Stock Status Summary – 2021

NSW Stock Status Summary – Pink Ling *(Genypterus blacodes)*

Assessment Authors and Year

Smoothey A.F. 2021 NSW Stock Status Summary 2020/21 – Pink Ling (*Genypterus blacodes*). NSW Department of Primary Industries. Fisheries. 15 pp

Stock Status

Current stock status	On the basis of the evidence contained within this assessment, Pink Ling are currently assessed as **sustainable** for the NSW component of the stock.

Stock Status Summary

The fishery scientific assessment summarised in this document is considered adequate to meet the legislative requirements for supporting a Total Allowable Catch (TAC) determination for NSW Pink Ling is that commissioned by the Australian Fisheries Management Authority (AFMA) and published as 'Eastern Pink Ling' in the 'Pink Ling (*Genypterus blacodes*)' section of the Fishery Status Reports by the Australian Bureau of Agricultural and Resource Economics and Sciences, (Patterson et al. 2020); hereinafter referred to as the Commonwealth assessment). The Commonwealth assessment references quantitative stock assessments for Pink Ling, including those for Eastern Pink Ling in 2015 (Cordue 2015) and a 2018 update (Cordue 2018).

The structure of this stock status summary is consistent with a format to inform a species status determination against criteria for the Status of Australian Fish Stocks reports (SAFS; www.fish.gov.au). It does not attempt to replicate the detail of the Commonwealth assessment but cites key information from that assessment.

Biology and stock structure

Pink Ling (*Genypterus blacodes*) are distributed around the south of Australia from the central NSW coast to southern Western Australia, including Tasmania. Pink Ling is a deep-water species commonly associated with muddy bottom on the continental shelf and upper slope at depths of 200–900 m. Pink Ling grow to a maximum length of 1.6 m and an age of about 26 years. Males and females have been recorded to mature at about 40–46 cm and 50–58 cm total length (TL), respectively.

Patterson et al. (2020) state clear and persistent differences in size and age composition (Morison et al. 2013) and differences in trends in Commonwealth commercial catch rates that indicate the existence of different stocks east and west of South Cape, Tasmania (147° East) but no genetic differences have been identified between these areas (Ward et al. 2001; Patterson et al. 2020). Despite the lack of genetic variation found between eastern and western pink ling, the differences in biological characteristics and catch-rate trends have led to Pink Ling being assessed as separate stocks east and west of longitude 147°E since 2013. Catches of pink ling are managed under a single TAC of 1,310 t. However, AFMA has management restrictions in place to constrain catches of the eastern stock to a notational catch-limit of 446 t and Pink Ling is in the second year of a three-year MYTAC.

Stock Status and assessment method

The Commonwealth assessment classifies the Eastern Pink Ling stock as not overfished and not subject to overfishing (Patterson et al. 2020). This assessment is based on a Commonwealth Tier 1 assessment (AFMA 2017 i.e. a quantitative model-based assessment). The assessment

underpinning the Commonwealth management of the Pink Ling stock is that of Cordue (2015), supplemented with an update of that 2015 assessment done in 2018 (Cordue 2018), as cited in Patterson et al. 2020.

Pink Ling (Eastern) were assessed against the SAFS criteria in 2014, 2016, 2018 and 2020. Status determination in 2014 was **undefined**, whilst for 2016 and 2018 the status was **sustainable** and the 2020 status is currently under review.

Fishery statistics summary

Fishery statistics underpinning the Commonwealth assessment and summarised here from Patterson et al. (2020) and references therein.

Within the Commonwealth, eastern and western stocks of Pink Ling are assessed separately but managed under a single TAC, with management arrangements in place to constrain fishing on eastern stocks to the eastern catch limit (Patterson et al. 2020).

The Eastern Pink Ling stock, described for the Commonwealth assessment, is associated with Commonwealth fishing zones 10, 20 and 30 (with catches from Zone 60 assigned to Zone 30; Cordue 2015).

The assessment summarised in this report is that for Eastern Pink Ling only, unless otherwise stated in the text. The assessment is detailed in Cordue (2015 and 2018) and summarised in Patterson et al. (2019 and 2020). Data sources in the assessment are catch histories from Commonwealth trawl and non-trawl (autoline) sectors and total NSW commercial catches (other state catches were small, within rounding error and ignored). Commonwealth discard estimates and landing multipliers were applied to data because Commonwealth trip limits were implemented during 2013 and 2014 resulting in three defined time periods in which there was no limit, a 50 kg limit or a 250 kg trip limit. Commonwealth catches were split by month within fishing method from 2013 (inclusive), allowing corrections to be applied to the three different trip limit periods. Other data were standardised trawl catch per unit effort (CPUE) (including 'period effect' for trip limit periods), length-frequency data by fishing method, zone and depth, and age–length data (Cordue 2015). The 2018 updated assessment (Cordue 2018) removed the 'period effects' from the eastern trawl CPUE analyses as their inclusion resulted in the CPUE time-series having '…an unrealistic increase in 2016 and 2017.' and instead 'discard ratios were applied to tow by tow data before the CPUE standardisation.', to account for discarding due to management measures (Cordue 2018).

