

Fisheries

Stock Status Report for the South Australian Giant Crab (*Pseudocarcinus gigas*) Fishery in 2020/21



L. McLeay

**SARDI Publication No. F2011/000332-11
SARDI Research Report Series No. 1123**

SARDI Aquatic Sciences
PO Box 120 Henley Beach SA 5022

February 2022

Fishery Status Report to PIRSA Fisheries and Aquaculture

Stock Status Report for the South Australian Giant Crab (*Pseudocarcinus gigas*) Fishery in 2020/21

Fishery Status Report to PIRSA Fisheries and Aquaculture

L. McLeay

**SARDI Publication No. F2011/000332-11
SARDI Research Report Series No. 1123**

February 2022

This publication may be cited as:

McLeay, L. (2022). Stock Status Report for the South Australian Giant Crab (*Pseudocarcinus gigas*) Fishery in 2020/21. Fishery Status Report to PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2011/000332-11. SARDI Research Report Series No. 1123. 20pp.

DISCLAIMER

The authors warrant that they have taken all reasonable care in producing this report. The report has been through the SARDI internal review process, and has been formally approved for release by the Research Director, Aquatic Sciences. Although all reasonable efforts have been made to ensure quality, SARDI does not warrant that the information in this report is free from errors or omissions. SARDI and its employees do not warrant or make any representation regarding the use, or results of the use, of the information contained herein as regards to its correctness, accuracy, reliability and currency or otherwise. SARDI and its employees expressly disclaim all liability or responsibility to any person using the information or advice. Use of the information and data contained in this report is at the user's sole risk. If users rely on the information they are responsible for ensuring by independent verification its accuracy, currency or completeness. The SARDI Report Series is an Administrative Report Series which has not been reviewed outside the department and is not considered peer-reviewed literature. Material presented in these Administrative Reports may later be published in formal peer-reviewed scientific literature.


© 2022 SARDI

This work is copyright. Apart from any use as permitted under the *Copyright Act 1968* (Cth), no part may be reproduced by any process, electronic or otherwise, without the specific written permission of the copyright owner. Neither may information be stored electronically in any form whatsoever without such permission.

Author(s): L. McLeay

Reviewer(s): G. Grammer (SARDI), S. Mayfield (SARDI) and S. Shanks (PIRSA)

Approved by: S. Mayfield
Science Leader - Fisheries

Signed: 

Date: 18 February 2022

Distribution: PIRSA Fisheries and Aquaculture, SARDI Aquatic Sciences, Parliamentary Library, State Library and National Library

Circulation: OFFICIAL

ALL ENQUIRIES

South Australian Research and Development Institute - SARDI Aquatic Sciences
2 Hamra Avenue West Beach SA 5024
PO Box 120 Henley Beach SA 5022
P: (08) 8207 5400 F: (08) 8207 5415 E: pirsa.sardiaquatics@sa.gov.au
W: <http://www.pir.sa.gov.au/research>

TABLE OF CONTENTS

LIST OF TABLES v

LIST OF FIGURES..... v

ACKNOWLEDGEMENTS vi

EXECUTIVE SUMMARY..... 1

1. INTRODUCTION 3

 1.1. Overview 3

 1.2. Biology 3

 1.3. Management arrangements and harvest strategy 3

 1.4. Stock status classification 5

2. METHODS..... 7

 2.1. Sources of data 7

 2.2. Primary Performance Indicator 7

 2.3. Additional Performance Indicators 8

3. RESULTS..... 9

 3.1. Total catch 9

 3.2. Targeted catch and effort..... 10

 3.3. Catch per unit effort (CPUE)..... 11

 3.4. Pre-recruit abundance 13

 3.5. Sex ratio..... 13

 3.6. Mean weight..... 14

 3.7. Spawning female abundance..... 15

4. SUMMARY 16

 4.1. Stock status 16

 4.2. Future research needs..... 17

5. REFERENCES 18

LIST OF TABLES

Table 1. Giant Crab Fishery statistics between 2017/18 and 2020/21. *Five-year average commercial CPUE of legal-size Giant Crab is the primary biological performance indicator (PI) listed in the management policy for the GCF. 2

Table 2. Stock status terminology. 6

Table 3. Target catch versus total catch of Giant Crab between 2000 and 2020. 10

LIST OF FIGURES

Figure 1. Total catch of Giant Crab and percentage of Giant Crab TACC caught State-wide in the GCF between 1986 and 2020. 9

Figure 3. State-wide annual commercial CPUE of legal-size Giant Crab in the GCF between 2000 and 2020. 11

Figure 4. State-wide five-year average (\pm SE) commercial CPUE of legal-size Giant Crab in the GCF between 2004 and 2020. 12

Figure 5. State-wide trends in the CPUE of Giant Crab pre-recruits caught in the GCF between 2000 and 2020. 13

Figure 6. State-wide trends in the sex ratio of Giant Crab caught in the GCF between 2000 and 2020. 13

Figure 7. State-wide trends in the mean weight of legal-size Giant Crab caught in the GCF between 2000 and 2020. 14

Figure 8. State-wide trends in Giant Crab female spawning abundance in the GCF between 2000 and 2020. 15

ACKNOWLEDGEMENTS

Funds for this research were obtained through licence fees managed by Primary Industries and Regions South Australia (PIRSA). John Feenstra (SARDI Aquatic Sciences) provided catch data through data extraction procedures run from the South Australian Rock Lobster (SARL) database. Kylie Odgers (SARDI Information Services Group) provided valuable and timely administrative support to data entry and corrections required in the SARL database. The report was formally reviewed by Dr Gretchen Grammer (SARDI Aquatic Sciences), Dr Stephen Mayfield (SARDI Aquatic Sciences), Steve Shanks (PIRSA), and approved for release by Dr Stephen Mayfield, Science Leader, Fisheries (SARDI Aquatic Sciences).

EXECUTIVE SUMMARY

This report provides an assessment of the status of the South Australian Giant Crab Fishery (GCF) using data to the end of the 2020 fishing season that extends from 1 October 2020 to 31 May 2021. It analyses fishery-dependent data at a State-wide scale, collected from two management zones, the Northern Zone (NZ) and Southern Zone (SZ), and from three commercial fishing sectors: (1) Miscellaneous Fishery sector; (2) South Australian Rock Lobster Fishery (SARLF) quota sector (RL-quota); and (3) SARLF by-product sector (RL by-product).

Catches of Giant Crab in the last eight seasons are among the lowest since the Total Allowable Commercial Catch (TACC) was implemented in 1999. In 2020, the total catch in the GCF was 15.4 t, comprising 69.7% of the 22.1 t TACC. The amount of targeted catch in the Miscellaneous Fishery sector and RL-quota sector in 2020 was the third lowest on record (14.8 t).

Estimates of catch per unit effort (CPUE) of legal-size Giant Crab declined in South Australia from 2008 to 2015 but have remained relatively stable since at >80% of the Target Reference Point ($RP_{\text{targ}} = 2.60 \text{ kg/potlift}$). Although the relative abundance of the Giant Crab stock across South Australia remains at relatively stable levels recently, there is some uncertainty in relation to the future performance of the GCF due to the biological susceptibility of Giant Crab populations to recruitment overfishing, and declining trends in catch and pre-recruit abundance relative to historic levels.

