 6c).

Longline catch was low from 1983/84 to 2008/09, after which catch increased exponentially with an equivalent increase in targeted LL effort from 2009/10 (Figure 6a, b). Longline catch was maintained at a high level (i.e., > 300 t per year) for six years from 2010/11 to 2015/16, with a peak in catch of 438 t in 2014/15 (Figure 6a). Targeted LL effort was low until 2008/09, when it increased by 138% to 1,675 fisher-days in 2009/10 (Figure 6b). Targeted LL effort then peaked at 3,109 fisher-days in 2011/12, with high levels of effort sustained until 2015/16, then a slow decline to 1,439 fisher-days in 2018/19 (Figure 6b). Targeted LL CPUE in kg.fisher-day^{-1} showed a long term increase from 1983/84 to the second highest peak of 139.7 kg.fisher-day^{-1} in 2009/10 (Figure 6d). Catch rate in kg.fisher-day^{-1} then maintained a high level to its peak of 146.5 kg.fisher-day^{-1} in 2014/15, and then slowly declined to 107 kg.fisher-day^{-1} by 2018/19 (Figure 6d). Contrastingly, targeted LL CPUE in kg/hook diverged from the catch rate of kg.fisher-day^{-1} during the peak of LL effort between 2009/10 and 2014/15. This divergence was associated with increased effort of gear/hooks set per day rather than the relative stable of number of fishers per day (Figure 6d).

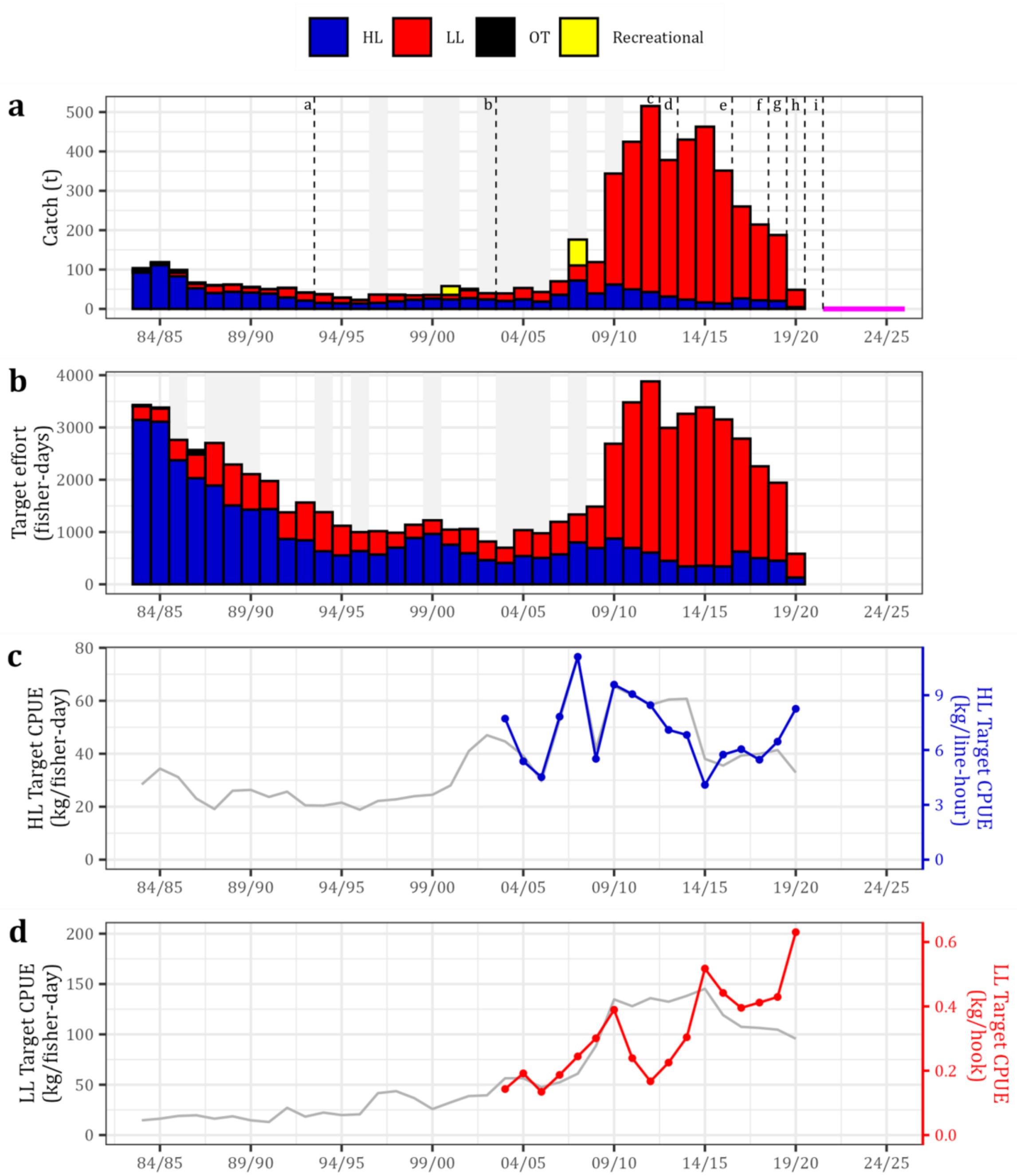

Figure 6. Key commercial fishery statistics for Snapper in the Gulf St Vincent (GSV) stock, grouped by key gear types – handline (HL, blue), longline (LL, red), and all other gears combined (OT). Long-term trends in annual estimates of: (a) total catch; (b) targeted effort; (c) HL catch per unit targeted effort; (d) LL catch per unit of targeted effort. Grey shading identifies years when data for one or more gear types were confidential (i.e., < 5 fishers). Letters in plot 'a' correspond to management changes described in Table A1 and the pink line shows annual total allowable commercial catch since 2021/22.

Regional age structures

For NGSV, annual age structures from 2020/21 to 2024/25 were generally characterised by a broad number of year classes and involved fish of up to 20 years of age (Figure 7). Some older fish have persisted in the population from the strong recruitment events in the late 2000s and the 2014 year class has continued to be well represented in recent years. The increased representation of the 2017, 2018, and 2019 year classes cumulatively accounted for approximately 50% of fish sampled in 2023/24 and 2024/25 (Figure 7).

There was considerable similarity in the general structure and year classes represented in the age structures for NGSV and SGSV (Figure 7). However, the 2014 year class was much more apparent for SGSV and accounted for over 35% of fish sampled in 2020/21 and 2021/22. Age structures for 2023/24 and 2024/25 showed the persistence of the 2014 year class and the increased representation of the 2017, 2018, and 2019 year classes (Figure 7).

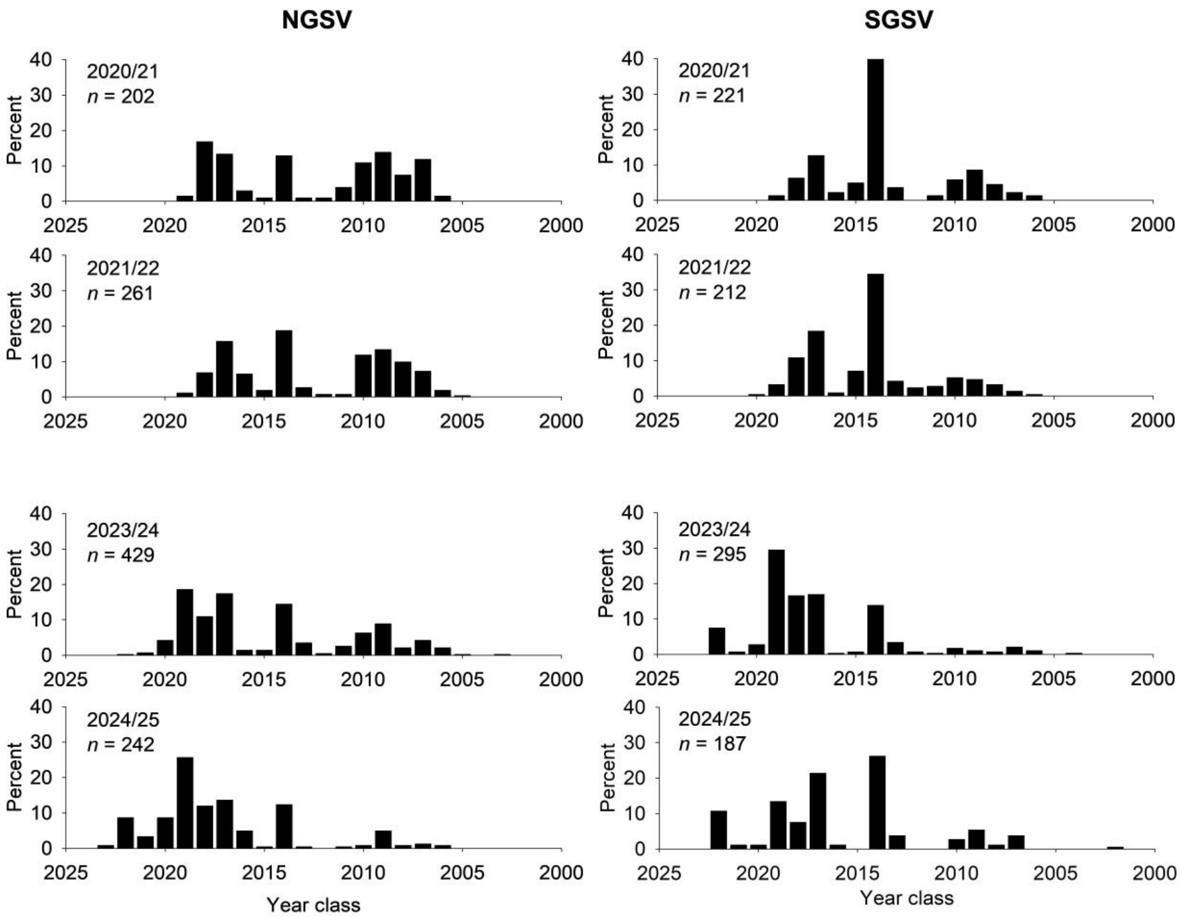

Figure 7. Annual age structures for Snapper sampled from northern (NGSV, left) and southern (SGSV, right) Gulf St Vincent between 2020/21 and 2024/25. For each year, data were presented as the relative percentage of fish accounted for by each year class, i.e., the year that they were spawned.