Catch Information

The catch information underpinning the Commonwealth assessment is summarised from Patterson et al. (2020).

> Combined eastern and western catches of Pink Ling increased steadily from the start of the fishery in about 1977 to reach a peak of 2,412 t in 1997 (Figure 1a). Despite TACs continuing to increase from 1997 to 2001, catches declined steadily to about 1,800 t in 2004. From 2004/05 to 2013/14, Pink Ling catches were limited by the TAC. Since 2013-14, catches have been stable at around 800 to 1,000 t. Commonwealth-landed catch in the 2019–20 fishing season was 834.8 t, based on CDRs, with 46% of the catch was from the east. Discards and state catches were not available for 2019-20. However, weighted averages of the previous four calendar years (2015 to 2018) estimated discards and state catches of 22.7 t and 55.5 t, respectively in the east and 20.8 t and 0.1 t, respectively, in the west (Burch et al. 2019). For the 2019-20 fishing season, total catch and discards were estimated to be 933.9 t.

Eastern Pink Ling catch in 2018–19 was 372 t and 346 t in the 2019-20 fishing season. Discards have been estimated to be 22 t based on the weighted average of the previous four seasons (2015-16 to 2018-19). When estimated discards are combined with average NSW state catch and Commonwealth logbook catch for 2019-20, the total fishing mortality is below 500 t per year.

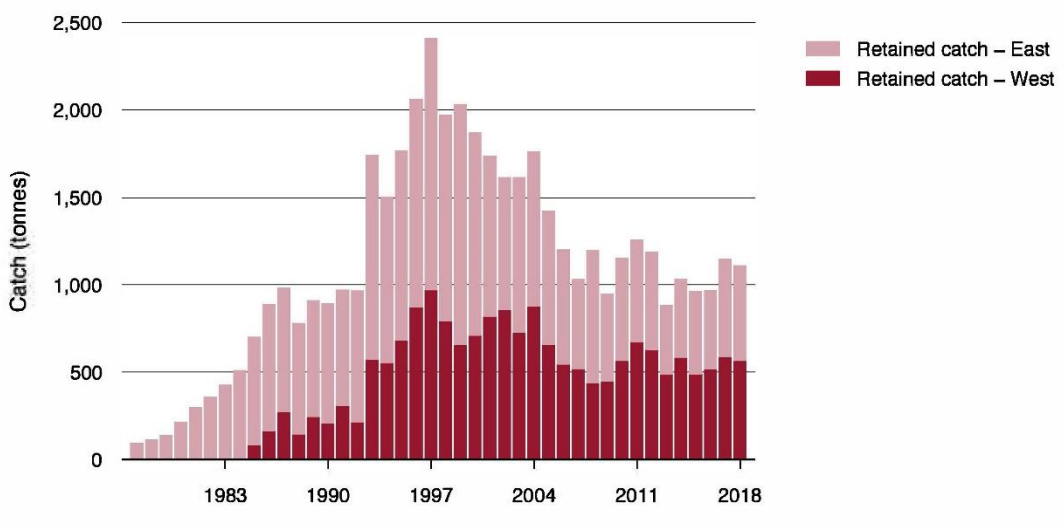
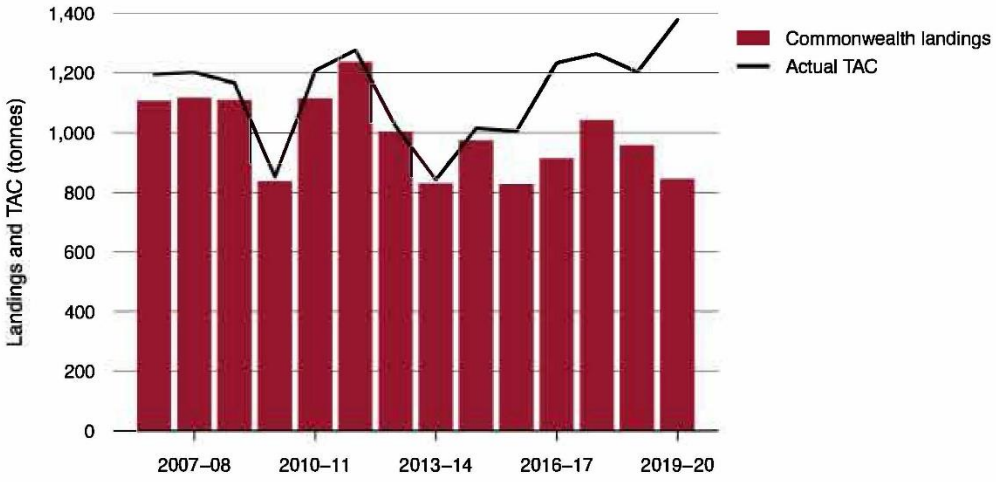


Figure 1a Pink Ling annual catches (Commonwealth Trawl Sector, Scalefish Hook Sector and states combined) and discards, 1977 to 2018 (from Patterson et al. 2020).