Determination of stock status in 2020 was aided by the implementation of recommendations made in SARDI's 2017 assessment of data sources and performance indicators (PIs) for the GCF, as well the management policy for the GCF developed in consultation with industry (PIRSA 2018). Within the management policy for the GCF, the status of the Giant Crab stock is defined in relation to how the primary biological PI, five-year average commercial CPUE of legal-size Giant Crab, aligns against its Trigger Reference Point (RP_{trig}) (PIRSA 2018).

In 2020, the estimate of five-year commercial CPUE of legal-size Giant Crab was 2.10 kg/potlift. This estimate is 7.7% above the Trigger Reference Point (RP_{trig}) of $\geq 1.95 \text{ kg/potlift}$. Under the decision rule within the management policy to categorise the Giant Crab stock status in South Australia, the stock is classified as '**sustainable**' in 2020 (PIRSA 2018).

Table 1. Giant Crab Fishery statistics between 2017/18 and 2020/21. *Five-year average commercial CPUE of legal-size Giant Crab is the primary biological performance indicator (PI) listed in the management policy for the GCF.

| Statistic | 2017/18 | 2018/19 | 2019/20 | 2020/21 |
|--|---------------------------|---------------------------|---------------------------|---------------------------|
| Total Allowable Commercial Catch (TACC) | 22.1 t | 22.1 t | 22.1 t | 22.1 t |
| Total commercial catch | 18.4 t | 18.1 t | 14.2 t | 15.4 t |
| % of TACC caught | 83% | 82% | 64% | 70% |
| Target effort | 7,582 potlifts | 8,141 potlifts | 6,969 potlifts | 7,727 potlifts |
| Five-year average commercial CPUE of legal-size Giant Crab* | 2.11 kg/potlift | 2.13 kg/potlift | 2.09 kg/potlift | 2.10 kg/potlift |
| Pre-recruit abundance | 0.74 pre-recruits/potlift | 0.67 pre-recruits/potlift | 0.46 pre-recruits/potlift | 0.47 pre-recruits/potlift |
| Mean weight | 2.98 kg | 3.15 kg | 3.20 kg | 3.09 kg |
| Sex ratio ($N_{\text{♀}}/N_{\text{♀+♂}}$) | 0.52 | 0.51 | 0.54 | 0.51 |
| Status | Sustainable | Sustainable | Sustainable | Sustainable |

Keywords: Giant Crab, King Crab, *Pseudocarcinus gigas*, fishery, South Australia.

1. INTRODUCTION

1.1. Overview

This status report for the South Australian Giant Crab (*Pseudocarcinus gigas*) Fishery (GCF) updates previous stock assessment and status reports for this species (Currie and Ward 2005; Currie *et al.* 2006; Currie 2008; Currie and Ward 2009; Currie 2010; Currie 2011a, b; Chick 2013; Stobart 2014; McLeay 2015; 2016; 2018; 2019; 2020; 2021) and is part of SARDI Aquatic Sciences' assessment program for the fishery. The report provides a synopsis of the information available for the GCF collected from commercial logbook returns from 1 November 1986 to 31 May 2021 and assesses the current status of the Giant Crab resource in South Australia.

1.2. Biology

Giant Crab (*P. gigas*), also known as King Crab, is endemic to southern Australian waters and distributed from southern Western Australia to central New South Wales (Kailola *et al.* 1993). They are a long lived (>30 years), slow growing xanthoid crab, reaching over 10 kg in weight with males growing to at least twice the size of females. While they occur at depths ranging from 20 to 600 m, the highest population densities are found at the edge of the continental shelf at depths of approximately 140 to 270 m (Levings *et al.* 1995). Mating occurs from June to July and females carry eggs for approximately four months before hatching occurs in October to November. Larval duration is approximately 50 days. Giant Crab is considered to be a single biological stock across southern Australia (Levings *et al.* 2001).

1.3. Management arrangements and harvest strategy

A detailed description of the history and management arrangements for the fishery is provided in Sloan (2002; 2003), PIRSA (2018), and previous stock assessment and status reports (Currie and Ward 2005; Currie *et al.* 2006; Currie 2008; Currie and Ward 2009; Currie 2010; Currie 2011a, b; Chick 2013; Stobart 2014; McLeay 2015; 2016; 2018; 2019; 2020; 2021). In summary, targeted fishing for Giant Crab began in South Australia in 1992 under Commonwealth licence arrangements. In 1997, management of the GCF was transferred solely to the Government of South Australia and separated into two zones, the Southern Zone (SZ) and Northern Zone (NZ), which are consistent with those designated for the South Australian Rock Lobster Fishery (SARLF). In 1999, an annual Total Allowable Commercial Catch (TACC) of 26 t was implemented for the GCF (NZ: 13.4 t and SZ: 12.6 t). In 2000, the TACC was reduced to 22.1 t (NZ: 13.4 t and SZ: 8.7 t) and has since remained unchanged (PIRSA 2009, 2018).

Commercial access to the Giant Crab resource is limited to licence holders in the South Australian Miscellaneous Fishery (Miscellaneous Fishery) and the SARLF. Within the

SARLF, Giant Crab quota is allocated to some licence holders as a unit holding (RL-quota). Remaining SARLF licence holders have an entitlement to land up to five individual Giant Crabs per fishing trip as bycatch (RL by-product). In 2019, the TACC was allocated among 15 licence holders: one in the Miscellaneous Fishery and 14 in the SARLF.

The Giant Crab fishing season is between 1 October – 31 May, with the fishing season in the SZ between 1 October and 30 April, and in the NZ between 1 November and 31 May. Fishing in each zone is managed via a mix of input and output controls (refer to Table 1 in PIRSA 2018). Fishers use a maximum of 100 steel-framed pots that must comply with pot-dimension specifications. A minimum legal-size limit of 150 mm carapace length is set for the GCF and females with external eggs are protected and must be returned to the water as soon as possible following capture.

The management policy for the fishery describes the overarching management arrangements and harvest strategy for the fishery (PIRSA 2018). The harvest strategy developed for the fishery is consistent with the South Australian Harvest Strategy Policy and Guidelines (PIRSA 2015a, b) and the National Harvest Strategy Guidelines (Sloan *et al.* 2014), and considers an assessment of data sources and performance indicators (PIs) for the fishery conducted by SARDI in 2017 (summarised in McLeay 2018).

The harvest strategy identifies five-year average commercial catch per unit effort (CPUE) of legal-size Giant Crab as the primary biological PI, with reference points for this PI based on targeted catch and effort information from 2000/01 to 2009/10. To inform the harvest strategy, five-year average commercial CPUE of legal-size Giant Crab (kg/potlift), calculated as the moving average CPUE of legal-size Giant Crab in the current and previous four fishing seasons, is applied within decision rules described in the management policy (PIRSA 2018).

