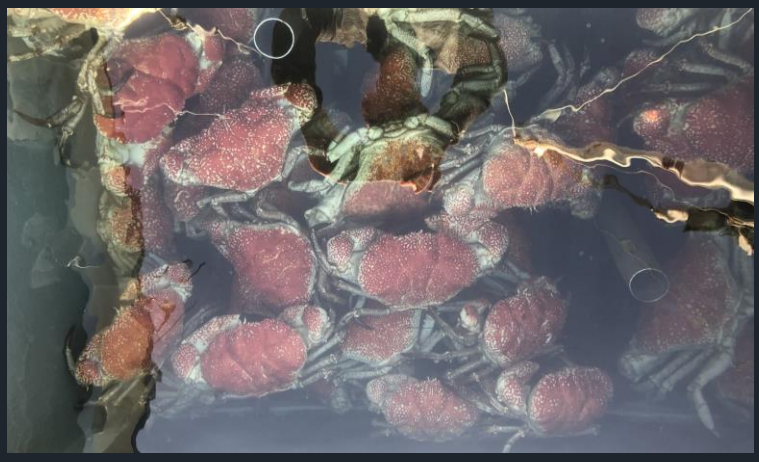
Victorian Fisheries AUTHORITY

Victorian Giant Crab Fishery

Stock Assessment Report

2021/2022 Season



We're hooked on SAFETY

Giant Crab - Pseudocarcinus gigas

Printed by Victorian Fisheries Authority, Melbourne, Victoria

Preferred way to cite this publication:
VFA (2023) 2021/22 Victorian Giant Crab Stock Assessment. Victorian Fisheries Authority Report Series No.37

ISBN 978-0-6455802-8-0 (Print)

ISBN 978-0-6455802-9-7 (Online)

Contact Details:
Victorian Fisheries Authority
1 Spring Street
Melbourne VIC 3001

Copies are available from the website www.vfa.vic.gov.au
For more information, contact the Customer Service Centre on 136 186.

Accessibility
If you would like to receive this publication in an alternative format, please telephone the Customer Service Centre on 136 186, email customer.service@ecodev.vic.gov.au, or via the National Relay Service on 133 677, www.relayservice.com.au.
This document is also available on the internet at www.vfa.vic.gov.au

Disclaimer
This publication may be of assistance to you but the State of Victoria and its employees do not guarantee that the publication is without flaw of any kind or is wholly appropriate for your particular purposes and therefore disclaims all liability for any error, loss or other consequence which may arise from you relying on any information in this publication.

Contents

Victorian Giant Crab Fishery

Stock Assessment Report for the 2021/22 Season

Executive Summary

In 2021/22, the total allowable commercial catch (TACC) for giant crab was 7.5 tonnes. The total landed catch during the TACC season (1 July 2021 to 30 June 2022) was 7.6 tonnes, which was entirely targeted. Note that the slight catch in excess of the TACC in 2021/22 has been deducted from the 2022/23 TACC as part of the normal operating procedure. During the fishing year (16 November 2021 to 14 September 2022) the catch was 7.0t.

In the previous 2020/21 assessment a large correction to effort data was applied that fundamentally changed the perspective of the CPUE trend from 2014/15 to 2020/21. This resulted in a significant reduction of CPUE and the understanding of the current stock status. The corrected data indicated that CPUE declined in 2020/21 to 0.55 kg/ adjusted pot day, which is just above the limit reference point.

The 2021/22 CPUE increased significantly to 0.95kg per adjusted pot day – well above the limit reference point. This is a very positive sign, but the strength of this evidence must be viewed with caution as significant changes in fishing operators occurred. Consequently, the change in CPUE may be more a result in the change of fishing activities than a change in the stock. The changes in the fishing fleet cannot be corrected/adjusted for due to the small nature of the fishery and the correction already applied to logbook data from 2014-2020. Given the slow growth of giant crab, such a rapid increase in biomass is unlikely. If this was due to a particularly strong age class growing up above the size limit, it would also be expected that mean weight would have decreased substantially – which did not occur. The CPUE in this year is reassuring, however further data is required (including length-frequency data) to provide an additional indicator of the stock status. In future when a longer time series of CPUE data is available from the new operators this will again provide insight into biomass trends.

