

Fisheries

Gulf St Vincent Prawn *Penaeus (Melicertus) latisulcatus* Fishery 2023/24



L. J. McLeay and G. E. Hooper

SARDI Publication No. F2007/000782-14
SARDI Research Report Series No. 1235

SARDI Aquatic and Livestock Sciences
PO Box 120 Henley Beach SA 5022

November 2024

Fishery Assessment Report to PIRSA Fisheries and Aquaculture



Government
of South Australia

Department of Primary
Industries and Regions



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This publication may be cited as:

McLeay, L.J. and Hooper, G.E. (2024). Gulf St Vincent Prawn *Penaeus (Melicertus) latisulcatus* Fishery 2023/24. Fishery Assessment Report to PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic and Livestock Sciences), Adelaide. SARDI Publication No. F2007/000782-14. SARDI Research Report Series No. 1235. 51pp.

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Date: 12 November 2024

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

Circulation: OFFICIAL

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ACKNOWLEDGMENTS

Funds for this research were provided by PIRSA Fisheries and Aquaculture, obtained through licence fees. SARDI Aquatic and Livestock Sciences provided substantial in-kind support. Thanks to the Saint Vincent's Gulf Prawn Boat Owners Association (SVGPBOA) and Gulf St Vincent prawn fishers for their contributions to surveys (including logistics, vessel time and personnel). Observer work during the November, March and April/May surveys was undertaken by SARDI staff Troy Rogers, Peter Hawthorne, Rob Baker, Chris Presser, Doug Graske, Andreas Reuter, Dave Schmarr and Graham Hooper. The catch and effort data from the SARDI Information Management System were entered by Nicole Bowden and provided by Angelo Tsolos of the Information Systems and Database Support Unit (PIRSA Fisheries and Aquaculture). We thank Dr Craig Noell for the development of statistical procedures. The report was formally reviewed by Dr Vittoria Cipriani and Dr Jason Earl (SARDI) of SARDI Aquatic and Livestock Sciences, and Jade Fredericks of PIRSA Fisheries and Aquaculture, and approved for release by Dr Stephen Mayfield, Science Leader, Fisheries (SARDI Aquatic and Livestock Sciences).

EXECUTIVE SUMMARY

This report determines the status of the Western King Prawn (*Penaeus (Melicertus) latisulcatus*) stock in Gulf St Vincent (GSV) through analyses of data collected by several long-term monitoring programs.

In 2023/24, the total commercial catch of Western King Prawn in the Gulf St Vincent Prawn Fishery (GSVPPF) was 112.0 t. This catch was among the lowest on record and was taken from ~70% of the available TACE (vessel-nights) with fishing conducted over 275 of 390 vessel-nights (77 vessel-nights pre-Christmas, 198 nights post-Christmas).

Estimates of catch per unit effort (CPUE), a measure of relative biomass (stock abundance), have declined since the fishery reopened in 2014/15.

In 2023/24, standardised fishery-independent survey (FIS) CPUE was 20.4 [16.1–25.6, 95% confidence intervals (CI)] kg/trawl-shot, the second lowest estimate on record.

In the last four seasons, nominal commercial CPUE estimates were among the lowest on record. In 2023/24, standardised annual commercial CPUE was 795 [746–847, 95% CI] kg/vessel-night, which was a 4% decrease since 2022/23.

Decreasing trends in prawn size have been recorded in FISs since 2014/15 and in commercial prawn-grade data since 2018/19. These trends are indicative of changes in the size-structure of the prawn stock that negatively impact the yield per recruit.

The percentage of April/May survey sites having prawn aggregations classified as 'fishable' (i.e. ≤ 32 prawns/kg and ≥ 30 kg/trawl-shot) has decreased since 2018/19, with those percentages in 2022/23 and 2023/24 the lowest recorded (<10%).

Collectively, the recent seasons of relatively small prawns, low catches and nominal CPUE, low prawn prices nationally, and sustained inflationary pressures leading to higher input costs, have led to several years of poor economic performance, with negative net economic return reported since 2019/20 (\$-2.5M in 2022/23, BDO EconSearch 2024).

The Department of Primary Industries and Regions (PIRSA) has adopted the National Fishery Status Reporting Framework (NFSRF) to determine the status of all South Australian fish stocks. The management plan for the GSVPPF provides the decision rules for classifying stock status relative to limit, trigger and target reference points defined for two performance indicators used as proxies for stock abundance (PIRSA 2022). The performance indicators are: 1) standardised fishery-independent survey (FIS) catch per unit effort (CPUE); and 2) standardised annual commercial CPUE.

In 2023/24, the estimate of standardised FIS CPUE was 10.3% above the trigger reference point (TrRP; 18.5 kg/trawl-shot) and standardised commercial CPUE was 7.7% above the Target

Reference Point (TargRP; PIRSA 2022). Despite reduced fishery performance in recent years, the 2023/24 estimates of standardised FIS CPUE and standardised commercial CPUE are both above the TrRP for these performance indicators (PIRSA 2022). This indicates that the biomass of the GSVPF Western King Prawn stock in 2023/24 is at a level to ensure that, on average, future levels of recruitment are adequate (i.e. recruitment is not impaired). Consequently, when the two performance indicators are applied in the decision rules within the harvest strategy to determine the status of the Western King Prawn stock in GSV (Table 6), the stock is classified as **'sustainable'**.

Table 1. Key Gulf St Vincent Prawn Fishery statistics between 2020/21 and 2023/24. Note, estimates of standardised annual commercial CPUE and standardised FIS CPUE will differ in each status report as data are updated within the Generalised Linear Model. Annual levels of TACE do not include TACE carryover.

	2020/21	2021/22	2022/23	2023/24
Total allowable commercial effort (TACE)	270 nights (20 pre-Christmas)	290 nights (45 pre-Christmas)	390 nights (80 pre-Christmas)	390 nights (80 pre-Christmas)
Total commercial catch	109.3 t (+2.2 t from survey)	138.7 t (+3.7 t from surveys)	156.4 t (+4.8 t from surveys)	112.0 t (+4.5 t from surveys)
Total effort	270 vessel nights (27 pre-Christmas) 2,603 hours	300 vessel nights (22 pre-Christmas) 3,135 hours	330 vessel nights (83 pre-Christmas) 3,105 hours	275 vessel nights (77 pre-Christmas) 2,676 hours
Standardised commercial CPUE	761 kg/vessel-night	796 kg/vessel-night	831 kg/vessel-night	795 kg/vessel-night
Standardised FIS CPUE	22.5 kg/trawl-shot	21.9 kg/trawl-shot	20.2 kg/trawl-shot	20.4 kg/trawl-shot
FIS Recruitment Index (FRI)	801 recruits.h ⁻¹	1,186 recruits.h ⁻¹	383 recruits.h ⁻¹	812 recruits.h ⁻¹
Status	Sustainable	Sustainable	Sustainable	Sustainable

Keywords: commercial fishery, trawling, prawns, Gulf St Vincent, South Australia, stock assessment.

1. INTRODUCTION

1.1. Overview

Stock assessments for the Gulf St Vincent Prawn Fishery (GSVVPF) are part of the South Australian Research and Development Institute's (SARDI - Aquatic and Livestock Sciences) ongoing fisheries' assessment program. This report assesses the current status of the Western King Prawn (*Penaeus (Melicertus) latisulcatus*) (Kishinouye 1896) stock in Gulf St Vincent (GSV) and includes new data from the 2023/24 fishing season.

The report has three objectives: 1) present information relating to the fishery and biology of Western King Prawn; 2) assess the 2023/24 status of the Western King Prawn stock resource in Gulf St Vincent; and 3) identify future directions for the research program.

1.2. Description of the fishery

1.2.1. Access

There are three commercial prawn fisheries in South Australia: the Spencer Gulf Prawn Fishery (SGPF), the West Coast Prawn Fishery (WCPF) and the GSVVPF. The SGPF is the largest prawn fishery in South Australia in terms of total catch and has 39 licences. The WCPF is the smallest of the prawn fisheries with three licences. There are currently 10 commercial fishing licences issued for the GSVVPF.

All three prawn fisheries use demersal otter trawls to target Western King Prawn at night between sunset and sunrise (Figure 1). Trawls tow funnel-shaped nets along the sea floor and retain the catch in bags located at the end of the net (commonly referred to as codends) (Figure 2). Licence holders in the GSVVPF are permitted to retain and sell two species of by-product harvested incidentally during prawn trawling: Balmain Bug (*Ibacus* spp.) and Southern Calamari (*Sepioteuthis australis*). A smaller penaeid (*Metapenaeopsis crassissima*) is also permitted to be retained in South Australian waters but is of low commercial value.

The fishing season of the GSVVPF occurs from 1 November to 31 October of the following year, with a closure in January and February. Fishing during the season generally occurs between the last quarter and first quarter of the moon and is permitted in depths greater than 10 m north of the geodesic joining GSV, Investigator Strait and Backstairs Passage (PIRSA 2017). The GSVVPF is divided into 121 spatial reporting blocks for research and management purposes (Figure 3). The major home ports for GSVVPF vessels are Port Adelaide and North Haven.

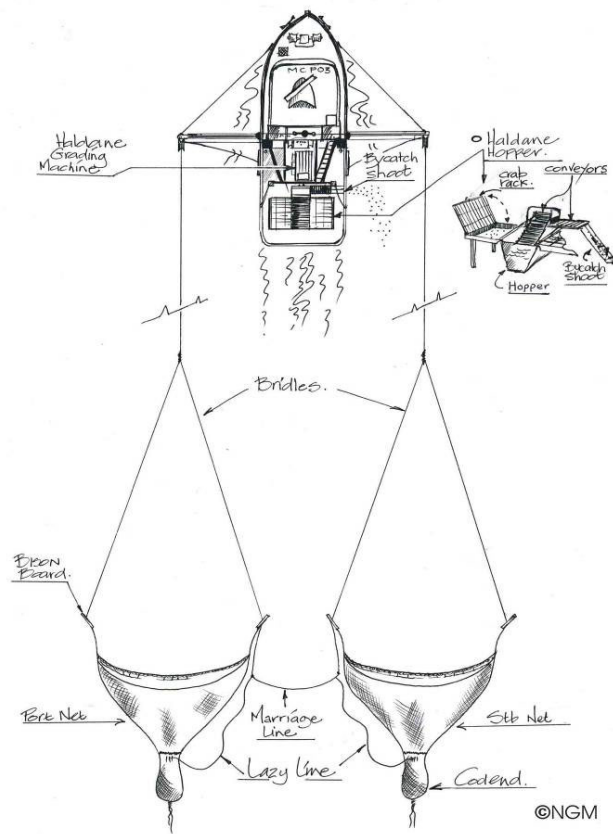


Figure 1. Double-rig trawl gear and location of hopper sorting and prawn grading systems used in the Gulf St Vincent Prawn Fishery. Figure from Carrick (2003).

