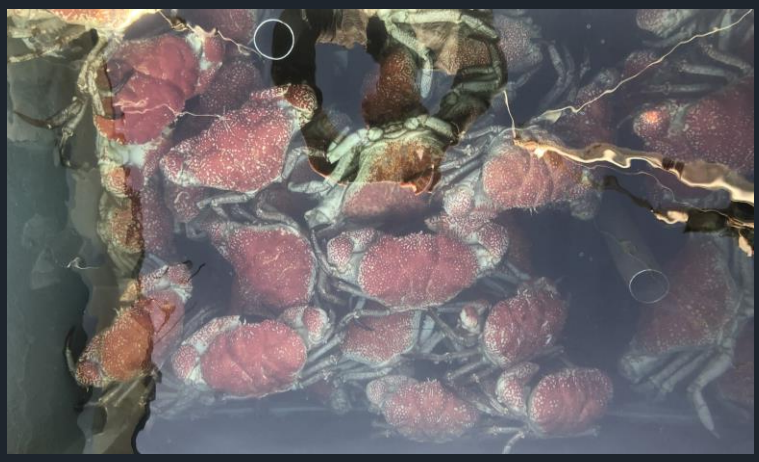
Victorian Fisheries AUTHORITY

Victorian Giant Crab Fishery

Stock Assessment Report

2023/2024 Season



We're hooked on SAFETY

Giant Crab - Pseudocarcinus gigas

Printed by Victorian Fisheries Authority, Melbourne, Victoria

Preferred way to cite this publication:
VFA (2025) 2023/24 Victorian Giant Crab Stock Assessment. Victorian Fisheries Authority Report Series No.36

ISBN 978-1-7635685-6-3 (Print)

ISBN 978-1-7635685-7-0 (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 2023/24 Season

Executive Summary

In 2023/24, the total allowable commercial catch (TACC) for giant crab was 7.5 tonnes. The total landed catch during the TACC season (1 July 2022 to 30 June 2023) was 7.0 tonnes, which was almost entirely targeted. During the fishing year (16 November 2022 to 14 September 2023) the catch was 6.6t.

CPUE decreased significantly from the recent 2022/23 high of 1.10 down to 0.66kg per adjusted pot day in 2023/24. This remains above the limit reference point and is at a similar level to the CPUE experienced prior to the previous two seasons. It is important to note that CPUE changes must be viewed with caution as significant changes in fishing operators have occurred recently. Consequently, the change in CPUE may be driven largely by the change of fishing activities rather 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 uncertainty in effort data from 2014-2020. Given the slow growth of giant crab, the observed rapid fluctuations in CPUE is unlikely to be driven primarily by biomass changes.

A revised harvest strategy is being developed and is included here for the first time. This harvest strategy utilises a three-year rolling average CPUE; this has been slowly and steadily increasing since 2020/21. This three-year running average falls between the proposed trigger and target reference points. Under the proposed harvest strategy this would indicate that the TACC remains unchanged.

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 retain 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 years following from significant TACC reductions. As with the Victorian fishery the Tasmanian data is limited and CPUE data is challenging to interpret.

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 provided promising initial data and was likely to become an important component of the stock assessment in future years. However, only limited length-frequency data has been collected 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 nearing completion. 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). The project has developed an imaging system 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 2023/24 quota season (1 July to 30 June) was 7.0t which was entirely targeted (Figure 1). Reference points for this fishery are based on the fishing year (16 November-14 September) - during this period the catch was 6.6t.

Table 1: Giant crab total allowable commercial catch by quota year between 2001–02 and 2023–24.

