Stock Status Summary – 2021

NSW Eastern School Whiting (*Sillago flindersi*)

Assessment Authors and Year

Hall, K.C. 2021. NSW Stock Status Summary 2020/21 – Eastern School Whiting (*Sillago flindersi*). NSW Department of Primary Industries, Fisheries NSW, Coffs Harbour. 17 pp.

Stock Status

Current stock status	On the basis of the evidence contained within this assessment, – Eastern School Whiting are currently assessed as **sustainable** for the NSW component of the stock.

Stock Structure

Eastern School Whiting is a temperate inshore demersal species that occurs in oceanic waters to a depth of about 100 m, from southern Queensland to South Australia, and including north-eastern Tasmania. The stock structure is currently unknown. Some historic genetic and growth data suggests there may be separate northern and southern stocks, with a division around Forster (Dixon et al. 1987). However, the power of the methods used to detect a difference was limited, and the results were difficult to interpret, with no clear geographic pattern in the genetic variation detected. Overall, the hypothesis of a single, genetically diverse panmictic stock could not be rejected, and the species has been assessed as a single south-eastern Australia biological stock (Conron et al. 2018). However, due to divergent fishing effort and assessment results between the northern and southern parts of the stock in recent years and ongoing uncertainty regarding the stock structure, stock status was reported according to management units in 2020.

The data presented in this summary relate to the NSW part of the stock (reproduced from Hall 2021).

Stock Status – New South Wales

Catch Rate Trends - Commercial Fisheries

Annual commercial catches of Eastern School Whiting in NSW state waters (following adjustment for mixed catches and species misreporting in northern NSW) peaked at 1,167 t in 1998 and remained above 700 t until 2012, after which catches decreased to a recent minimum of 495 t in 2014. Over the last five years catches have rapidly increased again to 1,188 t in 2017, 1,155 t in 2018 and 1,196 t in 2019 (Fig. 1). Most of the recent increase in catches was taken from waters north of Barrenjoey Point; although catches south of Barrenjoey Point also increased in 2019 after a catch quota was introduced in the northern fishery. A basket total allowable commercial catch (TACC) of 1,189 t for combined Eastern School Whiting and Stout Whiting was introduced in May 2019 for waters north of Barrenjoey Point. This TACC was reduced to 898 t in May 2020 in partial consideration of NSW stock assessment results, which included a stock status change to ‘depleting’ in 2019 (Hall 2020; Mapstone et al. 2020).

Most of commercial catch of Eastern School Whiting from NSW waters is taken by fish and ocean prawn trawlers in the Ocean Trawl Fishery (OTF) and Southern Fish Trawl Restricted Fishery (SFT). A small number of NSW Danish seine operators have also targeted trawl whiting in NSW since 2010. Danish seine and SFT catches have been combined with northern fish trawl (NFT) catches and are collectively referred to as the ‘fish trawl sector’. Historically, Eastern School Whiting catches were historically larger for the ocean prawn trawl sector than the fish trawl sector

and showed latitudinal variation across ocean zones (OZ1 to OZ10, north to south along the coastline), with larger catches in the north (OZ1 to OZ4) where the prawn trawl sector mainly operates (Figs 2 and 3). However, since 2007 this trend has gradually reversed, and the large increases in the commercial catch over the last 3 years were mostly taken by the northern fish trawl sector from OZ5 (Figs 2 and 3).

Eastern School Whiting is also targeted by Danish seine and trawl vessels in the Commonwealth Southern and Eastern Scalefish and Shark Fishery (SESSF) in offshore waters (>3 nm from the coastline) south of Barrenjoey Point (Fig. 4). The total Commonwealth catches of Eastern School Whiting were 767.7 t in 2017, 603.9 t in 2018 and 506 t in 2019. Much smaller commercial catches are also taken by trawl vessels in Victorian and Tasmanian state waters that on average account for less than 2% of the total catch.

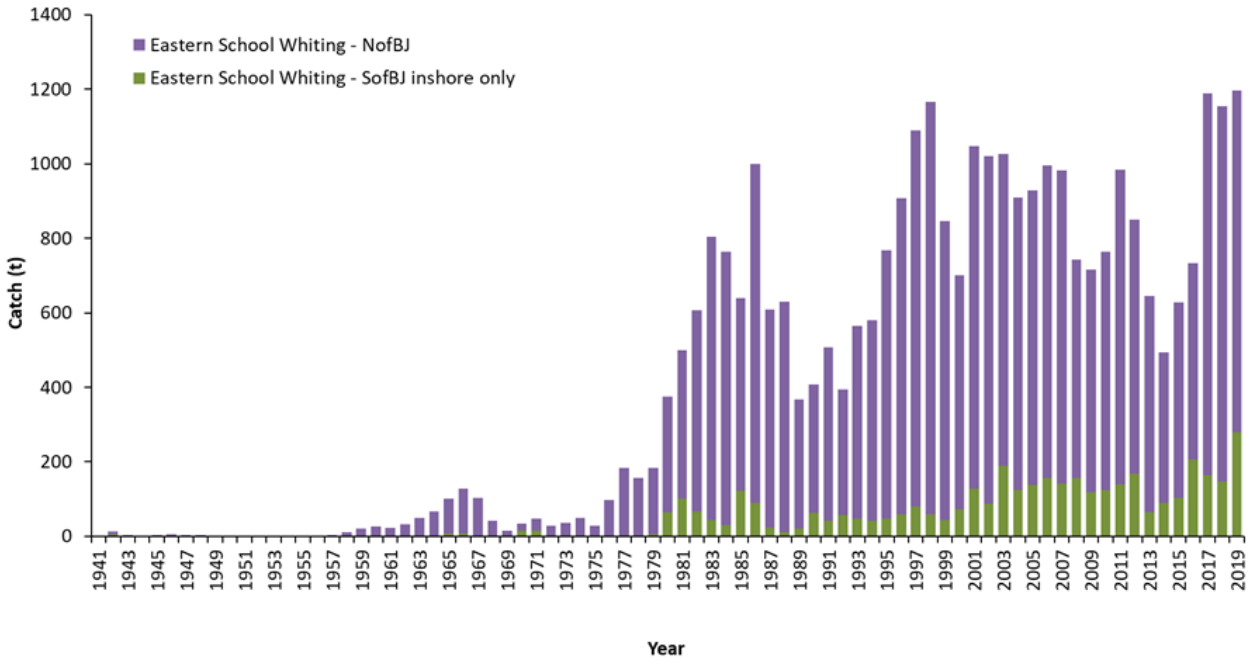


Figure 1. Annual adjusted commercial catches (tonnes) of Eastern School Whiting for NSW state waters (1941–2019). Estimated amounts taken north and south of Barrenjoey Point (NofBJ, SofBJ) are indicated. Catches have been adjusted for species misreporting in northern NSW and only oceanic 'mixed whiting' catches have been included for historical data.