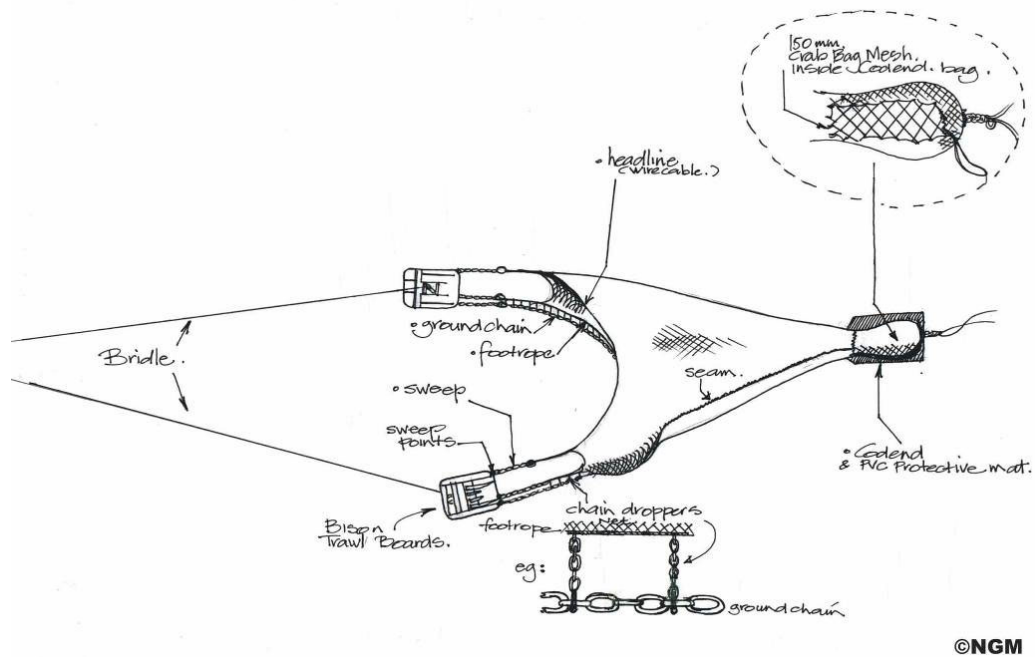


Figure 2. Trawl net configuration showing trawl boards, head rope, ground chain and codend with crab bag as used in the Gulf St Vincent Prawn Fishery. Figure from Carrick (2003).

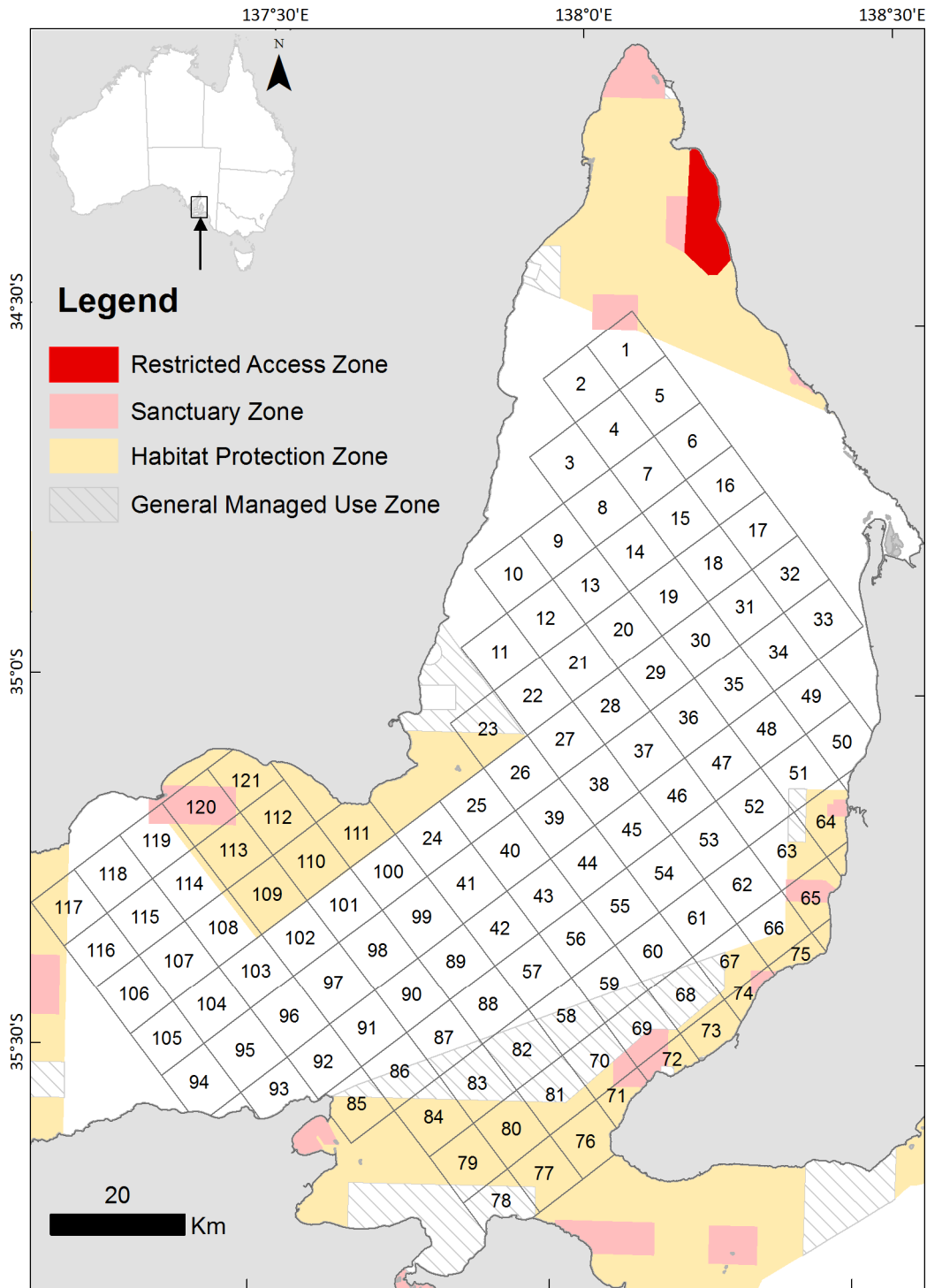


Figure 3. The spatial reporting blocks used in the Gulf St Vincent Prawn Fishery. South Australian Marine Park Zoning is also shown.

1.2.2. Management arrangements

The *Fisheries Management Act 2007* provides the legislative framework for the management of fisheries resources in South Australia. General regulations for South Australia's prawn fisheries are described in the *Fisheries Management (General) Regulations 2017*, with specific regulations located in the *Fisheries Management (Prawn Fisheries) Regulations 2017*. These three documents provide the overarching statutory framework for management of the GSVPF.

Management arrangements for the GSVPF have evolved since the fishery's inception in 1967 (Table 2). Between 1967 and 1979, the number of licences increased to a total of 22 before being reduced to 10 by 1990. Following licence rationalisation in 1990, the Western King Prawn stock was considered overfished, and the fishery was closed during the 1991/92 and 1992/93 fishing seasons to allow recovery. The fishery reopened in 1993/94, and in 1998, the first management plan for the fishery was introduced (Zacharin 1997). From 2004/05, four fishery independent surveys per season were undertaken to inform commercial fishing strategies. A second management plan was implemented in 2007 (Dixon and Sloan 2007).

A review of the GSVPF in 2011 (Knuckey *et al.* 2011) recommended that the fleet improve its operating efficiencies. Two key management changes were subsequently implemented for the 2011/12 season: 1) the number of surveys used to manage the fishery during the fishing season was reduced to two (i.e. April and May); and 2) in March 2012, all trawl nets used for commercial fishing were modified to T90-mesh (conventional diamond mesh turned 90 degrees) codends and fitted with Nordmøre-grids to improve catch selectivity, reduce levels of bycatch and facilitate the escapement of small prawns (Dixon *et al.* 2013).

Due to poor economic performance, the fishery was closed again in November 2012 at the request of licence holders. Following the fishery's closure in the 2012/13 and 2013/14 fishing seasons, a new management framework was developed with stakeholder input and implemented in November 2014 (PIRSA 2014). The management framework included an individual transferrable effort (ITE) system, with transferrable fishing nights as the effort unit. From 2013/14, the number of surveys was further reduced to one undertaken in May.

From 2014/15, control rules for spatial management, mean prawn size and mean nightly catches per vessel were adopted within the Saint Vincent Gulf Prawn Boat Owner's Association (SVGPOA) Industry Code of Practice. The Industry Code of Practice is a non-legislated document that describes the expected activities for licence holders in the

GSVVPF. From 2014/15, a revised daily logbook, nightly fishing reports and individual transferable quota units (effort) were also introduced (PIRSA 2022). The daily logbook requires licence holders to provide more detailed spatial information (start and end coordinates of each trawl-shot), and the nightly fishing reports provide a summary of the total catch unloaded per grade within 48 hours of unloading. Also, in November 2015, restrictions on the construction of the T90-mesh codend were modified so that no more than 33 meshes were made up of standard (diamond) mesh. Previously, between March 2012 and November 2015, no more than 10 meshes were allowed.

The third management plan for the fishery was implemented in April 2017, and stock status and Total Allowable Commercial Effort (TACE) for the fishery were determined from decision rules listed within the plan between 2016/17 and 2020/21 (PIRSA 2017). In 2021, a bio-economic model developed for the GSVVPF in 2015 was updated with biological, catch and economic information, and used to inform development of a new harvest strategy for the GSVVPF (Noell *et al.* 2015). The fourth management plan for the GSVVPF implemented in July 2022 details the new harvest strategy and principal policy arrangements for management of the fishery (PIRSA 2022).

The current management arrangements for the fishery are summarised in Table 3. The GSVVPF is currently a limited-entry (10 licence holders) fishery, which is managed by gear restrictions and a restriction on the number of fishing nights. Fishing takes place between sunset and sunrise. No trawling is permitted in waters shallower than 10 m. The harvest strategy listed in the management plan for the fishery uses decision rules for setting the total number of fishing nights (TACE) and number of pre-Christmas fishing nights each season (PIRSA 2022). The decision rules are based on limit, trigger and target reference points defined for two primary performance indicators relating to stock abundance:

- 1) standardised fishery-independent survey (FIS) catch per unit effort (CPUE), which is the average standardised CPUE from surveys conducted in March and April/May; and
- 2) standardised annual commercial CPUE.

These indicators are also used to determine the status of the Western King Prawn stock in GSV (see Section 1.6).

Table 2. Major management milestones for the Gulf St Vincent Prawn Fishery.

