Stock Status Summary 2021

NSW Stock Status Summary Gould's Squid (*Nototodarus gouldi*)

Assessment Authors and Year

Hall, K.C. 2020. NSW Stock Status Summary 2018/19 – Gould's Squid (*Nototodarus gouldi).* NSW Department of Primary Industries, Fisheries NSW, Coffs Harbour. 9 pp.

Stock Status

Current stock status	On the basis of the evidence contained within this assessment, Gould's Squid is currently assessed as **Sustainable** for the NSW component of the stock.

Stock Structure

Genetic studies support the hypothesis of a single biological stock of Gould's Squid (*Nototodarus gouldi)* throughout south eastern Australian waters (Jackson et al. 2003). Two techniques, statolith shape and statolith elemental composition, have also been used to determine dispersal patterns of Gould's Squid and evidence of separate stocks (Green et al. 2015). Adult statolith shape provided evidence that adults caught from Victoria and the Great Australian Bight belonged to different stocks; whereas, statolith elemental composition suggested that Gould's Squid caught at each location had hatched throughout their distribution. Hence, genetic homogeneity of the species is suspected to be a function of egg mass and juvenile drift resulting from seasonal longitudinal ocean currents rather than large-scale migration between the two regions (Green et al. 2015). Also, this drift appears to provide more juvenile squid from Victoria to the Great Australian Bight than occurs in the opposite direction. The current dominance of Victorian and Tasmanian regions in terms of fishing effort means that a single stock approach to management is appropriate at this time (Noriega et al. 2018).

Here, assessment of stock status is presented at the biological stock level—South-Eastern Australia.

The data presented in this summary relate to the New South Wales (NSW) jurisdiction.

Stock Status – New South Wales

Catch Trends - Commercial Fisheries

Annual commercial catches of Gould's Squid in NSW state waters steadily declined from a peak of 59.8 t in 1997/98 to a minimum catch of 4.9 t in 2010/11 (Fig. 1). Over the last 10 years catches have remained steady at an average of 8 t per annum, with a slight increase to 11.6 t in 2018/19.

Most of commercial catch of Gould's Squid from NSW waters is taken by fish and prawn trawling in the Ocean Trawl Fishery (Fig. 2). In most years the catch is fairly evenly split between the two trawl sectors. Most of the historical catch was taken from ocean zone 2 in northern NSW by the prawn trawl sector and from ocean zones 6 to 10 by the southern fish trawl sector (Fig. 3).

Catches of Gould's Squid in NSW waters are insignificant relative to the large catches taken by fisheries in other jurisdictions, including the Commonwealth Southern Squid Jig Fishery and Tasmanian trawl fisheries in the Southern Ocean and Bass Strait (Noriega et al. 2018). The

combined total catch for the South-eastern Australia biological stock in 2017 was 1,011 t, of which NSW catches accounted for 0.8% (8 t) (Noriega et al. 2020).