Note that although a revised harvest strategy is in the process of being developed this is still in the early stages and has not yet been finalised. As such, this assessment compares the fishery against existing reference points using the existing methodology.

Introduction

This document assesses the Victorian component of the giant crab (*Pseudocarcinus gigas*) stock. Giant crabs have been caught as by-product of rock lobster fishers operating in deeper waters from the early to mid-1900s. These early catches were sporadic, non-targeted and of limited value. In the early 1990s a substantial live market in Asia, Melbourne and Sydney was established. This significantly increased the value of giant crab and resulted in extensive targeting. The combined Victorian and Tasmanian catch peaked in the mid-1990s and likely exceeded 400t per annum. Due to the long-life history of giant crabs, these high catches resulted in rapid depletion of the stock. There is insufficient data available to estimate the biomass of the Victorian component of the stock and how low this fell, but analyses indicate that the Tasmanian component of the stock likely dropped below 10% of the unfished biomass at the peak level of depletion during the last decade.

In both Tasmania and Victoria the low CPUE arising from stock depletion resulted in a rapid reduction of fishing effort and catch, however the remaining fishing activity was sufficient to continue decreasing the CPUE in Tasmania and retaining it at low levels in Victoria. Consequently, a TACC was introduced in 2000/01 in Victoria (see Table 1) and at a similar time in Tasmania. Since the introduction of the TACC, the Victorian CPUE (which is the primary biomass indicator) has remained above the trigger and limit reference points in the current harvest strategy. The Tasmanian component of the stock reached a record low CPUE in 2019/20 but has risen slightly in the subsequent two years following from significant TACC reductions.

Due to the limited scale of the Victorian fishery there is no routine fishery independent monitoring program and the data available to conduct the assessment is limited. The assessment is consequently focussed on data collected from mandatory daily logbook returns. In 2018/19 an industry based voluntary length-frequency data collection commenced which has provided promising initial data and is likely to become an important component of the stock assessment in future years, however no new length-frequency data has been available since 2019/20 and hence it has not been possible to undertake new analyses of length-frequency data.

A FRDC project to address the lack of length frequency data across the giant crab fisheries is currently underway. This project is titled "*Giant Crab Enhanced Data Collection - Innovative approaches to enhance data collection in the Victorian, South Australian and Tasmanian Giant crab fisheries*" (FRDC 2019-114). It aims to develop imaging systems and hardware to facilitate onboard length-frequency data collection across fishing fleets in all three jurisdictions. This would provide a substantial development in data collection and enable new assessment and management options.

Catch data

The total landed catch of giant crab by all fishers in 2021/22 quota season (1 July to 30 June) was 7.6t which was entirely targeted (Figure 1). The slight over-run in catch during that season has been deducted from the TACC set in the following season.

Reference points for this fishery are based on the fishing year (16 November-14 September) - during this period the catch was 7.0t.

Table 1: Giant crab total allowable commercial catch by quota year between 2001–02 and 2022–23.

Year	Quota Season	TACC Set (t)
2001-02	16 Nov – 31 Mar	25
2002-03	1 Apr – 31 Mar	25
2003-04	1 Apr – 31 Mar	25
2004-05	1 Apr – 31 Mar	25
2005-06	1 Apr – 31 Mar	25
2006-07	1 Apr – 31 Mar	25
2007-08	1 Apr – 31 Mar	25
2008-09	1 Apr – 31 Mar	25
2009-10	1 Apr – 31 Mar	25
2010-11	1 Apr – 30 Jun	31
2011-12	1 Jul – 30 Jun	18
2012-13	1 Jul – 30 Jun	12
2013-14	1 Jan 14 – 30 Jun	9
2014-15	1 Jul - 30 Jun	10.5
2015-16	1 Jul - 30 Jun	10.5
2016-17	1 Jul - 30 Jun	10.5
2017-18	1 Jul – 30 Jun	10.5
2018-19	1 Jul – 30 Jun	10.5
2019-20	1 Jul – 30 Jun	10.5
2020-21	1 Jul – 30 Jun	10.5
2021-22	1 Jul – 30 Jun	7.5
2022-23	1 Jul – 30 Jun	7.5