Date	Management Change
1967	Commercial prawn fishing commenced in GSV.
1968	All SA waters closed to trawling except for specific managed zones for which permits are offered and all waters less than ten metres are closed to trawling.
1969	The <i>Preservation of Prawn Resources Regulations 1969</i> is introduced and vessels licensed to fish for prawns.
1975	The fishery is split into two zones: 1) Gulf St Vincent; and 2) Investigator Strait with eight permits issued to specifically fish in Investigator Strait (Copes 1990).
1977	Total number of licences issued in Gulf St Vincent reaches 14. Total number of fishers in both zones (Gulf St Vincent and Investigator Strait) reaches 22.
1982	Number of Investigator Strait zone permits reduced from eight to two. Total number of fishers in both zones (Gulf St Vincent and Investigator Strait) reaches 16.
1982	Triple rig trawl nets introduced.
1986	A review of management was completed by Prof Parzival Copes.
1986	A licence rationalisation strategy was implemented as an outcome of the review.
1987	The <i>Fisheries (Gulf St Vincent Prawn Fishery Rationalisation) Act 1987</i> is introduced.
1987	Two Investigator Strait entitlements are removed. Four GSVPF licences are also removed over the next four years and the two zones (Investigator Strait and Gulf St Vincent) are once again amalgamated.
1990	Prof Parzival Copes requested to complete his second review of the fishery.
1990	A total of 10 licences issued in the GSVPF.
1991	Fishery closed in June.
1991	A Select Committee of the House of Assembly of South Australia reviewed the fishery's management options.
1994	The fishery re-opened in February.
1995	A review of the fishery was conducted by Dr Gary Morgan (Morgan 1995).
1998	The first management plan for the fishery was introduced (Zacharin 1997).
2000	<i>Fisheries (General) Regulations 2000</i> enabled "large" vessels to enter the fleet.
2007	The second management plan was implemented (Dixon and Sloan 2007).
2011	A review of the fishery was undertaken by (Knuckey <i>et al.</i> 2011).
2012	The fishery was closed in November by unanimous agreement of industry. The T90-mesh codend was introduced.
2013	Morgan and Cartwright (2013) completed a review of the fishery management framework.
2014	A review of the stock assessment methods, processes and outputs was undertaken (Dichmont 2014). The fishery reopened in November 2014. Individual transferable units were introduced. A revised framework for longer-term management of the Gulf St Vincent Prawn Fishery was developed.
2017	The third management plan for the South Australian Commercial Gulf St Vincent Prawn Fishery was approved by the Minister for Agriculture, Food and Fisheries (PIRSA 2017).
2018	Establishment of the Gulf St Vincent Prawn Fishery Management Advisory Committee.
2020	50% of unfished nights allocated in the 2019/20 fishing season carried-over to 2020/21 as a COVID-19 assistance measure.
2021	An independent review was undertaken of the harvest strategy included in the 2017 management plan (PIRSA 2017).
2021	Under-catch and over-catch provisions (10%) formalised.
2022	The fourth management plan for the South Australian Commercial Gulf St Vincent Prawn Fishery was approved by the Minister for Primary Industries and Regional Development (PIRSA 2022).
2023	Commercial fishing period changed to 1 November to 31 October in following year (January and February remain closed).

Table 3. Current management arrangements for the Gulf St Vincent Prawn Fishery.

Management tool	Current restriction
Permitted species	Western King Prawn (<i>Penaeus (Melicertus) latisulcatus</i>), Balmain Bug (<i>Ibacus</i> spp.), Southern Calamari (<i>Sepioteuthis australis</i>), <i>Metapenaeopsis crassissima</i> .
Limited entry	10 licences
Licence transferability	Permitted
Corporate ownership	Permitted
Spatial and temporal closures	No fishing <10m depth or in aquatic reserves or marine parks (sanctuary zones/benthic protection areas)
Method of capture	Demersal otter trawl
Trawl rig	Single, double or triple
Trawling times	Not during daylight hours
Maximum combined headline length	27.43 or 29.26 m (non-amalgamated gear), 43.89 m (amalgamated gear)
Minimum codend mesh size	58 mm
Maximum vessel length	24 m
Maximum vessel power	340 kW
Catch and effort data	Daily logbook and catch disposal logbook submitted after each trip
Landing locations	Landings permitted anywhere in the State
Landing times	Landings permitted at any time during the season

1.3. Western King Prawn biology, biosecurity and prawn health

Previous stock assessment and stock status reports detail information relating to the distribution, habitat preferences, movement, growth, reproductive biology, life history and stock structure of the Western King Prawn stock in GSV (e.g. Dixon *et al.* 2011; 2012; Beckmann *et al.* 2015; Beckmann and Hooper 2016; McLeay *et al.* 2017; McLeay and Hooper 2018; 2019; 2020; 2021; 2022; 2023).

The potential effects of coastal pollutants, parasites and disease on growth, survival, reproduction and the overall health of Western King Prawn populations in South Australia are poorly understood. Roberts *et al.* (2010) assessed the disease status of prawns (focusing on viruses) collected from key nursery sites in both Spencer Gulf and Gulf St Vincent. A naturally occurring (endemic), and likely harmless, monodon-type baculovirus (MBV) was observed in ~60% of prawns. The MBV is a common virus known to occur throughout Australia.

White spot disease (WSD) is a highly contagious and lethal viral disease that was first detected in farmed prawns in south-east Queensland in December 2016. The most recent detections of WSD are from black tiger prawns (*Penaeus monodon*) at three prawn farms on the north coast of New South Wales between February and April 2023 ([Animal and Plant Pests and Diseases 2024](#)). The virus can cause high rates of mortality in affected prawns and is the subject of a national surveillance program. To date, all samples that have been collected and tested within jurisdictions outside of Queensland and New South Wales have returned negative results.

1.4. Research program

There have been numerous fisheries' research projects relevant to the Western King Prawn stock in GSV. Research has been undertaken to investigate population dynamics and biology (King 1977; Kangas 1999; Xiao and McShane 2000; Tanner and Deakin 2001; Roberts *et al.* 2012), stock structure (Carrick 2003), biosecurity and disease (Roberts *et al.* 2009), fishing gear technology (McShane 1996; Broadhurst *et al.* 1999; Dixon *et al.* 2013; Gorman and Dixon 2015; McLeay 2021), trawling impacts (Tanner 2003) and to develop fisheries models (Xiao 2004; Noell *et al.* 2015). Previous stock assessment and stock status reports detail the biological information and the history of commercial catch used to assess the status of the Western King Prawn stock in GSV (Kangas and Jackson 1997; Xiao and McShane 1998; Boxshall *et al.* 1999; Boxshall and Williams 2000; Boxshall and Johnson 2001; Svane 2003; Svane and Johnson 2003; Svane and Roberts 2005; Roberts *et al.* 2007a, 2007b; 2008; 2009; Hooper *et al.* 2009; Dixon *et al.* 2011; 2012; Beckmann *et al.* 2015; 2016; McLeay *et al.* 2017; McLeay and Hooper 2018; 2019; 2020; 2021; 2022; 2023).

From 2011 to 2014, three separate independent reviews of the stock assessment program and harvest strategy for the GSVPF were conducted (Knuckey *et al.* 2011; Morgan and Cartwright 2013; Dichmont 2014). As a result of these reviews, there was a rationalisation of the research program. The principal change was a reduction from four fishery-independent surveys (FISs) per year to one (conducted in May). During 2020 and 2021, a review of the harvest strategy and 2017 management plan recommended that two surveys per year be undertaken.

This report focuses on two annual FISs, conducted in March and April/May 2024, noting that November/December surveys are also undertaken to inform fishing strategies pre-Christmas but are not used for the purposes of stock assessment. Fishery-independent information from surveys in March and April/May is then combined with fishery-

dependent information collected from the GSVPF during the 2023/24 fishing season to assess the status of the Western King Prawn stock in GSV.

1.5. Information sources used for assessment

Fishery-independent data have been collected for the GSVPF using surveys coordinated by SARDI since 1984. Data from spatially stratified surveys conducted in March and April/May since 2004/05 are used to calculate standardised FIS CPUE (kg/trawl-shot). SARDI also maintains a comprehensive fishery-dependent catch and effort database for the GSVPF using data obtained from South Australian Fishing Industry Council (SAFIC) annual reports between 1968 and 1987. Data from July 1987 were obtained from daily commercial logbooks provided to SARDI by GSVPF licence holders. In 2023, the period for commercial fishing season changed from 1 November–31 July to 1 November–31 October in the following year. Data from 1 November–31 July in each fishing season since 1989/90 are used to calculate standardised commercial CPUE (kg/vessel-night) as these data are considered the most reliable for analysing trends in CPUE.

1.6. Stock status classification

A national stock status classification framework was developed to enable the consistent assessment of the status of Australian fish stocks (Flood *et al.* 2012; 2014; Stewardson *et al.* 2016; 2018; Piddocke *et al.* 2021; Roelofs *et al.* 2024). The stock status classification framework, which the management plan for the GSVPF refers to (PIRSA 2022), considers “*whether the current abundance (number or biomass [weight]) is at an adequate level and whether the level of fishing pressureis adequately controlled through management (www.fish.gov.au).*” The system combines information on both the current stock size and level of catch into a single classification for each stock against defined biological reference points. The stock is then classified as ‘sustainable’, ‘depleting’, ‘depleted’, ‘recovering’, ‘negligible’, or ‘undefined’ (Table 4).

Table 4. Stock status terminology (Roelofs *et al.* 2024; www.fish.gov.au).

	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 (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 mortality 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 non-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.

PIRSA has adopted the national stock status classification framework for South Australian fish stocks (Flood *et al.*, 2012, 2014; Piddocke *et al.* 2021; Roelofs *et al.* 2024). Status is categorised for the Western King Prawn stock in GSV from a combination of two primary performance indicators as defined in the harvest strategy for the fishery (PIRSA 2022):

- 1) standardised FIS CPUE (kg/trawl-shot), which is the average of standardised CPUE from surveys conducted in March and April/May; and
- 2) standardised annual commercial CPUE (kg/vessel-night).

To categorise stock status, estimates for each performance indicator are assessed against their relative limit, trigger and target reference points as defined in the harvest strategy for the fishery (Tables 5 and 6) (Tables 9 and 10, respectively in PIRSA 2022).

Table 5. Reference points for performance indicators in the Gulf St Vincent Prawn Fishery (PIRSA 2022). Note, the LRP is set at a level estimated to be at Maximum Sustainable Yield (MSY) set (conservatively) at 40% unfished levels (PIRSA 2022).

Reference Point	B ₀	Standardised Commercial CPUE (kg/vessel-night)	Standardised FIS CPUE (kg/trawl-shot)
Limit (LRP)	0.4B ₀	492 kg/vessel-night	14.8 kg/trawl-shot
Trigger (TrRP)	0.5B ₀	615 kg/vessel-night	18.5 kg/trawl-shot
Target (TargRP)	0.6B ₀	738 kg/vessel-night	22.2 kg/trawl-shot

Table 6. Decision rules for classifying the status of Western King Prawn stock in GSV (PIRSA 2022). **When primary performance indicators are below the LRP, stock status will be interpreted in consideration of the trajectory of the performance indicators for the fishery. # If a majority of the performance indicators are declining the fishery will be classified as depleted, or where a majority of performance indicators are increasing the fishery will be classified as recovering. When primary performance indicators are at or above the LRP and below the TrRP, stock status will be interpreted in consideration of the trajectory of the performance indicators for the fishery. If a majority of the performance indicators are declining the fishery will be classified as depleting, or where a majority of performance indicators are stable or increasing the fishery will be classified as sustainable.*

		Standardised FIS CPUE (kg/trawl-shot)					
		<14.8	≥14.8 (LRP)	<18.5	≥18.5 (TrRP)	<22.2	≥22.2 (TargRP)
Standardised Commercial CPUE (kg/vessel-night)	<492	Depleted or Recovering *	Sustainable unless performance indicators are declining #	Sustainable	Sustainable	Sustainable	Sustainable
	≥492 (LRP)						
	<615	Sustainable	Sustainable	Sustainable	Sustainable	Sustainable	
	≥615 (TrRP)						
	<738	Sustainable	Sustainable	Sustainable	Sustainable	Sustainable	
	≥738 (TargRP)						

2. METHODS

2.1. Fishery-independent surveys

Historically, surveys using commercial vessels with fishery-independent (SARDI) observers on-board, were conducted in GSV prior to the December, March, April and May harvest periods from 2004/05 to 2010/11, in April and May in 2011/12, and in May from 2013/14 to 2020/21. Surveys were typically undertaken using three to six vessels over two or three consecutive nights commencing on the second and third nights following the last quarter of the moon. There were two exceptions; 1) 2004/05 to 2007/08, when surveys were conducted during one night on the dark of the moon with approximately ten vessels; and 2) the 2013/14 survey, which was extended over the dark phase of the moon with only one vessel participating.