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
2023-24	1 Jul – 30 Jun	7.5
2024-25	1 Jul – 30 Jun	7.5

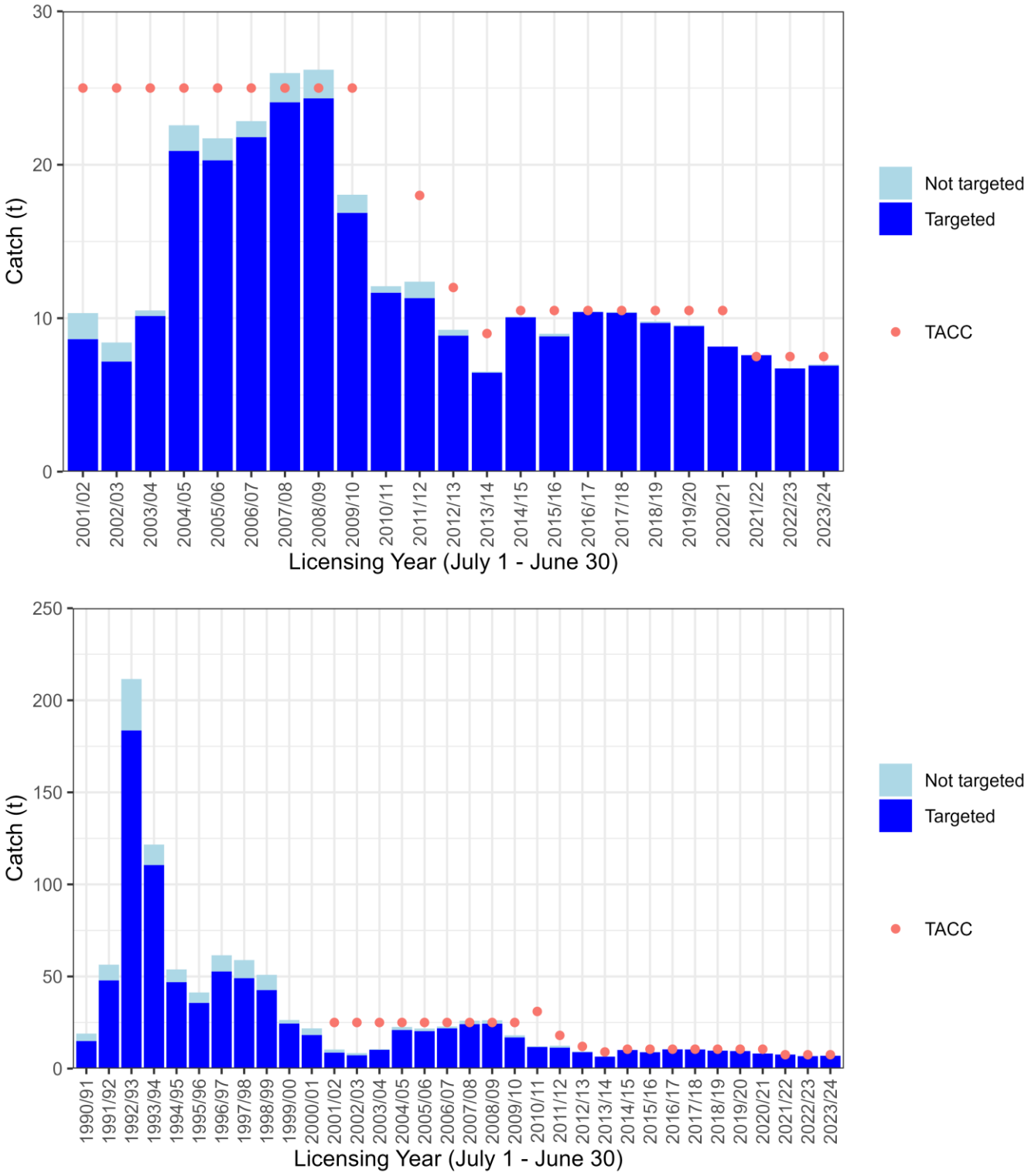


Figure 1: Total catch (t) and targeted catch history for the Victorian Giant Crab Fishery. Top: from 1990 onwards, bottom: detailed view of period since quota commencement. Red dots indicate the TACC which was first introduced for the 2001/02 season.