Decision rules are linked to defined Limit, Trigger and Target Reference Points for this PI to guide management arrangements and TACC setting in the following season. The Target Reference Point (RP_{targ}) for commercial CPUE of legal-size Giant Crab is 2.60 kg/potlift. Consistent with the National Harvest Strategy Policy (Sloan *et al.* 2014), the Trigger Reference Point (RP_{trig}) is set at 75% of RP_{targ} (1.95 kg/potlift) and the Limit Reference Point (RP_{lim}) is set at 50% of RP_{targ} (1.30 kg/potlift) (PIRSA 2018).

Decision rules are outlined within the management policy (PIRSA 2018) as follows:

- When five-year average commercial CPUE of legal-size Giant Crab is ≥ 1.95 kg/potlift (i.e. above RP_{trig}) it is recommended the TACC be set at 22.1 t for the entire GCF with 13.4 t of that TACC set for the NZ and 8.7 t set for the SZ.

- When five-year average commercial CPUE of legal-size Giant Crab is <1.95 kg/potlift and ≥ 1.30 kg/potlift (i.e. below RP_{trig} and above RP_{lim}) a review of the GCF will be undertaken.
- When five-year average commercial CPUE of legal-size Giant Crab is <1.30 kg/potlift (i.e. below RP_{lim}) a review of the GCF will be undertaken and appropriate management arrangements may be introduced for the fishery in a timely fashion.

1.4. Stock status classification

A National Fishery Stock Status Reporting Framework (NFSRF) was developed to enable the consistent assessment of the status of Australian fish stocks (Pidcocke *et al.* 2021). The system combines information on both the current stock size and level of catch into a single classification for each stock using defined biological reference points. Each stock is then classified as 'sustainable', 'recovering', 'depleting', 'depleted', 'undefined' or 'negligible' (Table 2) ([FRDC 2020](#)). PIRSA has adopted this classification system to determine the status of all South Australian fish stocks.

Following the assessment of data sources and PIs undertaken for the fishery by SARDI in 2017, Giant Crab stock status is now defined in relation to how the single PI, five-year average commercial CPUE of legal-size Giant Crab, aligns against the reference points within the management policy (PIRSA 2018). Within the management policy, the Giant Crab stock status is categorised as sustainable if the five-year average commercial CPUE of legal-size Giant Crab is at or above RP_{trig} (1.95 kg/potlift). Determination of stock status below RP_{trig} is not prescribed under the management policy.

Table 2. Stock status terminology (Pidcocke *et al.* 2021).

| 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 (i.e. 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 pressure 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 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 |

2. METHODS

2.1. Sources of data

Fishery-dependent data have been collected from the three commercial fishing sectors that have access to the Giant Crab resource (Miscellaneous Fishery, RL-quota and RL by-product) since 1986. Data are unavailable to identify SARLF licence holders that held Giant Crab quota between 1999 and 2005. Data within this period were allocated to the RL-quota sector by referencing SARLF licence holders who held Giant Crab quota in 2006, and an additional SARLF licence holder (between 1999 and 2002). From 2006, PIRSA has provided information to SARDI to identify licence holders among each fishing sector with Giant Crab entitlement. All other fishery-dependent data from SARLF licence holders without allocated Giant Crab quota are assigned to the RL by-product sector.

Prior to 2000, data relating to Giant Crab catch were reported via a mandatory daily logbook program implemented for the SARLF. From 2000, a separate logbook reporting system was implemented for the GCF. Data from quota holders (Miscellaneous Fishery, RL-quota sectors) are reported through this system. Data from Rock Lobster fishers who catch Giant Crab incidentally (RL by-product sector) are reported through the logbook program in the SARLF. Data for Giant Crab catch recorded by the Miscellaneous Fishery and RL-quota sectors since 2000 are considered the most robust in assessing the stock status of the GCF, as they more accurately capture targeted fishing effort towards Giant Crab (McLeay 2018).

All data are entered and maintained by SARDI Aquatic Sciences. Data are checked for errors during data entry, and further validated during data entry and reporting operations. SARDI staff contact licence holders to correct any errors or missing information identified in the quality assurance process. All references to a fishing season in this report refer to the year the fishing season started (e.g. data reported for 2020 includes data from 1 October 2020 to 31 May 2021). Due to confidentiality provisions, where data are confidential from <5 licence holders, data from each zone and sector are aggregated and presented at a State-wide scale. All means are reported \pm standard error.

2.2. Primary Performance Indicator

The primary biological PI for the GCF is the five-year average commercial catch per unit effort (CPUE) (kg/potlift) of legal-size Giant Crab (PIRSA 2018). This PI is calculated as the moving average of annual CPUE measured from the current and previous four fishing seasons. It uses data relating to targeted fishing collected through catch logs recorded by the Miscellaneous Fishery and RL-quota sectors in the NZ and SZ since 2000.

Reference points for this PI are based on targeted catch and effort information from 2000/01 to 2009/10.

2.3. Additional Performance Indicators

Catch (total and % of TACC), effort, mean weight, pre-recruit abundance, sex ratio and spawning female abundance are additional indicators that provide context for assessing future performance of the GCF. Effort, mean weight, pre-recruit abundance, sex ratio and spawning female abundance are reported using data from targeted fishing for Giant Crab in the Miscellaneous Fishery and RL-quota sectors since 2000. Catch of Giant Crab includes all catch reported through both GCF and SARLF logbook programs and consequently includes non-targeted catch of Giant Crab by non-quota holders in the SARLF (RL by-product sector).

3. RESULTS

3.1. Total catch

State-wide catch of Giant Crab landed by all three fishing sectors was negligible prior to 1992. Thereafter, catches varied annually, averaging 11.3 ± 3.6 t between 1986 and 1998, including a historical high of 34.1 t in 1997 (Figure 1). Following introduction of a TACC in 1999, catches remained relatively stable up until 2012, ranging from 18.0 t in 2009 to 27.0 t in 1999. In 2020, the total catch was 15.4 t. This is the second lowest catch on record since TACC was implemented but an increase of 1.3 tonnes since 2019. The TACC has not been caught for the last eight seasons. In 2020, the catch comprised 69.7% of the 22.1 t TACC.