Daily egg production method (DEPM) estimate of spawning biomass

A total of 716 Snapper eggs were sampled in GSV from 185 stations (i.e., 33% of stations sampled). The distribution and abundance of Snapper eggs varied spatially throughout the survey area. Patches of high egg densities were sampled near the Orontes Bank, and offshore from Stansbury and Rapid Head (Figure 8). Areas of moderate egg densities were distributed in the northern region of the survey area adjacent to Ardrossan and Long Spit, and in the middle of GSV. The lowest densities of eggs were sampled on the eastern side of the gulf and south of the metropolitan coastline (Figure 8).

A total of 330 adult Snapper were processed from 27 samples throughout the survey area. There was considerable latitudinal variation in the estimates of spawning fraction among samples. Estimates of spawning fraction were generally < 0.25 for samples in the northern half of the survey area and were generally > 0.75 for samples in the south (i.e., south of a line from Stansbury to West Beach) (Figure 8). Approximately 30% of the Snapper sampled in the north of the survey area were classified as 'spent', meaning that they had recently finished spawning for the season. The overall estimate of spawning fraction was 0.49 in 2025, which was lower than the estimate of 0.88 in 2022 (Table 2).

The estimated spawning biomass of Snapper for GSV in 2025 was 525 ± 122 t, which was approximately 50% higher than the previous survey in 2022 (i.e., 351 ± 66 t) (Table 2). The increased estimate of spawning biomass between surveys was primarily driven by the lower estimate of spawning fraction (*S*) in 2025.

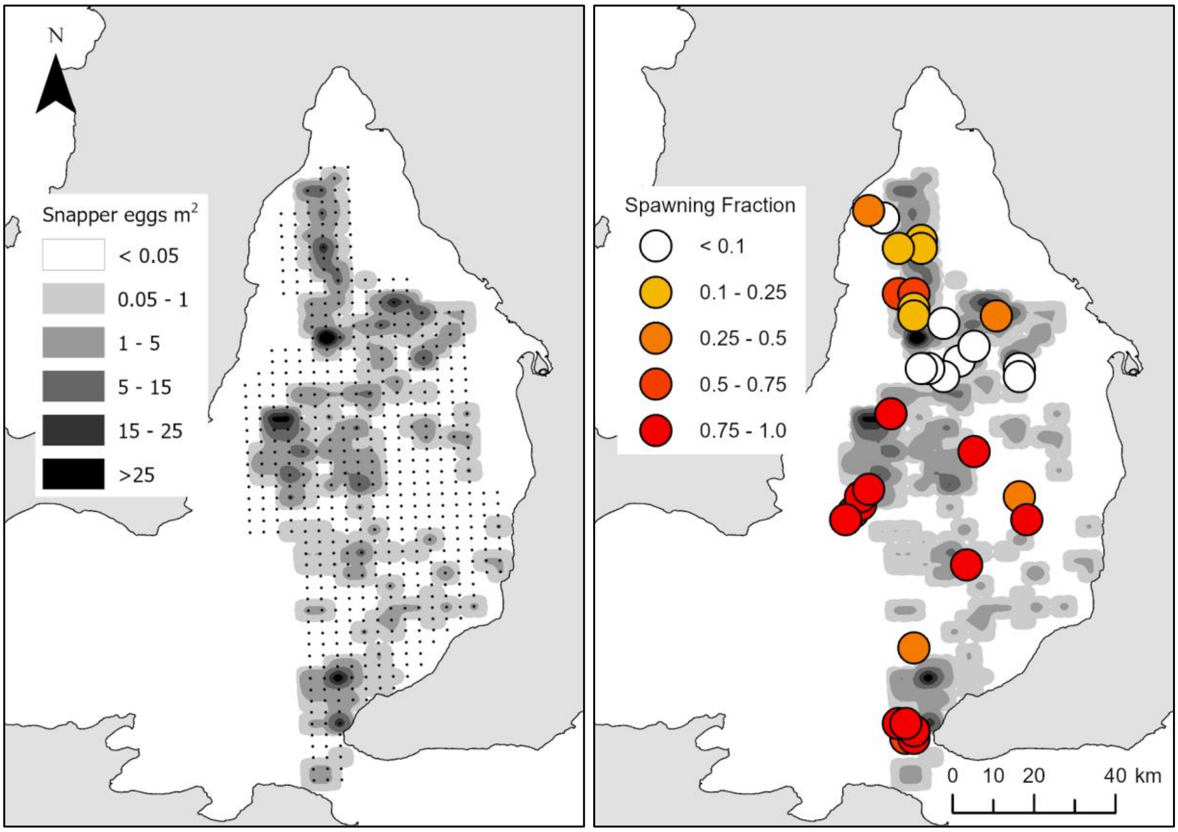

Figure 8. (Left) Spatial distribution of Snapper egg density (eggs.m^{-2}) from the DEPM survey in Gulf St Vincent in January 2025. Symbols (●) identify the stations sampled. (Right) Spatial distribution of adult samples collected during the survey colour-coded by spawning fraction.

Table 2. Summary of parameters and the estimated spawning biomass (SB) (t) of Snapper for DEPM surveys in Gulf St Vincent from 2014 to 2025. P_0 – mean daily egg production (eggs.m^{-2}); *A* – spawning area (km^2); *W* – mean female weight (kg); *R* – sex ratio by female weight; *F* – batch fecundity of *W*; *S* – spawning fraction; SE – standard error. *Estimates of spawning biomass from previous DEPM surveys (2013 to 2022) were re-analysed using the same analytical methods and survey area applied in 2024/25 to produce estimates of spawning biomass that are comparable between years.

Year	P_0	*A*	*W*	*R*	*F*	*S*	*SB* (t)*	SE
2014	6.69	1,858	4.45	0.50	271,975	0.44	1,018	323
2018	3.27	2,773	3.63	0.50	225,433	0.72	502	146
2020	3.32	2,738	3.79	0.50	234,608	0.80	392	68
2022	5.75	1,565	3.73	0.50	231,134	0.88	351	66
2025	5.60	1,430	3.03	0.50	190,650	0.49	525	122

Hydroacoustic survey

Snapper were detected at 86% (*n* = 31 of 35) of the aggregation sites surveyed in GSV (Table 3). This involved a combination of Snapper dominated aggregations (observed at 68% of sites) and mixed Snapper aggregations (observed at 56% of sites). Aggregations of SPF were observed at 88% of sites and aggregations of unknown composition were observed at 91% of sites. Identification of Snapper from the acoustic data was validated by underwater observations of Snapper dominated aggregations at 62% of sites and mixed Snapper aggregations at 53% of sites.

The estimated number of Snapper per site ranged from 3 to 1,412 individuals, with corresponding estimates of biomass ranging from 0.01 to 5.23 t per site. The range reflected uncertainty in species composition within mixed aggregations and variation in abundance among sites. A mean of 278 individuals were estimated per site with an estimated biomass of 1.0 t (Table 3). Across the survey area, a total of 7,624 to 9,586 Snapper were detected with an estimated biomass of 28.2 to 35.5 t (Table 3).

Table 3. Estimated number and biomass (t) of Snapper at each reference area during the optical-acoustic survey in Gulf St Vincent in January 2025.

Reference Area	No. sites surveyed	No. sites with Snapper	Mean no. Snapper per site (#)	Mean biomass of Snapper per site (t)	Total no. Snapper (#)	Total biomass of Snapper (t)
Northern	4	4	370	1.4	1,464–1,495	5.4–5.5
Central	20	18	187	0.7	2,875–3,871	10.6–14.3
Western	4	4	599	2.1	2,233–2,396	8.3–8.9
Southern	7	5	288	1.1	1,052–1,824	3.9–6.8
Total	**35**	**31**	**278**	**1.0**	**7,624–9,586**	**28.2–35.5**

Standardised CPUE

Standardised CPUE for the GSV stock declined steadily from 1983 to 1990, before stabilising and increasing over the next decade to a peak that was > 50% above the time-series average by 2001 (Figure 9). Thereafter, standardised CPUE declined during the early 2000s, before increasing again, to another peak that was 50% above the time-series average in 2010. After 2010, CPUE declined to levels almost 50% below the long-term average by 2018/19. These most recent CPUE estimates were the lowest recorded since approximately 1990 (Figure 9). The large peaks observed during the summer time-steps were less pronounced in the standardised CPUE compared with the nominal CPUE, because the months when Snapper aggregate to spawn were excluded from the standardisation.