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 involving 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 pot-lifts. 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, hence the decline from 2013/14 to 2020/21 is also considered reliable (as reliable as can be expected given the other aspects of the dataset).

CPUE trend

The targeted CPUE in 2023/24 was 0.66 kg / adjusted pot day (Figure 2 , Table 2). This is a significant decline from the high level in the previous two years. However, CPUE remains above the current reference points.

The high level of variability in CPUE is unlikely to be representative of the stock as giant crab are slow growing and such large changes in biomass over short periods (increases and decreases) are unlikely to be possible. This was part of the motivation for proposing a three-year running mean for CPUE in the draft harvest strategy (Figure 3). This running mean has been slowly increasing since 2020/21. Under the new proposed harvest strategy, the three year running mean falls between the trigger and target indicating that the TACC should remain unchanged.

High-grading

Significant high grading to fish to demand was reported by fishers. A new approach was applied adjusting the CPUE by the proportion of legal-size crabs that were discarded (Figure 4). This provided a positive adjustment to recent CPUE and elevated the 2023/24 three year mean above the proposed target reference point.

This adjustment method assumes that the discarded giant crabs have the same mean weight as those retained. Demand is currently incentivizing discarding of large giant crabs. Consequently, this method is likely to be under-estimating the effect on CPUE and is thereby providing a precautionary CPUE value. The incompleteness of discarding records also contributes to underestimating the impacts of high-grading on CPUE.