In 2021, a review of the harvest strategy and 2017 management plan recommended that, for stock assessment purposes, two surveys per year be undertaken to account for any within-season fluctuations in prawn abundance (PIRSA 2022). Beginning in 2021/22, March and April/May surveys were conducted within a timeframe of 2 days prior to/or 2 days after the new moon in March, and in April or May. Timing of April/May surveys is dependent on the timing of the monthly lunar phase. If the timing of the new moon in May is after 7 May, then the FIS is undertaken around the new moon period in April (PIRSA 2022). This flexibility in survey timing avoids any potential catch sampling bias associated with decreases in water temperature in the latter part of May. This report used historical data from March and April/May surveys conducted from 2004/05 to 2010/11, and in 2023/24, to examine trends in FIS CPUE since 2004/05.

T90-mesh codends with Nordmøre bycatch reduction grids were introduced into the GSVPF in 2012 to improve prawn size-selectivity and reduce discards (Dixon *et al.* 2013). Consequently, vessels participating in surveys since 2011/12 have had a paired trawl configuration with one side of the trawl comprising a T90 mesh codend (57 mm) and the other side of the trawl comprising a diamond-mesh codend (51 mm). The reference levels relating to standardised FIS CPUE (kg/trawl-shot) described within the current harvest strategy are derived from historical data collected from diamond-mesh (51 mm) codends only since 2004/05 (PIRSA 2022). Consequently, only survey data collected from diamond-mesh codends are presented in this report as they are more informative from a historical perspective and directly inform stock status determination.

A total of 109 fixed survey sites are located in GSV (Figure 4). From 2004/05 to 2023/24, the number of sites sampled ranged from 92–109, except for 2013/14 where a reduced survey of 46 sites was completed. In 2024, 99 trawl shots were completed on the nights

of 8 and 9 March 2024 and 97 shots were completed on the nights of 6 and 7 May 2024. Each shot began close to a known location (recorded by Global Positioning System, GPS), considering bottom trawl conditions (e.g. fouling), and continued in a set direction for a period of 30 minutes. The total distance covered was dependent on trawl speed, which was influenced by vessel power, tide and weather conditions. Data collected for each shot location included the total catch weight, catch weight of each prawn-size grade, number of nets used, trawl duration, tide direction, and the number of prawns in a 7 kg bucket ('bucket count' - recorded before grading of the catch has occurred and used as a rapid measure to estimate prawn size).

The number of prawns in a 7 kg subsample collected from diamond-mesh codends was used to estimate mean prawn size (n prawns/kg), with higher estimates representing smaller prawns and lower estimates representing larger prawns. The GPS locations of each trawl station were used to map prawn size and CPUE across the survey area.

In 2022, the GSVPF updated its commercial fishing strategy guidelines with respect to prawn size and catch rate criteria. Noting that these guidelines are an industry initiative to maximise yield per recruit and profit, and are not regulated by PIRSA, areas classified as fishable in the GSVPF are those characterised by:

- a size of ≤ 224 prawns/ 7 kg bucket (equating to ≤ 32 prawns/kg).
- a catch rate that is:
 - ≥ 0.5 kg/min/net (equating to nominal FIS CPUE of ≥ 30 kg/trawl-shot and a commercial fishing '*trigger*' limit of 480 kg/8 hours fishing).
 - ≥ 0.75 kg/min/net (equating to nominal FIS CPUE of ≥ 45 kg/trawl-shot and a commercial fishing '*target*' level of 720 kg/8 hours fishing).

Survey information is used to guide subsequent fishing strategies. This report describes the spatial distribution of prawn size and catch rates recorded at survey sites in relation to these criteria.

A random sample of 100 prawns was also taken from each shot to obtain information on sex ratio and length-frequency. Length-frequency measurements for prawns sampled from the diamond-mesh codend in April/May surveys were used to determine the FIS Recruitment Index (FRI), which is estimated as the catch rate of recruits per trawl-hour, with 'recruits' defined by prawn size: < 33 mm CL for males and < 35 mm CL for females.

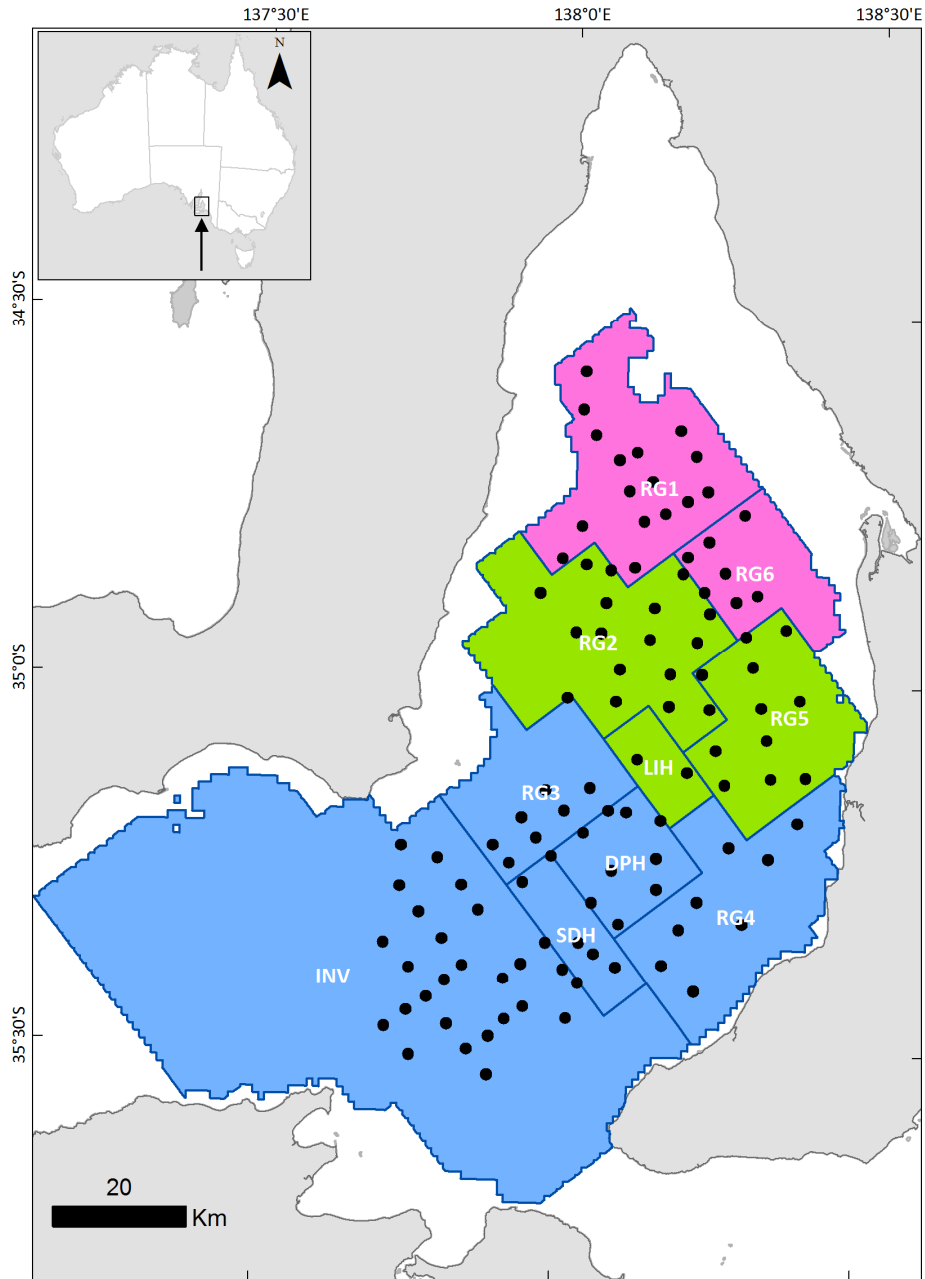


Figure 4. The 109 survey stations sampled by FISs and regions of the Gulf St Vincent Prawn Fishery. The northern gulf (pink) includes Region 1 (RG1) and Region 6 (RG6), the central gulf (green) includes Region 2 (RG2), Region 5 (RG5) and Little Hole (LIH), and the southern gulf (blue) includes Deep Hole (DPH), Southern Deep Hole (SDH), Region 3 (RG3), Region 4 (RG4) and Investigator Strait (INV).

2.2. Fishery statistics

2.2.1. Catch and effort

Fishery catch (t) and effort (vessel-nights or trawl-hours) data are presented for fishing seasons between 1968/69 and 2023/24. In this report, a 'fishing season' is defined as the period from 1 November to 31 October of the following year, with a closure in January and February. Data from 1 November–31 July in each fishing season since 1989/90 are used to calculate nominal and standardised commercial CPUE (kg/vessel-night) (see Section 1.5). Fisher-estimated prawn catch for each shot was adjusted using validated post-harvest catches reported in monthly logbooks. Catch and effort data are reported separately from FIS catches, which are retained for sale by the SVGPBOA.

The main spawning period for Western King Prawns in GSV extends from November to March, so catch and effort data are also presented for early (November–December), late (January–March) and non-spawning (April–October) periods. The spatial distribution of the annual harvest per fishing block is presented from 2011/12–2023/24.

All data are entered and maintained by PIRSA Information Services. Data are checked for errors during data entry, and further validated via database lookup tables and validation routines that are activated during data entry and reporting operations. PIRSA staff contact licence holders to correct any errors or missing information identified in the quality assurance process.

2.2.2. Prawn size

Mandatory reporting of commercial prawn-grade data in daily logbooks was introduced in 2005/06. The grade is determined from the number of prawns to the pound (e.g. 'U10' = under 10 prawns per pound). To facilitate interpretation of the prawn-grade data, grades were assigned to four size categories (Table 7). Soft and broken prawns that were not graded, were assigned to a fifth category ('S&B'). Data presented are from commercial fishing nights only and reported as the proportion of the total catch occurring in each of the size categories (see Dixon *et al.* 2012).

Table 7. Categories assigned to reported prawn grades from commercial logbook data for the Gulf St Vincent Prawn Fishery. The grade is determined from the number of prawns to the pound (e.g. 'U10' = under 10 prawns per pound).