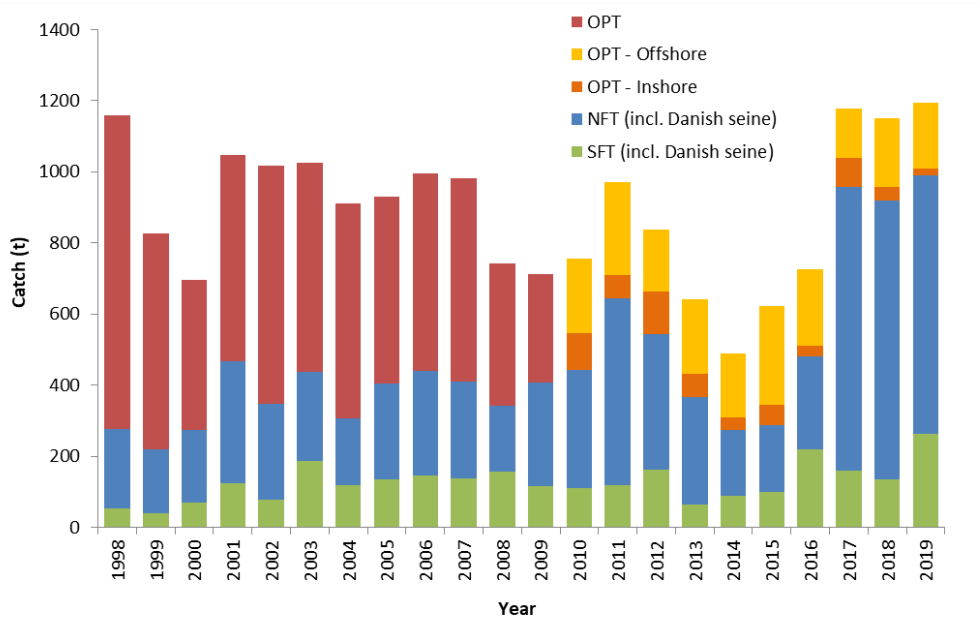


Figure 2. Annual adjusted commercial catches (tonnes) of Eastern School Whiting for NSW waters (1998–2018) for different sectors and endorsements of the NSW Ocean Trawl Fishery. OPT = Ocean Prawn Trawl, NFT = Northern Fish Trawl, SFT = Southern Fish Trawl.

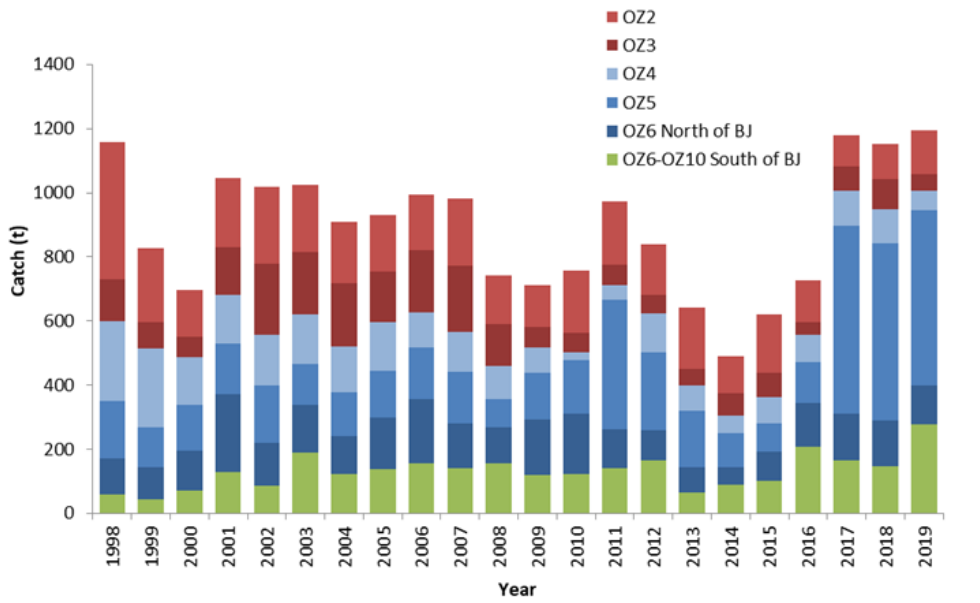


Figure 3. Annual adjusted commercial catches (tonnes) of Eastern School Whiting from the NSW Ocean Trawl Fishery in each ocean zone (OZ1 to OZ10, 1 degree of latitude each) from north to south along the coastline. Catches in OZ6 are divided into amounts taken north and south of Barrenjoey Point (BJ) and zones south of BJ are aggregated for confidentiality reasons.

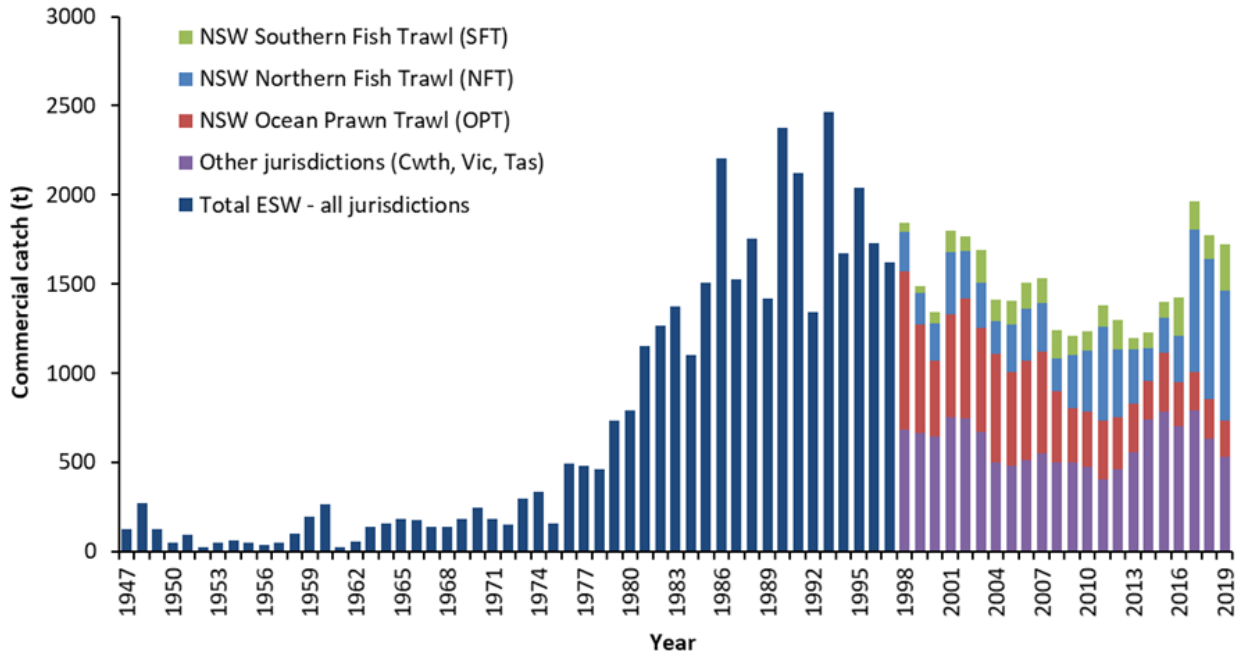


Figure 4. Annual adjusted commercial catches (tonnes) of Eastern School Whiting (ESW) for all jurisdictions combined (1947–1997) and for sectors of the NSW Ocean Trawl Fishery relative to the combined catches other jurisdictions (1998–2019), including the Commonwealth (Cwth), and Victorian (Vic) and Tasmanian (Tas) state waters. Data for other jurisdictions from Day (2020).