Note: TAC total allowable catch.
Source: AFMA catch disposal records

Figure 1b Pink Ling annual catches (Commonwealth Trawl Sector, Scalefish Hook Sector and states combined and fishing season total allowable catch (TAC) 2006-07 to 2019-20 (from Patterson et al. 2020).

Recreational and Indigenous

Inclusion of recreational catch has been raised as an issue for consideration in Commonwealth assessments (SESSF RAG 2017). However, catches of Pink Ling outside the commercial fishing

sector are likely negligible. The most recent recreational survey completed in New South Wales did not report the capture of any Pink Ling (Murphy et al. 2020).

Illegal Unregulated and Unreported

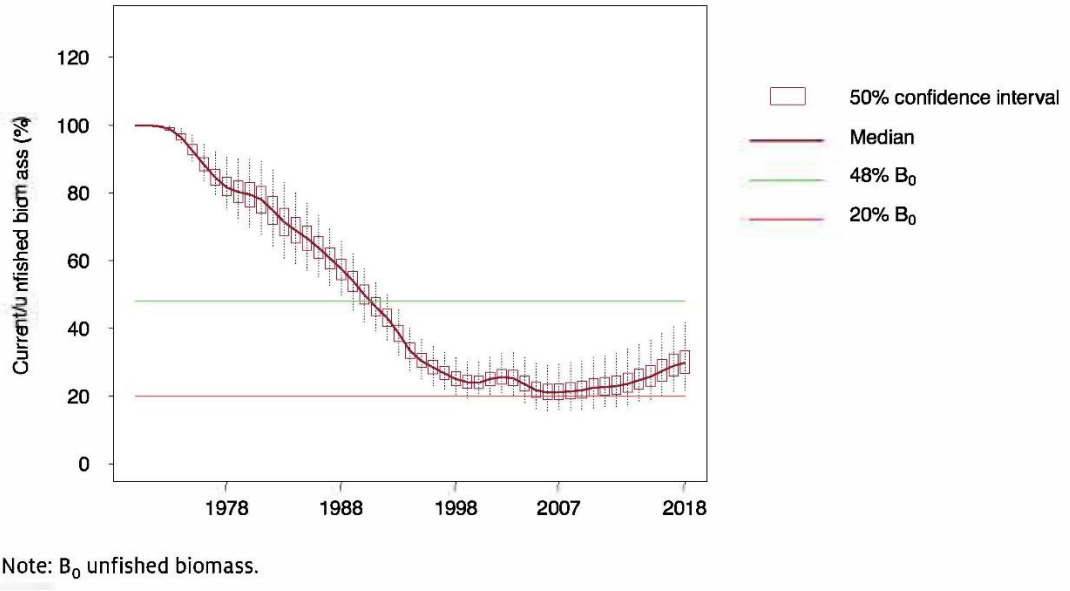
The level of Illegal Unregulated and Unreported (IUU) fishing has not been quantified.

Spawning stock biomass

Pink Ling (Eastern) spawning stock biomass (SSB) estimates from Tier 1 assessment (integrated quantitative stock assessment; AFMA 2017; Commonwealth of Australia 2007, 2017) and predicted biomass as a proportion of unfished biomass (B_0) at constant-catch scenarios with performance indicators (future SSB, probability estimates of being below the limit and year of SSB being at target reference point) are presented in Figure 2 (from Patterson et al. 2020).

The Commonwealth assessment summarised from Patterson et al. (2020) states:

> The 2018 assessment produced an RBC of 260 t for the eastern stock in 2019. Projections of eastern stock response to various constant-catch scenarios indicated that catches below 550 t posed a relatively low (<5%) risk to the stock falling below the limit reference point ($0.48SB_0$), with at least 50% probability, in a reasonable time-frame (before 2050) for catches up to 500 t per year (Table 1; Cordue 2018). Subsequently, AFMA set a TAC for the eastern stock of 428 t for the 2019-20 fishing season.
>
> The Cordue (2018) assessment estimated the median biomass depletions for the eastern stock in 2018 to be 30% of the unfished spawning stock biomass ($0.30SB_0$, Figure 2). This was below the target reference point of $0.48SB_0$, but above the limit reference point of $0.20SB_0$ in the east. The eastern stock is therefore classified as **not overfished**.
>
> For the 2019-20 fishing season, total combined catch and discards were estimated to be 834.8 t, which is below the 2019 combined RBC of 1,410 t. The total fishing mortality for eastern pink ling was estimated (using the catch ratio from logbooks) to be 462.2 t, which is above the RBC of 260 t. Although total fishing mortality of eastern Pink Ling was above the RBC, at that mortality level the probability of the biomass being depleted to below 0.2 B_0 in 2021 is less than 0.04%. Furthermore, the eastern stock is expected to be rebuilt to the target reference point ($0.48SB_0$) with at least a 50% probability in a reasonable time-frame (before 2050) for catches up to 500 t per year. The stock is therefore classified as **not subject to overfishing**.



Note: B_0 unfished biomass.

Figure 2 Estimated spawning stock biomass for Eastern Pink Ling, 1970 to 2018 (Cordue 2018, cited in Patterson et al. 2020).