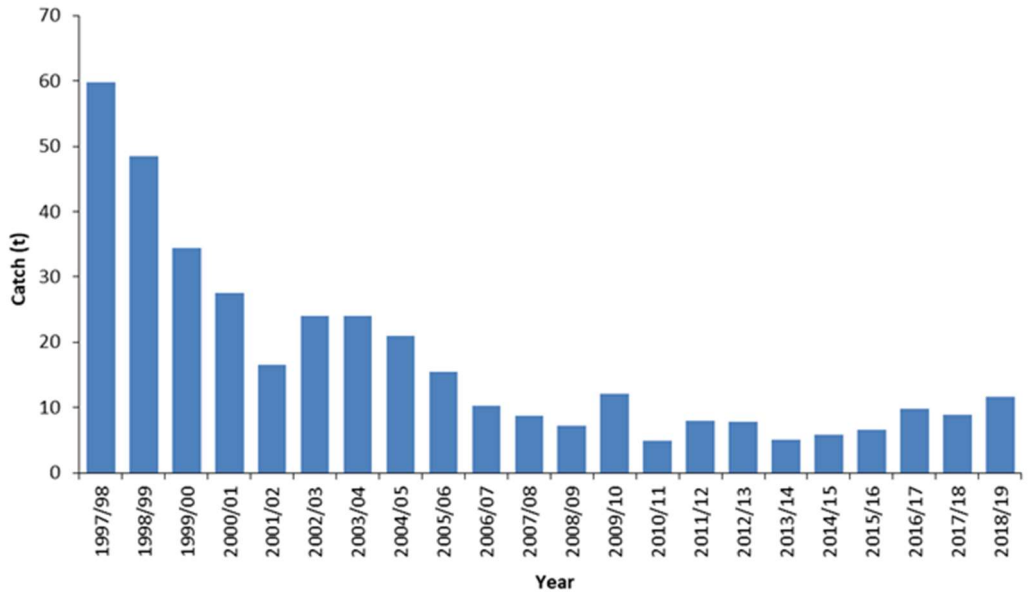

Figure 1. Annual commercial landings (tonnes) of Gould's Squid for NSW waters (1997/98–2018/19) for all fishing methods.

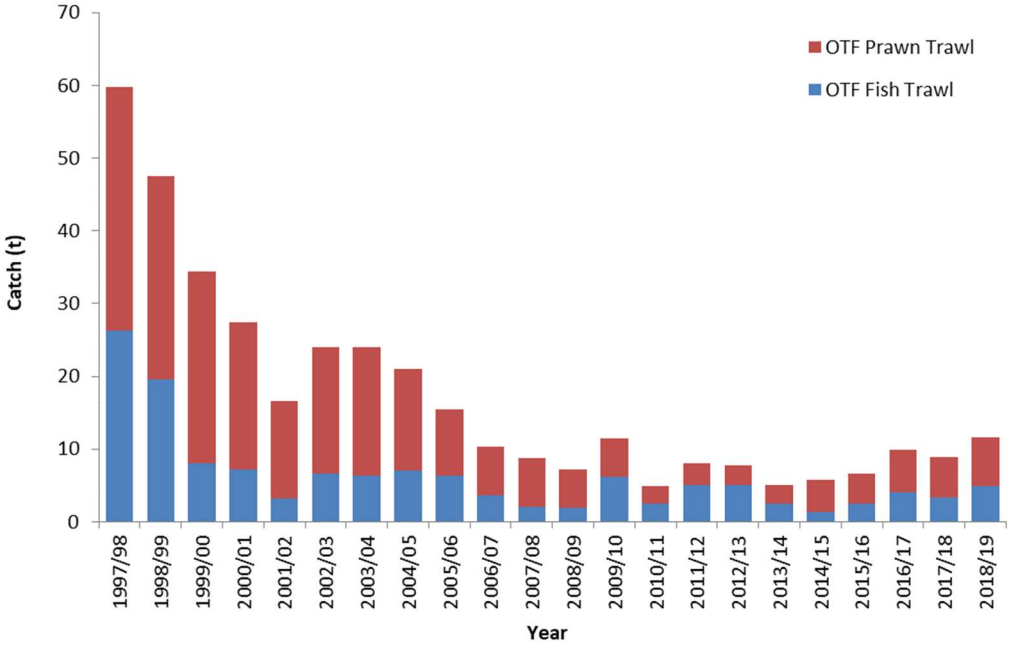

Figure 2. Annual commercial catches (tonnes) of Gould's Squid by sector for NSW Ocean Trawl Fishery (1997/98–2018/19).