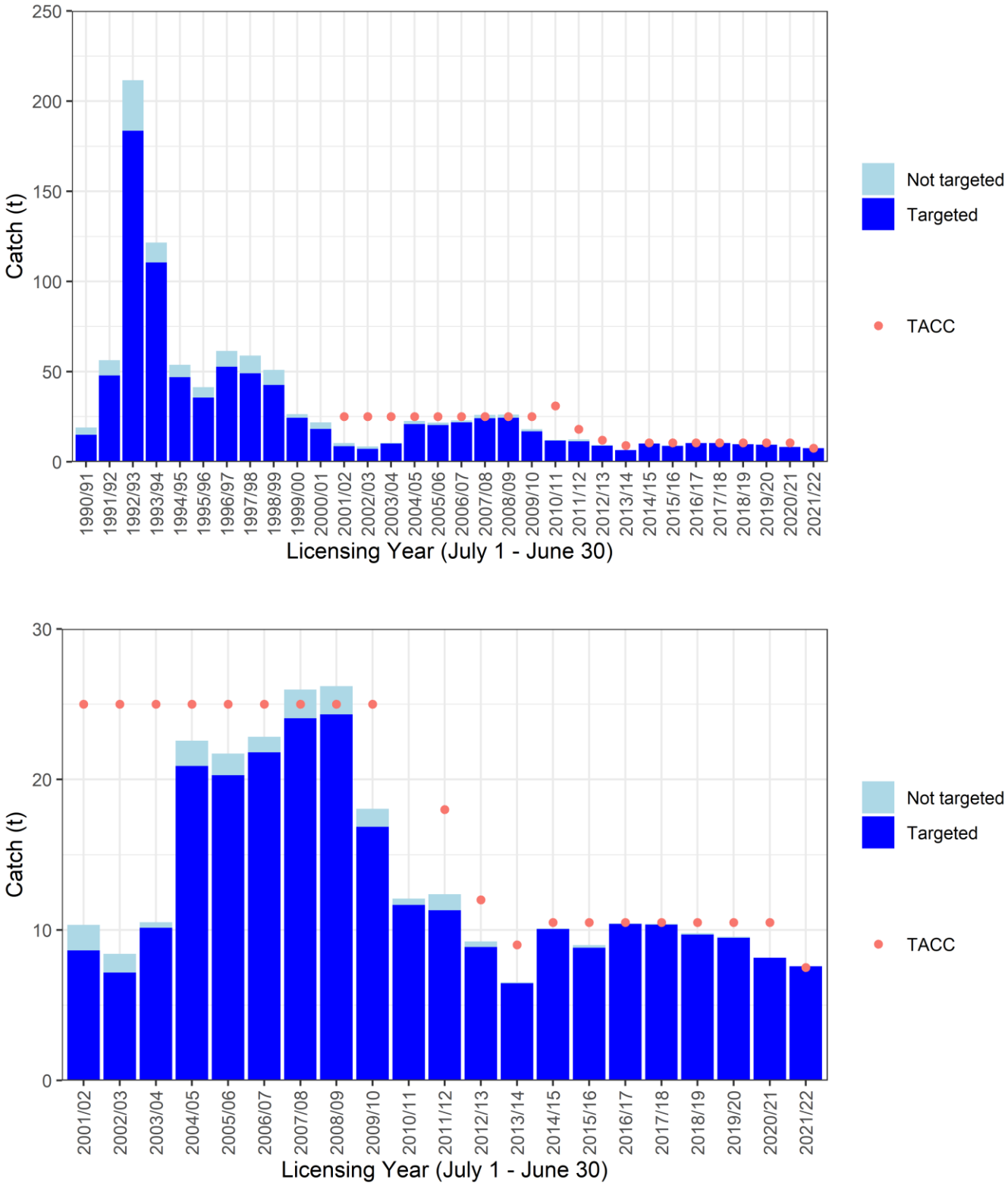


Figure 1: Total catch (t) and targeted catch history for the Victorian Giant Crab Fishery. Top: from 1990 onwards, bottom: detailed view of period since quota commencement. Red dots indicate the TACC which was first introduced for the 2001/02 season.