Table 1. Base-case 2018 stock assessment performance indicators for Eastern Pink Ling, showing stochastic projections at a range of future constant catches (Cordue 2018, cited in Patterson et al. 2020).

Annual catch (t)	B_{2021}/B_0	B_{2028}/B_0	Probability $B_{2021}<0.2B_0$	Probability $B_{2028}<0.2B_0$	Rebuild year
0	0.42	0.72	0	0	2023
300	0.37	0.53	0.01	0	2026
400	0.35	0.47	0.02	0.01	2030
450	0.34	0.44	0.02	0.01	2033
500	0.33	0.41	0.04	0.02	>2040
550	0.32	0.38	0.05	0.05	>2050
600	0.32	0.35	0.06	0.11	>2050
650	0.31	0.31	0.08	0.18	>2050

Notes: B_0 Unfished biomass. B_{year}/B_0 Predicted biomass ratio in given year. $B_{year} < 0.2B_0$ Biomass below 20% B_0 in given year. Rebuild year is the projected year for rebuilding to 48%B_0.
Source: Cordue 2018

Stock assessment methodology

Year of most recent assessment	2015 (Cordue 2015), supplemented by Cordue (2018).
Assessment method	Commonwealth Tier 1, integrated quantitative stock assessment
Main data inputs	Catch – Commonwealth trawl and non-trawl (autoline) sectors; total NSW commercial catches (other state catches were small, within rounding error and ignored) (Cordue 2015) Commonwealth discard estimates and landing multipliers were applied to data due to Commonwealth trip limits implemented during 2013 and 2014 (no limit; 50 kg; and 250 kg trip limit) (Cordue 2015) Standardised CPUE – Commonwealth trawl sector, including 'period effect' for trip limit periods (Cordue 2015) Updated assessment in 2018 removing 'period effect' and including discard ratio to tow by tow data prior to CPUE standardisation (Cordue 2018). Length-frequency data by fishing method, zone and depth (various years from 1998 see Cordue 2015) Conditional age–length data by fishing method (various years see Cordue 2015) Age frequencies data by fishing method (various years see Cordue 2015)
Main data inputs (rank)[†]	All main data inputs: assumed minimum rank 2 (medium quality)
Key model structure and assumptions	Tier 1 – Integrated quantitative stock assessment (AFMA 2017; Commonwealth of Australia 2003, 2017)

Table describing model structure (Source: Cordue 2015)

Model years	1970-2015	Stock status assessed mid-year 2015
Biomass parameterisation	B_0	Estimated parameter. R_0 is derived.
Recruitment parameterisation	Haist, lognormal prior, sigmaR = 0.7	Also, a moderate penalty on year class strengths (YCS) averaging to 1.
YCS estimated (i.e., recruitment deviations)	East: 1969-1977, 1983-2010 West: 1975-2010	Cohorts 1978-1982 in the east were not well sampled and their YCS were assumed to equal 1.
Steepness	0.75	As used in 2012. A conservative value – it may be higher. Fixed.
Maturity	Logistic at age: a_{50} = 5 yr, ato95 = 2 yr	Approximates the length-based curve used in the 2012 assessment. Fixed.
Trawl selectivities	Three blocks in the east: 1970-99, 2000-2006, 2007-2015. Two in the west: 1970-2006, 2007-2015. Double normal at age, same for males and females.	Estimated in the model. Timing of blocks indicated by events and confirmed by data analysis. Separate male and female selectivities in a sensitivity.
Non-trawl selectivities	Logistic at age, same for males and females.	Estimated in the model. Separate male and female selectivities in a sensitivity.
Growth	Separate male and female von Bertalanffy	Estimated in the model.
Length-weight relationship	a 2.93e-9 b 3.139	Fixed at 2012 assessment values. (cm to tonnes)

Table describing 2018 model structure (Cordue 2018)

Model years	1970-2018	Stock status assessed mid-year 2018
Biomass parameterisation	B_0	Estimated parameter. R_0 is derived.
Recruitment parameterisation	Haist, lognormal prior, sigmaR = 0.7	Also, a moderate penalty on year class strengths (YCS) averaging to 1.
YCS estimated (i.e., recruitment deviations)	East: 1969-1977, 1983-2012 West: 1975-2012	Cohorts 1978-1982 in the east were not well sampled and their YCS were assumed to equal 1.
Steepness	0.75	As used in 2012. A conservative value – it may be higher. Fixed.
Maturity	Logistic at age: a_{50} = 5 yr, ato95 = 2 yr	Approximates the length-based curve used in the 2012 assessment. Fixed.
Trawl selectivities	Three blocks in the east: 1970-99, 2000-2006, 2007-2018. Two in the west: 1970-2006, 2007-2018. Double normal at age, same for males and females.	Estimated in the model. Timing of blocks indicated by events and confirmed by data analysis. Right hand limb has a weakly informed prior to encourage a domed shape
Non-trawl selectivities	Logistic at age, same for males and females.	Estimated in the model.
FIS selectivities	Double normal at age, same for males and females	Right hand limb has a weakly informed prior to encourage a domed shape
Growth	Separate male and female von Bertalanffy	Estimated in the model.
Length-weight relationship	a 2.93e-9 b 3.139	Fixed at 2012 assessment values. (cm to tonnes)