Prawn size category	Grade in logbook
Extra Large	U6 U8, XL U10, L
Large	9/12 U12 LM 10/15 13/15 10/20 (50%), 12/18 (50%)
Medium	10/20 (50%), 12/18 (50%) 16/20, M
Small	SM, 19/25 21/25 S, 20+, 21/30 26+ 30+, 31/40
Soft & Broken	S/B, B&D, MIX, REJ, SMS, blank, ERR

2.3. Catch rate standardisation

CPUE is commonly used as an indicator of relative biomass (stock abundance) in crustacean fisheries worldwide. However, to improve the relationship between CPUE and relative biomass, it is important to standardise CPUE to account for the influence of variables that are not related to abundance. Generalised linear models (GLMs) within R statistical software (R Core Team 2024) were used to standardise FIS CPUE (kg/trawl-shot) since 2005 and annual commercial CPUE (kg/vessel-night) since 1989/90. Models incorporated a Gaussian error structure, with cubic-root transformation and identity link function.

Estimates of standardised annual commercial CPUE and standardised FIS CPUE will differ from previous reports due to the GLM updates implemented in the latest harvest strategy and management plan for the fishery (PIRSA 2022) and as new data from the latest season (e.g. 2023/24) are added to the GLM. In 2023/24, annual estimates of standardised FIS CPUE (kg/trawl-shot) were calculated from the average of predicted monthly CPUE estimates for March and April/May FISs. Variables used in the GLM for standardising FIS CPUE were fishing year-survey (combined term), region, vessel, depth and sea-surface temperature (SST), with effort used as an offset variable. Variables used for standardising annual commercial CPUE were fishing year, month, region, licence number, depth, lunar phase (luminosity), SST and effort. Luminosity data were obtained from the [NASA Horizons Web-interface](#). Standardised estimates of CPUE are presented with 95% confidence intervals.

3. RESULTS

3.1. Fishery-independent surveys

3.1.1. CPUE

March surveys were not conducted between 2011/12 and 2020/21 and FIS CPUE in this period was not estimated. In 2023/24, the estimate of nominal March FIS CPUE was 17.9 kg/trawl-shot and similar to the 2022/23 estimate of 17.7 kg/trawl-shot (Figure 5a). Nominal April/May FIS CPUE has been estimated since 2004/05. Nominal April/May FIS CPUE declined from 42.3 ± 3.5 kg/trawl-shot in 2007/08 to a historical low of 22.3 ± 2.1 kg/trawl-shot in 2011/12 prior to the fishery being closed in 2012/13 and 2013/14 (Figure 5a). The fishery was then reopened in 2014/15, following a reduced survey in 2013/14 that recorded an estimate of nominal April/May FIS CPUE of 56.5 ± 5.0 kg/trawl-shot. Nominal April/May FIS CPUE then generally declined reaching 23.1 ± 2.1 kg/trawl-shot in 2020/21 before increasing 25% in 2021/22, to 28.9 ± 2.6 kg/trawl-shot (Figure 5a). In 2023/24, nominal April/May FIS CPUE was 23.1 ± 2.1 kg/trawl-shot.

Fishing year-survey, region, vessel and depth were all highly significant variables in the GLM used to standardise estimates of nominal FIS CPUE from March and April/May FISs (Table 8). The term 'fishing year-survey' explained ~9% of the deviance in the model. A total of 11% of model deviance was explained by the factors 'region' (7%), 'depth' (3%) and 'vessel' (1%) indicating that 80% of the deviance was caused by unknown factors. Sea surface temperature (SST) was not a significant term in the model (Table 8).

Standardised FIS CPUE remained above the target reference point (TargRP; 22.2 kg/trawl-shot) in 15 out of 19 years since 2004/05 (Range: 20.2–49.0 kg/trawl-shot) (Figure 5b). With the exception of 2017/18, standardised FIS CPUE declined since 2015/16 and was below the TargRP between 2021/22 and 2023/24. The 2023/24 estimate of 20.4 [16.1–25.6, 95% CI] kg/trawl-shot is the second lowest estimate on record, 8.1% below the TargRP and 10.3% above the trigger reference point (TrRP; 18.5 kg/trawl-shot) (Figure 5b).

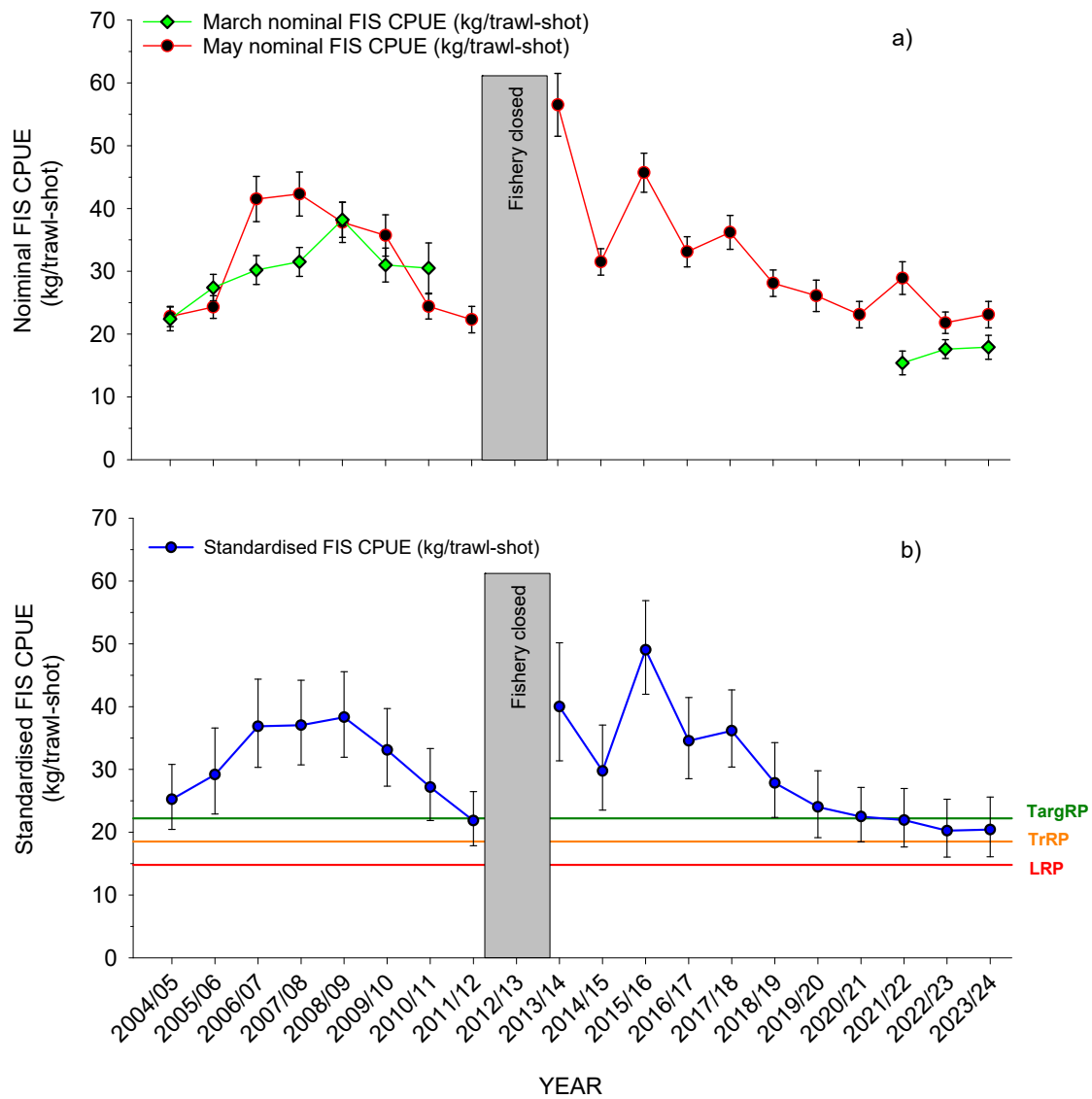


Figure 5. Catch Per Unit Effort estimates calculated from diamond-mesh codends during March and April/May surveys between 2004/05 and 2023/24 (a) nominal FIS CPUE (kg/trawl-shot) from March (green line) and April/May (red line) surveys; (b) standardised FIS CPUE (kg/trawl-shot), which is the average standardised FIS CPUE from March and April/May surveys. Note, a reduced survey was conducted in May 2013/14 (n=46 trawl shots). Error bars = standard error for estimates of nominal CPUE, and upper and lower (95%) confidence intervals for standardised CPUE. Grey area indicates the period when no survey occurred during the fishery closure.

Table 8. Analysis of deviance (Type II test) for the GLM used to standardise survey CPUE for the Gulf St Vincent Prawn Fishery. Abbreviations: SS, sum of squares; df, degrees of freedom; *F*, *F*-statistic.

Effect	SS	df	<i>F</i>
Fishing year-survey	352	43	11.1***
Region	267	7	51.5***
Vessel	57	13	5.9***
Depth	113	1	153.4***
SST	0	1	0.02 ^{NS}
Residuals	3,191	4,318	NA

Significance: *** $p < 0.001$, NS = non-significant

3.1.2. Prawn Size

Mean prawn size (n prawns/kg (PP/KG)) is estimated from the 7-kg subsample taken per shot and has a negative relationship with the number of prawns per kg (i.e. smaller mean prawn size = more prawns per kg). In March FISs from 2004/05 to 2010/11, the mean size of prawns decreased from 27.5 ± 0.6 to 35.4 ± 0.8 prawns/kg (Figure 6). In the 2023/24 March FIS, the number of prawns per kg was 35.8 ± 1.2 , slightly (5.6%) below the mean prawn size estimated from all March FIS (33.9 ± 0.9 prawns/kg) (Figure 6).

Trends in mean prawn size estimated from April/May FISs from 2004/05 to 2011/12 are similar to those estimated from March FISs. During this period the mean size of prawns progressively decreased from 31.0 ± 1.0 to 37.1 ± 1.2 prawns/kg (Figure 6). Following the fishery closure, the mean size of prawns increased 11.1% to 33.0 ± 1.1 in 2013/14, and in 2014/15, an estimate of 29.3 ± 0.8 prawns per kg was recorded, equating to the largest mean prawn size estimated from an April/May FIS (Figure 6). Mean prawn size then decreased and by 2018/19 was the smallest on record (43.2 ± 1.7 prawns/kg). In 2020/21, mean prawn size increased to 36.3 ± 1.2 prawns/kg but then decreased in the last three seasons. In 2023/24, the number of prawns per kg from the April/May FIS was 40.1 ± 1.6 prawns/kg, the third lowest estimate of mean prawn size recorded from April/May FISs.