CPUE Analysis

Background

Giant crab CPUE is the primary biomass indicator used to assess the status of this fishery. A major difficulty in calculating historic CPUE arises from the catch being a mix of by-catch and targeted fishing. This is further complicated as, historically, targeting was poorly documented and the proportion of by-catch versus targeted catch has varied through time.

Separate giant crab and southern rock lobster fishing returns were mandated with the introduction of quota management in November 2001. For returns prior to April 1998, the target species was not specified, and the effort targeted at giant crab was separated from effort targeted at southern rock lobster on the basis of two criteria. That is, where pots were set at depths greater than 140 metres or where more than 70% of the combined catch of these two species was giant crab, all of the effort was assumed to be targeted at giant crab.

Following the introduction of quota management, separate logbooks for the giant crab and southern rock lobster fisheries led to some inconsistencies in the reporting of the target species. This resulted in a reduced giant crab catch per unit effort (CPUE) overall, which was inconsistent with the observations of the most active fishers. A new measure of CPUE was therefore introduced. This measure involves the targeted catch and effort for only those fishers landing significant amounts of giant crab in a fishing year and with an extended record of crab fishing.

Data filtering

The Giant Crab Fishery requires careful data filtering, as a substantial portion of the catch through time has been taken in conjunction with rock lobster fishing and sporadically by small catchers. To obtain data that is most representative of the underlying biomass, it is therefore important to filter the data. The following criteria have been used for over 6 years with some minor changes:

- A fisher must exceed 500kg of giant crab catch in a fishing year for their data from that year to be included
- A fisher must have >200 records in the database (giant crab or lobster) over all years
- A fisher must have recorded they are targeting giant crab or both
- Removal of identified erroneous records.

Prior to the 2020/21 assessment, the first two criteria were 1000kg and >300 records. The relaxation of the criteria was necessary as the old criteria would have excluded key data and prevented calculation of a meaningful CPUE index for this year. To provide a consistent index these criteria have been applied across all years. This has altered the exact values of historic CPUE but not the trends or overall impression of stock status.

It should be noted that additional data filtering changes are under consideration through the development of the new harvest strategy. However utilisation of these requires updating of the associated reference points as they fundamentally alter what the CPUE index is representing. Consequently they are not used here.

Soak time correction

Giant crab targeted CPUE is expressed as kg per 24-hour period that a pot was set (soak days). Including a measure of soak time in the CPUE calculation is important because the pots are usually left to soak for several days and catch initially increases with soak time. Prior to 2001/02, soak days were estimated by counting days between entries in the daily logbook, with the maximum soak days in this calculation capped at seven days (after which time pots generally cease to attract additional crabs as the bait is depleted). Logbooks were modified during the 2001/02 fishing year to collect soak days directly.

A review undertaken by the Victorian Rock Lobster and Giant Crab Resource Assessment Group highlighted that a four-day soak-time cap was more appropriate, and that this relationship was non-linear. It was found that the

catch increases by 38% every additional day that a pot is left in the water up to a maximum of four days total soak time. Consequently, a relationship between catch and soak time was introduced in the CPUE calculation. This substantially altered the CPUE time series as typical soak times had changed in recent years. This relationship was re-analysed in 2017; whilst the current coefficient (38% increase in catch per day) gives the best fit between catch and soak-time, there is substantial uncertainty around this relationship and the CPUE time series is sensitive to the relationship used. Coupled with the small number of operators in this fishery, this indicates that caution should be used when interpreting the CPUE time series.

Effort Correction

In early 2021, after the release of the 2019/20 assessment report, it became evident that a large correction to effort data for two fishers was required due to inconsistent effort reporting for both soak time and potlifts. This correction is applied from 2014/15 to April 2021. It is unclear how appropriate it is for earlier years in that period, but the corrected effort (and consequent CPUE value) from 2020/21 onwards is considered reliable. As such, the decline from 2013/14 to 2020/21 is also considered as reliable as can be expected given the other aspects of the dataset.

Impact of size limit change

The size limit for male crabs was reduced to 140mm in August 2019. This was shortly before the end of the fishing season, consequently only 12 crabs were landed within the new size limit in 2018/19 assessment period with negligible impact on CPUE. In 2019/20 15% of landed crabs were between 140mm and 150mm. In 2020/21 this fell to 7%.