Sources of uncertainty evaluated	Model sensitivities were investigated (after Cordue 2015), including: - fixed mortality, *M* (low = 0.2, medium = 0.24, high = 0.28), low and high sigmaR (0.5, 0.8) - alternative maturity ogives (shifted up or down one year) - a tighter coefficient of variation on the CPUE indices (10%) - double the effective sample sizes on the age and length frequencies, sex-specific selectivities and inclusion of the fishery independent survey indices - 2014 trawl age frequency - the exclusion of the period effects in the CPUE indices 2018 model sensitivities were investigated, including (after Cordue 2018): **Eastern model** — **Description** M=0.2 — Reference model with M=0.2 M=0.23 (Base) — Reference model with M=0.23 Est. M (Ref.) — The reference model where M is estimated using the posterior from the western assessment M=0.28 — Reference model with M=0.28 Unf. M — Reference model but a uniform prior on M Period CPUE — Using the trawl CPUE indices where period effects were estimated and M estimated Per. M=0.23 — As for "Period CPUE" but with M=0.23 Linkall CPUE — Using the trawl CPUE where all vessels were used as linking vessels and M estimated No FIS — The reference model but with no FIS indices or length frequencies

† Main data inputs (rank)

1 – High quality: data have been subjected to documented quality assurance and peer review processes, are considered representative and robust and provide a high level of confidence to support fisheries management decisions.

2 – Medium quality: data have been subjected to some internal quality assurance processes, have some documented limitations, but are still considered sufficiently accurate and informative to be useful to inform management decisions with some caveats.

3 – Low quality: data have been subjected to limited or no quality assurance processes, may be compromised by unknown or documented limitations that have not been fully explored, but are considered the best available information and require a high level of precaution to be exercised when interpreted to inform management decisions.

Status indicators and limits - Reference levels

Biomass indicator or proxy	SSB (AFMA 2017; Commonwealth of Australia 2007, 2017)
Biomass limit reference level	B_{20} ($0.2B_0$) – $<B_{20}$: no targeted fishing, rebuilding strategy will be developed (AFMA 2017)

Fishing mortality indicator or proxy	Risk of overfishing i.e. low risk of SSB < B_{20} under future catch scenarios run through base case – implied from Patterson et al. 2020 (despite catches > RBCs)
Fishing mortality limit reference level	Not specified within the risk profile outlined (Patterson et al. 2020)
Target reference level	B_{48} ($0.48B_0$) (AFMA 2017)

Stock Assessment Results

Biomass status in relation to limit	Performance measure above limit – Spawning stock biomass estimated at $0.30SB_0$ in the 2018 assessment (Cordue 2015, 2018 and Patterson et al. 2020)
Fishing mortality in relation to limit	Not subject to overfishing (Patterson et al. 2020).
Previous SAFS stock status	2014 SAFS status – **Undefined** 2016 SAFS status – **Sustainable**
Current SAFS stock status	2018 SAFS status – **Sustainable**

Fishery interactions

There are interactions between the Commonwealth Trawl and Auto Lining Fisheries and other commercially fished, by-catch and other species, including threatened and endangered species. Various management and mitigation measures are in place to address many of these issues (AFMA 2018)

The Commonwealth Trawl Fishery interacts with other commercial and non-commercial bycatch and discard marine species, a range of endangered threatened and/or protected species and marine habitats (AFMA 2014; Wayte et al. 2007)

NSW fishery information

Information presented in figures and table below is summarised by financial year (July–June).

The commercial fishery data presented in this section of the report includes total Pink Ling catch landed in NSW from 1976/77 to present and catches reported from the NSW Ocean Trap and Line - Line East (OTLLE) from 2009/10. These data are provided as supplementary information to the

assessment and to help inform the NSW total allowable catch determination. NSW commercial fishery records have not been consistently reported throughout the history of the fishery (Chick 2018). Catch from 1976/77 to 1996/97 (inclusive) includes catch from outside current NSW waters (i.e. Commonwealth catches). Total catch from 1997/98 is restricted to waters in NSW jurisdiction. From 1993 landing Pink Ling was prohibited in the NSW Ocean Trawl Fishery.

State-wide fisheries catch

Annual total catch of Pink Ling demonstrated a substantial increase from the mid-1970s, catches showed a peak in excess of 500 t in 1984/85 and ~450 t in 1993/94, with a trough in 1988/89 of ~230 t (Figure 1a and b). For three years from 1997/98, reported catches of Pink Ling in NSW were greater than 40 $t.yr^{-1}$. Over the proceeding 9 years, from 2000/01 to 2008/09, annual catches were <25 $t.yr^{-1}$ (range 9.2 t – 24.6 t) and averaged ~16 $t.yr^{-1}$. Between 2008/09 and 2009/10, the total annual catch increased ~25 t to 48.2 t and since 2009/10 annual catches have remained above 40 $t.yr^{-1}$. Since 2013/14 the annual catch of Pink Ling in NSW has exceeded 50 $t.yr^{-1}$, with highest catch since 2009/10 being 68.8 t, landed in 2016/17. Catch in 2019/20 was 45.3 t (Figure 3). Annual landings of Pink Ling in NSW are less than 7% of the total annual catches landed in the Commonwealth (SESSF Commonwealth Trawl Sector, SESSF Gillnet, Hook and Trap Sector and South East Non-Trawl Fishery, Figure 4).