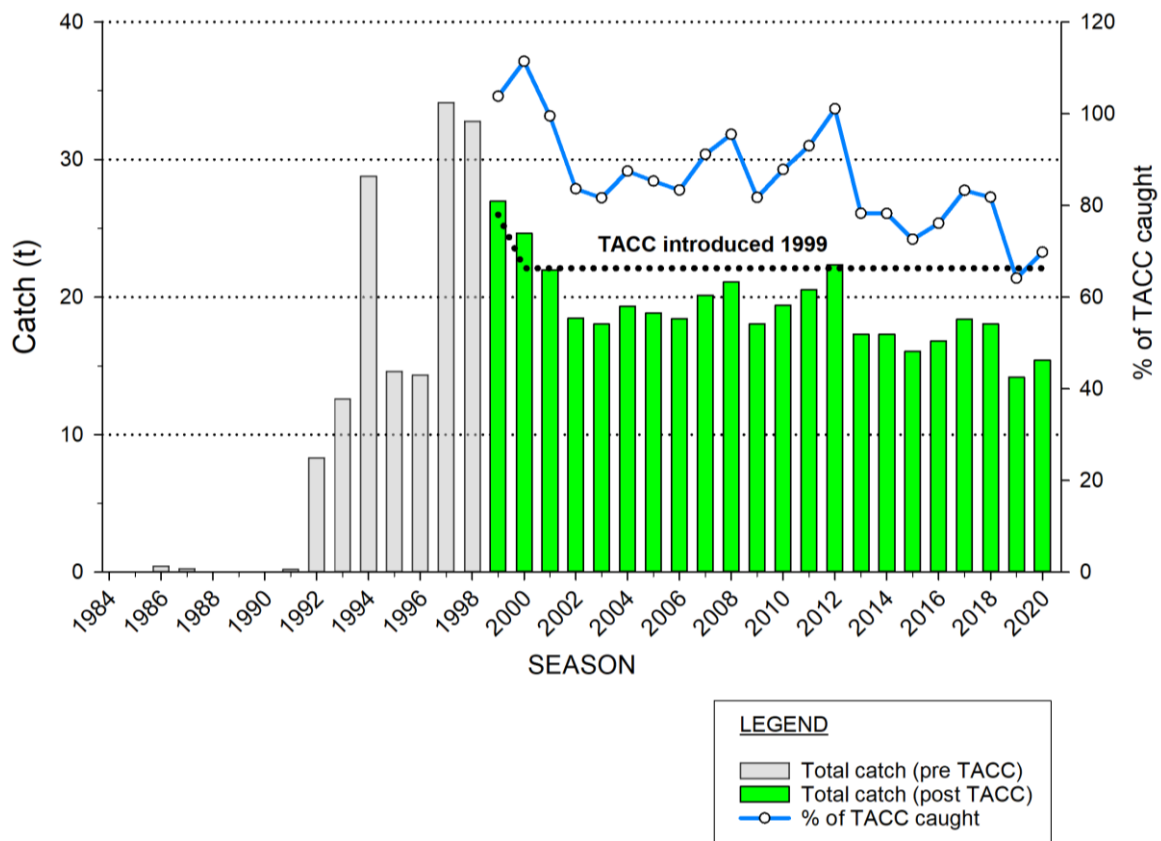


Figure 1. Total catch of Giant Crab and percentage of Giant Crab TACC caught State-wide in the GCF between 1986 and 2020.

3.2. Targeted catch and effort

Targeted catch of Giant Crab landed within the Miscellaneous Fishery and RL-quota sectors represents 90.9% of all catch reported in the GCF since 2000 and at least 75% of the total catch recorded in each season since 2000 (Table 3). In 2020, targeted catch landed by the Miscellaneous Fishery and RL-quota sectors was 14.8 t. Targeted catch in 2020 comprised 96.2% of the total catch recorded in the GCF (15.4 t) (Table 3).

Table 3. Target catch versus total catch of Giant Crab between 2000 and 2020.

| SEASON | Target catch (t) | Total catch (t) | % Target catch |
|--------|------------------|-----------------|----------------|
| 2000 | 21.7 | 24.6 | 88.1 |
| 2001 | 17.6 | 22.0 | 80.2 |
| 2002 | 16.1 | 18.5 | 86.9 |
| 2003 | 15.8 | 18.0 | 87.6 |
| 2004 | 14.5 | 19.3 | 75.0 |
| 2005 | 17.2 | 18.9 | 91.2 |
| 2006 | 17.5 | 18.4 | 95.2 |
| 2007 | 16.3 | 20.1 | 81.1 |
| 2008 | 18.1 | 21.1 | 85.9 |
| 2009 | 16.1 | 18.1 | 89.3 |
| 2010 | 18.9 | 19.4 | 97.3 |
| 2011 | 19.7 | 20.6 | 96.0 |
| 2012 | 21.8 | 22.3 | 97.7 |
| 2013 | 16.4 | 17.3 | 95.0 |
| 2014 | 17.0 | 17.3 | 98.1 |
| 2015 | 15.1 | 16.0 | 93.9 |
| 2016 | 16.5 | 16.8 | 98.2 |
| 2017 | 17.2 | 18.4 | 93.6 |
| 2018 | 16.8 | 18.1 | 92.9 |
| 2019 | 13.7 | 14.2 | 97.0 |
| 2020 | 14.8 | 15.4 | 96.2 |

Since 2000, State-wide trends in total targeted fishing effort in the Miscellaneous Fishery and RL-quota sectors range from 4,738 potlifts in 2004 to 9,457 potlifts in 2009 (Average 2000–2020: 7,465± 297 potlifts per season) (Figure 2). From 2012, targeted fishing effort generally declined, reaching 6,969 potlifts in 2019. In 2020, a total of 7,727 potlifts was recorded (Figure 2).

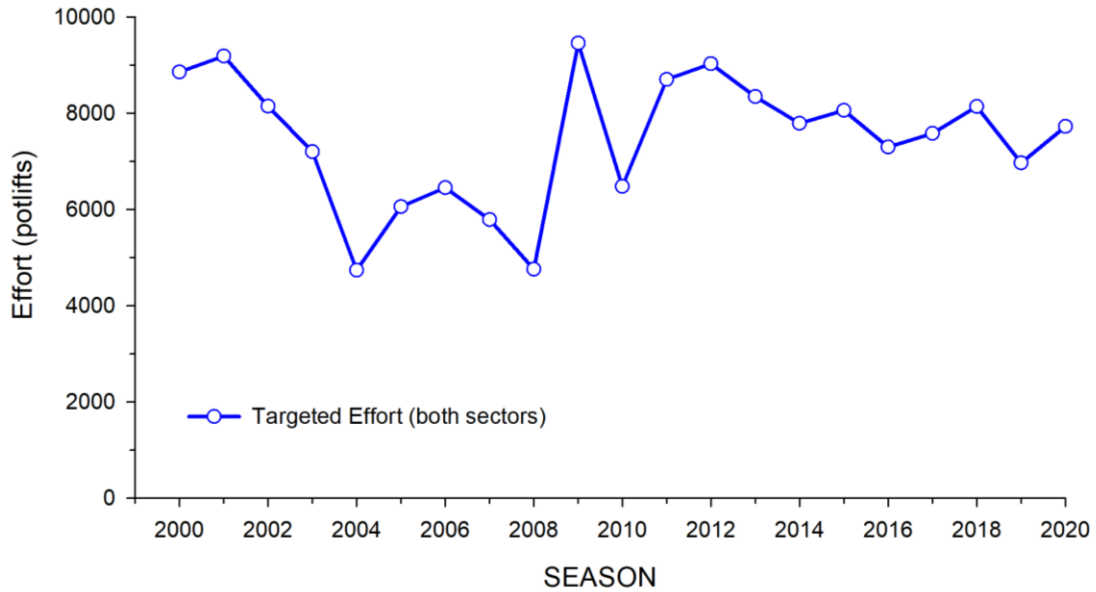


Figure 2. State-wide targeted fishing effort in the GCF between 2000 and 2020.