Catch Trends - Recreational and Indigenous

The most recent estimate of the recreational harvest of combined trawl whiting (Eastern School Whiting and Stout Whiting) in NSW was approximately 10,933 fish or around 1.54 t during 2017/18 (Murphy et al. 2020). This estimate was based on a survey of Recreational Fishing Licence (RFL) Households, comprised of at least one fisher possessing a long-term (1 or 3 years duration) fishing licence and any other fishers resident within their household. The equivalent estimated recreational harvest in 2013/14 was approximately 50% larger at around 21,152 fish (Murphy et al. 2020). Relative to the commercial catch, these recreational catches are negligible, comprising approximately 0.1% of the total harvest from NSW waters in 2013/14 (Hall 2018). There are no data on Aboriginal harvest, but these catches are also assumed to be negligible.

Fishing Effort Trends – Commercial Fisheries

Commercial fishing effort for Eastern School Whiting was collected as number of days fished on monthly records prior to July 2009 and as numbers of hours fished per daily event after July 2009. To form a longer time series of effort, recent daily events were re-aggregated, with effort in days fished estimated from the number of fishing events entered for each fisher in each month where Eastern School Whiting was reported on at least one day; and were adjusted for multi-day trips reported as a single fishing event by dividing the total number of hours by 12.

In the ocean prawn trawl sector, reported effort for Eastern School Whiting declined rapidly from around 12,000 days fished and 120,000 trawl hours in the early 2000s to 4,270 days fished and 39,125 hours trawled in 2009. Since then effort has declined more gradually to an estimated 3,531 days fished and 39,125 hours trawled in 2019 (Fig. 5). Therefore, most of the decline in effort occurred prior to the catch reporting change in 2009. In contrast, reported effort for Eastern School

Whiting in the fish trawl sector was initially more variable and has continued to decline after the reporting change in 2009 from 2,029 days fished and 18,537 hours trawled to 1,144 days fished and 8,188 hours trawled in 2019 (Fig. 6).

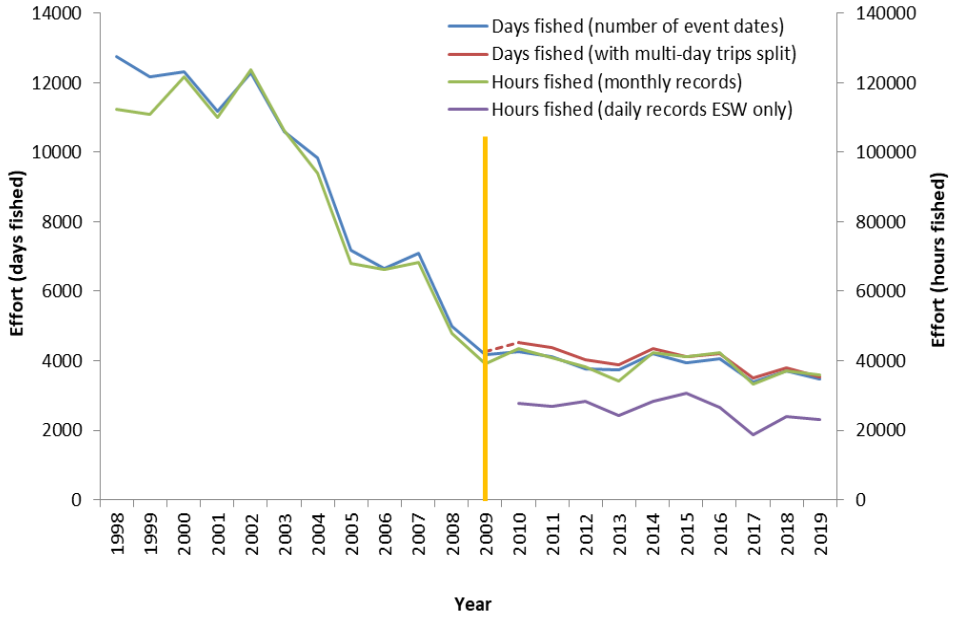


Figure 5. Annual adjusted effort (days and hours fished) for ocean prawn trawl fishers that reported landing Eastern School Whiting (ESW) on at least one day in each month.

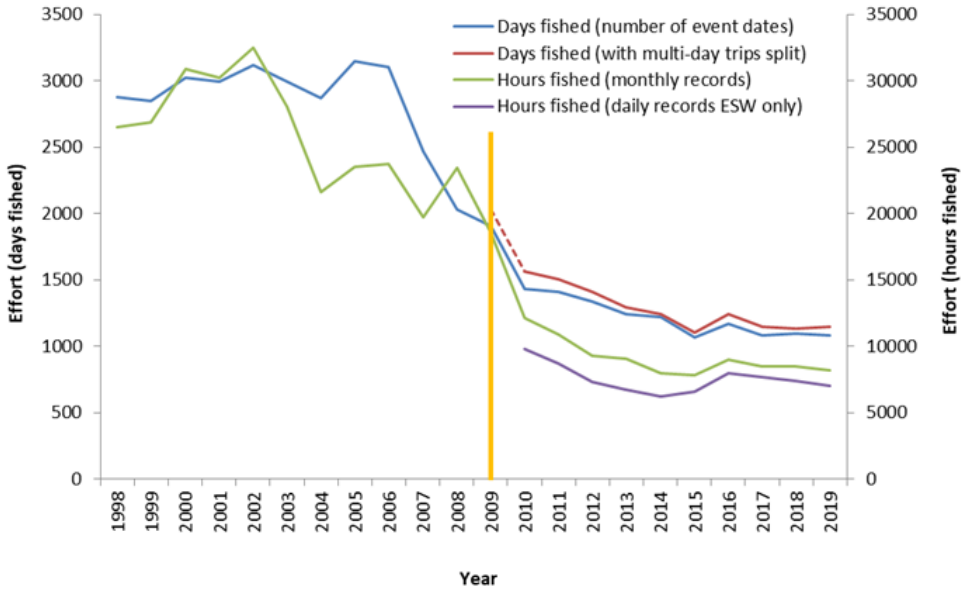


Figure 6. Annual adjusted effort (days and hours fished) for fish trawl fishers (including Danish seine) that reported landing Eastern School Whiting (ESW) on at least one day in each month.