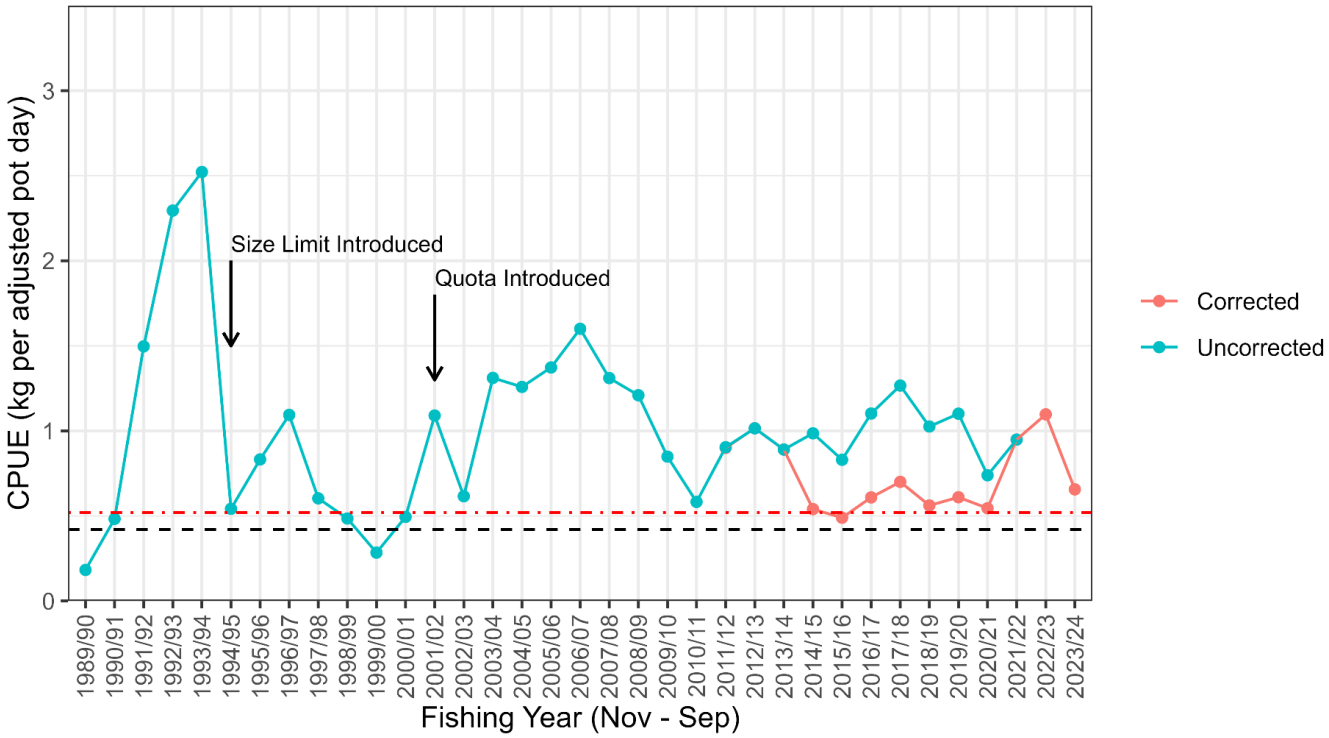


Figure 2: Targeted CPUE of giant crab (kg/adjusted pot day) corrected for a maximum of 4 days soak, with a slope of 0.38 for all fishers landing > 500kg of giant crab in a given year and with > 200 days of fishing overall. Dashed red line and solid black line represent limit and trigger reference points, 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.