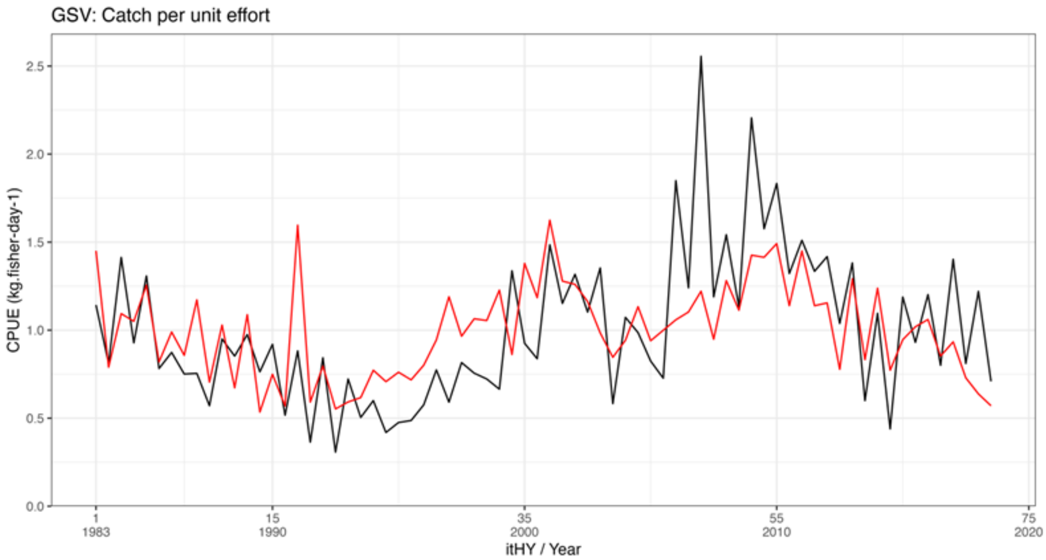

Figure 9. Catch rate standardisation for the Gulf St Vincent (GSV) stock showing nominal (black) and standardised (red) catch per unit effort (CPUE) for handline from 1983 to 2019.

SnapEst model outputs

Model estimated relative biomass decreased in the mid-1980s and early 1990s consistent with low recruitment during the 1980s (Figure 10). Estimated relative biomass then increased significantly from the mid-1990s and continued to increase throughout the 2000s to a peak in 2009 (i.e., > 60% of unfished levels). The increase in biomass was associated with a series of strong recruitment events during the 1990s and 2000s and concurrent low levels of exploitation (Figure 10). Thereafter, estimated relative biomass declined significantly during the 2010s and reached a low in 2020 (i.e., < 15% of unfished levels). The decline was driven by high and increasing estimates of harvest fraction and low recruitment during the 2010s.

Since the fishery closure was implemented in late 2019, modelled relative biomass has increased at a slow rate but remained < 20% of unfished levels in 2025 (Figure 10). The slow increase in estimated relative biomass from 2020 to 2025 was associated with the continued growth of fish that were in the population when the closure was implemented and the addition of some new fish from recruitment in 2017, 2018, and 2019. The low estimate of harvest fraction reflected the nominal estimate of mortality applied since the closure to account for incidental mortality from all fisheries and sectors, retained Traditional catches, and Snapper retained for research purposes.

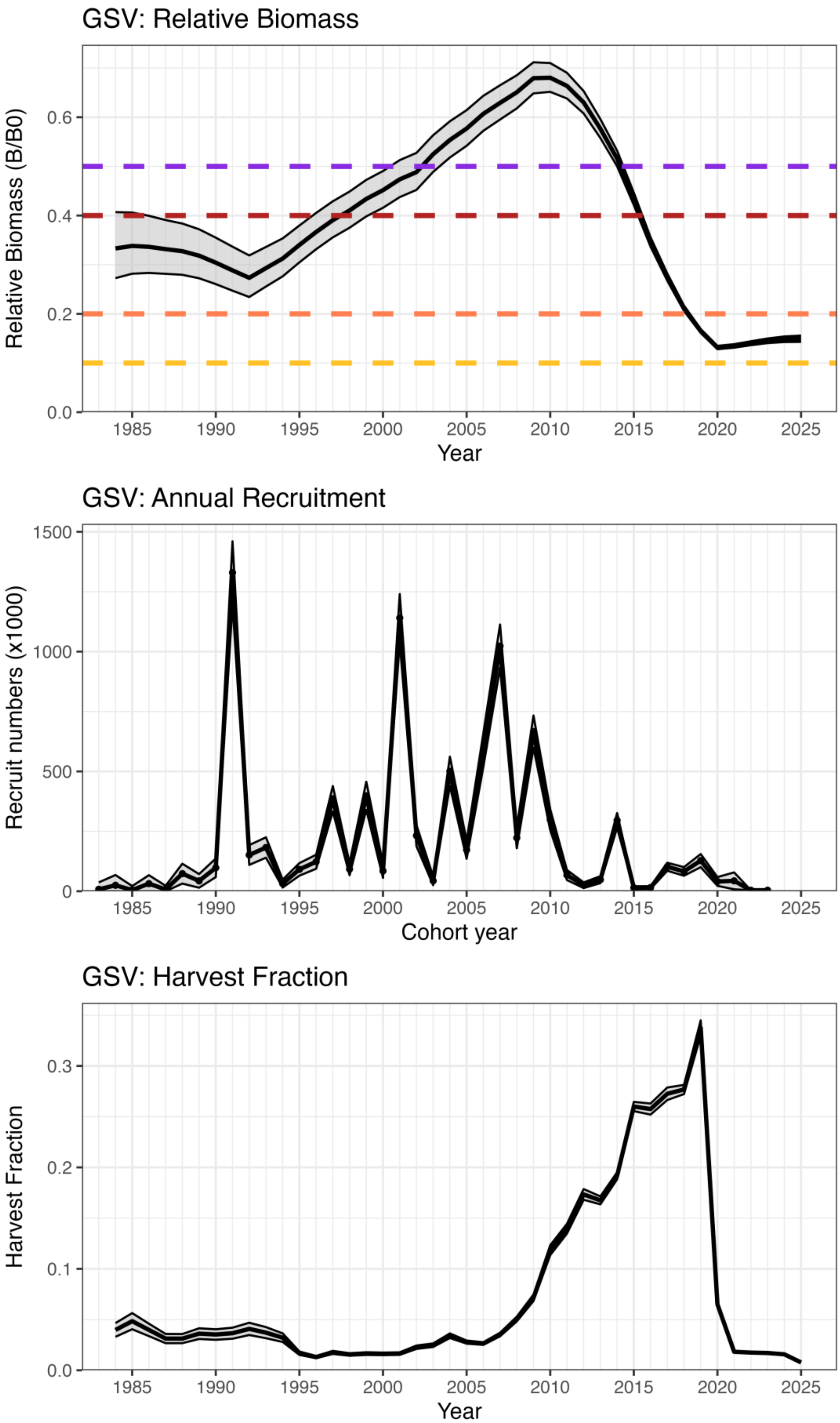

Figure 10. Time series of annual biological performance indicators from the SnapEst fishery assessment model for the Gulf St Vincent (GSV) stock from 1984 to 2025. Top – relative biomass (B/B_0); middle – recruitment; bottom – harvest fraction. Shading shows 95% confidence intervals.

Stock status

- The regional age structures for NGSV and SGSV involved a broad number of age classes with fish up to 20 years of age. The age structures for 2023/24 and 2024/25 demonstrated that the 2014 year class was the highest represented cohort in Gulf St Vincent, whilst the 2017, 2018, and 2019 year classes were well represented and have emerged as potential years of moderate recruitment.
- The estimate of spawning biomass for Gulf St Vincent using the DEPM was approximately 50% higher for the survey in January 2025 (i.e., 525 ± 122) compared to January 2022 (i.e., 351 ± 66 t). The increased estimate for 2025 was primarily driven by a reduction in overall spawning fraction across the survey area.
- Model estimated relative biomass (i.e., $B/B_{est}0$) increased slowly over the past five years but remained < 20% of unfished levels in 2025.
- The GSV stock has been classified as 'depleted' since 2020 (Fowler et al. 2020). Compared with the SG/WC stock, there is weaker evidence of recovery. However, on the basis of the evidence provided above, the GSV stock is classified as '**recovering**'. This means that (i) biomass remains depleted (i.e., < 20% of unfished levels), (ii) recruitment remains impaired, (iii) management measures are in place to promote stock recovery, and (iv) recovery is occurring.