3.3. Catch per unit effort (CPUE)

Annual estimates of CPUE of legal-size Giant Crab increased from 2.45 kg/potlift in 2000 to a peak of 3.81 kg/potlift in 2008 before decreasing to 1.87 kg/potlift in 2015 (Figure 3). Since then, annual CPUE has remained between 1.92 and 2.27 kg/potlift. In 2020, annual commercial CPUE of legal-size Giant Crab was 1.92 kg/potlift (Figure 3).

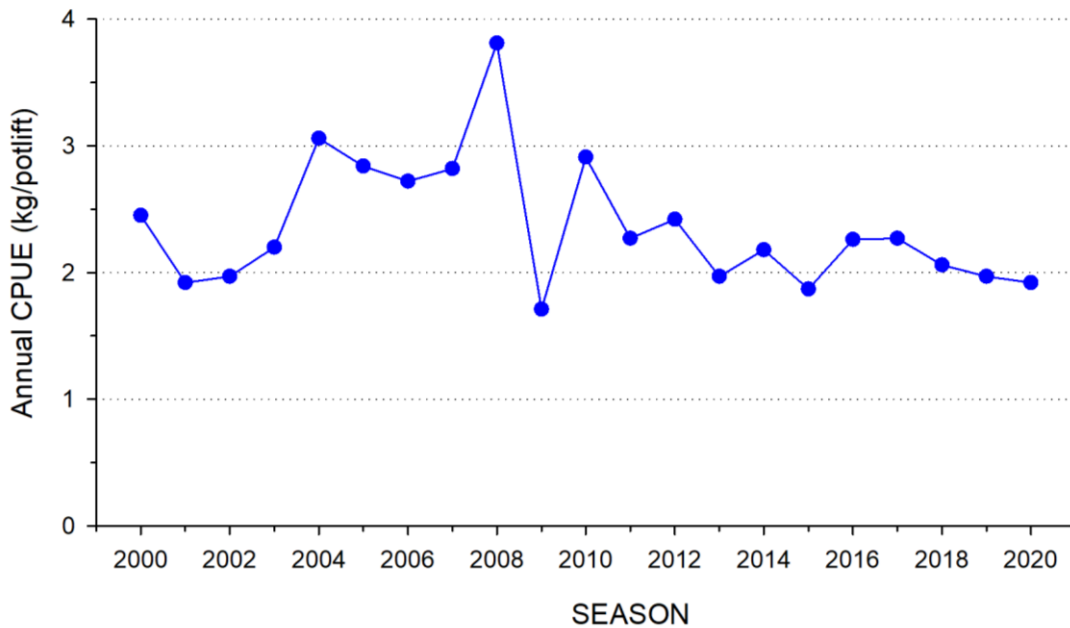


Figure 3. State-wide annual commercial CPUE of legal-size Giant Crab in the GCF between 2000 and 2020.

From 2004, five-year average commercial CPUE of legal-size Giant Crab increased from 2.32 kg/potlift to a peak of 3.05 kg/potlift in 2008, before decreasing to 2.25 kg/potlift in 2013 (Figure 4). Since then, CPUE has been relatively stable, at >80% of the Target Reference Point ($RP_{targ} = 2.60$ kg/potlift). In 2020, commercial CPUE of legal-size Giant Crab was 2.10 kg/potlift, which is 80.8% of RP_{targ} and 7.7% above the Trigger Reference Point (RP_{trig})(1.95 kg/potlift) (Figure 4).

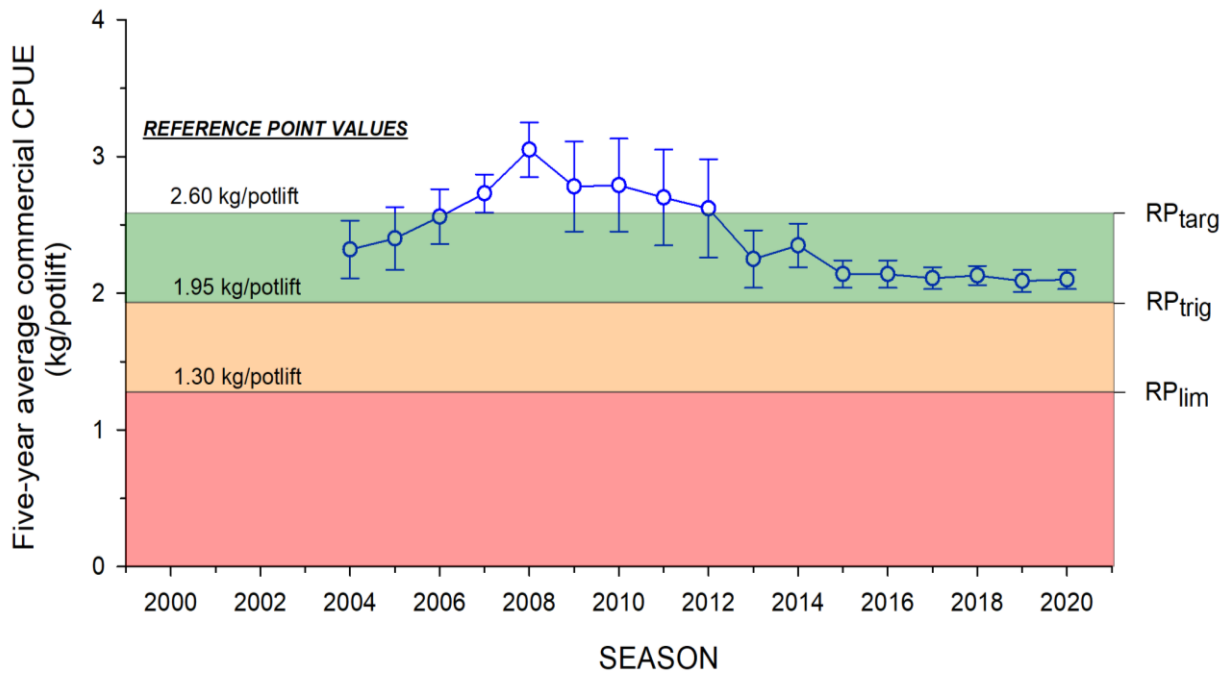


Figure 4. State-wide five-year average (\pm SE) commercial CPUE of legal-size Giant Crab in the GCF between 2004 and 2020. Target Reference Point = RP_{targ} ; Trigger Reference Point = RP_{trig} ; Limit Reference Point = RP_{lim} .

3.4. Pre-recruit abundance

State-wide seasonal estimates of pre-recruit (undersize Giant Crab) abundance have steadily declined since 2008, with 2019 and 2020 the lowest estimates on record (2019: 0.46 pre-recruits/potlift; 2020: 0.47 pre-recruits/potlift) (Figure 5).