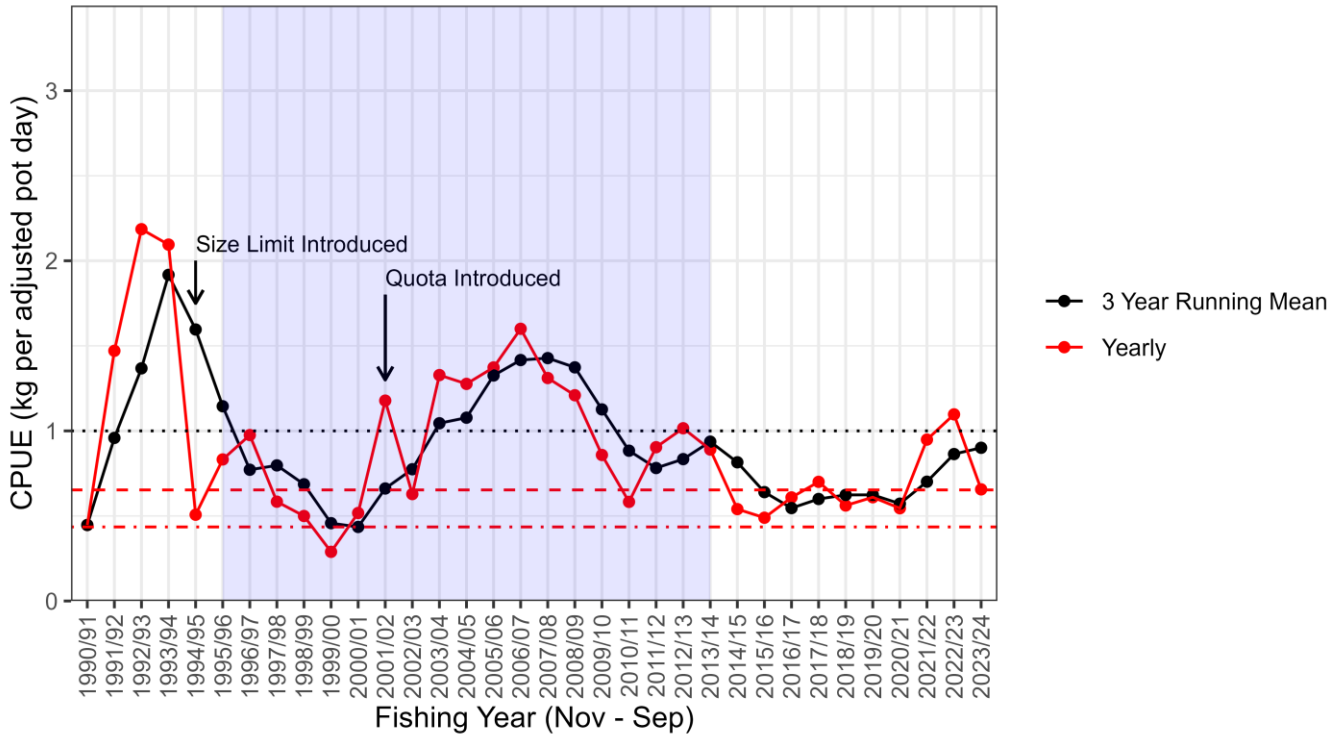


Figure 3: CPUE (kg per adjusted pot day). The current agreed time series is shown in red and the three year running mean from the draft harvest strategy in black. The target, trigger and limit reference points are shown as horizontal lines from top to bottom. The shaded purple are is the proposed reference period.

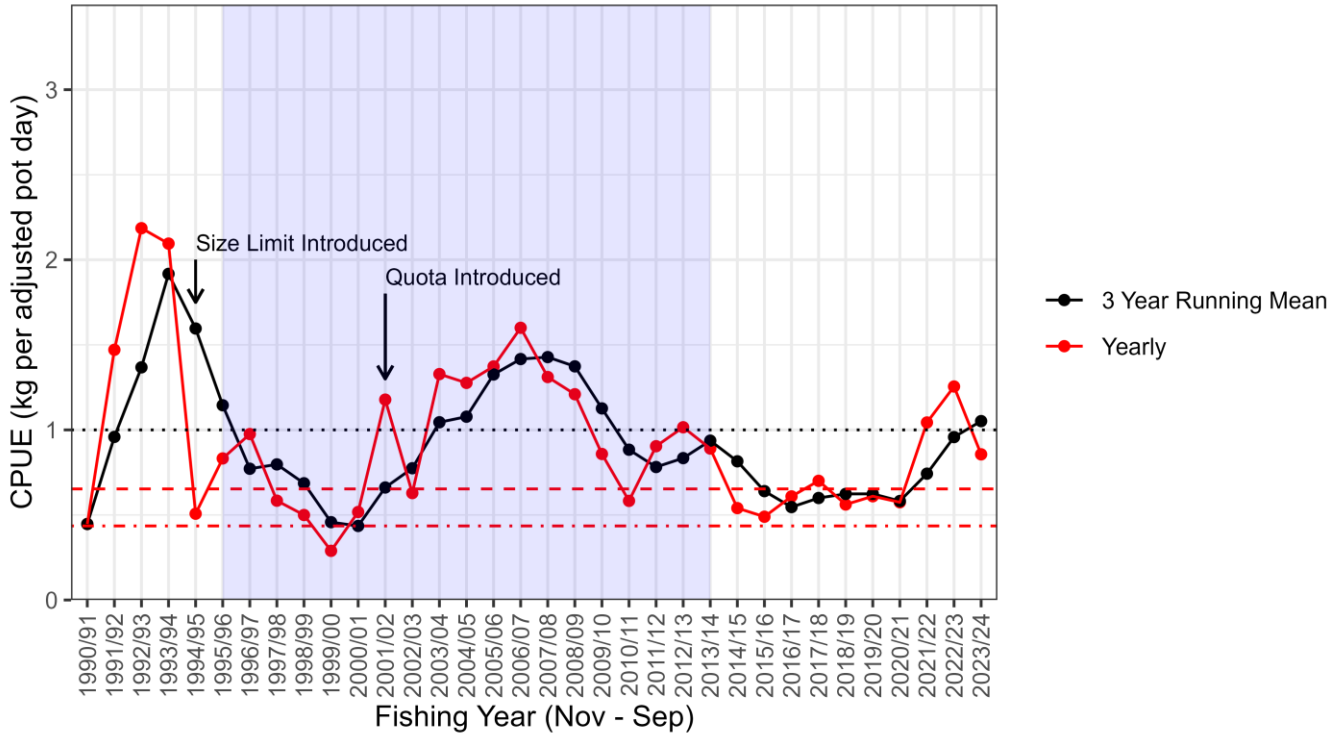


Figure 4: CPUE (kg per adjusted pot day) adjusted for high-grading discarding in recent years. See Figure 3 for more details.