SOUTH-EAST REGION

Fishery statistics

Total commercial catch of Snapper in the SE Region was relatively low until 2005/06, when catches rapidly increased to the highest on record of 230 t in 2009/10 (Figure 11a). High catches persisted at 208 t for 2010/11, then declined sharply to 6 t in 2015/16 (Figure 11a). Total commercial catch then increased to moderate levels of ~40 t for 2018/19 and 2019/20, prior to the introduction of total allowable catches (TACs). Following the implementation of the MSF reform in July 2021, commercial catches of Snapper have been constrained by TACCs (Table 4). Total allowable commercial catch was 36 t for 2021/22 and 2022/23 and then increased to 52.5 t for 2023/24 and 2024/25 (Table 4). Commercial fishers have caught between 67.6% and 79.9% of their allocation annually since July 2021.

Handline catch and targeted effort has consistently been low in the SE Region, with the peak of catch and effort occurring in 2006/07 with 16 t and 444 fisher-days (Figure 11a, b). Targeted HL CPUE steadily increased from 1983/84 to its peak in 2006/07 of 54.4 kg.fisher-day^{-1}. Catch rates have subsequently declined with handlines now rarely used in the region (Figure 11c).

Longline catch has accounted for the majority (91%) of the total commercial catch in the SE Region (Figure 11a). Up to 2006/07, annual targeted catches were generally < 5 t, which then rapidly increased to a peak of 221 t and 204 t in 2009/10 and 2010/11 (Figure 11a). Longline catch then sharply declined and is now regulated by TACC (Figure 11a). Targeted LL effort mirrored the trend in LL catch, peaking at 2,853 in 2010/11, then declined to 876 fisher-days in 2024/25. Targeted LL CPUE steadily increased to a peak of 84.8 kg.fisher-day^{-1}, then declined to 37.4 kg.fisher-day^{-1} in 2015/16, before increasing to its highest recorded catch rate of 101.8 kg.fisher-day^{-1} in 2020/21 (Figure 11d). After 2018/19, the two metrics of LL catch rate diverged due to improved fisher efficiency in setting more hooks per day.

Table 4. Reported Snapper catch (t) for the commercial, charter, and recreational sectors in the SE Region from 2021/22 to 2024/25. TAC – total allowable catch.

	Comm.			Charter			Rec.		
FY	TAC (t)	Catch (t)	%	TAC (t)	Catch (t)	%	TAC (t)	Catch (t)	%
21/22	36.0	25.1	69.7	6.4	1.3	19.7	5.1	3.0	58.7
22/23	36.0	28.8	79.9	5.4	2.0	31.9	5.1	2.8	54.0
23/24	52.5	35.4	67.6	9.3	1.4	14.9	7.5	4.1	55.3
24/25	52.5	41.2	78.4	9.3	1.9	20.4	7.5	6.2	82.2

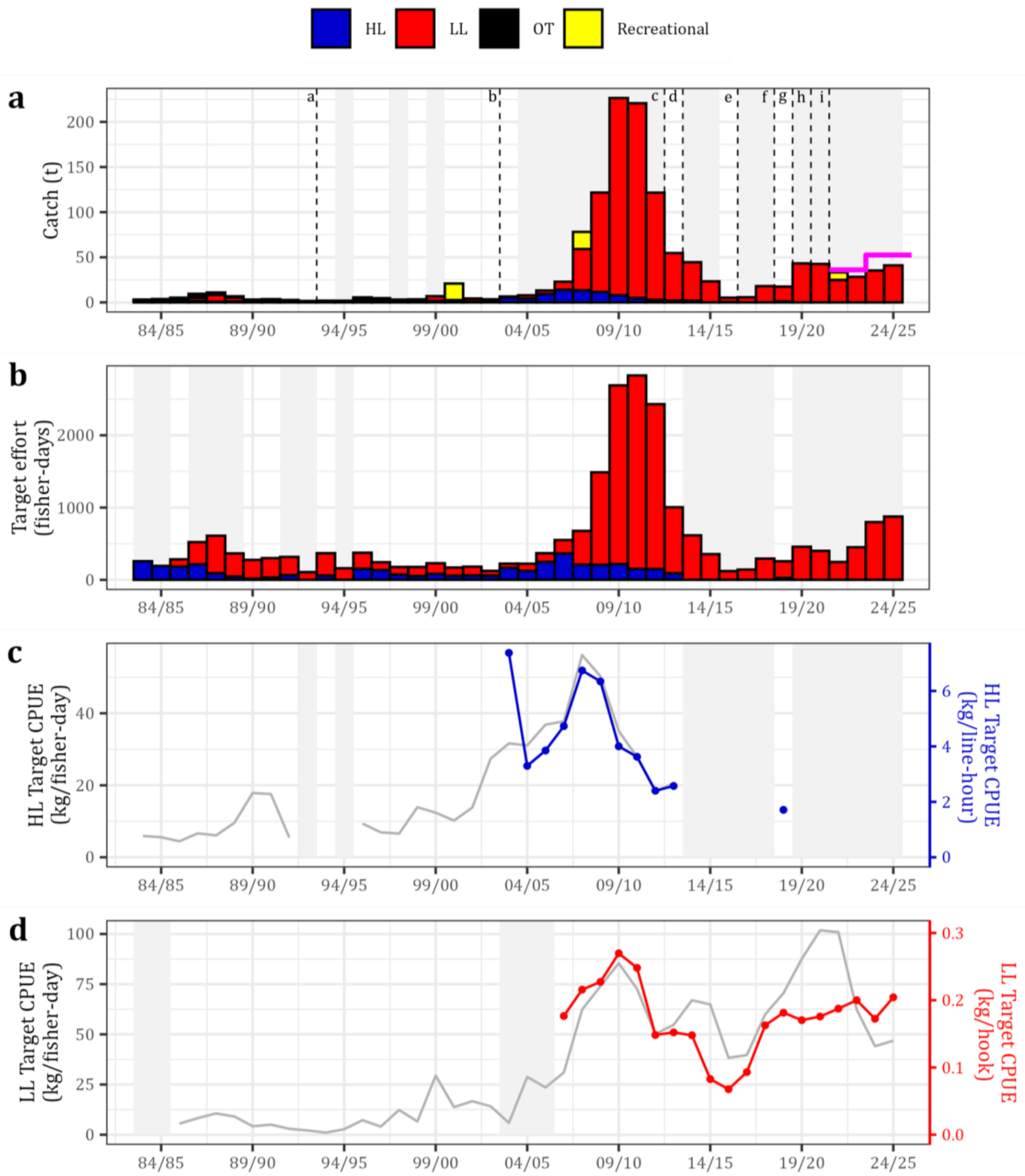

Figure 11. Key commercial fishery statistics for Snapper in the South-East Fishing Zone, grouped by key gear types – handline (HL, blue), longline (LL, red), and all other gears combined (OT). Long-term trends in annual estimates of: (a) total catch; (b) targeted effort; (c) HL catch per unit targeted effort; (d) LL catch per unit of targeted effort. Grey shading identifies years when data for one or more gear types were confidential (i.e., < 5 fishers). Letters in plot 'a' correspond to management changes described in Table A1 and the pink line shows annual total allowable commercial catch since 2021/22.