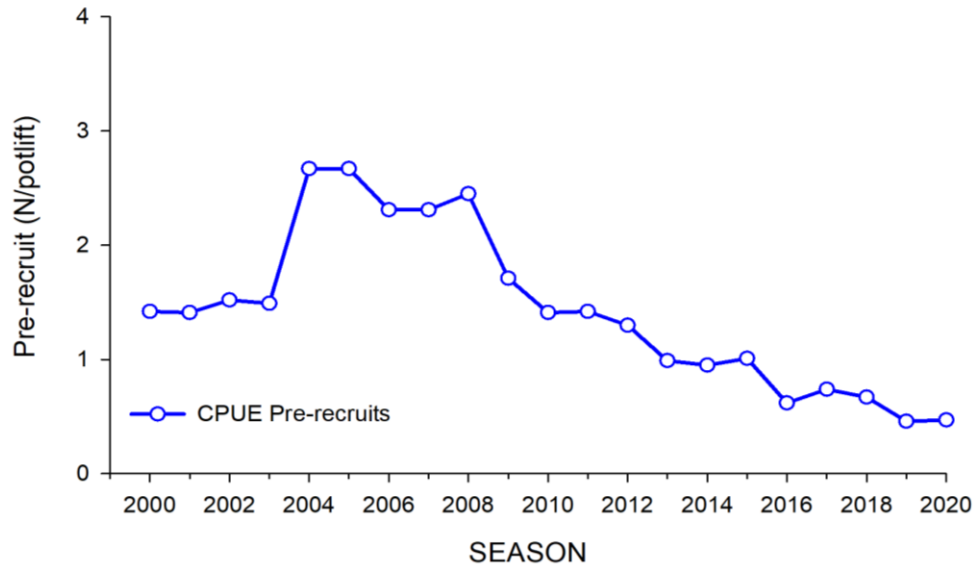


Figure 5. State-wide trends in the CPUE of Giant Crab pre-recruits caught in the GCF between 2000 and 2020.

3.5. Sex ratio

State-wide seasonal trends in sex ratio since 2000 ranged from 0.45 in 2006 to 0.64 in 2012 (Figure 6). In 2020, the sex ratio was 0.51, indicating a relatively even number of females and males in the catch (Figure 6).

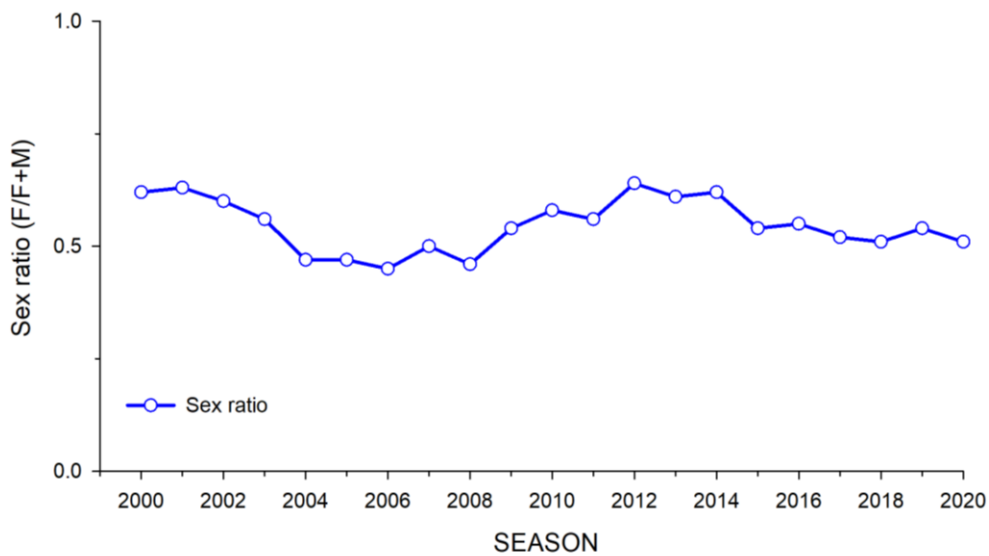


Figure 6. State-wide trends in the sex ratio of Giant Crab caught in the GCF between 2000 and 2020. A sex ratio of 0.5 equates to 50% of females in the catch. F=Female; M= Male.

3.6. Mean weight

Since 2000, State-wide seasonal estimates of the mean weight of legal-size Giant Crab have ranged between 2.85 and 3.20 kg per crab per season (average: 2.98 ± 0.02) (Figure 7). The mean weight of legal-size Giant Crab in 2020 was 3.09 kg and the fourth highest on record (Figure 7).

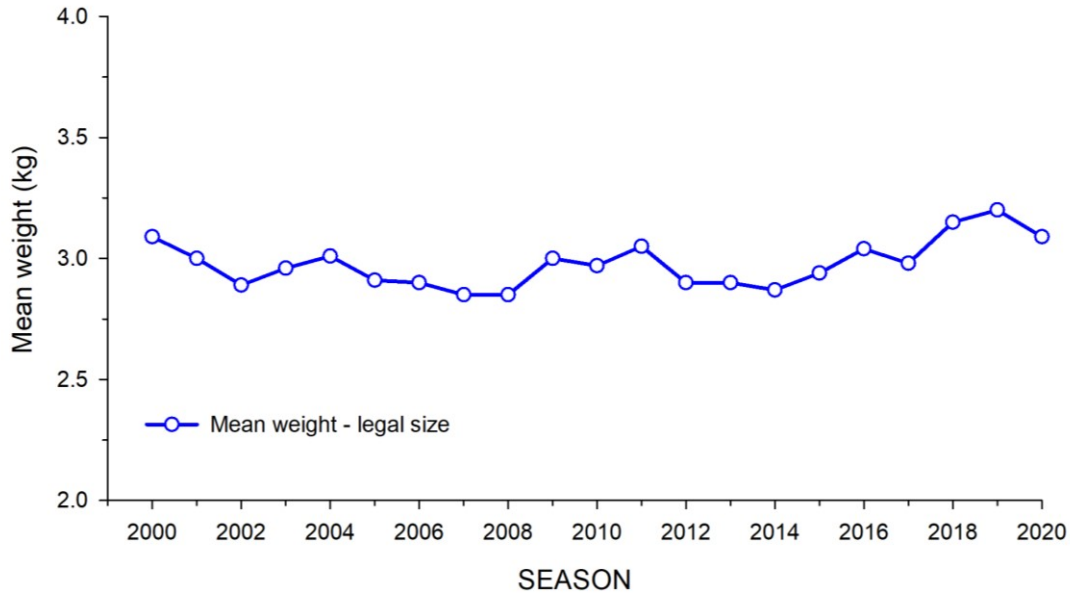


Figure 7. State-wide trends in the mean weight of legal-size Giant Crab caught in the GCF between 2000 and 2020.

3.7. Spawning female abundance

State-wide seasonal trends in the number of spawning females reported in the catch steadily increased from 2000 to 2016, reaching a maximum of 0.15 spawning females/potlift in 2016 (Figure 8). Since 2016, the number of spawning females reported has decreased by 54.6%, and in 2020 the index was 0.07 spawning females/potlift (Figure 8).