In the 2019/20 assessment a correction was applied to provide a CPUE trends across a consistent size range. In the 2020/21 and 2021/22 (this) assessment this correction is not considered, as the effect is secondary to the effort correction. Furthermore, restricting CPUE as an indicator of legal-size biomass is consistent with the intent of monitoring exploitation rate. This approach is also proposed for the harvest strategy under development.

CPUE trend

The targeted CPUE in 2021/22 was 0.95 kg / adjusted pot day (Figure 2 , Table 2). This is a substantial increase from the previous year and close to the recent peak (2012/13) of 1.02kg / adjusted pot day. If representative of the stock, this would be a reassuring sign (although still 25-30% lower than during the peak from the early to late 2000s). However, the fishing fleet has changed considerably in the last two seasons with a change in the key operators. Due to the small number of operators, the lack of overlapping fishing by them, and the extended period of questionable effort data, it is not possible to provide a meaningful standardization across this period. This is purely due to the restructure that took place and not the quality of the data provided by the new operators. In future years, as a longer time series of data becomes available from the new operators, the trends in CPUE will provide greater insight.

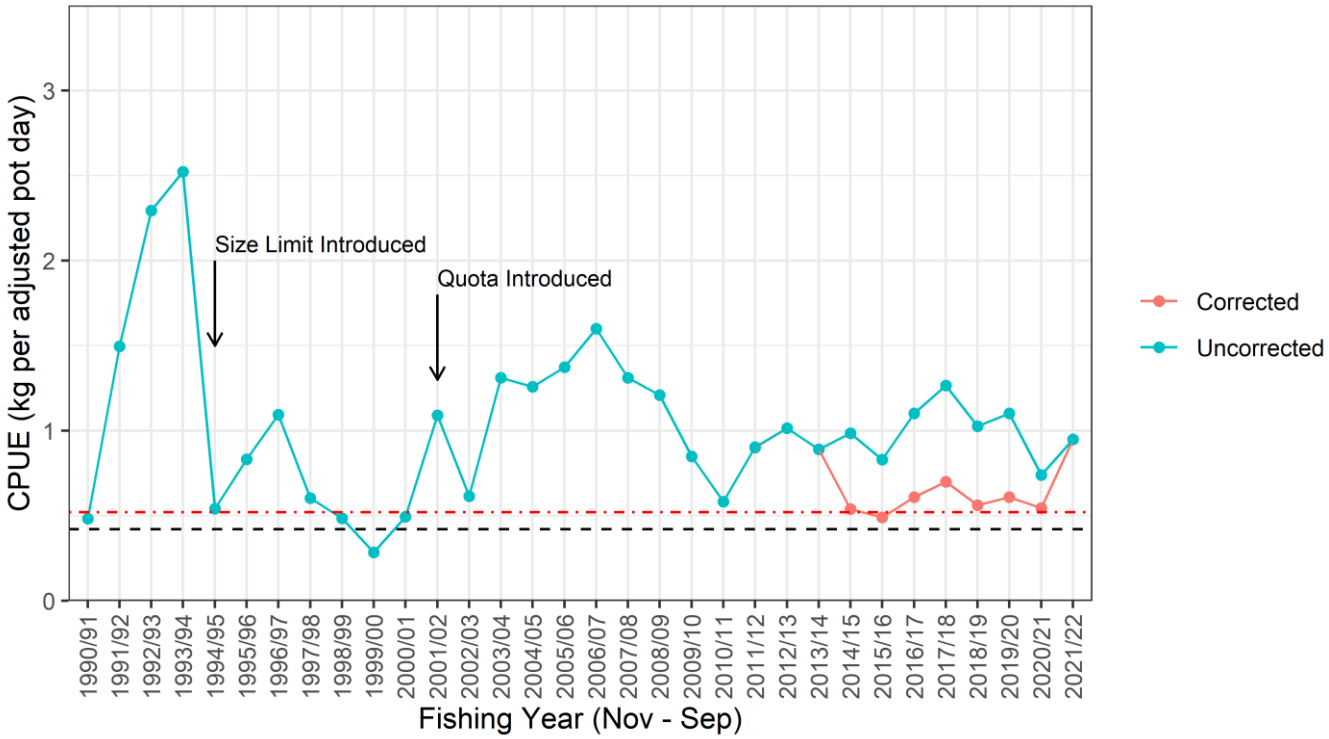


Figure 2: Targeted CPUE of giant crab (kg/adjusted pot day) corrected for a maximum of 4 days soak, with a slope of 0.38 for all fishers landing > 500kg of giant crab in a given year and with > 200 days of fishing overall. Dashed red line and solid black line represent limit and trigger reference points, respectively. The blue line indicates data that has not been corrected for inconsistent effort reporting (from 2014/15 to April 2021) whilst the red line shows the corrected data which corresponds to the best estimate of CPUE during this period.