Pink Ling are landed almost exclusively in the OTLLE endorsement (2009/10-2019/20 ≥98.8%, range 40.3-68.5 $t.yr^{-1}$; Figure 5), and within the OTLLE, almost exclusively by the setline demersal fishing method (2009/10-2019/20 ≥86%; range 38.2-66 $t.yr^{-1}$; Figure 6).

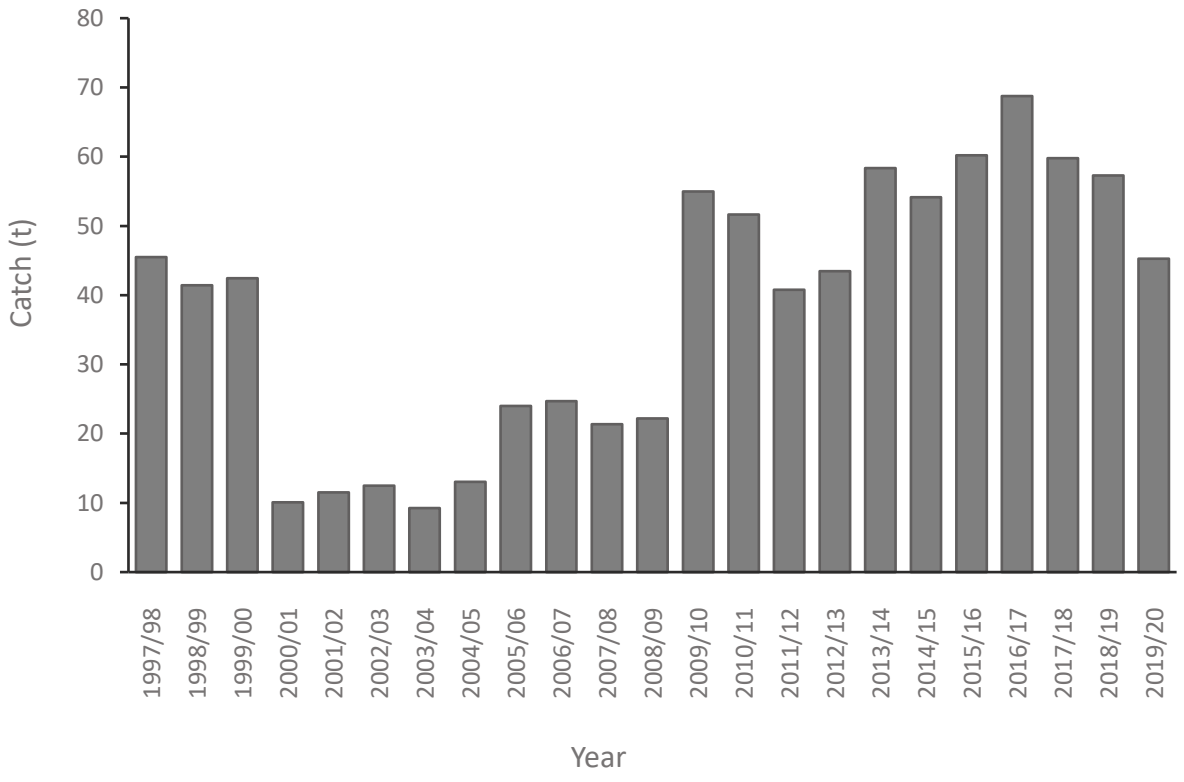


Figure 3 Annual catch (t) of Pink Ling from all fishing methods reported to NSW from 1997/98 to 2019/20.