Catch rate Trends – Commercial Fisheries

Monthly catch rates (catch-per-unit-effort, CPUE in kg per day fished) for Eastern School Whiting taken by the fish trawl (excluding Danish seine) and ocean prawn trawl sectors were compiled from monthly records between 1998 and 2009 and re-aggregated daily records between 2010 and 2019. Catch rates were standardized for month, ocean zone and vessel using the r-package 'cede' (Haddon 2018). Continuity of the time series across the catch reporting change in July 2009 must be interpreted with caution. Daily catch rates (CPUE in kg per hour trawled) were also compiled from daily fishing event records from 2010 to 2019 and standardised for month, ocean zone, vessel and capture depth (taken from the mean depth of the reported c-square).

The mean standardized catch rates of Eastern School Whiting have been consistently lower for the ocean prawn trawl sector relative to the fish trawl sector (Figs 7 and 8). The two sectors operate in mostly different ocean zones, use different gears and vary in their targeted fishing practices, which account for these differences.

Monthly catch rates of the ocean prawn trawl sector rapidly declined from 1998 to 2000 to more than 50% below the long-term average, then steadily increased and have remained above or near the 22-year average since 2006 (Fig. 7). This suggests the stock in northern NSW may have initially declined following the peak catches in the late 1990s, but has since recovered. Trends in recent daily catch rates decreased from 2010 to 2014, spiked in 2015 and have returned to levels near the 10-year average over the last 3 years (Fig. 7).

Monthly catch rates of the fish trawl sector fluctuated below the long-term average in the early 2000s and then steadily increased to a peak in 2011, before rapidly declining for two years and then increasing to remain above the 22-year average for the last 4 years. Trends in recent daily catch rates show a similar trend, with a rapid decline between 2011 and 2013 and then a return to near the 10-year average over the last 4 years (Fig. 8).

Mean annual ocean prawn trawl catch rates of Eastern School Whiting showed some latitudinal variation across ocean zones (for which sufficient data are available) and were on average highest in OZ4 and OZ3 (Fig. 9). This spatial variation suggests some finer scale population dynamics may be occurring.

The Eastern School Whiting catch rates in OZ1 and OZ2 are influenced by the overlap in species distribution with Stout Whiting. When ocean prawn trawl catch rates were reanalysed with only data from OZ3 to OZ6 included, the trend for the combined fleet shows a steady decrease between 2010 and 2016, followed by a rapid increase in 2017 and 2018 and sudden decrease again in 2019 to below the long-term average (Fig. 9). The combined catch rate (OZ3–OZ6, bottom right in Fig. 9) was the series selected for the NSW ocean prawn trawl for inclusion in the Commonwealth Tier 1 modelling. It was considered the least likely to be influenced by overlap with Stout Whiting further north (i.e., OZ1 and OZ2).

Analyses of the spatial variation in fish trawl catch rates by separate ocean zones also suggest that the recent catch rate increases in the sector have predominantly occurred in OZ6 and OZ7 south of Barrenjoey Point; and that catch rates in OZ5 have decreased by over 50% between 2011 and 2014 and have remained low since (Fig. 10). Eastern School Whiting catch rates in OZ5 near Newcastle are showing some evidence of localised depletion over the last 10 years in both ocean prawn trawl and fish trawl indices. The combined catch rate north of Barrenjoey Point (OZ4–OZ6, bottom right in Fig. 10) was the series selected for the NSW fish trawl for inclusion in the Commonwealth Tier 1 modelling. It was considered the least likely to be influenced by Commonwealth trawling to the south of Barrenjoey Point (i.e., OZ7 and further south).