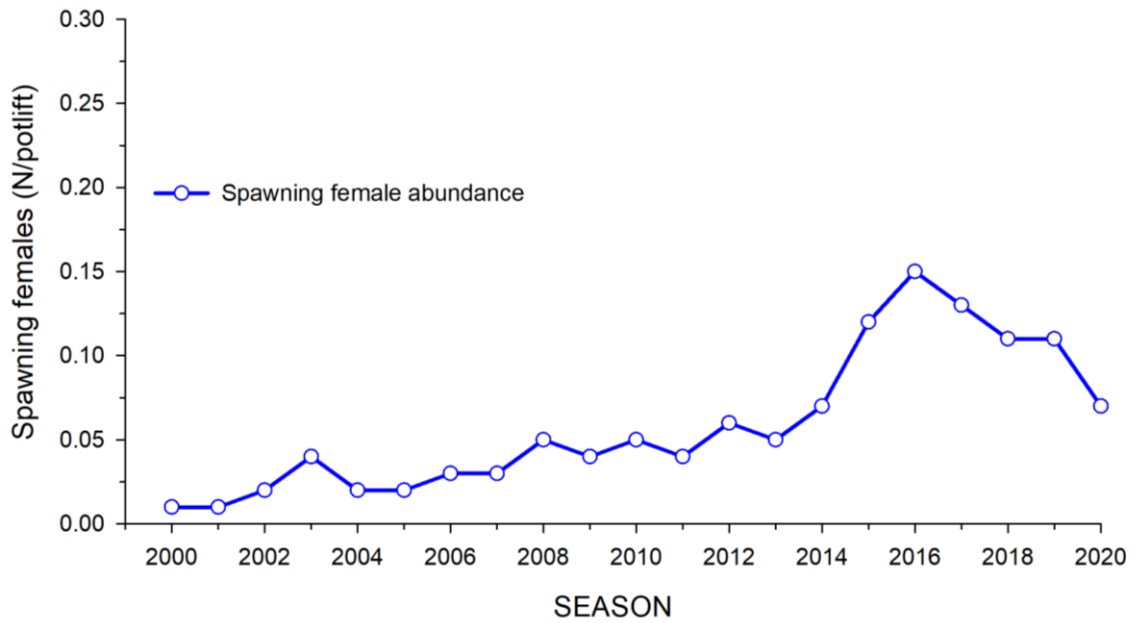


Figure 8. State-wide trends in Giant Crab female spawning abundance in the GCF between 2000 and 2020.

4. SUMMARY

4.1. Stock status

The 2020 season assessment of the South Australian Giant Crab stock builds on previous stock assessments for this species (Currie and Ward 2005; Currie *et al.* 2006; Currie 2008; Currie and Ward 2009; Currie 2010; Currie 2011a, b; Chick 2013; Stobart 2014; McLeay 2015; 2016; 2018; 2019; 2020; 2021). The assessment is supported by information on the species' fisheries biology and stock structure (Levings *et al.* 2001), implementation of recommendations made in SARDI's 2017 assessment of data sources and PIs for the GCF (McLeay 2018), and the management policy for the GCF (PIRSA 2018).

The long-lived and slow-growth life-history characteristics of the Giant Crab render the species susceptible to recruitment overfishing. Catch declines have been reported across core areas of the species' distribution in Victoria and Tasmania, despite multiple TACC reductions in these states (Stewardson *et al.* 2018). In South Australia, catches in 1997 and 1998 were up to 54% higher than the TACC of 22.1 tonnes set since 2000, and catches in the last eight seasons are now among the lowest recorded since a TACC was introduced.

In 2020, the total catch in the GCF was 15.4 t. This was the second lowest catch on record since TACC was implemented, comprising 69.7% of the TACC of 22.1 t, and is the eighth consecutive season that the TACC has not been fully taken. The amount of targeted catch reported in 2020 was also the third lowest on record (14.8 t). Reductions in the amount of catch reported in recent seasons reflect the reduced catches reported in the SZ since 2005 (Note, catches by zone are not able to be reported due to data confidentiality requirements).

Estimates of CPUE of legal-size Giant Crab declined in South Australia from 2008 to 2015 but have remained relatively stable since at >80% of the Target Reference Point ($RP_{\text{targ}} = 2.60$ kg/potlift). Although the abundance of the Giant Crab stock across South Australia remains at relatively stable levels recently, there is some uncertainty in relation to the future performance of the GCF due to the biological susceptibility of Giant Crab populations to recruitment overfishing, and declining trends in catch and pre-recruit abundance relative to historic levels.

Within the management policy for the GCF, the status of the Giant Crab stock is defined in relation to how the primary biological PI, five-year average commercial CPUE of legal-size Giant Crab, aligns against its Trigger Reference Point (RP_{trig}) (PIRSA 2018). In 2020, the estimate of five-year commercial CPUE of legal-size Giant Crab was 2.10 kg/potlift. This estimate is 7.7% above the RP_{trig} . (1.95 kg/potlift). Under the decision rule within the management policy to categorise the Giant Crab stock status in South Australia, the stock is classified as '**sustainable**' in 2020 (PIRSA 2018).

4.2. Future research needs

Under the management policy for the GCF, the classification of stock status is determined using a single biological PI, five-year average commercial CPUE of legal-size Giant Crab, with reference points for this PI based on targeted catch and effort information from 2000/01 to 2009/10. The reliance on fishery-dependent data, and CPUE as the primary PI to inform stock status reflects the relatively small size of the fishery, and it should be noted that CPUE can potentially be influenced by gear selectivity or changes in fishing patterns, fleet efficiency or fleet dynamics (Quirijns *et al.* 2008; Maunder *et al.* 2006). In addition, this assessment does not consider the period immediately prior to the introduction of the TACC when catches were higher. Consequently, the current assessment is made in relation to a CPUE or stock biomass 'baseline' that may be different to that existing prior to 2000.

These sources of uncertainty may be addressed in the future. Firstly, it is recommended that statistical modelling procedures, such as Generalised Linear Modelling, should be developed to standardise estimates of commercial CPUE of legal-size Giant Crab to account for temporal, spatial, environmental and fishery-related factors that may influence CPUE. Secondly, future stock assessments may be enhanced through the implementation of cost-effective methods that acquire additional information to assess stock size. Funding through the Fisheries Research and Development Corporation (FRDC) has recently been provided to assess the suitability of electronic monitoring (on-board cameras) in collecting additional biological information (e.g. length, sex, survival) that can be applied in population models to enhance Giant Crab stock assessment across its entire fished distribution (FRDC Project 2019/114 - Giant Crab Enhanced Data Collection - Innovative approaches to enhance data collection in the Victorian, South Australian and Tasmanian Giant Crab fisheries). The project is being led by the Victorian Fisheries Authority in collaboration with scientists from South Australia and Tasmania and is due for completion in January 2023. If these improvements to data collection and population modelling approaches can be realised, they will assist in refining stock assessment and management approaches for Giant Crab in South Australia and nationally.

