Stock Status Summary 2021

NSW Stock Status Summary – Spanner Crab *(Ranina ranina*)

Assessment Authors and Year

Johnson, D. 2021. NSW Stock Status Summary 2020/21 – Spanner Crab – (*Ranina ranina).* NSW Department of Primary Industries. Fisheries NSW. 8 pp.

Stock Status

Current stock status	On the basis of the evidence contained within this assessment, Spanner Crab is currently assessed as **Sustainable** for the NSW component of the stock.

Stock Structure

Mitochondrial DNA analysis indicates that Spanner Crabs on the east coast of Australia comprise a single biological stock (Brown et al. 1999). The scale of this assessment is made at the jurisdictional level (NSW).

Stock Status – New South Wales

Catch Trends - Commercial fisheries

Total annual reported commercial catches of Spanner Crabs rapidly increased from 150 t to 487 t between 1984/85 – 1987/88, and then fluctuated between 209 t (1989/90) and 444 t in 1997/98 (Fig. 1). Catches exceeded 100 t yr^{-1} from 1990/91 to 2007/08, and then declined to lowest annual reported landings of 79 t in 2014/15. Total reported commercial landings of Spanner Crab constrained by a TAC of 169 tonnes in 2018/19 and 2019/20 were 111.7 t and 87.9 t, respectively (Fig. 1).

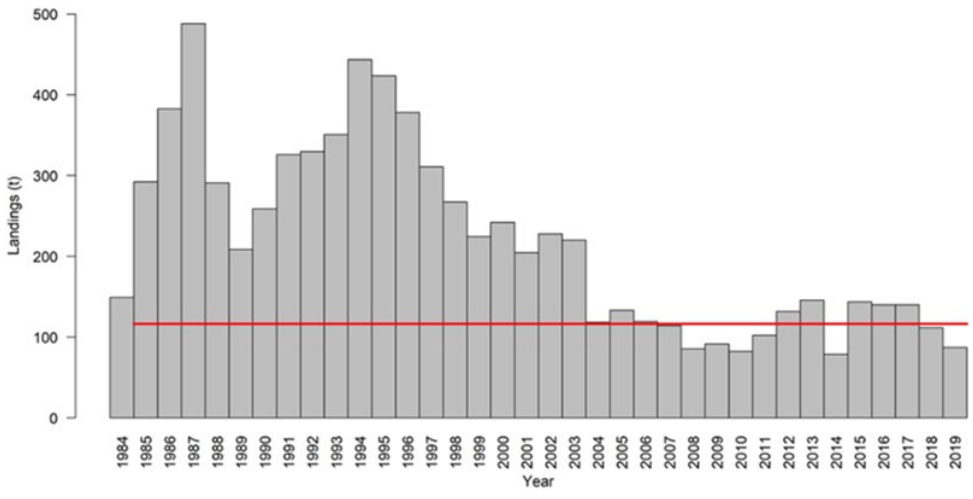


Figure 1. Annual reported commercial catch (t) from 1984/85 to 2019/20. Solid red line represents 10-year average catch.

Recreational and Indigenous

The most recent recreational survey completed in New South Wales did not report the capture of any Spanner Crabs (Murphy et al. 2020). However, the survey methodology is potentially too broad to pick up species, such as Spanner Crabs, which tend to be caught by 'niche' fisheries.

Fishing effort trends

Effort$_{dy}$ increased from less than 300 days in 1984/85 to a historical peak of 2, 462 days in 1997/98 then declined to less than 700 days in 2014/15 (Fig. 2A). In response to revised management arrangements in the fishery, effort$_{dy}$ decreased from 892 days in 2015/16 to 673 and 654 days in 2018/19 and 2019/20, respectively. Following the introduction of daily reporting (2009/10) fishers have been required to report number of net-lifts per fishing day.

From a minimum of 46,400 net-lifts(nl) in 2010/11, effort$_{nl}$ increased to 70, 900 net-lifts in 2013/14 and was 49, 900 net-lifts in 2019/20 (Fig. 2B).