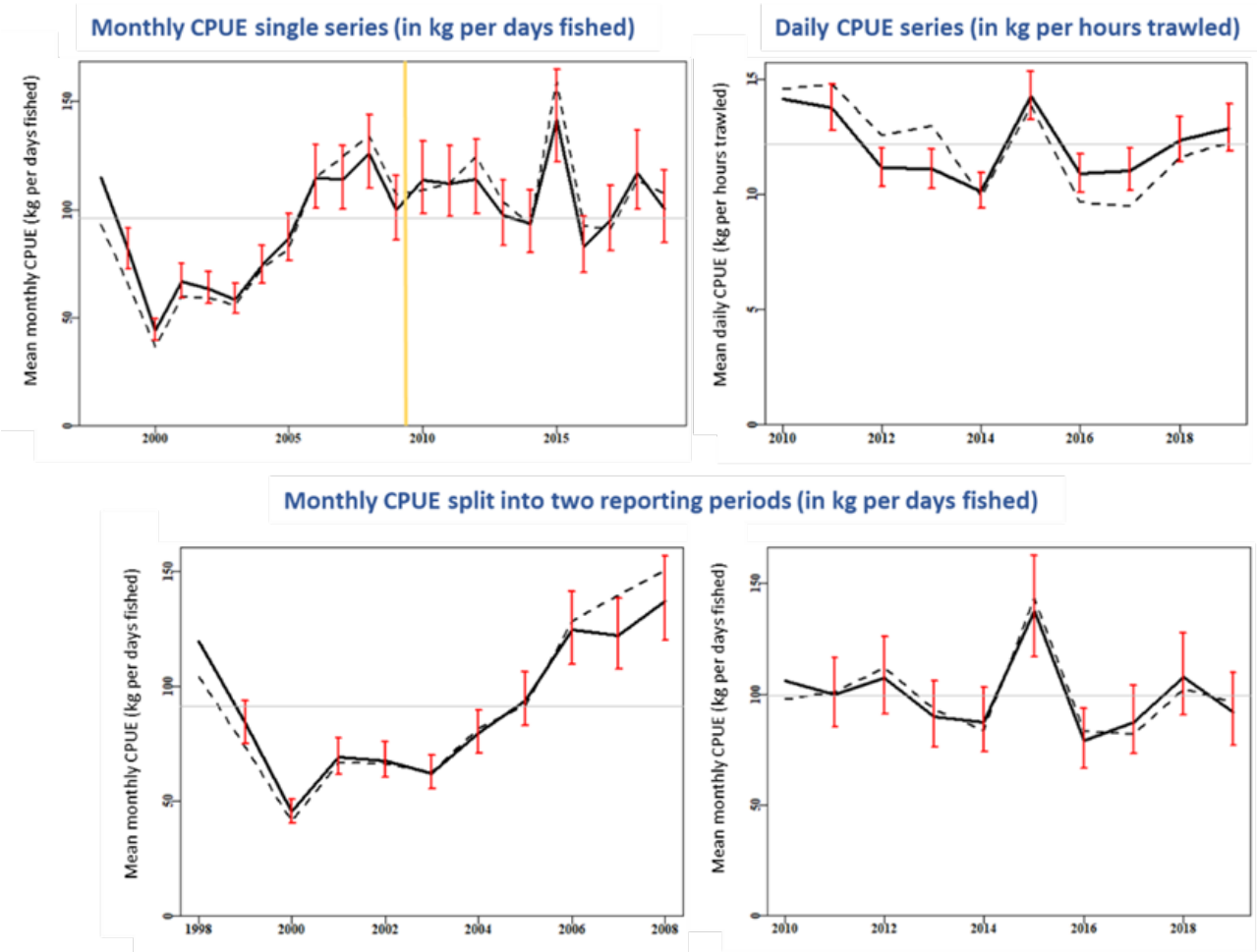


Figure 7. Mean standardised catch rates (catch-per-unit-effort, CPUE) of Eastern School Whiting for the ocean prawn trawl sector in the NSW Ocean Trawl Fishery, estimated from monthly records (1998–2009) and re-aggregated daily records (2010–2019) in kg per days fished (top left and bottom) and from daily fishing event records in kg per hours trawled (top right). The dashed and solid lines indicate the nominal and standardised mean CPUE (± 95% confidence intervals), respectively; the gold vertical line indicates the change from monthly to daily catch reporting and the grey horizontal line indicates the long-term averages for each series.

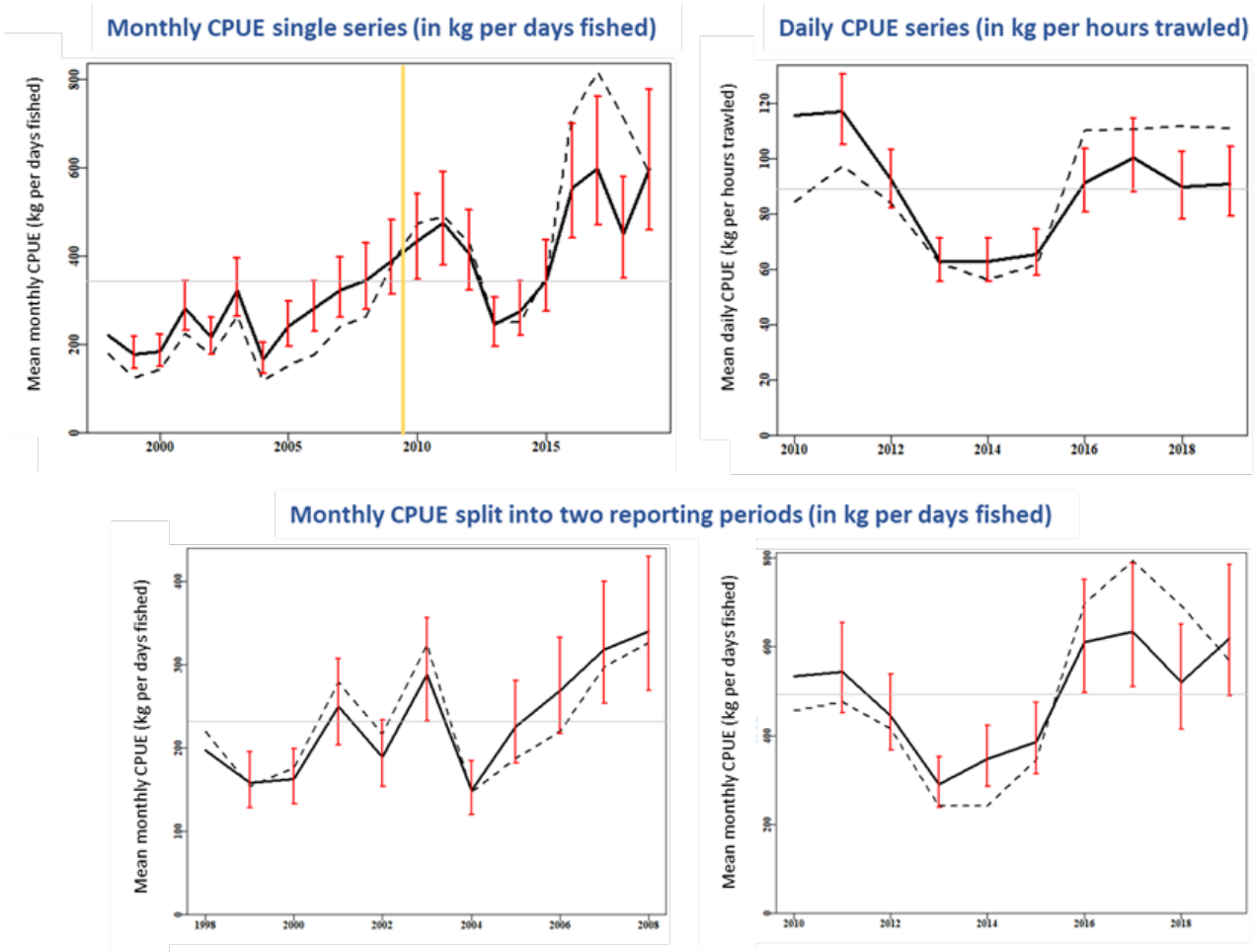


Figure 8. Mean standardised catch rates (catch-per-unit-effort, CPUE) of Eastern School Whiting for the fish trawl sector in the NSW Ocean Trawl Fishery, estimated from monthly records (1998–2009) and re-aggregated daily records (2010–2019) in kg per days fished (top left and bottom) and from daily fishing event records in kg per hours trawled (top right). The dashed and solid lines indicate the nominal and standardised mean CPUE (± 95% confidence intervals), respectively; the gold vertical line indicates the change from monthly to daily catch reporting and the grey horizontal line indicates the long-term averages for each series.