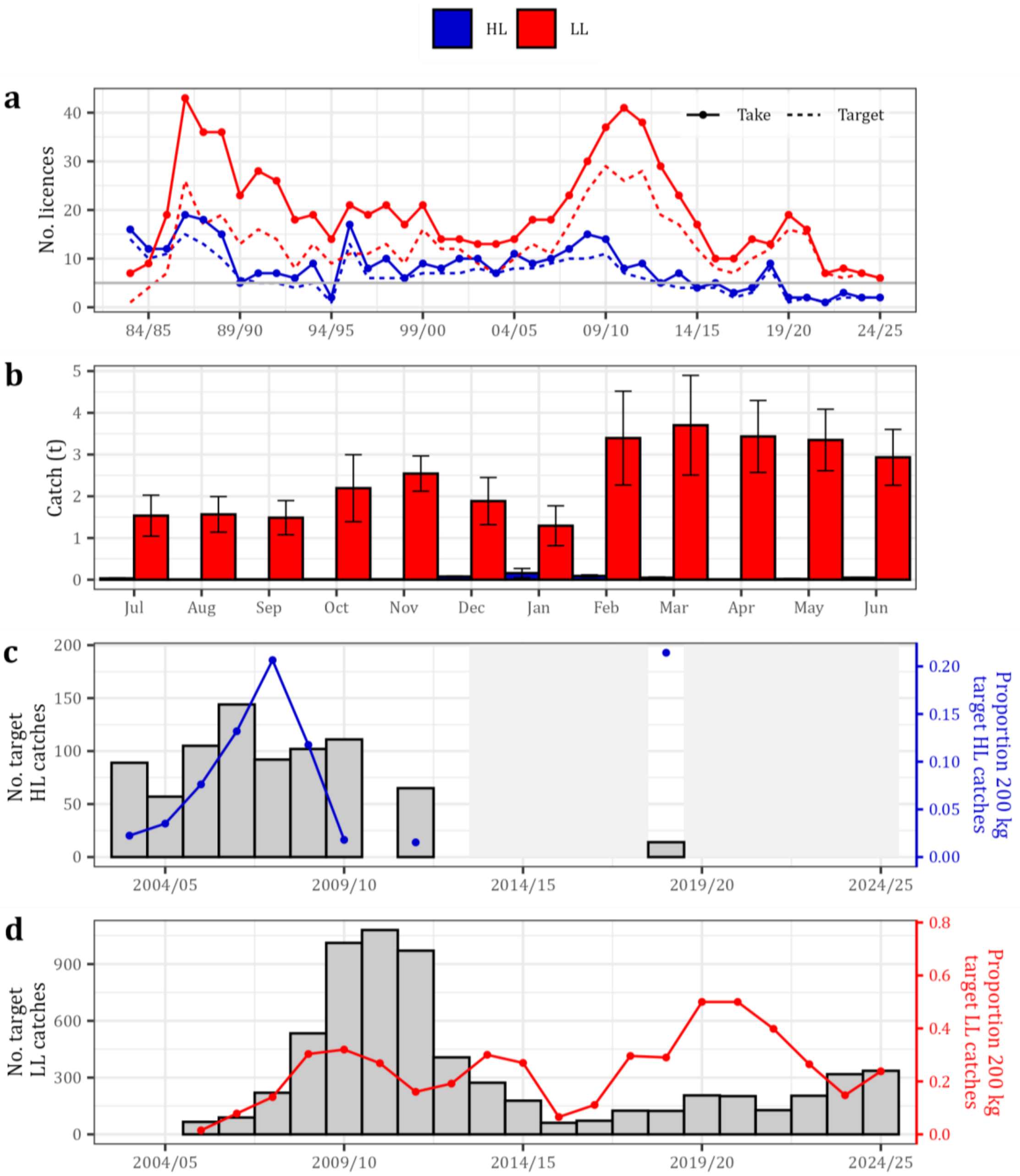

Figure 12. Key commercial fishery statistics for Snapper in the South-East Fishing Zone, grouped by key gear types – handline (HL, blue) and longline (LL, red). Long-term trends in annual estimates of: (a) number of licences that take and target Snapper; (b) average catch by month (error bars = standard error) from 2015/16 to 2024/25; (c) number of daily HL catches and proportion of HL catches > 200 kg; and (d) number of daily LL catches and proportion > 200 kg. Grey shading identifies years when data for one or more gear types were confidential (i.e., < 5 fishers).

Length and age structures

There was considerable similarity in the annual length and age structures for the SE Region over the past five years. The length structures involved fish from approximately 32 cm CFL (i.e., equivalent to the MLL of 38 cm TL) to 65 cm CFL, with the modal length progressively increasing from 2020/21 to 2023/24 (Figure 13). The age structures were dominated by the 2013 and 2014 year classes from 2020/21 to 2022/23, and by the 2014 year class in 2023/24 and 2024/25 (Figure 13). The 2014 year class has accounted for approximately 40% of Snapper sampled from the SE Region over the past five years. Recent age structures also demonstrate the emergence of the 2018 year class, which accounted for 24% of fish sampled in 2024/25 and was responsible for the shift in modal length towards the MLL (Figure 13).

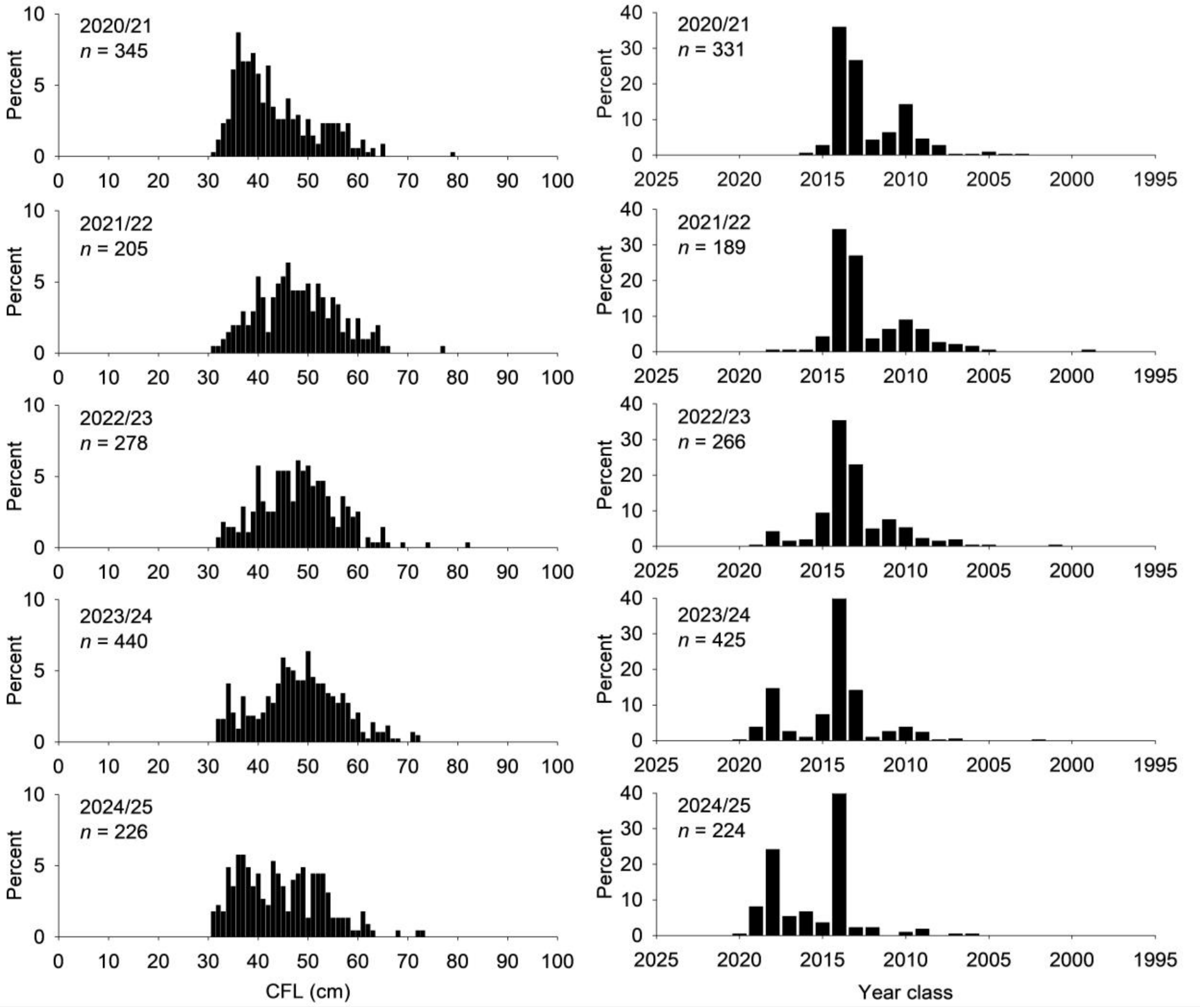

Figure 13. Annual length (left) and age (right) structures for Snapper sampled in the South-East Region from 2020/21 to 2024/25. For each year, data are presented as the relative percentage of fish accounted for by each length (i.e., 1 cm bin) and year class (i.e., the year that they were spawned).

Standardised CPUE

Standardised CPUE for SE Region followed a similar trend to the nominal CPUE. CPUE remained low from 1983 until the mid-2000s. Thereafter, three peaks were observed in 2009, 2013, and 2021 (Figure 14). In each of these peaks, the CPUE reached levels two or three times above the time-series average. The most recent estimates in 2024 were approximately 40% above the average for the time series (Figure 14).

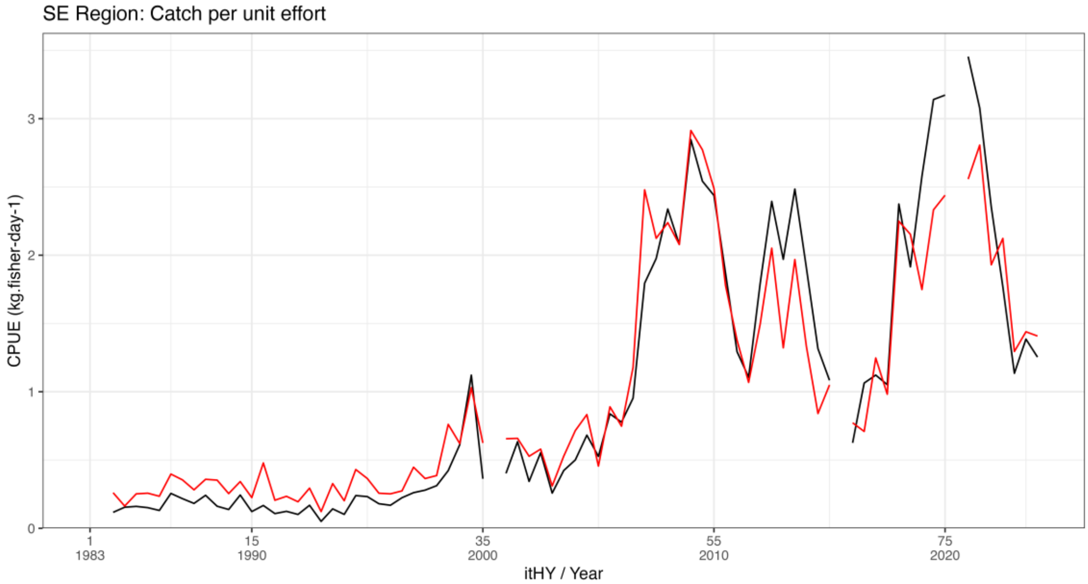

Figure 14. Catch rate standardisation for the South-East (SE) Region showing nominal (black) and standardised (red) catch per unit effort (CPUE) for longline from 1983 to 2025. Gaps in the timeseries are due to confidential data (i.e., < 5 fishers).