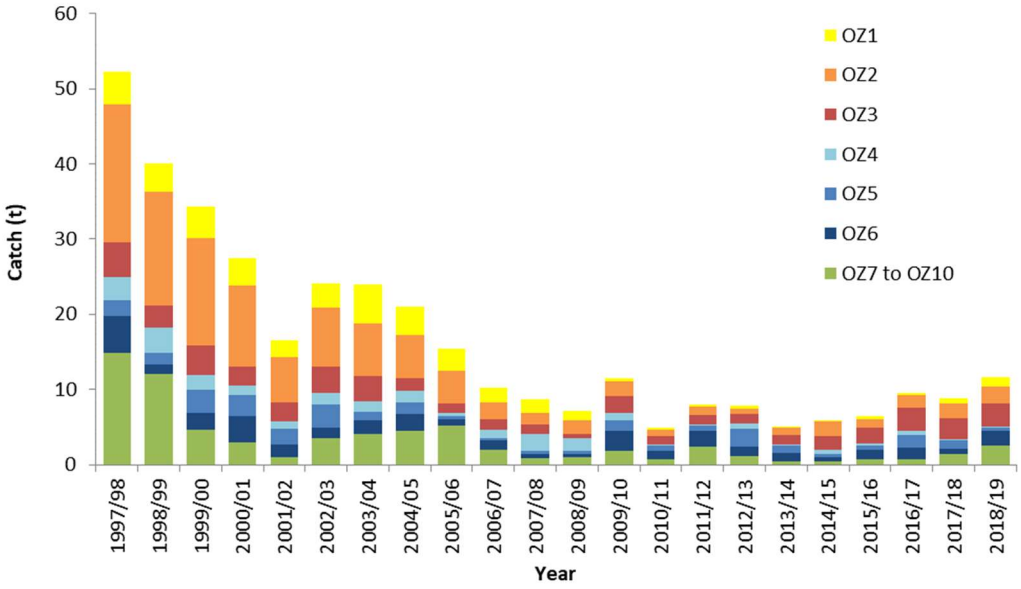

Figure 3. Annual commercial catches (tonnes) of Gould's Squid by ocean zone for NSW Ocean Trawl Fishery (1997/98–2018/19).

Catch Trends - Recreational and Indigenous

The most recent estimate of the recreational harvest of combined squid species (excluding Southern Calamari) was 108,213 squid during 2017/18 (Murphy et al. 2020); however, very little of this is thought to be Gould's Squid because of the generally deep offshore habitat of the species. The 2017/18 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 of combine squid in 2013/14 was approximately 26% smaller at around 79,819 squid (Murphy et al. 2020).

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 Gould's Squid was collected as number of days fished on monthly records prior to July 2009 and as numbers of hours trawled 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 Gould's Squid 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 prawn trawl sector, reported effort for Gould's Squid declined rapidly from around 9,905 days fished in 1998/99 to a minimum of 1,172 days fished in 2012/13 (Fig. 4). Since then effort has increased slightly to 2,502 days fished in 2018/19. Most of the decline in effort occurred prior to the catch reporting change in 2009. In contrast, reported effort for the fish trawl sector has remained relatively steady, but at a consistently lower level (Fig. 4). Reported effort for the fish trawl sector was 492 days fished in 2018/19.