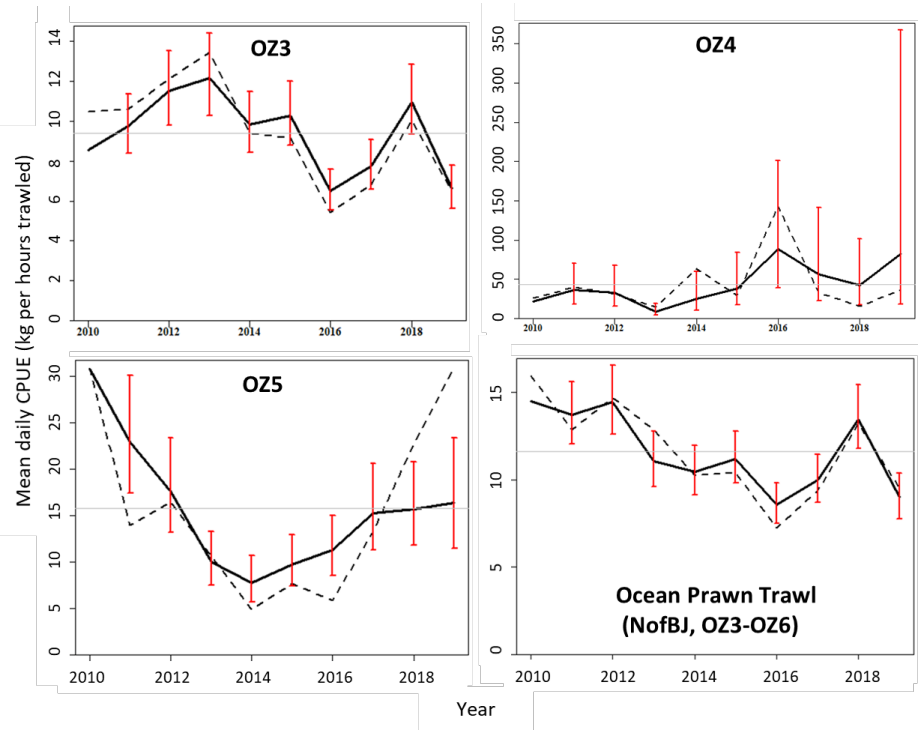


Figure 9. Variation in mean standardised catch rates (catch-per-unit-effort, CPUE, in kg per hours trawled from daily event records) of Eastern School Whiting across different ocean zones (comprising one degree of latitude) for the ocean prawn trawl sector of the NSW Ocean Trawl Fishery (2010–2019). The dashed and solid lines indicate the nominal and standardised mean CPUE (± 95% confidence intervals), respectively, and the grey horizontal line indicates the long-term average for each series.

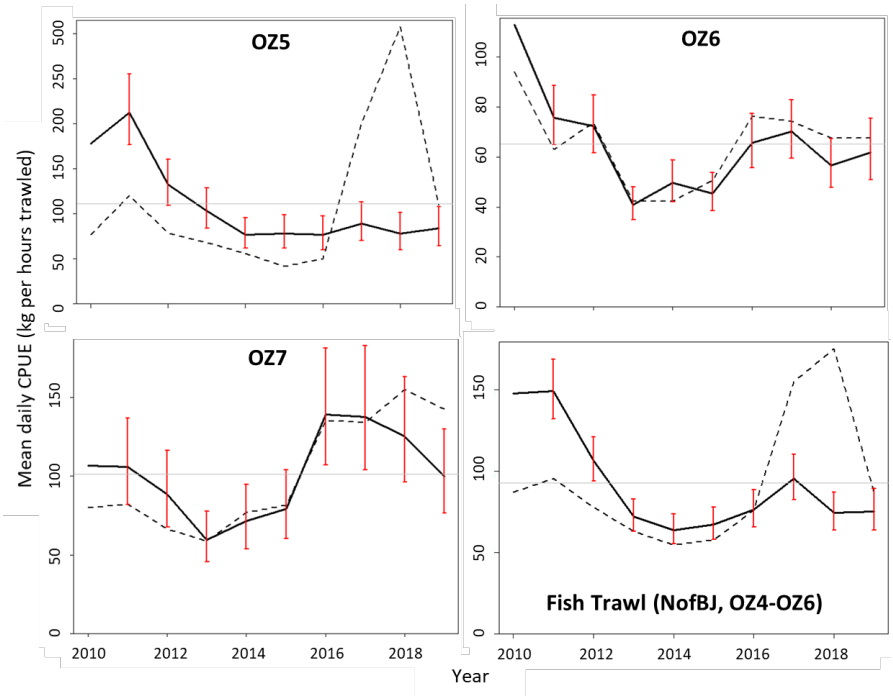


Figure 10. Variation in mean standardised catch rates (catch-per-unit-effort, CPUE, in kg per hours trawled from daily event records) of Eastern School Whiting across different ocean zones (comprising one degree of latitude) for the fish trawl sector of the NSW Ocean Trawl Fishery (2010–2019). The dashed and solid lines

indicate the nominal and standardised mean CPUE (± 95% confidence intervals), respectively, and the grey horizontal line indicates the long-term average for each series

Stock assessment methodology

Year of most recent assessment	2020 using data up to 2019, completed by CSIRO on behalf of AFMA (Day et al. 2020, cited in AFMA 2021). The previous full assessment was completed in 2017 using data up to 2016 (Day 2017), which was partially updated in 2019 (Day 2020).
Assessment method	Commonwealth Tier 1 stock assessment involving an integrated population dynamics model fitted to historical catches, standardised catch-per-unit-effort (CPUE) indices, length frequencies and conditional age-at-length data, discard rates and aging errors using Stock Synthesis version SS-V3.30.16 (Methot et al. 2020).
Main data inputs	Commercial landings – reported annual catch, taken from fisher logbooks of various sources compiled into five fleets – Commonwealth Danish seine (combined with Tasmanian and Victorian); Commonwealth otter trawl (combined with Victorian and NSW Southern Fish Trawl); NSW Danish seine, NSW fish trawl (north of Barrenjoey Point) and NSW prawn trawl; 1942–2019. For TAC determination the 2020 total catch was assumed to be equivalent to the 2019 catch. Estimated discards and rates – from an onboard observer program for four fleets (excluding NSW Danish seine fleet, which was assumed to have no discarding); Commonwealth data available 1994–2019, with some years missing; NSW data for two time periods. Commercial catch rates – reported annual CPUE data for four fleets – Commonwealth Danish seine (in catch-per-shot, 1986–2019), Commonwealth trawl (in catch-per-h, 1995–2019), NSW fish trawl and prawn trawl (in catch-per-day from monthly records, 1998–2008 and catch-per-h from daily events, 2010–2019); all normalised to a mean of 1. Length compositions – from Commonwealth and NSW fleets for retained and discarded catches from onboard observer programs (weighted by number of shots, 1990–2019); and for retained catches from port monitoring (weighted by number of trips, 1951–2019, with many early years missing). Age-at-length and ageing error data – from sectioned otoliths processed by Fish Ageing Services Pty Ltd for fish sampled from the Commonwealth Danish seine fleet (1991–2019) and trawl fleet (2001–2019, with some years missing); and processed by