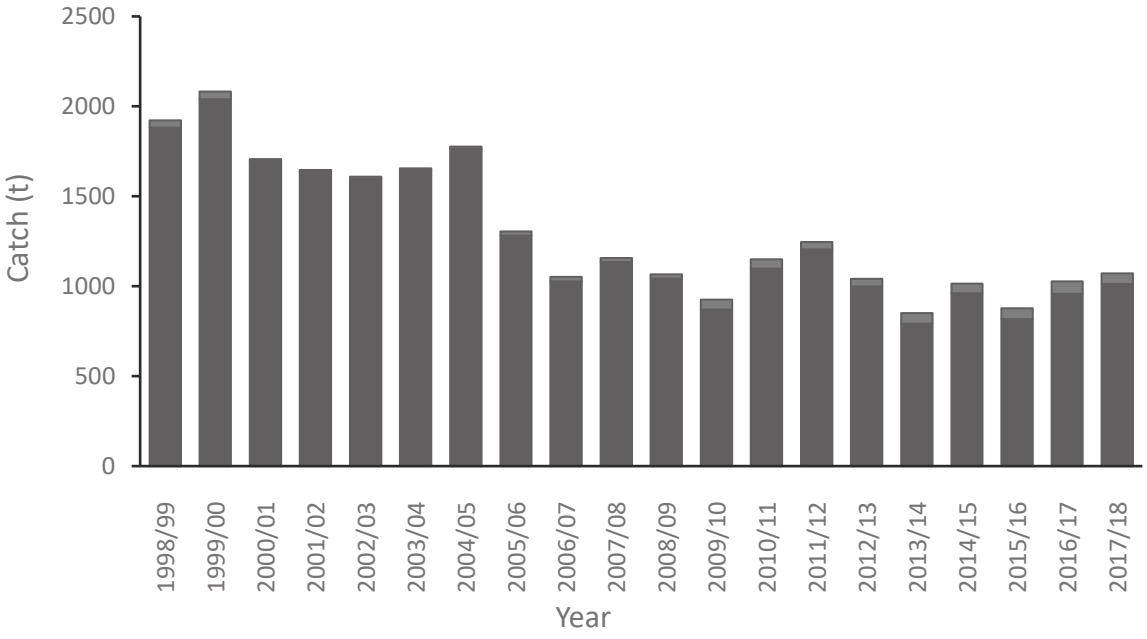


Figure 4 Use Eastern stock data only Annual catch (t) of Pink Ling from the Commonwealth (SESSF Commonwealth Trawl Sector, SESSF Gillnet, Hook and Trap Sector & South East Non-Trawl Fishery) and all fishing methods reported to NSW from 1998/99 to 2017/18. Data sourced from ABARES.

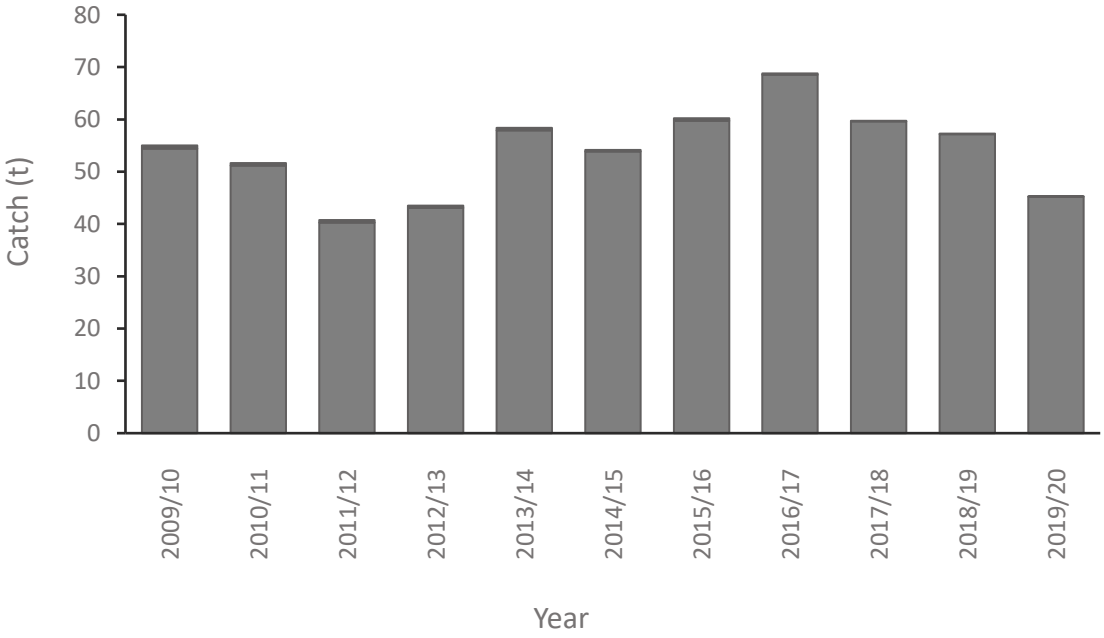


Figure 5 Annual catch (t) of Pink Ling in NSW Ocean Trap and Line - Line East (grey) and all other endorsement codes (black) from 2009/10 to 2019/20.