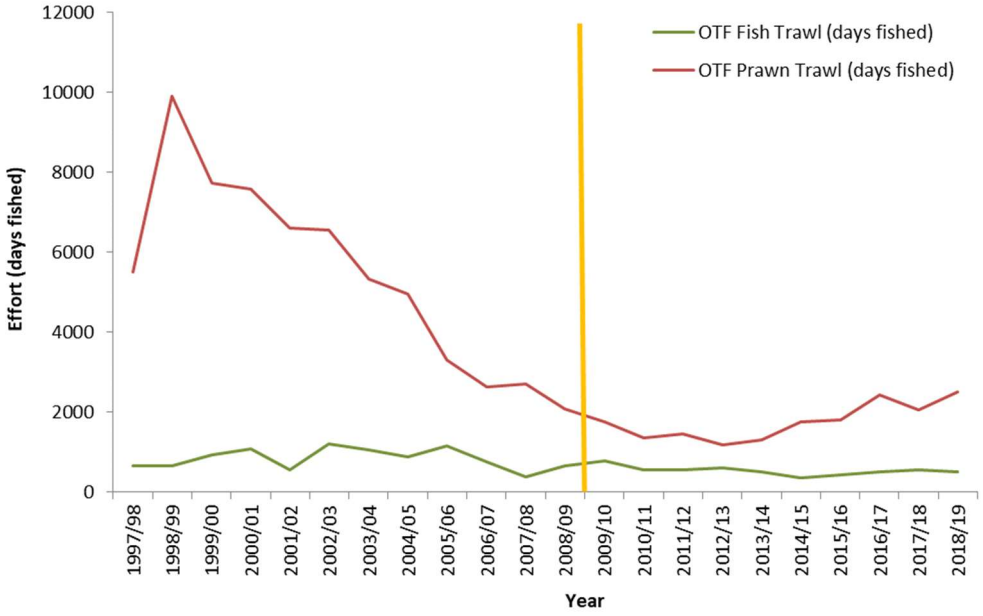

Figure 4. Annual effort (days fished) of prawn trawl and fish trawl fishers of the NSW Ocean Trawl Fishery that reported landing Gould's Squid on at least one day in each month. The gold vertical line indicates the change from monthly to daily catch reporting.

Catch Rate Trends - Commercial Fisheries

Monthly catch rates (catch-per-unit-effort, CPUE in kg per day fished) for Gould's Squid taken by the fish trawl and 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 Gould's Squid for the fish trawl and prawn trawl sectors showed similar trends. While historical rates have fluctuated, there was an overall declining trend from 1998 to 2006, followed by a slight increase in 2007. Recent catch rates also declined in the early 2010s but have since steadily increased in all years but the last and are currently near the long-term average for all series analysed (Figs 5 and 6).