Table 2: Giant crab total catch and targeted CPUE (kg/adjusted pot day) during fishing years (16 November–14 September) from 1990/91 to 2021/22.

Fishing Year	Total Catch (t)	CPUE
1990/91	18.9	0.45
1991/92	56.7	1.47
1992/93	226.8	2.19
1993/94	122.3	2.09
1994/95	38.8	0.51
1995/96	44.4	0.83
1996/97	68.7	0.98
1997/98	51.0	0.58
1998/99	50.4	0.50
1999/00	25.3	0.29
2000/01	19.7	0.52
2001/02	9.5	1.18
2002/03	8.4	0.63
2003/04	10.5	1.33
2004/05	22.7	1.28
2005/06	21.7	1.37
2006/07	20.3	1.60
2007/08	27.6	1.31
2008/09	27.2	1.21
2009/10	16.4	0.85
2010/11	11.3	0.58
2011/12	12.6	0.90
2012/13	8.8	1.02
2013/14	6.5	0.89
2014/15	10.5	0.54
2015/16	10.0	0.49
2016/17	10.0	0.61
2017/18	10.0	0.70
2018/19	9.2	0.56
2019/20	11.7	0.61
2020/21	7.0	0.55
2021/22	7.0	0.95

Size Structure

The average size of landed crabs is available through landings and daily catch reports. Consequently, a full time series of this data is available throughout the duration of the fishery. This data has remained relatively consistent since 2006/07. The decrease in mean weight in 2019/20 is influenced by the reduction in the male size limit in that year. The mean weight in 2020/21 was consistent with that in 2019/20. A slight decline in mean weight was observed in 2021/22, however this occurred around the same time as a major change in the key operator in the fishery. Hence it is unclear whether this small change in mean weight is indicative of a change to the stock or change in fishing operation.

A new length-frequency data collection program commenced in 2018/19, which resulted in the measurement of 986 crabs. However, no new data has been collected since that year.

When compared to previous measurements from the mid and late 2000s, there was a broader size range of crabs in 2018 and 2019, particularly males (Figure 4). In combination with similar CPUE levels, this suggests a lower exploitation rate is being applied to the population. However, the lower frequency of 160-169mm and 170-179mm animals is either inconsistent with this view or indicative of a period of comparatively low recruitment.

The interpretation must be treated with caution due to the small nature of the fishery. Furthermore, comparison with historical data can be misleading due to the substantial changes that have occurred between the two length-frequency measurement data sets. A consistent approach to the monitoring of length-frequency data would provide greater insight in future assessments.