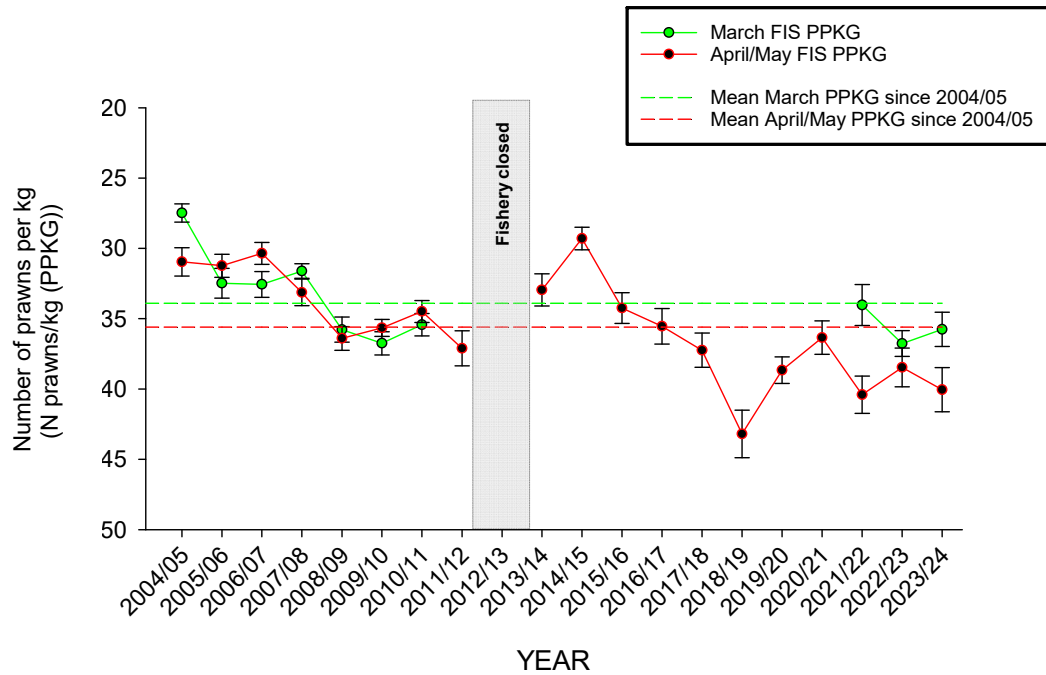


Figure 6. Prawn size as estimated by the mean number of prawns/kg calculated from diamond-mesh codends during March (green) and April/May surveys (red) between 2004/05 and 2023/24. Note, no March surveys were undertaken from 2011/12–2020/21.

3.1.3. Spatial patterns in CPUE and size

Figure 7 depicts temporal trends in the percentage of March and April/May survey sites characterised by prawn aggregations averaging ≤ 32 prawns/kg and catch rates of ≥ 30 kg/trawl-shot (commercial fishing strategy guidelines: ‘fishable’ sites). No March surveys were undertaken between 2011/12 and 2020/21. Figures 8a-b and 9a-b depict the spatial patterns of catch rate for different size prawns in March and May FIS, respectively. Spatial patterns in prawn size and abundance in March and April/May are generally indicative of smaller prawns entering the fishery from recruitment areas in northern Gulf St Vincent (Figures 8a-b, and 9a-b).

The percentage of March survey sites averaging ≤ 32 prawns/kg and catch rates of ≥ 30 kg/trawl-shot ranged between 7.5% (2009/10) and 28.8% (2006/07) between 2004/05 and 2010/11 (Figures 7 and 8). In the March FIS in 2023/24, 4% of sites (n=4 sites) had prawn aggregations with this size and catch rate criteria (Figures 7 and 8b).

The percentage of April/May survey sites having prawn aggregations averaging ≤ 32 prawns/kg and catch rates of ≥ 30 kg/trawl-shot ranged from 7.6% in 2011/12 prior to the fishery closure, to 41.3% in 2013/14 prior to the fishery reopening (Figure 7). The percentage of sites characterised by these size and catch rate criteria has decreased since 2018/19 (Figure 7) with the April/May FIS in 2022/23 and 2023/24 recording the

lowest percentages of sites classified as 'fishable' of any April/May FIS (2022/23: 6.7%; 2023/24: 5.2% (Figures 7 and 9b).

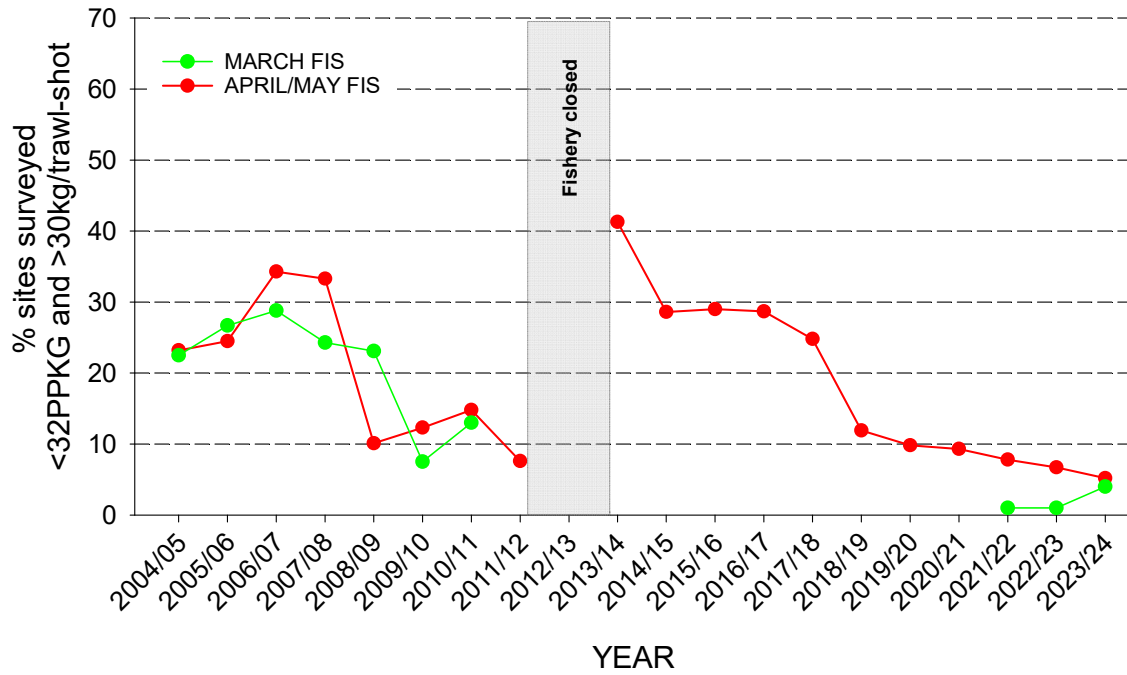


Figure 7. Trends in the percentage of March (green) and April/May survey (red) sites considered 'fishable' under the commercial fishing strategy guidelines, that is, with prawn aggregations of criteria <32 prawns/kg and CPUE of >30kg/rawl-shot between 2004/05 and 2023/24.

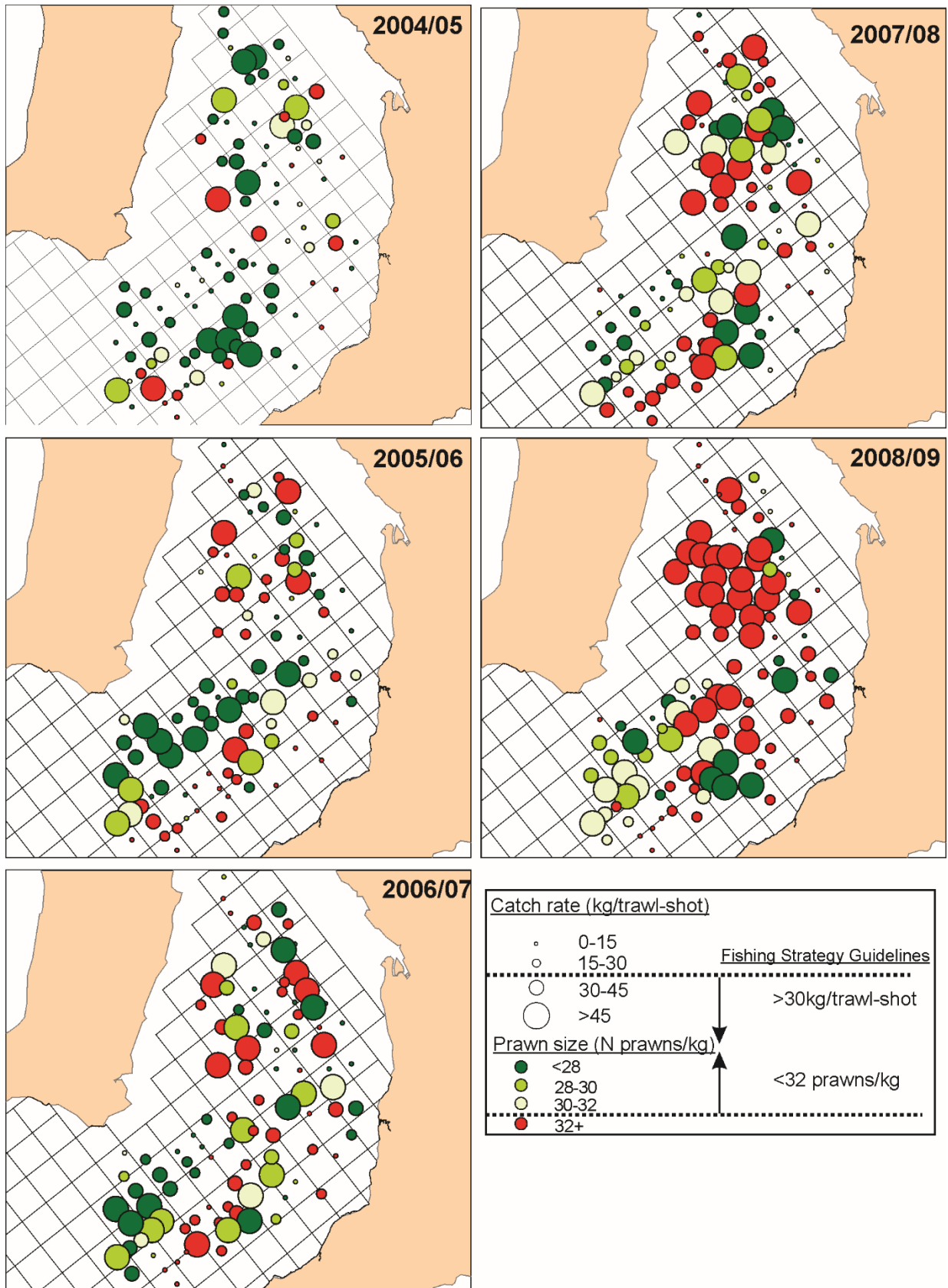


Figure 8a. Catch rate and mean size of prawns sampled from the diamond-mesh codend during March FISs in the GSVPF from 2004/05–2008/09. Note, no March surveys were undertaken from 2011/12–2020/21.