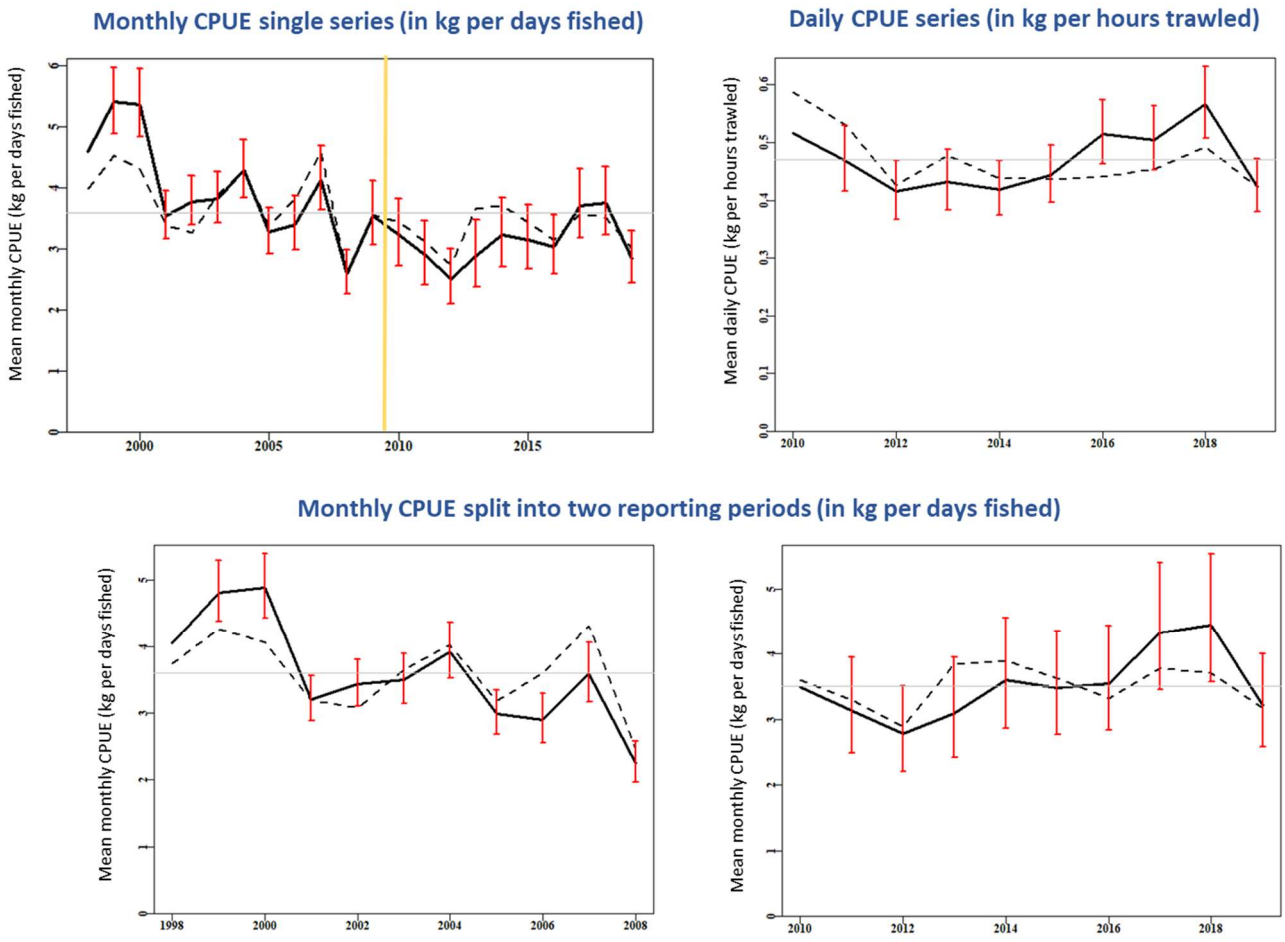

Figure 5. Mean standardised catch rates (catch-per-unit-effort, CPUE) of Gould's Squid for the prawn trawl sector in the NSW Ocean Trawl Fishery, estimated from monthly records (1998–2009) and re-aggregated daily records (2010–2019) in kg per days fished (top left and bottom) and from daily fishing event records in kg per hours trawled (top right). The dashed and solid lines indicate the nominal and standardised mean CPUE, 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.