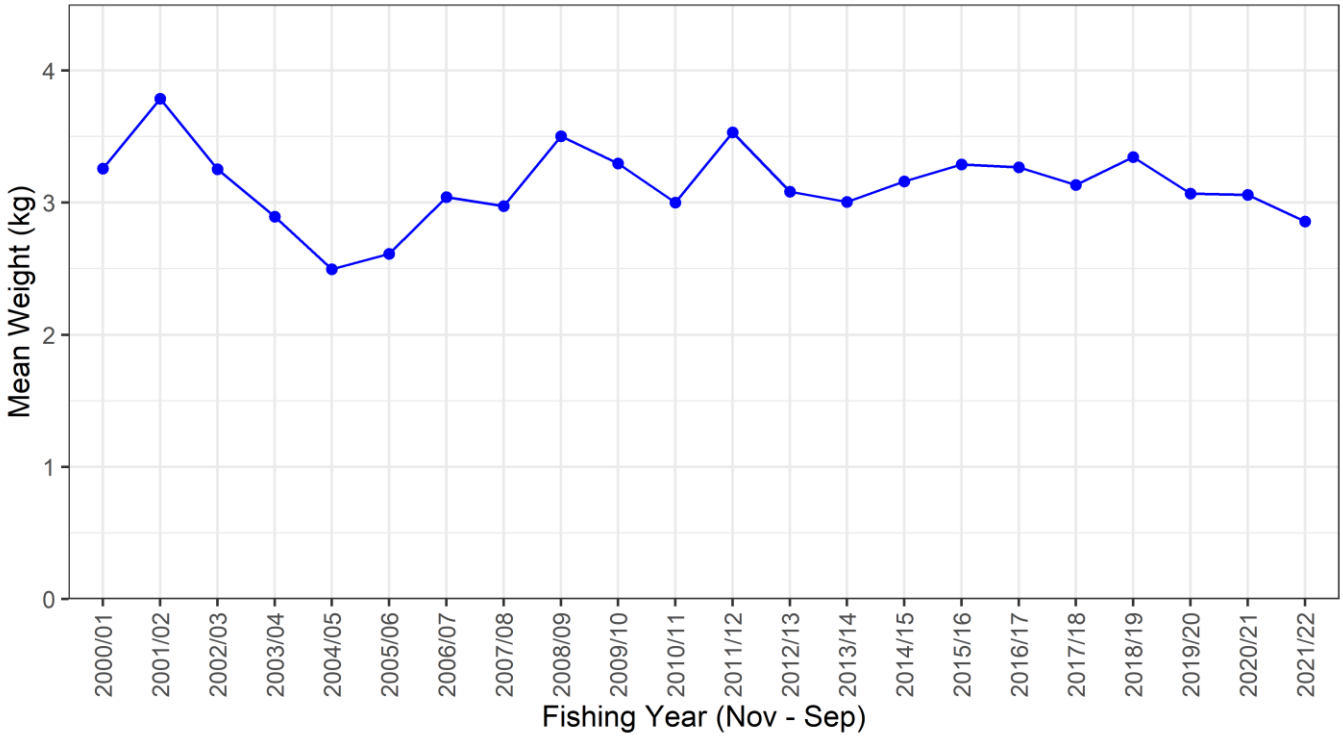


Figure 3: Mean weight (kg) per landed crab for all fishers from the 2000/01 fishing year onwards.