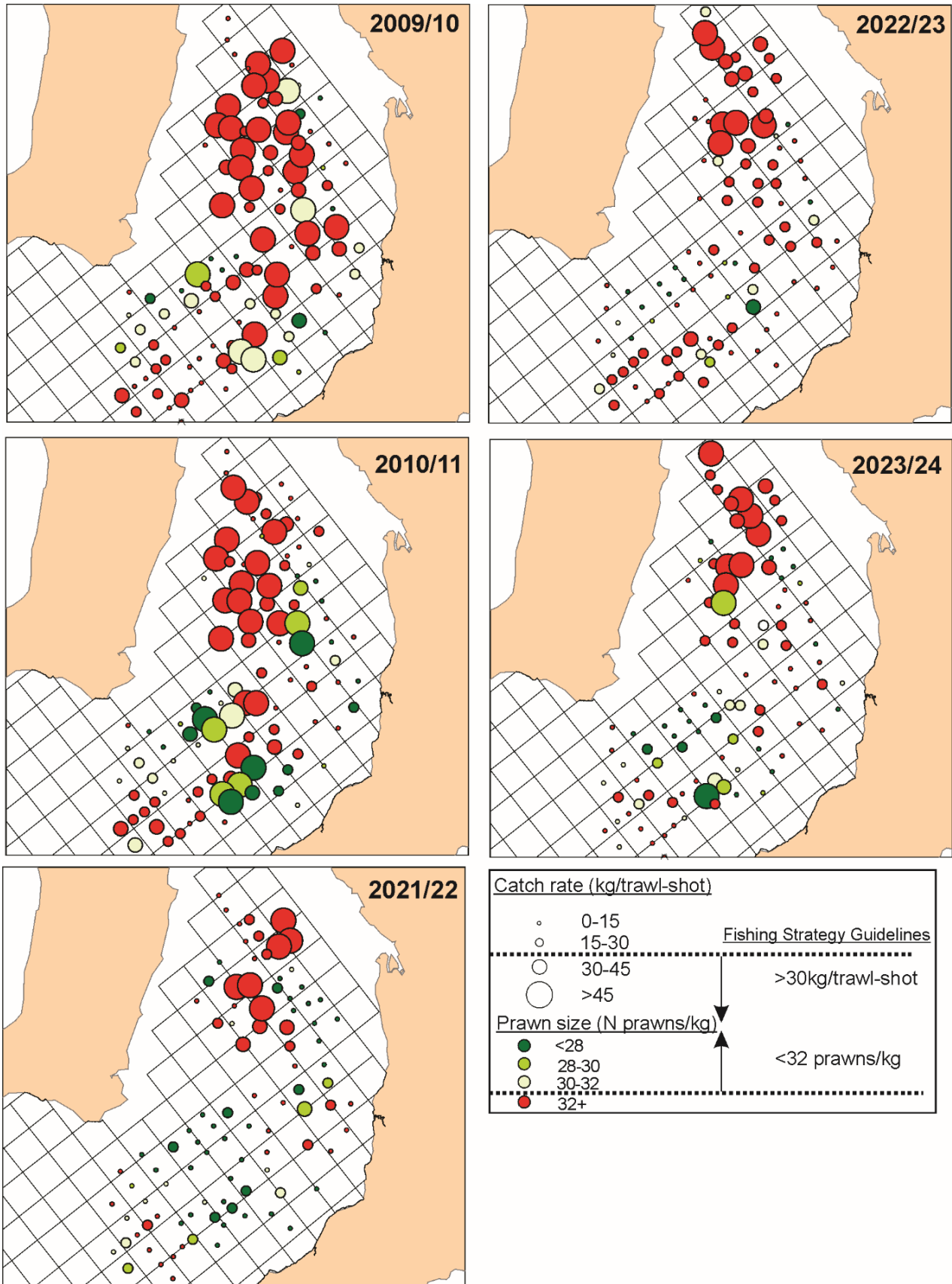


Figure 8b. Catch rate and mean size of prawns sampled from the diamond-mesh codend during March FISs in the GSVPF from 2009/10–2010/11 and 2021/22–2023/24. Note, no March surveys were undertaken from 2011/12–2020/21.

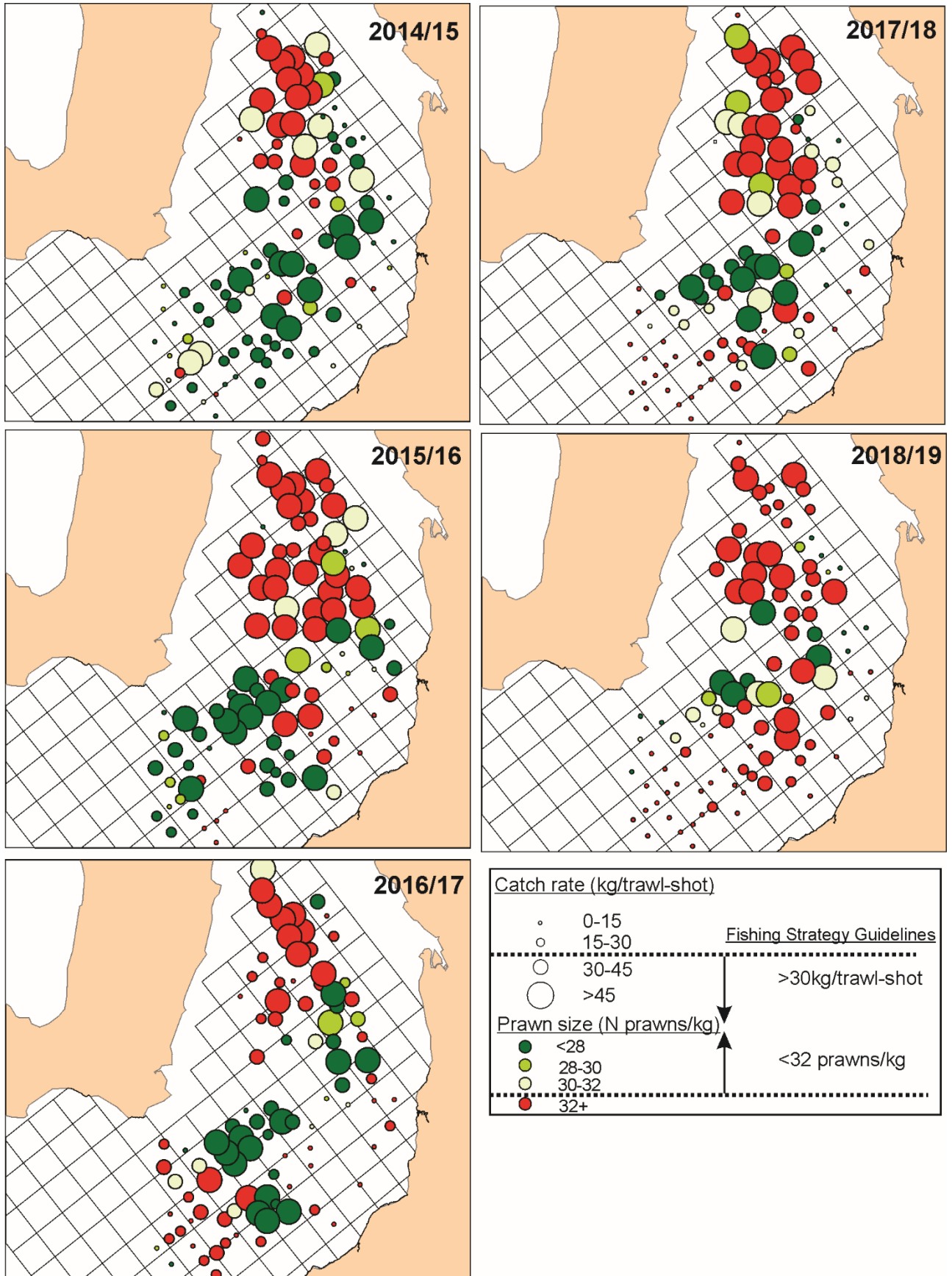


Figure 9a. Catch rate and mean size of prawns sampled from the diamond-mesh codend during April/May FISs in the GSVPF from 2014/15–2018/19.

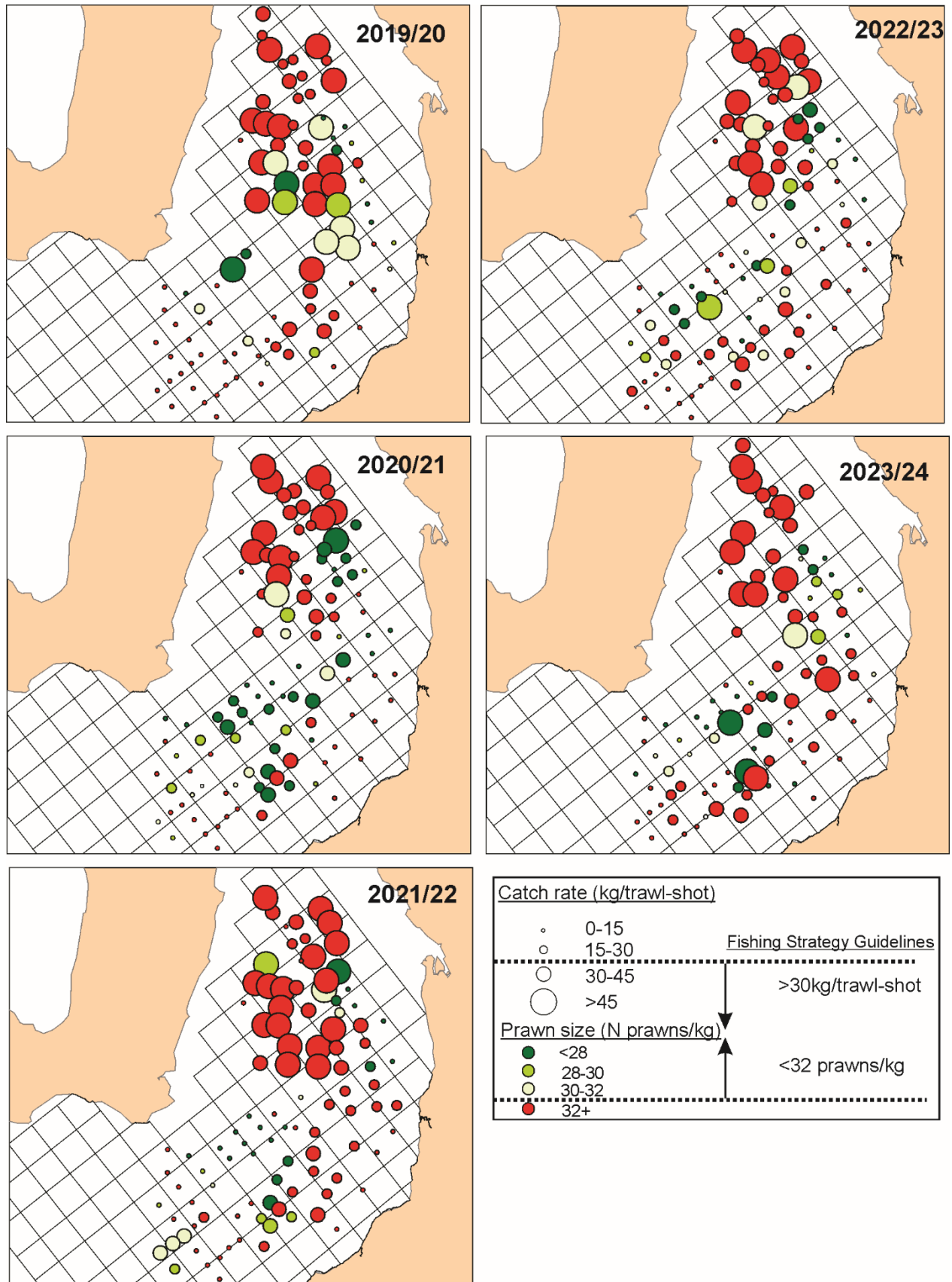


Figure 9b. Catch rate and mean size of prawns sampled from the diamond-mesh codend during April/May FISs in the GSVPF from 2019/20–2023/24.