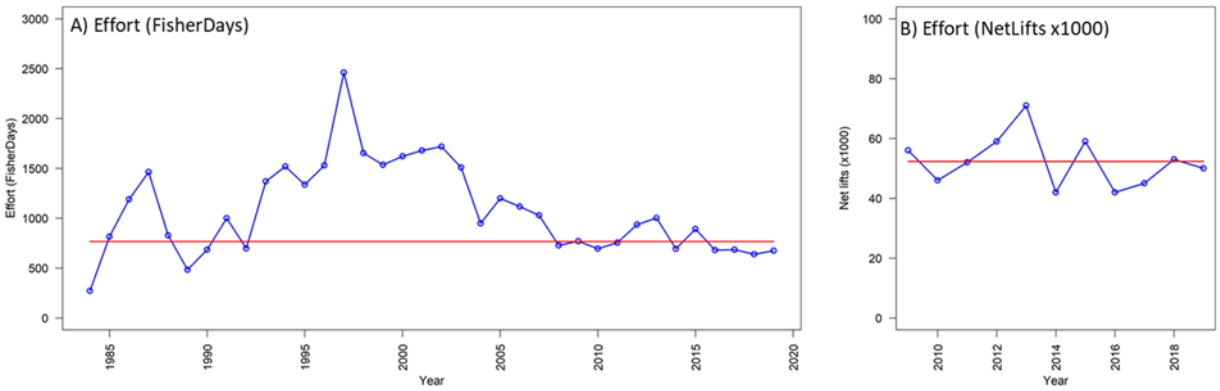


Figure 2. Annual reported commercial effort in units of A) FisherDays (1984/85 to 2019/20) and B) net lifts (2009/10 to 2019/20). Solid red line represents 10-year average. Note: changes in reporting requirements limit consistent interpretation of the effort (FisherDays) time series.

Catch rate trends

Nominal catch rates of Spanner Crabs have remained relatively steady and have been above long-term averages for the past two years. CPUE$_{dy}$ increased from less than 100 kg.day^{-1} (1984/85-1986/87) to a maximum of 205 kg.day^{-1} in 2016/17 (Fig. 3A). CPUE$_{dy}$ exceeded 100 kg.dy^{-1} from 1987/88 to 2019/20 but was more variable between 2011/12-2013/14 than in recent years (Fig. 3A). From a minimum of 1.7 kg.netlift(nl)$^{-1}$, CPUE$_{nl}$ increased to 2.7 kg.nl^{-1} in 2015/16 and was at a historical peak of 3.3 kg.nl^{-1} in 2016/17 (Fig. 3B). The nominal average CPUE$_{nl}$ in NSW is approximately double that observed in QLD waters (QDAF 2020).

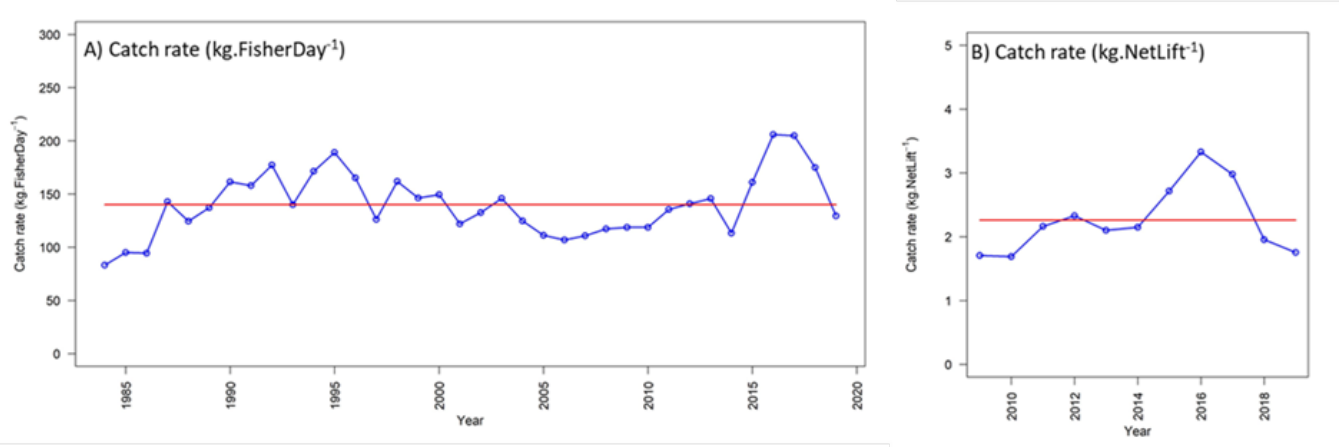


Figure 3. Annual reported catch rate in units of A) kg.FisherDay^{-1} from 1984/85 to 2019/20 and B) kg.nl^{-1} from 2009/10 to 2019/20. Solid red line represents 10-year average.