SnapEst model outputs

Model-estimated relative biomass for the SE Region demonstrated considerable variability throughout the timeseries. From 1984 to 2004, modelled relative biomass was stable at a low level, which was consistent with low modelled recruitment. Estimated relative biomass then increased significantly from 2004 to a peak in 2009, which reflected recruitment of the strong 2001 and 2004 year classes to the fishable biomass (Figure 15). Thereafter, estimated relative biomass rapidly declined from 2009 to 2015 associated with high estimates of harvest fraction and poor recruitment since 2004.

Estimated relative biomass increased from 2015 to 2020 and remained stable at a moderate to high level from 2020 to 2025 (i.e., 30-40% of unfished levels) (Figure 15). This trend in modelled biomass was associated with recruitment in 2010, 2013, 2014, and 2018. There is a strong relationship between the modelled timeseries of recruitment for the SE Region and the density of age-0 Snapper in annual surveys in Port Phillip Bay, Victoria, which is the primary nursery area for the Western Victorian Stock (Fowler et al. 2017). High densities of age-0 Snapper were sampled in the surveys in 2018 and 2022, and it is anticipated that these fish will continue to enter the fishable biomass in the SE Region over the next few years. The high level of model uncertainty in recent years reflects the modest sizes of length and age samples from 2014 to 2019 and the higher relative level of uncertainty in CPUE as an index of stock abundance (compared to DEPM estimates of spawning biomass).

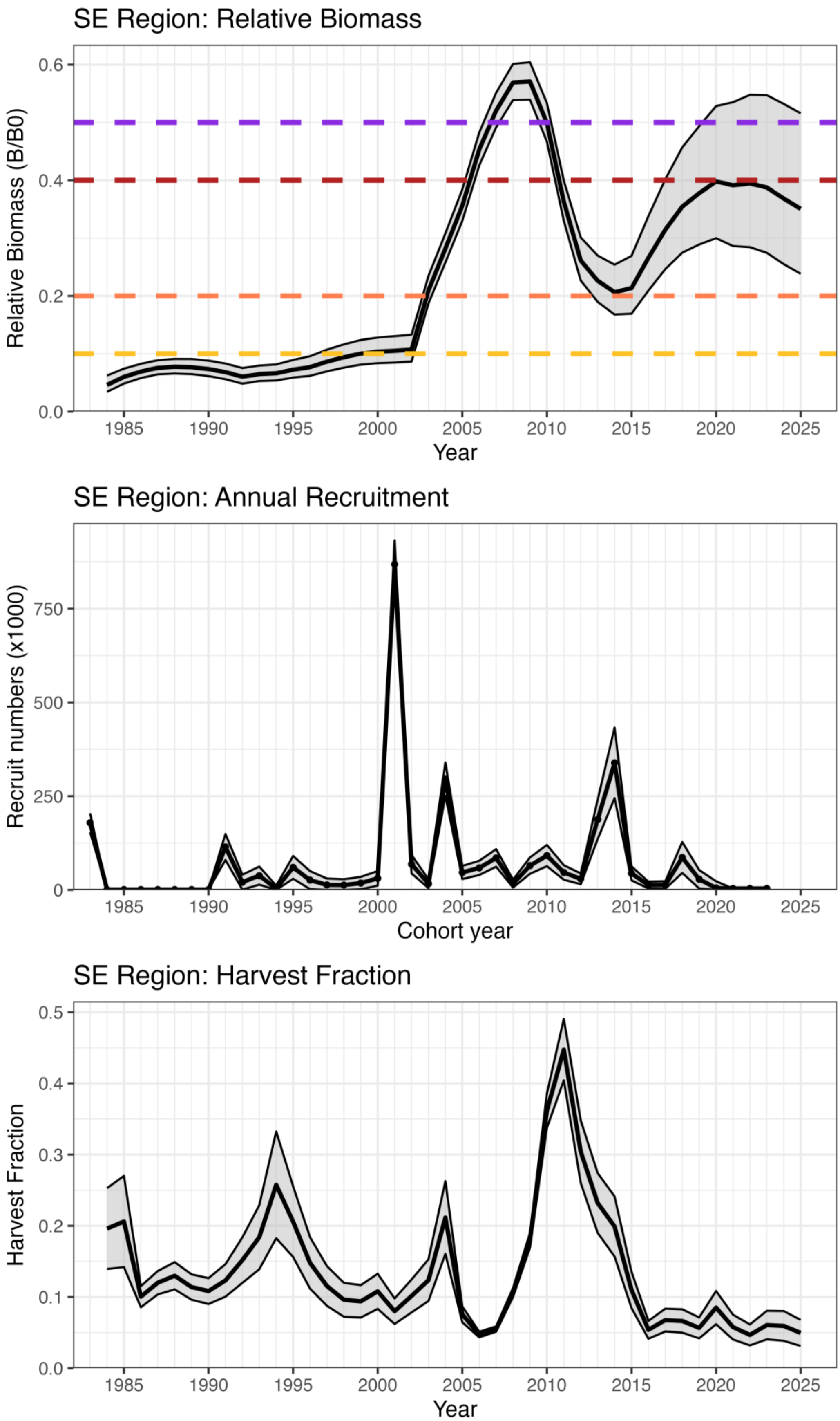

Figure 15. Time series of annual biological performance indicators from the SnapEst fishery assessment model for the South-East (SE) Region from 1984 to 2025. Top – relative biomass (B/B_0); middle – recruitment; bottom – harvest fraction. Shading shows 95% confidence intervals.

Stock status

- Stock status for the Western Victorian Stock is determined by the Victorian Fisheries Authority and was classified as '**sustainable**' in the most recent assessment (Bell et al. 2024) and Status of Australian Fish Stocks (SAFS) Reports (Rogers et al. 2024).

- Data for the SE Region are consistent with this stock status:
  - Fishing mortality in the SE Region is managed by a total allowable catch (TAC) for each sector. In 2024/25, the commercial sector caught 78% of their allocation, charter sector 20%, and recreational sector 82%.
  - Standardised longline catch per unit effort (CPUE) declined in 2023/24 and 2024/25 from a near record high in 2022/23 but remains above the historic long-term mean.
  - Population length and age structures for the SE Region were dominated by the 2014 year class, which accounted for > 40% of fish in the population. The 2018 year class has emerged as a potentially strong year class in the samples collected in 2023/24 and 2024/25. The 2014 and 2018 year classes were strong juvenile recruitment events in Port Phillip Bay, Victoria, which is the primary nursery area for the Western Victorian Stock.
  - Model estimated relative biomass has been relatively stable at a moderate to high level over the past five years (i.e., 30-40% of unfished levels) (i.e., 2020 to 2025). This trend was associated with recruitment of the strong 2014 year class and the emergence of the 2018 year class in recent years.

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APPENDIX 1 – Methods

Fishery statistics

Catch and effort data from 1 January 1984 to 30 June 2025 were analysed for the four commercial fisheries with access to Snapper (i.e., Marine Scalefish Fishery (MSF), Northern Zone Rock Lobster Fishery (NZRLF), Southern Zone Rock Lobster Fishery (SZRLF), Lakes and Coorong Fishery (LCF)). This included records of location by Marine Fishing Area (MFA), gear type and units, daily catch weights, and the number and weight of Snapper caught. Annual estimates by financial year were calculated for total catch, effort, and catch per unit effort (CPUE), which were differentiated by the two main gear types of handline (HL) and longline (LL).

Data from the Charter Boat sector were obtained from the Marine Scalefish Fishery Information System (MSFIS). Daily records of the number and estimated weight of retained Snapper were analysed from 1 July 2006 to 30 June 2025. Monthly recreational catch data from 2020 to 2025 were sourced from PIRSA Fishery Compliance. Recreational catch estimates (i.e., total weight) for the SE Region were based on the reported number of Snapper retained multiplied by the average weight for the region (i.e., 1.98 kg, derived from data in SARDI's Snapper biological information database). Estimates of recreational catches in previous years were sourced from recreational fishing surveys in 2000/01 (Henry and Lyle 2003), 2007/08 (Jones 2009), 2013/14 (Giri and Hall 2015), and 2021/22 (Beckmann et al. 2023).

Table A1. Summary of key management measures applied for the commercial Snapper fishery. Reference labels correspond to Figures 3, 8, and 13.