Table 2: Giant crab total catch and targeted CPUE (kg/adjusted pot day) during fishing years (16 November–14 September) from 1990/91 to 2023/24.

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	7.4	0.95
2022/23	5.9	1.10
2023/24	6.6	0.66

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 of a major change in the key operator in the fishery and 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 in subsequent years. In 2022/23, collection of some length-frequency data resumed however, due to the small sample size, this has limited utility and is not presented here.

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 6). 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.

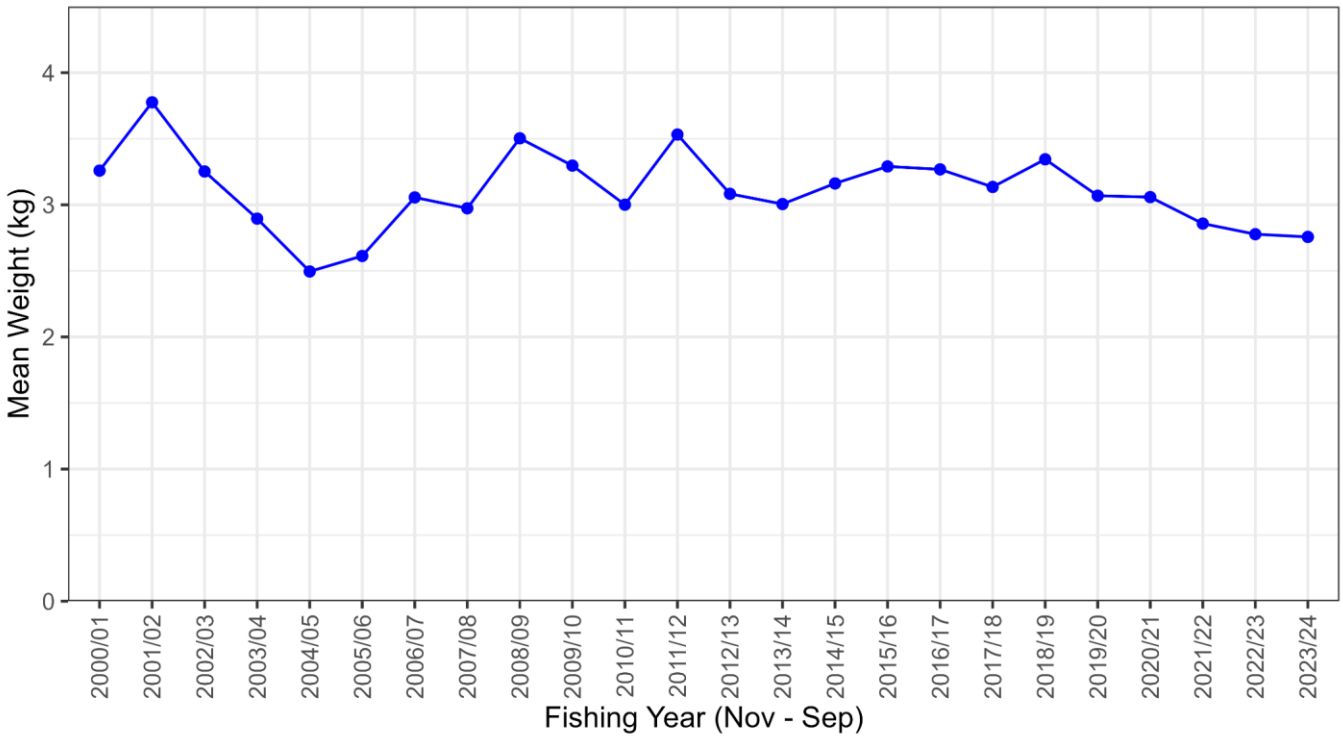


Figure 5: Mean weight (kg) per landed crab for all fishers from the 2000/01 fishing year onwards.