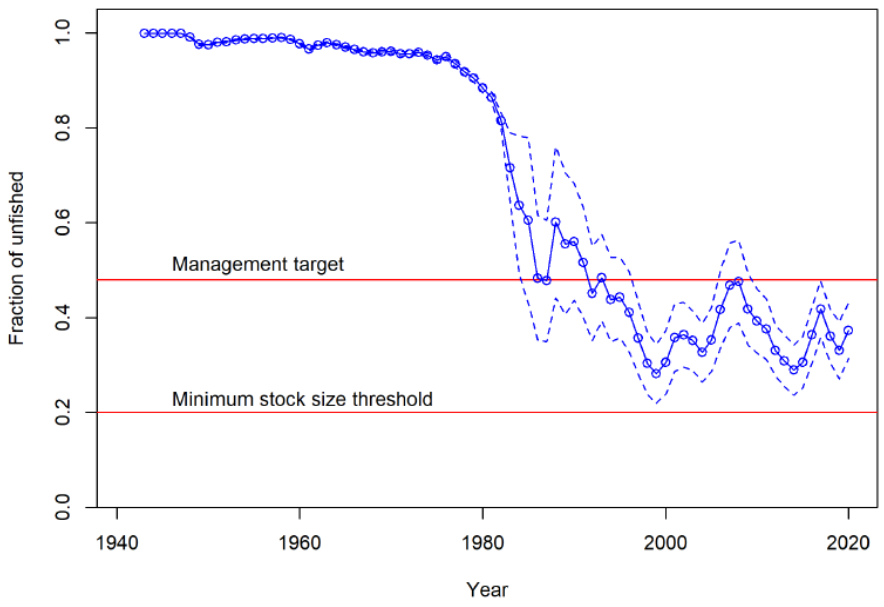
	the NSW DPI ageing laboratory for the NSW fish and prawn trawl fleets for two time periods. Life-history parameters – many were estimated from the modelling (e.g., all four von Bertalanffy growth parameters, recruitment and selectivity parameters for each fleet); others were taken from relevant literature (e.g., age and size at sexual maturity of 2 years and 16 cm FL, fecundity assumed to be proportional to spawning biomass, natural mortality fixed to M=0.6, steepness of the stock-recruitment relationship was set at h=0.75 and length–weight relationship parameters of a=1.32 x 10^{-5} and b=2.93) (Day et al. 2020, cited in AFMA 2021).
Key model structure and assumptions	Population dynamics modelling, comprising an integrated age-structured model with multiple fishing fleets exploiting a single stock within the area of the fishery. *Assumptions:* a single-sex model (length data are not available by sex); single season of spawning assumed across the whole stock; the population was at an unfished biomass and equilibrium age-structure at the start of 1942; population abundance is proportional to standardised catch rates; the selectivity of fleets, rate of natural mortality and growth (mean size-at-age) are constant over time; selectivity is logistic for all fleets; and average annual recruitment follows a Beverton–Holt stock–recruitment relationship. For more details on Stock Synthesis model assumptions see Methot and Wetzel (2013).
Sources of uncertainty evaluated	Twenty-five different model sensitivities were tested in the 2020 Tier 1 assessment, including the effects of: • varying the stock–recruitment steepness parameter (from h=0.75 to 0.65 or 0.85); • varying the natural mortality (from M=0.6 to 0.5 or 0.75 per year); • varying the age at 50% maturity (from 16 to 14 or 18 cm FL); • varying the recruitment process error (from σ_R=0.7 to 0.6 or 0.8); • placing different weightings on length (x 2 or x 0.5), age (x 2 or x 0.75) and survey CPUE data (x 1.5 or x 0.5); • excluding each CPUE series in turn or including only that CPUE series; and • reverting to the original 3-fleet, base-case model from 2017. In addition, likelihood profiles of key parameters, retrospective analyses and jitter analyses were run as additional diagnostic tools to assess the model fits obtained from both the updated three-fleet model and new five-fleet model, along with assessment of the effects of a low-recruitment scenario on the estimated spawning biomass and forward catch projections.

Status Indicators and Limits Reference Levels

Biomass indicator or proxy	None specified in a formal harvest strategy for the NSW part of the stock. In the interim, for the purposes of this stock assessment the following were selected: the spawning biomass depletion (as a percentage of the estimated unfished female spawning biomass, SSB_0) estimated every 3–5 years from Commonwealth population biomass modelling; and standardised CPUE-based reference points in interim years.
Biomass Limit Reference Level	None specified in a formal harvest strategy for the NSW part of the stock. In the interim, the reference points outlined in the harvest strategy framework for the Commonwealth SESSF (AFMA 2017) were adopted: 20% SSB_0 for the limit reference point (Blim) and 48% SSB_0 as the target reference point (Btarg). An inflection point at 35% SSB_0 that stipulates a management response is also outlined in a 20:35:48 harvest control rule. Current catch rates were assessed relative to long-term averages.
Fishing mortality indicator or proxy	None specified in a formal harvest strategy for the NSW part of the stock. In the interim, for the purposes of this stock assessment the following were selected: the spawning potential ratio (1-SPR) as a proxy for fishing mortality that integrates fishing mortality across all fleets in the fishery, from Commonwealth population biomass modelling; and fishing mortality estimates from catch-curve analyses of age structures from commercial catches in interim years (not completed in 2019).
Fishing mortality Limit Reference Level	None specified in a formal harvest strategy for the NSW part of the stock. In the interim, the reference points outlined in the harvest strategy framework for the Commonwealth SESSF (AFMA 2017) were adopted: a target fishing mortality (Ftarg) to achieve a Btarg of 48% SSB_0, with scaled fishing mortality between an inflection point of 35% SSB_0 to zero fishing mortality at Blim of 20% SSB_0. Current fishing mortality estimates were assessed relative to past levels.

Stock Assessment Results

Biomass status in relation to limit	The 2017 Commonwealth Tier 1 base-case assessment (using data up to 2016) estimated the spawning stock biomass was at 47% of the unexploited stock biomass (SSB_0); albeit with considerable uncertainty (95% asymptotic intervals of 30–70%) (Day 2017). Under the agreed 20:35:48 harvest control rule for a Commonwealth Tier 1 assessment (AFMA 2017), an RBC of 1,615 t was estimated for the entire eastern Australian stock for the three years 2018 to 2020, with a long-term yield of 1,641 t, assuming average recruitment in the future (Day 2017). The RBC estimate for the 2017 model included a discard estimate of 119 t for 2018. The partially updated base-case assessment in 2019 (which included recent CPUE-indices and catches to 2018 and estimated catches for 2019), estimated a revised spawning biomass of 36% of SSB_0 for an average recruitment scenario since 2014 (when it was last estimated) and 27% of SSB_0 under a low recruitment scenario (Day 2020). Under the agreed 20:35:48 harvest control rule, a revised RBC of 1,165 t and 318 t was estimated for 2020 under average and low recruitment scenarios, respectively (Day 2020). The 2020 Commonwealth Tier 1 base-case assessment (using data up to and including 2019), which used a five-fleet model and included increased NSW fisheries and biological data, estimated the spawning stock biomass was at 33% of SSB_0 in 2020 and would increase to 41% of SSB_0 in 2021 assuming average recruitment; with improved uncertainty in the estimate (95% asymptotic intervals of 35–45%) (Day et al. 2020, cited in AFMA 2021). Under the agreed 20:35:48 harvest control rule for a Commonwealth Tier 1 assessment (AFMA 2017), an RBC of 2,140 t for 2020 and 2021 was estimated for the entire eastern Australian stock of Eastern School Whiting, with a long-term yield of 2,448 t, assuming average recruitment in the future. The RBC estimate for the five-fleet model includes a larger combined jurisdictional discard estimate of 370 t for 2020. The results of the 25 sensitivity analyses suggested that changes to some of the fixed parameters had a significant influence on model fits and stock status estimates (Day et al. 2020, cited in AFMA 2021). Results were particularly sensitive to adjustments in the recruitment steepness parameter, *h*, natural mortality estimates, M, and the size at 50% maturity, with estimates of spawning stock biomass ranging between 31% and 57%.