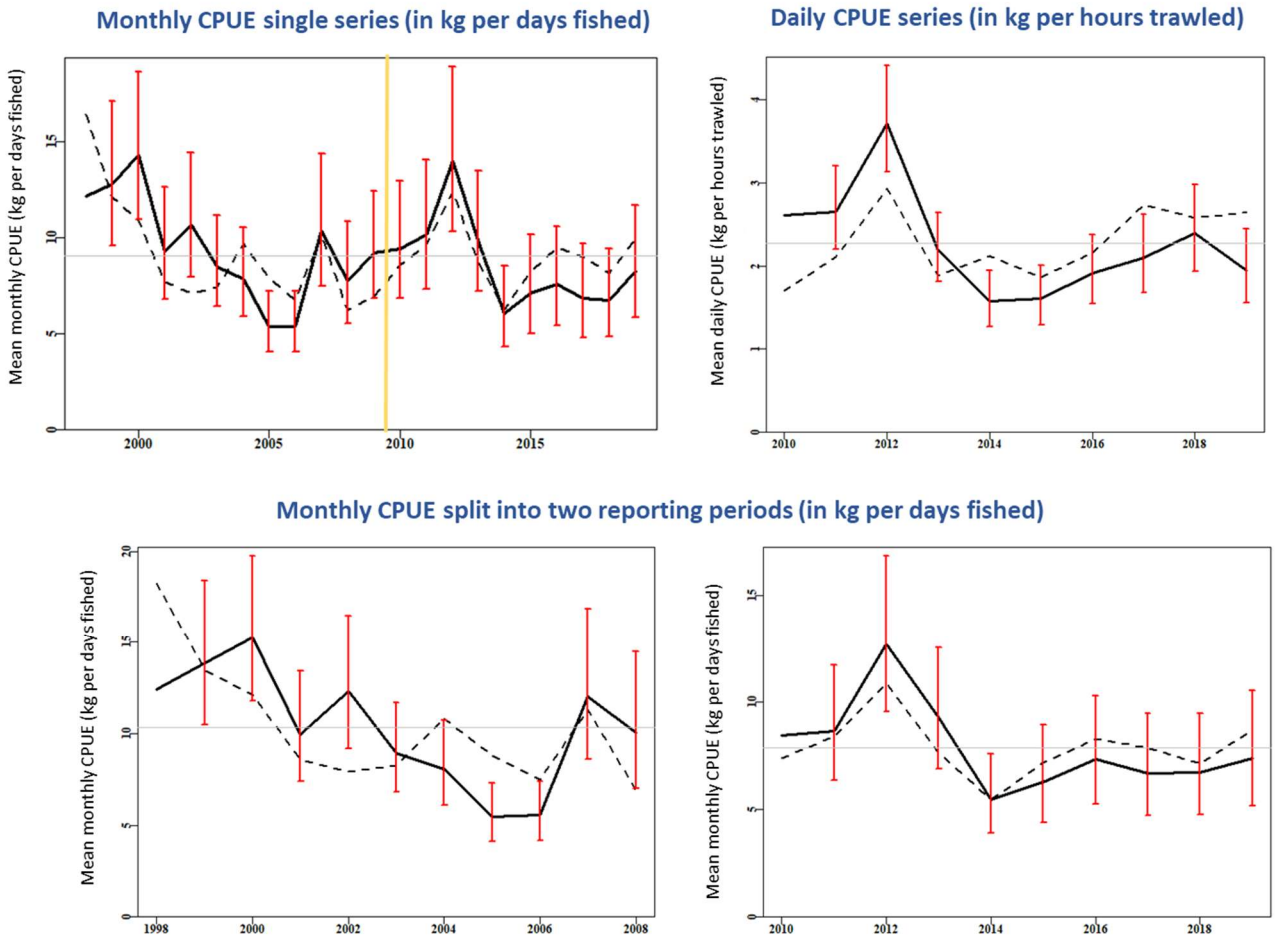

Figure 6. Mean standardised catch rates (catch-per-unit-effort, CPUE) of Gould's Squid for the fish trawl sector in the NSW Ocean Trawl Fishery, estimated from monthly records (1998–2009) and re-aggregated daily records (2010–2019) in kg per days fished (top left and bottom) and from daily fishing event records in kg per hours trawled (top right). The dashed and solid lines indicate the nominal and standardised mean CPUE, 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.

Stock Assessment Methodology

Year of most recent assessment	2020 No quantitative joint stock assessment of the entire biological stock is undertaken.
Assessment method	A weight-of-evidence approach was used for this stock status assessment of Gould's Squid in NSW waters. It relies on analyses of standardised catch rates for the two main fishing fleets of the OTF, fish trawl (otter trawl, excluding Danish seine) and prawn trawl (otter trawl), across all ocean zones.

Main data inputs	Commercial catch and effort data – for all NSW commercial fisheries by fiscal years (1997/98– 2018/19). Recreational catches – estimated annual catches for combined squid species from three periods – national recreational and indigenous fishing survey (2000/01) and NSW recreational fishing surveys (2013/14 and 2017/18). Commercial catch rates historical – reported annual CPUE data for the ocean prawn trawl and fish trawl sectors of the OTF by calendar years in kg per days fished (1998–2019) from monthly records – standardised. Commercial catch rates recent – reported annual CPUE data for the ocean prawn trawl and fish trawl sectors of the OTF by calendar years in kg per hours trawled (2010–2019) from daily records – standardised.
Key model structure and assumptions	The CPUE standardisations and analyses assume that the annual catch rates are a relative index of abundance and are not unduly influenced by other factors that are not accounted for through standardisation. Catch rates were standardised for the influences of different months, ocean zones, vessels and capture depths (daily records only). Using fishing effort as an indicator of relative fishing pressure assumes that fish catchability and fishing power have not changed significantly over the monitoring period.
Sources of uncertainty evaluated	Changes in fishing effort distribution following catch reporting changes from monthly to daily event reporting in July 2009.