Stock Assessment Methodology

Year of most recent assessment	2021
Assessment method	Weight of evidence approach, including; standardised commercial catch rates and an index of relative abundance derived from annual fishery-independent surveys (FIS). Catch rate kg.day^{-1} were standardised by year, month, net-lifts, catch, fisher experience, fishing power and lunar phase. The adjusted catch rate is compared to upper and lower deciles which are calculated from a 10-year historical mean (mean of catch rate).
Main data inputs	NSW Standardised catch rates - kg.dy^{-1} 2009/10 to 2019/20. NSW - CPUE- kg.dy^{-1} 1984/85 to 2019/20. Standardised catch rates from fishery-independent surveys (NSW) 2005 to 2021. Landed catch -1984/85 to 2019/20.
Key model structure and assumptions	Spanner Crab standardised catch rates were predicted from generalised linear models (GLM). The GLM statistical modelling provided an estimate of mean catch rates that were corrected for a variety of variables that bias raw data. The GLM models were fitted using the statistical software packages GenStat (VSN International, 2017) and R (R Development Core Team 2017). The importance of individual model terms was assessed formally using F statistics by dropping individual terms from the full model (VSN International 2017). Explanatory model terms considered different catch rates between fishing years, seasons, individual fisher operations, their transformed fishing effort (the number of net-lifts, which was a function of the number of ground-lines used, nets per ground-line and

	ground-line lifts per day; log or cube root scale), the spatial locations of catches based on 6 x 6 min latitude and longitude grids. Commercial catch rates were predicted from the model 'year' term using Genstat and R procedures for prediction, which provided the annual abundance estimates standardised to the mean number of net-lifts per fisher-day. Assumptions: that annual catch rates are a relative index of abundance and not unduly influenced by other factors that are not accounted for through standardisation.
Sources of uncertainty evaluated	Known or likely uncertainties in the key indicators were taken into consideration in ranking of the quality of key indicators, and in reaching a conclusion regarding stock status.

Status Indicators and Limits Reference Levels

Biomass indicator or proxy	NA - no formal indicators or reference points determined
Biomass Limit Reference Level	NA – no biomass limits or targets have been set
Fishing mortality indicator or proxy	NA - no formal indicators or reference points determined
Fishing mortality Limit Reference Level	NA – no fishing mortality limit has been set

Stock Assessment Results

1. Standardised commercial catch rates	Standardised commercial catch rate (sCPUE) results indicate that NSW OTLSCN fishery remained above the lower deciles between 2009/10 and 2019/20. However, when compared to the historical peak of sCPUE in 2016 (205.8 kg.FisherDay^{-1}), sCPUE in 2018/19 (159.8 kg.FisherDay^{-1}) and 2019/20 (137.2 kg.FisherDay^{-1}) has declined by 28 and 39%, respectively Similarly, nominal catch rates (kg.nl^{-1}) in 2018/19 (1.78 kg.nl^{-1}) and 2019/20 (1.95 kg.nl^{-1}) were lower than the historical peak of 3.33 kg.nl^{-1} in 2016.

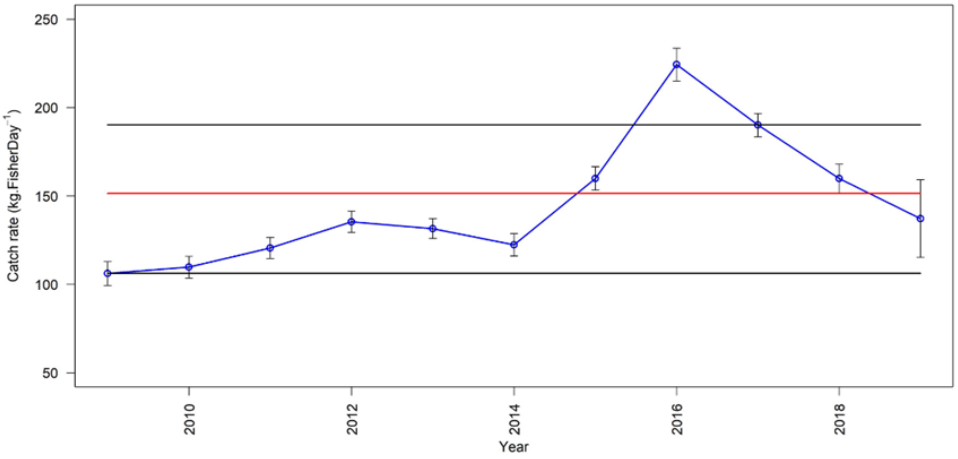


Figure 4. Standardised commercial catch rate (kg.fisher-day^{-1} + net lifts) ± 95% confidence interval. Solid line is the 10-year average mean of catch rate, dashed lines indicates upper (90th percentile) and lower deciles (10th percentile) of mean catch rate.