Time-trajectory of relative spawning stock biomass (solid line) of Eastern School Whiting with 95% asymptotic intervals (dashed lines) for the 2020 Tier 1 stock assessment five-fleet, base-case model. Figure reproduced from Day et al. (2020, cited in AFMA 2021).	
Fishing mortality in relation to limit	Results of the 2017 population dynamics modelling suggested that the spawning potential ratio (1-SPR, relative to the target) integrated across all fleets for the south-eastern Australian stock of Eastern School Whiting was near the target. The Tier 1 Commonwealth assessment in 2017 estimated an average RBC of 1615 t for the whole stock for the three years 2018 to 2020 (Day 2017). The total combined catches over this period were 1701 t in 2017, 1916 t in 2018 and 1743 t in 2019 (catch chart). When combined with the weighted average discards (estimated as 103.92 t for the 2018-19 year, ABARES 2019) the total mortality has exceeded the estimated RBC over the last three years. The partial update of the assessment in 2019 revised the predicated RBC under an average recruitment scenario to 1165 t for 2020 (Day 2020). The New South Wales basket TAC was reduced from 1189 t in 2018-19 to 898 t for the 2019-20 fishing season, of which on average approximately 668 t is likely to be Eastern School Whiting. However, this TAC does not include the Southern Fish Trawl Fishery that operates in New South Wales state waters south of Barrenjoey Point, which landed 280 t in 2019. Therefore, the estimated portion of the NSW TAC comprising Eastern School Whiting, combined with the Commonwealth TAC, likely Southern Fish Trawl catch and estimated discards for all jurisdictions could exceed the revised RBC by 1.6 times (estimated total 1 928 t versus RBC of 1 165 t). Results of the 2020 Tier-1 assessment indicate, through the spawning potential ratio, that the target fishing mortality had exceeded the target mortality in each of the last 3 years (Day et al. 2020, cited in AFMA 2021). However, the estimated RBC in 2020 and 2021 from the updated model increased to 2 140 t, and while this includes a larger amount of total discards than previous RBCs, the overall productivity of

	the stock was increased and the certainty in the parameter estimates improved. Consequently, the current level of fishing mortality is considered unlikely to cause the stock to become recruitment impaired.
Previous SAFS stock status	Eastern School Whiting was assessed as a **sustainable stock** under the SAFS framework in 2016 and 2018. The Commonwealth part of the stock was assessed as **not overfished** and **not subject to overfishing** in 2020 based on the partial update of the Tier 1 stock assessment in 2019, forward catch projections under assumed average recruitment and reliance on the existing SESSF Harvest Strategy (Emery et al. 2020).
Current stock status	Given the uncertain stock structure of Eastern School Whiting, decrease in biomass estimates to 35% of unfished levels in 2020 under average recruitment and total removals in excess of the RBC over three years that was concentrated in NSW waters, the level of fishing mortality was considered sufficient to cause recruitment impairment (especially with a decrease in the predicted RBC from 1,615 t in 2019 to 1,165 t in 2020), the NSW part of the biological stock was classified as a **depleting stock** in 2019. However, the results of the 2020 update to the Commonwealth Tier 1 assessment, which included an increased amount of NSW data, predicted that the stock level had increased from 33% of unfished spawning biomass in 2019 to 41% in 2021, assuming average recruitment in the future, and that the estimated RBC for 2020 and 2021 increased to 2,140 t (Day et al. 2020, cited in AFMA 2021). Therefore, the status of NSW part of the Eastern School Whiting stock was changed and is currently assessed as a **sustainable stock** in 2020**.**

Qualifying Comments

- NSW DPI, in collaboration with an external working group, are currently developing a NSW Trawl Whiting harvest strategy for the OTF.
- The most recent update of the Commonwealth Tier 1 stock assessment for Eastern School Whiting included an increased amount of NSW data (catches and catch rates, lengths, ages and discard rates) that make the outcomes of the modelling particularly relevant for assessing the NSW part of the stock.
- Therefore, the outcomes of this assessment are considered relevant for determining stock status and informing TACC determination in NSW waters.
- The assessment suggests that the exploitable biomass of Eastern School Whiting was previously depleted to near the limit reference level in the early 2000s following large commercial harvests during the 1990s, and that the stock has since recovered to a more sustainable level.
- The species has been subject to catch quota controls in Commonwealth fisheries since 1993, which has likely aided this recovery. NSW fisheries data also suggest that the input controls used

to manage the commercial OTF proved effective at reducing effort levels and consequently fishing pressure on Eastern School between 1998 and 2016.

- However, recent catches of Eastern School Whiting in NSW have rapidly increased over the last 3 years, such that total catches across all jurisdictions have exceeded the estimated RBC in 2017, 2018 and 2019.
- The recent update of the Commonwealth Tier 1 assessment estimated that Eastern School Whiting spawning biomass had declined to 33% of unfished levels in 2019 and that the fishing mortality levels over the last three years had exceeded Ftarg; however, biomass is predicted to recover to 41% in 2021 assuming average recruitment.
- The uncertainty around the accuracy of historical commercial catch data (especially in northern NSW where the two species distributions overlap and considerable species misreporting is known to occur) should be considered when interpreting the results of stock assessments.
- Temporal and spatial variation in discard rates of trawl whiting in NSW waters differ from those in other jurisdictions and are likely to change again in response to the quota introduction for some OTF species in NSW. These form another source of uncertainty in the NSW harvest data that are not adequately accounted for in past assessments.
- Regional variation in trends in NSW catch rates and catches of both species suggest that some finer-scale population dynamics in response to exploitation may be occurring.
- Potential influence of catch-reporting changes on commercial catch rates (especially during the transition from monthly to daily reporting around July 2009) limits the application of CPUE series as an index of relative abundance in NSW waters.
- Ongoing misreporting of multi-day trips as single fishing events further compromise the accuracy of current NSW catch-rate data.
- Data assessed in this report date only as far back as 1941. Trawl fishing in NSW waters is known to have occurred since at least 1920. Before the export markets in SE Asia developed for these species, they were considered trash fish and possibly had high discard mortality even though they were not retained in large quantities until the 1970s. Any potential historical discard mortality has not been considered in this stock assessment.

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