YEAR	MANAGEMENT MEASURE	REGION	DETAILS	PLOT REF.
1993	Gear restriction	State-wide	Prohibition of catching Snapper with fish traps or any net	a
2003	Seasonal closure	State-wide	Month long closure implemented in November of each year	b
2012	Trip limit (kg)	SG & GSV	800 kg daily trip limit applied	c
2012	Seasonal closure	State-wide	Seasonal closures extended to mid-December	c
2013	Spatial closures	SG & GSV	Spatial closures implemented for key spawning areas from November to January inclusive.	d
2013	Trip limit (kg)	SG & GSV	500 kg daily trip limit applied	d
2013	LL Hook limit	SG & GSV	Hook limits reduced to 200 from 400	d
2016	Trip limit (kg)	SG	200 kg daily trip limit applied	e
2016	Trip limit (kg)	GSV/SE	350 kg daily trip limit applied	e
2018	Spatial closure	SG and GSV	Locations of spawning closures revised	f
2019	Fishery closures	SG, GSV/KI & WC zones	Snapper fishery closed to all sectors	g
2020	TAC introduced	SE	TAC introduced from 2019 onwards	h
2021	ITQ introduced	State-wide	ITQ and fishing zones introduced and removal of seasonal closure in the SE Region	i

Length and age structures

The population dynamics and fishery productivity of Snapper populations in SA are fundamentally driven by highly variable inter-annual recruitment, i.e., the number of age-0 juveniles added to the population each year (Fowler and Jennings 2003, Fowler et al. 2017, Fowler 2025). This temporal variation in recruitment in manifested in the age structure of the population as distinct strong and weak year classes that are consistent amongst years (McGlennon et al. 2000, Fowler and McGlennon 2011).

Since 2000, a weekly market sampling program has been undertaken by SARDI researchers to provide biological data for Snapper caught by commercial fishers across SA. The closure of the SG/WC and GSV stocks precluded the collection of biological information from fishery catches for these stocks. To overcome this, a targeted adult sampling program was implemented to collect representative biological samples and continue the annual time series of regional length and age structures. This involved contracting commercial MSF fishers to collect samples of Snapper from representative regions, i.e., the West Coast (WC) of Eyre Peninsula, northern Spencer Gulf (NSG), southern Spencer Gulf (SSG), northern Gulf St Vincent (NGSV), and southern Gulf St Vincent (SGSV). The fish sampled were processed at local fish processing facilities and the product donated to Food Bank. Biological samples from the SE Region were accessed through the market sampling program.

Each fish was processed following a standard protocol to collect information on length, weight, sex, stage of maturity, and the otoliths removed. The determination of fish age followed a standard protocol that involved the preparation of a transverse section of a single otolith. Annual length and age structures were developed for each of the six regions to monitor trends in recruitment and population characteristics. See Drew et al. (2022) for more information.

Regional estimates of spawning biomass

The spawning biomass of Snapper in Spencer Gulf and Gulf St Vincent was estimated using the daily egg production method (DEPM) in December 2024 and January 2025, respectively. The DEPM surveys in 2024/25 were the fifth undertaken for each gulf since 2013.

The underlying principle of the DEPM is that spawning biomass can be determined from the relative density of pelagic eggs per unit area (i.e., total daily egg production) divided by the mean number of eggs produced per unit mass of adult fish (i.e., mean daily fecundity) (Parker 1980, Lasker 1985). Total daily egg production is the product of mean daily egg production (P_0) and total spawning area (*A*). Mean daily fecundity is calculated by dividing the product of mean sex ratio (by weight, *R*), mean spawning fraction (*S*), and mean batch fecundity (*F*) by mean female weight (*W*). Spawning biomass (*SB*) is calculated according to the equation:

$$SB = \frac{P_0 \cdot A}{\left(\frac{R \cdot S \cdot F}{W}\right)} \qquad \text{(Equation 1)}$$

The sampling methods, laboratory processing, and analytical approach to calculate the six parameters of the DEPM were described in Drew et al. (2022). In 2023/24, a targeted research project was completed through the Snapper Science Program to refine the DEPM methodology for Snapper (FRDC Project No. 2023-091). From the results of the study, the Snapper DEPM Working Group provided a series of recommendations that were adopted for the 2024/25 application of the DEPM. These included:

- Uniform grid of plankton sampling stations at a high spatial intensity (i.e., 1.5 × 1.5 nm) that was targeted at the key spawning area in SG and GSV which has resulted in an increase in the number of stations sampled from 272 to 500 in SG and from 270 to 560 in GSV;
- Plankton samples collected using vertical rather than oblique tows;
- Fix mean female sex ratio by weight (R) at 0.50;
- Histological analysis of ovaries classified as ‘hydrated’ to improve the understanding of reproductive biology (i.e., batch fecundity and spawning fraction); and,
- Re-analysis of data from previous DEPM surveys (i.e., 2013 to 2022) using the same analytical methods and survey area applied in 2024/25 to produce estimates of spawning biomass that are comparable between years.

Hydroacoustic survey

Active acoustic methods combined with underwater optics provide a fishery-independent, non-invasive approach to estimate the biomass of Snapper aggregations (Scoulding et al. 2023). In this study the estimates provide indices of abundance, not total spawning biomass, and can be used to monitor trends in Snapper abundance through time. This component of the assessment was led and delivered by researchers from the CSIRO.

A targeted acoustic-optical survey was completed in GSV from 9 to 18 January 2025. A total of 34 aggregation sites were surveyed that were grouped in four reference areas: northern (4 sites), central (20 sites), western (4 sites), and southern (7 sites) (Figure A1). Site selection was informed by commercial fishers, industry stakeholders, and previous research. At each aggregation site, a series of 250-500 m transects were completed in a ‘star’ pattern to collect acoustic data (Figure A1). The acoustic equipment was attached to a powered vessel operated by a commercial fisher and an uncrewed surface vessel (USV) operated by researchers. After the acoustic data was collected, underwater cameras were deployed to validate the composition of the fish assemblage. The survey design was informed by a series of field experiments completed in summer 2023/24 through the Snapper Science Program – Theme 2: Estimates of Biomass (FRDC Project No. 2023-091).

Snapper were identified from the echograms based on their target strength and acoustic morphology. Acoustic data were processed using Echoview software and grouped into five classification categories (Figure 2) to improve accuracy and reduce misidentification risk:

- Snapper – aggregation dominated by Snapper.
- Mixed Snapper – Snapper > 50% of acoustic signal.
- SPF – aggregation dominated by SPF species including Yellowtail Scad (*Trachurus novaezelandiae*), Blue Mackerel (*Scomber australasicus*), and Australian Anchovy (*Engraulis australis*).
- Mixed small-pelagic fish (SPF) – Snapper < 50%, aggregation dominated by SPF.
- Unknown – uncertain composition, mixed species including Silver Trevally (*Pseudocaranx georgianus*).

For each aggregation site, the number and biomass of Snapper was estimated using geostatistical simulations of acoustic data, accounting for sampling uncertainty and species composition. Applying these assumptions produced a range of biomass estimates for each aggregation site.

- Snapper-only schools: assumed 100% Snapper
- Mixed snapper schools: 50–80% attributed to Snapper
- Mixed SPF schools: 20–50% attributed to Snapper

The estimated number and biomass of Snapper at each aggregation site was then combined to provide estimates for each reference area.

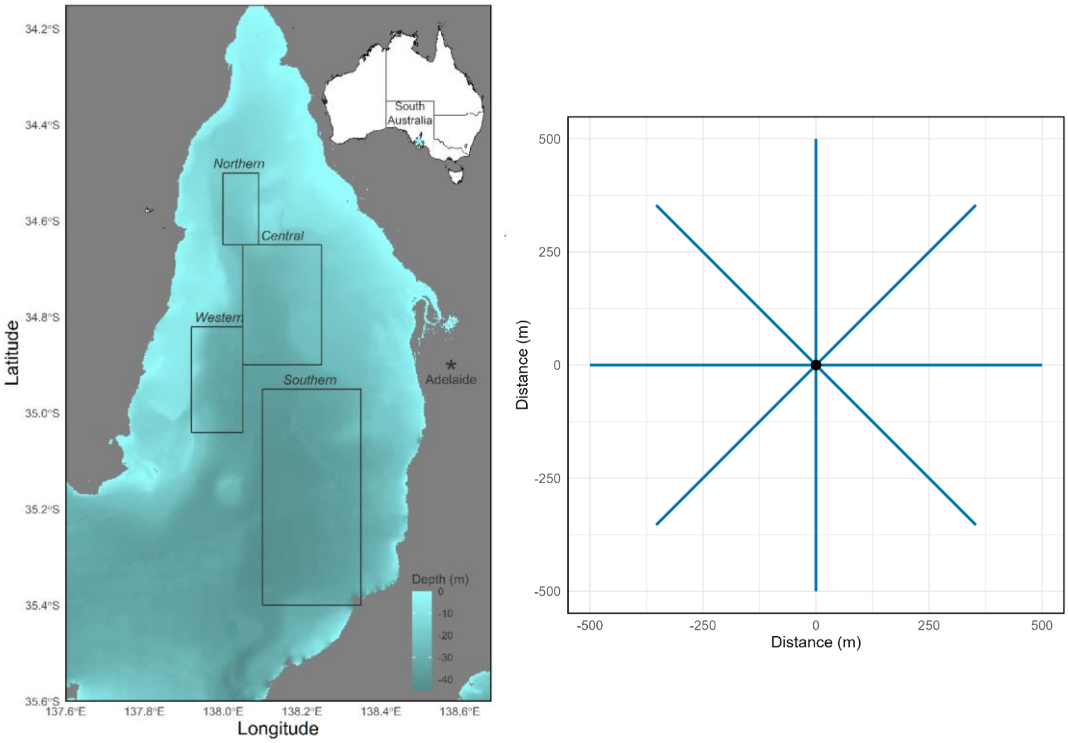

Figure A1. Left – bathymetric map of Gulf St Vincent showing the four reference areas (Northern, Central, Western, and Southern) considered in the acoustic-optical survey. Right – Star-pattern survey design used to collect acoustic data at each aggregation site. The pattern consisted of evenly distributed transects radiating from a central point.