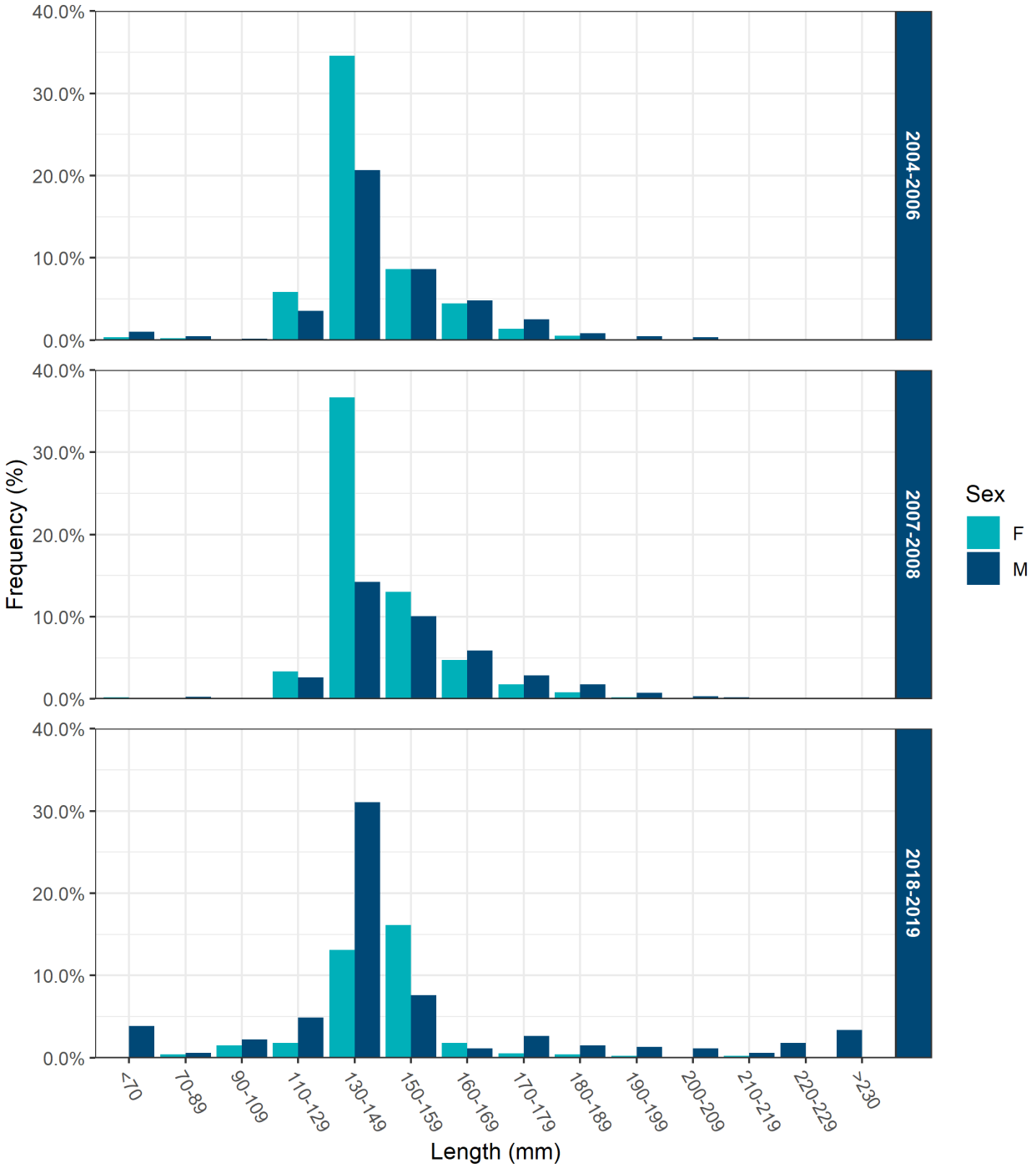


Figure 6: Length frequency measurements from the new industry-based data collection program (bottom) and data from previous data collection periods binned using the same size categories. Note that crabs measuring less than 150mm are categorised into 20mm bins and above 150mm into 10mm bins.