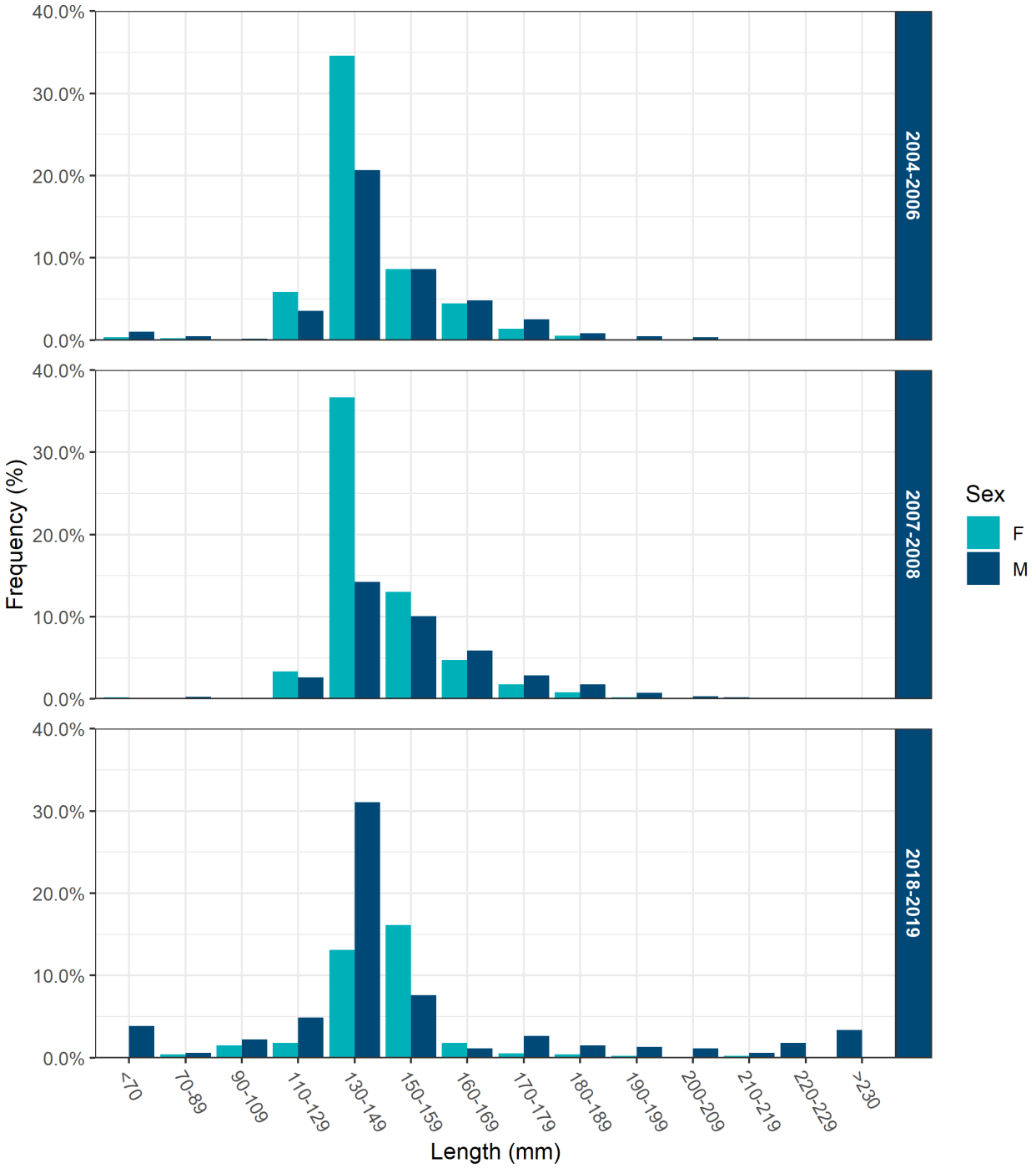


Figure 4: Length frequency measurements from the new industry-based data collection program (bottom) and data from previous data collection periods binned using the same size categories. Note that crabs measuring less than 150mm are categorised into 20mm bins and above 150mm into 10mm bins.

Evaluation

The fishery was evaluated by comparing the biological stock performance indicator of targeted CPUE against the giant crab biological reference points (Figure 2). The reference points prescribed in the Giant Crab Management Plan (2010) are based on 'fishing year' (November–September) and include a targeted CPUE limit reference point (mean for the 3-fishing-year period from 1998/99 to 2000/01) of 0.52 kg/ adjusted pot day and a trigger reference point (80% of limit reference point) of 0.42 kg/ adjusted pot day.

The calculated targeted CPUE in 2021/22 was 0.95kg/ adjusted pot day, this was above the limit reference point (0.52 kg/ adjusted pot day) and consequently also the trigger reference point. This represents a substantial CPUE increase, however the low CPUE value over recent years, coupled with the uncertainty in this data causes ongoing concern for the stock. The uncertainty in the last two years is due to the industry restructure that has taken place. As a longer timeseries of CPUE data becomes available from the new operators, this will again provide insight into biomass trends.

There are no formal reference points associated with the additional length-frequency data collected in 2018/19. Development of an associated reference point may be desirable in the future, however several years of data are required to be able to obtain a consistently recorded time-series and determine an appropriate reference point.

Appendix 1: Historical events in the Giant Crab fishery

Year	Licensing Season	Significant event
From Early-Mid 1900s		Giant crabs caught as by-catch of rock lobster fishers operating in deep waters. Catches sporadic, non-targeted and of limited value.
Early 1990s		Substantial live market for giant crabs develops leading to extensive targeting
1993	1992-93	Peak giant crab catch
1994	1994-95	Legal minimum length of giant crab (both sexes) introduced at 150mm
2001	2001-02	Introduction of quota management Giant Crab Western zone
2004	2004-05	Introduction of Marine Protected Areas (MPAs) Western Zone
2019	2019-20	Male minimum legal length reduced to 140mm in August 2019
2021	2021-22	It became clear that the effort data in recent year was significantly under-estimated and that this error may extend back to the 2014-15 season

Victorian
Fisheries
AUTHORITY

We're hooked on
SAFETY