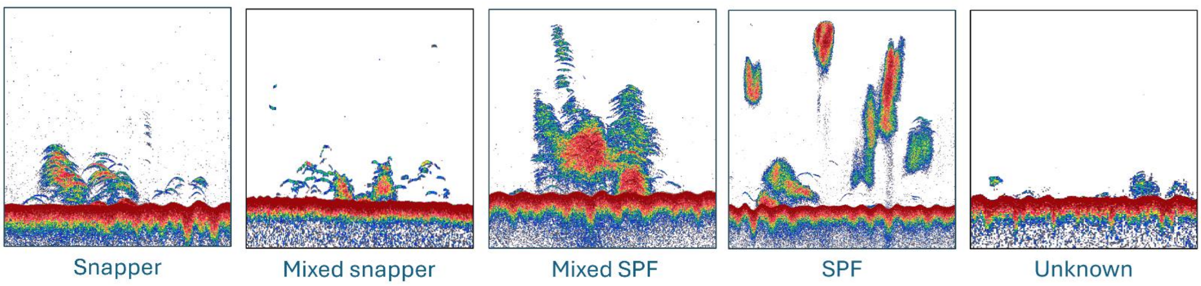

Figure A2. Example acoustic echograms illustrating the five categories used in biomass estimation: Snapper, Mixed Snapper, Mixed SPF, Small Pelagic Fish (SPF), and Unknown. These categories were defined based on acoustic morphology, location, and expert interpretation.

Fishery assessment model ('SnapEst')

The SA Snapper fishery assessment model, 'SnapEst', is a dynamic, spatial, age- and length-structured model (McGarvey and Feenstra 2004; Drew et al. 2022). SnapEst integrates multiple data sources, biological and fishery-derived, to estimate the model-based fishery performance indicators of fishable biomass (i.e., fish above minimum legal length (MLL)), recruitment, and harvest fraction. As per the 2022 assessment, the model estimates were at the biological stock scale for the SG/WC and GSV stocks and at the fishery management zone for the SE Region (Drew et al. 2022).

The data sources used as inputs to the SnapEst model were:

- Total commercial catch (t) by region from 1984 to 2025;
- Retained charter boat catch from logbooks since September 2005;
- Estimates of recreational catch data from the telephone and diary surveys undertaken in 2000/01 (Henry and Lyle 2003), 2007/08 (Jones 2009), and 2013/14 (Giri and Hall 2015). Recreational catch was interpolated for years outside of surveys based on data from the 2007/08 survey;
- Annual age structure proportions from commercial catch sampling:
    - SG/WC – 1999 to 2003, 2004 to 2011, 2013 to 2025,
    - GSV – 1999 to 2003, 2005 to 2011, 2013 to 2025, and
    - SE Region – 1999, 2002, 2006 to 2014, 2016, 2019 to 2025;
- Length-frequency data from commercial catch sampling above;
- Handline (HL) CPUE (kg.fisher-day^{-1}) from commercial catch and effort data as an index of abundance for the SG/WC and GSV stocks prior to the fishery closures in 2019, and longline (LL) CPUE (kg.fisher-day^{-1}) for all years in the SE Region; and
- Estimates of spawning biomass from DEPM surveys in SG (i.e., 2013, 2018, 2019, 2021, and 2024) and GSV (i.e., 2014, 2018, 2020, 2022, and 2025).

A description of model configuration, specifications, and parameters was provided in Drew et al. (2022). Following a comprehensive review of the model by an international fishery modelling expert (Haddon 2023) and a review of biological parameters for Snapper, there have been considerable updates to the SnapEst model through a targeted research project in the Snapper Science Program (FRDC Project No. 2023-091). These updates include:

- Change of instantaneous natural mortality rate (*M*) from 0.05 to 0.125 yr^{-1};
- Revised biological parameters for maturity-at-age, weight-at-length, and length-at-age (i.e., growth) for each stock;
- Setting of 'other' mortality of 20 t per year for the SG/WC and GSV stocks since the fishery closures were implemented (i.e., 1 November 2019) to account for discard mortality of incidentally captured Snapper across all fisheries and sectors, retained traditional fishery catches, and Snapper collected for research purposes;
- Revised timeseries of estimated spawning biomass from DEPM surveys in SG and GSV from the DEPM Refinement project (FRDC Project No. 2023-091);
- Fitting to the estimates of spawning biomass from the DEPM as a relative index of abundance (rather than absolute), with the DEPM catchability coefficient estimated for the SG/WC stock with that SG/WC catchability coefficient applied and fixed for GSV;
- Adjusted weighting of different data sources in the objective function;

- Fitting to standardised CPUE (rather than nominal), and using the entire time series of available CPUE data for SG/WC and GSV up to the fishery closures (rather than until the start of DEPM); and,
- Development of a forward projection model for each stock to forecast trends in biomass under various recruitment scenarios, estimate unfished biomass (i.e., $B_{est}0$), and calculate relative biomass (i.e., $B/B_{est}0$) to assess the reference points prescribed in the Management Plan (PIRSA 2025).

SnapEst was fitted to DEPM, age structures and standardised CPUE derived from HL for the SG/WC and GSV stocks, and from LL in the SE Region. The CPUE values used as inputs for the standardisation were calculated as the ratio of total catch (kg) to total effort (fisher-days) aggregated by the factors included in each respective model (e.g., half yearly time-step, month, etc.). The standardisation process involved fitting a linear model using the natural logarithm of CPUE as the response variable, and as a function of factors that may influence catchability and fishing efficiency beyond stock abundance. For the SG/WC and GSV stocks, these factors included licence number, month, half-yearly time step, MFA, target species as a 3-level factor (i.e. Snapper, other species, or no particular target), and number of handlines and number of hours (binned) as alternative effort metrics. Months from November to January (inclusive) were excluded to remove potential seasonal biases associated with seasonal closures since the early 2000s. Catch rate was standardised separately for the regions within each stock to account for regional variability in catch, effort, and catch rates. The regional indices were then combined using a catch-weighted mean to produce the final timeseries of standardised catch rate. In the SE Region, predictors included month and the average number of hooks and number of sets (binned) as additional effort metrics. All models assumed a Gaussian error distribution. Nominal and standardised catch rates were normalised to a mean of 1 by dividing each estimate by the mean of the time series.

Stock status

A weight-of-evidence approach was used to determine stock status that considered both fishery-dependent and fishery-independent information. The fishery-dependent data were: (i) commercial and recreational fishery statistics, and (ii) regional population length and age structures. The fishery-independent data were: (i) estimates of spawning biomass for SG and GSV using the DEPM, and (ii) estimates of biomass at specific aggregation sites in GSV from a hydroacoustic survey. These data sources were incorporated into the fishery assessment model (‘SnapEst’) which estimated the biological performance indicators of fishable biomass, recruitment, and harvest fraction for each stock. Stock status was determined using the National Fishery Status Reporting Framework (Table A2) (Roelofs et al. 2024).

Table A2. Classification scheme used to assign stock status using the National Fishery Status Reporting Framework (Roelofs et al. 2024).

	Stock status	Description	Potential implications for management of the stock
	Sustainable	Biomass (or proxy) is at a level sufficient to ensure that, on average, future levels of recruitment are adequate (recruitment is not impaired) and for which fishing mortality (or proxy) is adequately controlled to avoid the stock becoming recruitment impaired (overfishing is not occurring).	Appropriate management is in place.
	Depleting	Biomass (or proxy) is not yet depleted and recruitment is not yet impaired, but fishing mortality (or proxy) is too high (overfishing is occurring) and moving the stock in the direction of becoming recruitment impaired.	Management is needed to reduce fishing mortality and ensure that the biomass does not become depleted.
	Recovering	Biomass (or proxy) is depleted and recruitment is impaired, but management measures are in place to promote stock recovery, and recovery is occurring.	Appropriate management is in place, and there is evidence that the biomass is recovering.
	Depleted	Biomass (or proxy) has been reduced through catch and/or non-fishing effects, such that recruitment is impaired. Current management is not adequate to recover the stock, or adequate management measures have been put in place but have not yet resulted in measurable improvements.	Management is needed to recover this stock; if adequate management measures are already in place, more time may be required for them to take effect.
	Undefined	Not enough information exists to determine stock status.	Data required to assess stock status are needed.
	Negligible	Catches are so low as to be considered negligible and inadequate information exists to determine stock status.	Assessment will not be conducted unless catches and information increase.