Status Indicators and Limit Reference Levels

Biomass indicator or proxy	None specified in a formal harvest strategy. In the interim, for the purposes of this assessment the trend in commercial catch rates of the ocean prawn trawl and fish trawl sectors of the OTF were selected as indices of relative abundance.
Biomass Limit Reference Level	None specified in a formal harvest strategy. In the interim, for the purposes of this stock assessment current catch rates were assessed relative to long-term averages of each time series.
Fishing mortality indicator or proxy	None specified in a formal harvest strategy. In the interim, for the purposes of this assessment the trend in annual total commercial fishing effort for the prawn trawl and fish trawl sectors of the OTF were selected as indicators of relative fishing pressure.

Fishing mortality Limit Reference Level	None specified in a formal harvest strategy. In the interim, for the purposes of this stock assessment current fishing effort levels were compared against historic levels.

Stock Assessment Results

Biomass status in relation to limit	Current standardised catch rates are near the long-term averages with no significant declines in recent years. In all cases, increasing or stable trends are evident in catch rates over the last 3 years. The longer-term catch rates must be interpreted with caution due to the potential influence of catch reporting changes in July 2009. The weight of evidence indicates that the biomass of the stock is unlikely to be recruitment overfished and that current harvest rates are permitting some biomass recovery following declining catch rates between 1998 and 2006.
Fishing mortality in relation to limit	Fishing effort has slightly increased over the last 8 years, but is still well below levels reported in the 2000s that preceded decreasing catch rates. Fishing levels in NSW waters are insignificant relative to removals from the stock in other jurisdictions. The weight of evidence indicates that the current level of fishing pressure is unlikely to cause the stock to become recruitment overfished.
Previous SAFS stock status	Gould's Squid was previously assessed as a **sustainable stock** under the SAFS framework in 2018 (Noriega et al. 2018).
Current stock status	On the basis of the evidence above, which includes stable trends in standardised catch rates over the last 9 years and current low levels of fishing effort, Gould's Squid is currently assessed as a **sustainable stock.**

Qualifying Comments

- Overall, the data collated in this stock assessment suggest that the input controls used to manage effort in the commercial OTF have proved effective at reducing effort levels between 1997/98 and 2018/19 and consequently fishing pressure on Gould's Squid.
- Recent increasing or stable trends in catch rates and slightly lower fishing mortality estimates suggest that current harvest rates are sustainable and may be permitting some recovery of biomass.
- The potential influence of catch reporting changes on commercial catch rates (especially during the transition from monthly to daily reporting around July 2009) limits their application as an index of relative abundance.
- Ongoing misreporting of multi-day trips as single fishing events further compromise the accuracy of current catch-rate data.

- Variation in discard rates for this species is unknown, but is likely to be significant given that retention of this species can be market driven based on anecdotal reports from fishers.
- Squid species misidentification by fishers is also suspected, given that some catches of Gould's Squid are also reported from estuaries where the species is unlikely to occur, leading to greater uncertainty in the logbook data. Catch records from ocean zones only were included in the current stock assessment.
- Data assessed in this report date only as far back as 1997/98. Trawl fishing in NSW waters is known to have occurred since at least 1920. Even if Gould's Squid were not retained from trawling before 1997/98, they are still likely to have been caught by trawl gears as by-catch. Any potential historical discard or targeted mortality prior to 1997/98 has not been considered in this stock assessment.

References

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