5. REFERENCES

- Chick, R.C (2013). South Australian Giant Crab (*Pseudocarcinus gigas*) Fishery. Status Report 2011/2012. Status Report to PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2011/000332-3. SARDI Research Report Series No. 691. 20p.
- Currie, D.R. and Ward, T.M. (2005). South Australian Giant Crab (*Pseudocarcinus gigas*) Fishery. Fisheries Assessment Report to PIRSA. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. RD04/0215-2. 27p.
- Currie, D.R., Mayfield, S., McGarvey, R. and Gardner, C. (2006). South Australian Giant Crab (*Pseudocarcinus gigas*) Fishery. Fisheries Assessment Report for PIRSA. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. RD04/0215-3. SARDI Research Report Series 137.
- Currie, D.R. (2008). South Australian Giant Crab (*Pseudocarcinus gigas*) Fishery. Status Report for PIRSA Fisheries. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2008/000067-1. SARDI Research Report Series 268.
- Currie, D.R. and Ward, T.M. (2009). South Australian Giant Crab (*Pseudocarcinus gigas*) Fishery. Fisheries Assessment Report for PIRSA. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2007/000698-2. SARDI Research Report Series 345.
- Currie, D.R. (2010). South Australian Giant Crab (*Pseudocarcinus gigas*) Fishery Status Report 2008/09. Status Report to PIRSA Fisheries. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2007/000698-3. SARDI Research Report Series 427.
- Currie, D.R. (2011a). South Australian Giant Crab (*Pseudocarcinus gigas*) Fishery Status Report 2009/10. Fishery Status Report to PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2011/000332-1. SARDI Research Report Series 568.
- Currie, D.R. (2011b). South Australian Giant Crab (*Pseudocarcinus gigas*) Fishery Status Report 2010/11. Fishery Status Report to PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2011/000332-2. SARDI Research Report Series 591.
- FRDC (2020). How are the Status of Australian Fish Stock Reports done? <https://www.fish.gov.au/about/how-are-the-status-of-australian-fish-stock-reports-done>. Accessed 10/01/2020.
- Kailola, P.J., Williams, M.J., Stewart, P.C., Reichelt, R.E., McNee, A. and Grieve, C. (1993). Australian Fisheries Resources. Bureau of Resource Science and Fisheries Research and Development Corporation, Canberra. p. 422.
- Levings, A., Mitchell, B. D., Heeren, T., Austin, C. and Matheson, J. (1995). Fisheries Biology of the Giant Crab (*Pseudocarcinus gigas*, Brachyura, Oziidae) in Southern Australia. In: High Latitude Crabs: Biology Management and Economics. University of Alaska Sea Grant College Program Report No.96-02, Alaska. pp. 126-151.

Levings, A., Mitchell, B.D., McGarvey, R., Mathews, J., Laurenson, L., Austin, C., Heeron, T., Murphy, N., Miller, A., Rowsell, M. and Jones, P. (2001). Fisheries Biology of the Giant Crab *Pseudocarcinus gigas*. Final report to the Fisheries Research and Development Corporation, Australia, for projects 93/220 & 97/132. Deakin University.

Maunder, M.N., Sibert, J.R., Fonteneau, A., Hampton, J., Kleiber, P. and Harley S.J. (2006). Interpreting catch per unit effort data to assess the status of individual stocks and communities. *ICES Journal of Marine Science*, 63: 1373-1385.

McLeay, L. (2015). South Australian Giant Crab (*Pseudocarcinus gigas*) Fishery Status Report 2013/14. Fishery Status Report to PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2011/000332-5. SARDI Research Report Series No. 834. 17pp.

McLeay, L. (2016). South Australian Giant Crab (*Pseudocarcinus gigas*) Fishery Status Report 2014/15. Fishery Status Report to PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2011/000332-6. SARDI Research Report Series No. 895. 16pp.

McLeay, L. (2018). Stock Status Report for the South Australian Giant Crab (*Pseudocarcinus gigas*) Fishery in 2016/17. Fishery Status Report to PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2011/000332-7. SARDI Research Report Series No. 976. 19pp.

McLeay, L. (2019). Stock Status Report for the South Australian Giant Crab (*Pseudocarcinus gigas*) Fishery in 2017/18. Fishery Status Report to PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2011/000332-8. SARDI Research Report Series No. 1009. 19pp.

McLeay, L. (2020). Stock Status Report for the South Australian Giant Crab (*Pseudocarcinus gigas*) Fishery in 2018/19. Fishery Status Report to PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2011/000332-9. SARDI Research Report Series No. 1050. 19pp.

McLeay, L. (2021). Stock Status Report for the South Australian Giant Crab (*Pseudocarcinus gigas*) Fishery in 2019/20. Fishery Status Report to PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2011/000332-10. SARDI Research Report Series No. 1090. 20pp.

Piddocke, T. Ashby, C., Hartmann, K., Hesp, A. Hone, P., Klemke, J., Mayfield, S., Roelofs, A., Saunders, T., Stewart, J., Wise, B. and Woodhams, J. (eds) (2021). Status of Australian fish stocks reports 2020, Fisheries Research and Development Corporation, Canberra. www.fish.gov.au/about/what-are-the-status-of-australian-fish-stock-reports.

PIRSA (2009). Ecological Assessment of the South Australian Giant Crab (*Pseudocarcinus gigas*) Fishery. Re-assessment report prepared for Commonwealth Department of the Environment, Water Heritage and the Arts, for the purposes of part 13 and 13 (A) of the *Environment Protection and Biodiversity Conservation Act 1999*.

PIRSA (2015a). South Australian Fisheries Harvest Strategy Policy. Primary Industries and Regions South Australia. Adelaide, Australia.

PIRSA (2015b). Guidelines for implementing the South Australian fisheries harvest strategy policy. Primary Industries and Regions South Australia. Adelaide, Australia.

PIRSA (2018). Management Policy for the South Australian Commercial Giant Crab Fishery. Primary Industries and Regions South Australia. Adelaide, Australia.

Quirijns, F.J., Poos, J.J. and Rijnsdorp, A.D. (2008). Standardizing commercial CPUE data in monitoring stock dynamics: Accounting for targeting behaviour in mixed fisheries. *Fisheries Research*. 89(1): 1-8.

Sloan, S. (2002). A report prepared for Environment Australia on the Management of the South Australian Giant Crab (*Pseudocarcinus gigas*) Fishery. For the purposes of section 303FN (Approved Wildlife Trade Operation) of the *Environment Protection and Biodiversity Conservation Act 1999*.

Sloan, S. (2003). Ecological Assessment of the South Australian Giant Crab (*Pseudocarcinus gigas*) Fishery. Assessment Report prepared for the Commonwealth Department of the Environment and Heritage, against the 'Guidelines for the ecologically sustainable management of fisheries'. For the purposes of Part 13 and 13(A) of the *Environment Protection and Biodiversity Conservation Act 1999*.

Sloan, S.R., Smith, A.D.M, Gardner, C., Crosthwaite, K., Triantafillos, L., Jeffries, B. and Kimber, N. (2014). National Guidelines to Develop Fishery Harvest Strategies. FRDC Report – Project 2010/061. Primary Industries and Regions, South Australia, Adelaide.

Stewardson, C., Andrews, J., Ashby, C., Haddon, M., Hartmann, K., Hone, P., Horvat, P., Klemke, J., Mayfield, S., Roelofs, A., Sainsbury, K., Saunders, T., Stewart, J., Nicol, S. and Wise, B. (2018). Status of Australian Fish Stocks reports 2018. Fisheries Research and Development Corporation, Canberra.

Stobart, B. (2014). South Australian Giant Crab (*Pseudocarcinus gigas*) Fishery Status Report 2012/13. Fishery Status Report to PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2011/000332-4. SARDI Research Report Series No. 763. 15p.