2. Catch rate of Spanner Crabs from annual fishery independent surveys.

Catch rates (in mean CPUE number.Groundline^{-1}) of total crabs (legal + undersize) were fairly stable between 2005 and 2014, after which they rapidly increased in 2015 (30.6 crabs.Groundline^{-1}). Following the increase in 2015 and 2016, catch rates declined in 2017 (20.8 crabs.Groundline^{-1}) and remained stable and above the mean catch from 2018 to 2019.

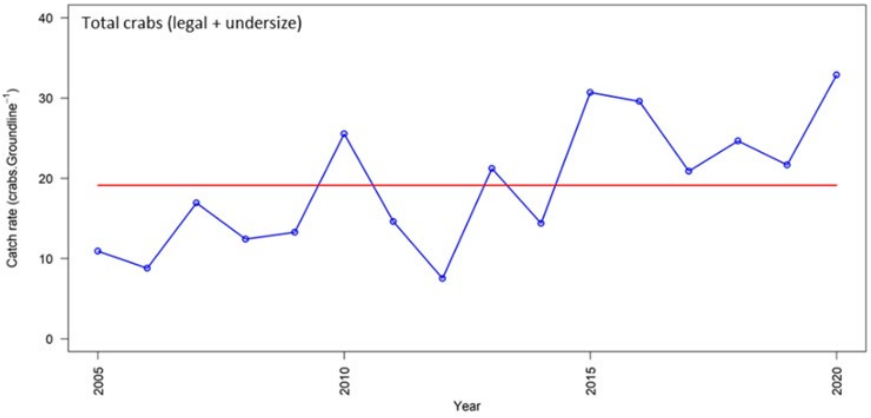
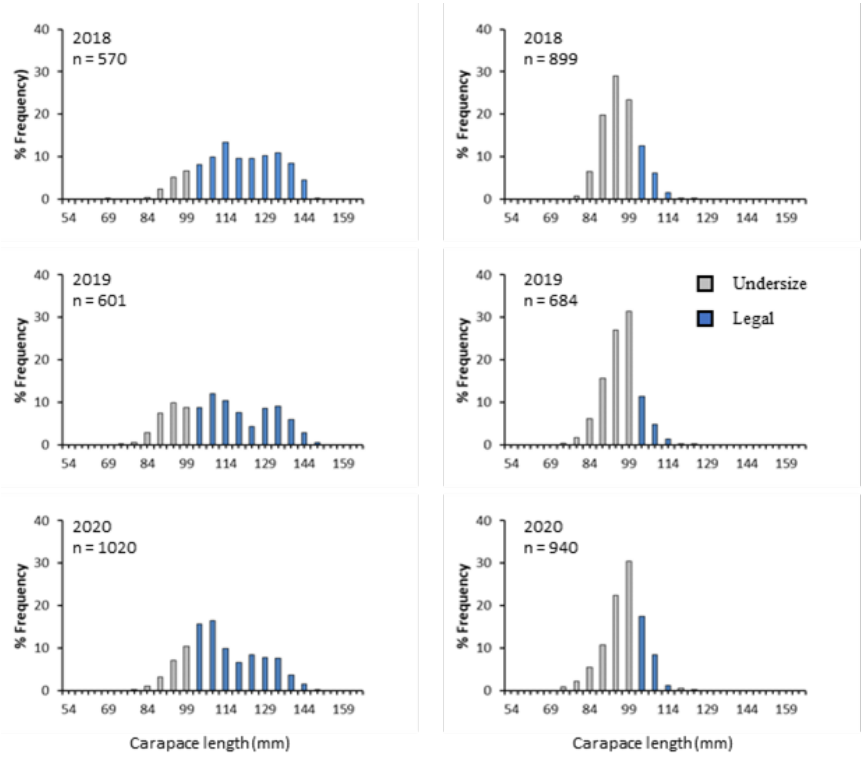


Figure 5. Catch rates of crabs (crabs.Groundline-1) from NSW fishery-independent surveys. Solid red line represents the mean of catch rate (2005 - 2020).