Evaluation

Current harvest strategy

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 2022/23 was 1.10kg/ 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 three 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.

Proposed harvest strategy

Due to the lack of length-frequency data and verification of Vic e-catch data, the fishery is presently at Level 1 of the harvest strategy.

The three-year running mean of targeted CPUE is between the trigger and target reference points. Consequently, the TAC would remain unchanged under the proposed harvest strategy.

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
2024	2022-23, 2023-24	Significant high-grading reported as contributing to low CPUE

Appendix 2: Proposed Harvest Strategy

Section 4 Extract: TACC Setting Rules

Determining the tier

1. Level 1 is the baseline management arrangements for the Fishery and applies unless the requirements are met at another level.
2. Level 2 is applied if recent representative length frequency data is available in sufficient quantity to provide insight into stock structure.
3. Level 3 can be applied if representative length-frequency data is available for three or more years, and a suitable model-based stock assessment has been conducted.

Level 1

Due to the small nature of this fishery and the stochasticity in the CPUE time series, it is inappropriate to have a strictly defined harvest control rule. The following harvest control rule provides a guide to TACC setting at Level 1 that provides sufficient flexibility to allow management to consider other information about the Fishery which may be available on a sporadic basis:

1. If CPUE exceeds the threshold reference point the TACC remains unchanged.
2. If CPUE falls below the threshold reference point the TACC is reduced by up to 50%.
3. If CPUE falls below the limit reference point, a stock rebuilding strategy is developed and the TACC is reduced by 50-100%.
4. If the existing TACC exceeds the cap at a particular level that the Fishery returns to, the TACC is reduced to that cap. This could occur in the event that the Fishery has been at a higher level and had TACC increases, before returning to a lower level.

There is no firm rule for a fishery closure. If the CPUE falls significantly below the threshold reference point this will be investigated in detail. This includes consideration and appropriateness of retaining a sentinel fishery under a research permit to maintain data collection and monitoring (the only data source for the Fishery).

The starting TACC under this harvest strategy will commence at 8.5 tonnes within Level 1. This is below the Level 1 cap and no mechanisms exist to increase the TACC under this level. The cap remains relevant, however, as it will apply in the event that the fishery progresses to a higher level, experiences a TACC increase/s at that level and then returns to Level 1.

Level 2

Under Level 2, additional information about the length-frequency composition is available to assess stock abundance, including undersize stocks. Due to the low productivity attributes of giant crab and the limitations of the data, a precautionary approach is required that enables the impacts of TACC changes to be observed. This harvest control rule adds TACC increases to the Level 1 strategy:

1. If CPUE falls below the threshold reference point, the TACC is reduced by up to 50%.
2. If CPUE falls below the limit reference point, a stock rebuilding strategy is developed and the TACC is reduced by 50-100%.
3. If the CPUE is above the target reference point, the TACC can be increased by 20%. A maximum increase of a total of 20% can be applied in any three-year period.
4. Length-frequency data provides a secondary indicator. A TACC increase is conditional on satisfactory recruitment from this indicator.

Level 3

The nature of the harvest control rule under Level 3 will depend on the assessment model and the quality of the model-based stock assessment. However, the intent is to allow for more rapid TACC increases (e.g. 20% per year) whilst remaining confident that the Fishery will fluctuate around the target reference point and remain above the threshold reference point with a 90% probability.


Victorian
Fisheries
AUTHORITY


We're hooked on
SAFETY