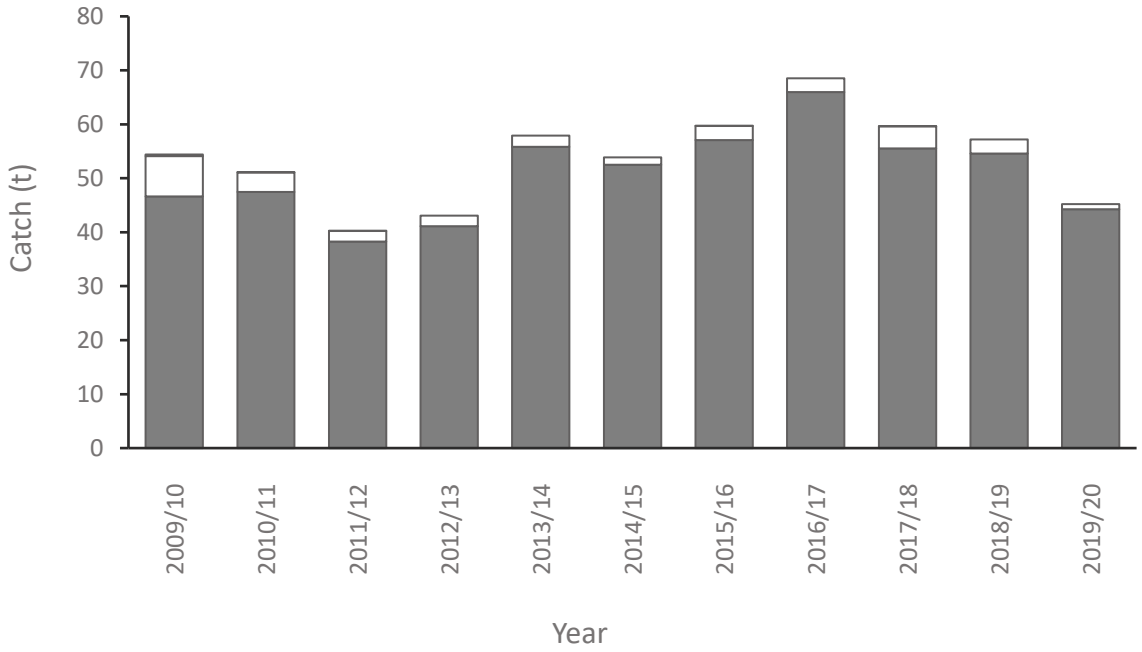


Figure 6 OTLLE – fishing methods - Annual catch (t) of Pink Ling in NSW Ocean Trap and Line - Line East (OTLLE) by setline (grey columns; demersal (STD), trotline (TTL) and unspecified setline (ST)), dropline (white columns; DPL), and other methods (black columns) from 2009/10 to 2019/20.

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Appendix 1 - Reliability and Relevance of the Commonwealth Assessment to assessment of stock status in NSW

1. Because the stock of Eastern Pink Ling fished in Commonwealth and State jurisdictions is considered a single biological stock, it is reasonable that NSW use the Commonwealth assessment as the basis for determining stock status in NSW.

2. The commercial landings data used in the model include landings data from NSW.

3. The Commonwealth assessment does not consider recreational or Aboriginal catch. The model is conditioned on commercial catch data alone. Neither does the process by which the Commonwealth TAC is calculated from the RBC account for recreational/Aboriginal catch. Surveys of the catches in NSW by NSW-resident recreational fishers during 2013/14 and by 1-3 year licence holders in 2017/18 did not detect any catches of Pink Ling (West et al, 2015; Murphy et al., 2020). The interpretation of this result is that catches of Pink Ling by recreational fishers in NSW are negligible, relative to the magnitude of commercial catches. Thus, the omission of recreational and Aboriginal catch from the model and Commonwealth assessment has little effect on the assessment outcome of the Eastern Pink Ling stock.

4. Uncertainty in estimates of discards in the model are related to trip limits implemented from 2013-2016. AFMA supplied a list of the different eastern trip limits:
    a. 26 September 2013 to 30 April 2014: 50 kg per day
    b. 1 May 2014 to 13 February 2015: 250 kg per day
    c. 14 February 2015 to 19 May 2015: 50 kg per day
    d. 20 May 2015 to 30 April 2016: 175 kg per day

Appendix 2 - Additional information relevant to TAC setting in NSW

1. The Pink Ling TAC for the May 2018-April 2019 fishing season was set at the 8-year maximum catch of 67.7 tonnes (BN18/5302).

2. The IAP recommended that the initial allocation of quota shares for Pink Ling be calculated based on 20% on the proportion of access shares held + 80% on recorded landings for an individual fishing business in the Ocean Trap & Line – Line East Share Class over the selected criteria period 2009/2010 to 2016/2017 (inclusive), but with the "worst catch year" for each business removed (https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0009/832464/Ocean-Trap-and-Line-IAP-Final-Report.pdf).

3. Statistics describing landings of Pink Ling from NSW commercial fisheries may inform determination of a NSW TAC that is consistent with the development of an inter-jurisdictional resource sharing policy.

4. Landings of 43.32 t were reported against a TAC of 67.7 t in 2019/20 which suggests that the current TAC was not constraining total catches.

5. In 2019-20 approximately 15.84 t of quota was held by fishing business that reported nil landings of Pink Ling.

6. 35.27 t (52.1%) of the 2020-21 Pink ling TAC (67.7 t) was taken at 16th November 2020 (55% of season complete).

7. SESSF notational catch-limit recommendation for the eastern stock of Pink Ling for 2021-22 was 427 t, which was a 19 t reduction on the 2020-21 notational catch-limit (446 t). Moreover, SESSF TAC recommendation for 2021-22 was 1121 t, which was a 189 t reduction on the 2020-21 TAC (1310 t, https://www.afma.gov.au/sites/default/files/sessf_tac_recommendations_2021-22_-_for_concession_holders.pdf).