Catch rates during the most recent survey (2020) reached a peak of 32.9 crabs per groundline. Catch rates of legal-sized crabs reached a peak in 2016 (22.2 crabs.Groundline^{-1}) after which they declined and fluctuated around the mean from 2017 to 2019. The historical peak in catches rates of legal-sized crabs (2016) occurred one year after the historical peak of catch rates in undersized crabs (2015). Similarly, after two consecutive years of increases in catch rates of undersized crabs (2018 - 2019), catch rates of legal-sized crabs increased in 2020.

2. Size-structure of Spanner Crabs from annual fishery independent surveys.	Fishery-independent survey results in both NSW and QLD indicate there is marked sexual dimorphism in Spanner crabs, with males being generally larger than females. In recent years, the proportion of female crabs protected by the legal-size limit (93 mm orbital carapace length = 100 mm rostral carapace length) in NSW ranged between 70 and 85% in 2016 and 2019, respectively. The NSW survey also shows consistent numbers of small male crabs (below the minimum legal size), indicating continued recruitment to the fishery. However, the degree to which the exploitable NSW stock is dependent on recruitment from QLD is unknown.  Length-frequency distribution of legal (blue bars) and undersize (grey bars) male and female Spanner Crabs caught from NSW fishery-independent surveys (2018 - 2020). Carapace-length refers to distance between centre spine and mid carapace base (Rostral carapace length – RCL, applied in QLD). Note: Minimum legal size (MLS) in NSW is defined as orbital carapace length (OCL- base of eye orbit to mid carapace base). The legal size limit is the same in both jurisdictions i.e. NSW 93 mm OCL = QLD 100 mm RCL.
Previous stock status	**Status of Key Australian Fish Stocks (East Coast; NSW and QLD)** 2016 Sustainable (SAFS McGilvray & Johnson 2016) 2018 Depleting (SAFS McGilvray & Johnson 2018)
Current stock status	2020 Sustainable (Roelofs, Johnson & McGilvray & 2021)*

*Under review

Qualifying Comments

Status of the QLD Spanner Crab stock is assessed relative to limit and target reference points prescribed in the harvest strategy/ management procedure (Campbell et al. 2016, QDAF 2020). The management procedure followed a process of a baseline quota and performance targets for standardised catch rates with range intervals. The stock performance indicators are the average fishery and survey standardised catch rates in the most recent two completed calendar years. In 2017, it was identified that the base quota of 1, 631 tonnes was not effectively constraining harvest and decisions rules were not adjusting the TAC in response to declining indicators. In response, Queensland Department of Agriculture and Fisheries (QDAF) declared a TAC of 847 tonnes for the 2018/19 fishing season (90% of the reported 2017 harvest of 941 tonnes). The purpose of the reduced TAC was to restrict total fishing mortality and increase protection on the spawning stock. In 2020, the QLD fishery was assessed against a revised harvest strategy (QDAF 2020) relative to target reference points of 1.33 $kg.nl^{-1}$ ($CPUE_{targ}$ 95% of the 2006 - 2010 average) and 10.49 legal-sized crabs per groundline (FIS_{targ} 95% of the 2006 - 2010 average). The average of the commercial (0.54) and survey index (0.58) in 2019 (0.56) and 2020 (0.56) was less than 1, which resulted in no change in the TAC using the revised harvest strategy rules.

Given the small proportion of total landings taken in New South Wales (<15% with revised QLD TAC of 847 t), it is unlikely that fishing of this part of the stock is having a detrimental effect on the entire East Coast stock. However, currently it is unknown if the NSW Spanner Crab fishery is represented by a small biomass of rapidly growing animals or a large, slow-growing biomass. The degree to which the exploitable NSW stock is dependent on recruitment from QLD is unknown.

Being able to estimate the total fishing mortality is fundamental to understanding the dynamics of the Spanner Crab population, estimating and setting appropriate annual catch limits and managing the fishery sustainably. Previous studies investigating mortality of undersize, discarded Spanner Crabs reported significant rates of mortality due to disentanglement: 60 - 70% of crabs with one or more dactyli removed died within 50 days, whilst 100% of crabs which lost whole limbs (after being pulled off nets) died after eight days (Kennelly et al. 1990). To evaluate the effects that morality due to disentanglement may have on the Spanner Crab population, it may be necessary to quantify rates of discarding and estimate annual fishery-wide discard rates. Management actions to remove or reduce mortalities may provide the opportunity to increase fishery production.

References

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