3.1.4. Recruitment

FRI estimates show high interannual variability, ranging between 239 and 1,186 recruits.h⁻¹ since 2004/05 (Figure 10). Since the fishery closure between 2012/13 and 2013/14, the FRI averaged 756 ± 78 (SE) recruits.h⁻¹. In 2023/24, the FRI was estimated from a total of 96 completed trawl shots and was 812 ± 114 recruits.h⁻¹ (Figure 10), which is slightly above the average FRI recorded since 2013/14.

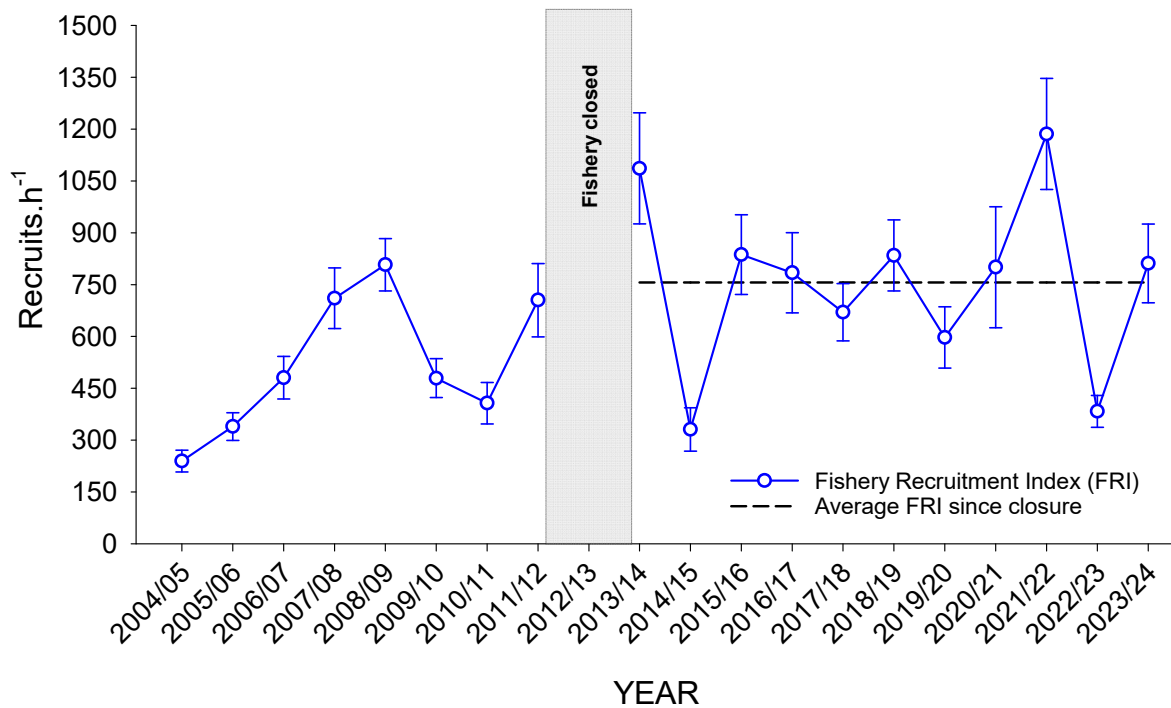


Figure 10. The FIS recruitment index (FRI) (recruits.h⁻¹) calculated from diamond-mesh codends during April/May surveys between 2004/05 and 2023/24.

3.2. Fishery statistics

3.2.1. Catch and effort

The total commercial catch of Western King Prawn in the GSVPF in 2023/24 was 112.0 t, with an additional 4.5 t taken in the November 2023, March and April/May 2024 surveys (Figure 11a, Appendix 1). The 2023/24 commercial catch is the third lowest recorded since 1970/71 and 46% below the estimated mean annual catch since 2000/01. The last five seasons of catch rank within the top ten lowest catches recorded since 1970/71 (Figure 11a).

In 2023/24, 35.5 t of the catch was taken during the early spawning period prior to Christmas (November–December), which was 32% of the total annual catch. Catch taken during the late spawning period (January–March) in 2023/24 (14.0 t) comprised 13% of the total catch (Appendix 1). The highest percentage of the 2023/24 catch (62.5 t, 56%) was harvested during the non-spawning period (April–July).

In 2023/24, commercial fishing was conducted over 275 of the TACE of 390 vessel-nights (nights) determined from decisions rules within in the harvest strategy (PIRSA 2022) (Figure 11b). A total of 77 vessel-nights was fished pre-Christmas in 2023/24. A total of 2,676 trawl-hours was recorded in 2023/24, which is 4% less than the average trawl-hours reported since the fishery reopened in 2014/15 ($2,787 \pm 103$ trawl-hours; Figure 11c). A summary of total catch (t) and effort (vessel-nights) since 1989/90 is provided in Appendix 2.

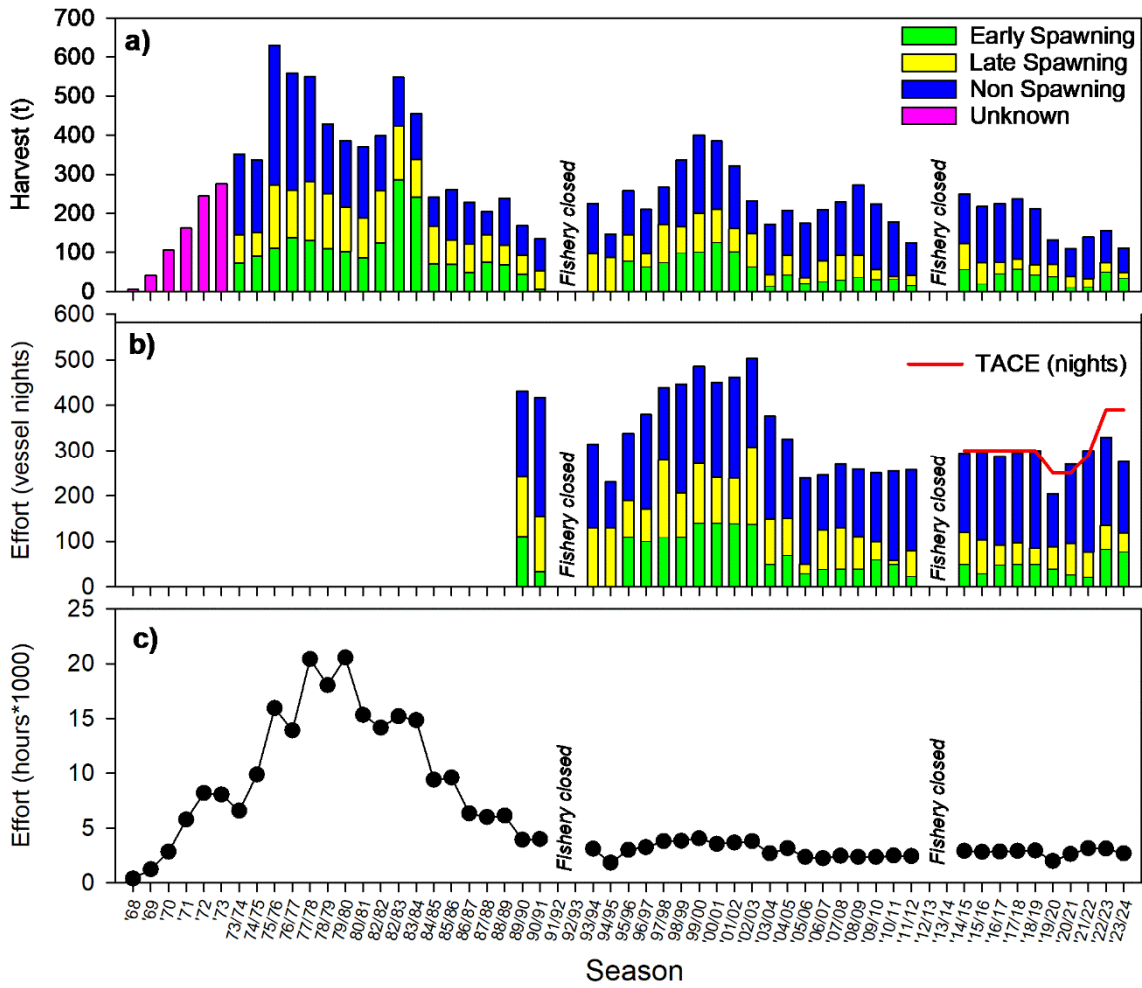


Figure 11. Fishery-dependent catch and effort data for the Gulf St Vincent Prawn Fishery since 1968; (a) annual catch (t) and (b) effort (vessel-nights) separated by early spawning (November–December), late spawning (January–March) and non-spawning (April–October) periods; and (c) annual commercial effort (hours * 1000). Catch data from surveys not included. Annual levels of TACE do not include TACE carryover.

3.2.2. CPUE

In the last four seasons, nominal commercial CPUE estimates were among the lowest on record ranging from 405–477 kg/vessel-night. Estimates of standardised annual commercial CPUE since 1989/90 are higher than estimates of nominal CPUE (Figure 12). This can be attributed to effort being fixed in the GLM at a typical vessel-night value of ~9 hours, and post 2012, the model accounting for reductions in catch following introduction of T90-mesh into the fishery. Despite the differences in scale of annual nominal and standardised CPUE estimates, the trend in both CPUE metrics is similar over time. A summary of nominal and standardised annual commercial CPUE since 1989/90 is provided in Appendix 2.

Fishing year:month, region, lunar phase, lunar phase (lagged), licence number, sea surface temperature and effort were significant variables in the final model (Table 9). Effort was the most influential variable, explaining 77.2% of the total model deviance. Other significant variables explained a total of 8.0% of the total model deviance and 14.8% of the deviance was caused by unknown factors. Depth was not a significant term in the model (Table 9).

Table 9. Analysis of deviance (Type II test) for the GLM used to standardise annual commercial catch in the Gulf St Vincent Prawn Fishery. Abbreviations: SS, sum of squares; df, degrees of freedom; *F*, *F*-statistic.

Effect	SS	df	<i>F</i>
fishing year:month	11,436	176	65.2***
region	214	7	30.7***
lunar phase	181	1	181.6***
lunar phase (lagged)	57	1	57.4***
licence no	152	9	17.0***
sst	69	1	69.0***
effort	116,733	1	117,152***
depth	1.13	1	1.14 (NS)
residuals	21,800	21,657	

significance: *** $p < 0.001$. NS = non-significant

From 1993/94 to 2004/05, estimates of standardised annual commercial CPUE ranged from 710 [664–757, 95% CI] kg/vessel-night in 2004/05 to 932 [888–977, 95% CI] kg/vessel-night in 2000/01 (Figure 12). From 2004/05, standardised annual commercial CPUE steadily increased, reaching 1,053 [991–1118, 95% CI] kg/vessel-night in 2008/09 before declining to 735 [680–793, 95% CI] kg/vessel-night in 2010/11. The fishery was then closed in 2012/13 and 2013/14.

Following reopening of the fishery in 2014/15, the estimate of standardised annual commercial CPUE was the highest estimate on record at 1197 [1129–1268, 95% CI] kg/vessel-night and 62% above the target reference point (TargRP). Standardised annual commercial CPUE then declined but remained between 43–56% above the TargRP of 738 kg/vessel-night between 2015/16 and 2019/20 (Figure 12). Standardised annual commercial CPUE then declined and in the last four seasons has remained <15% above the TargRP. In 2023/24, standardised annual commercial CPUE was 795 [746–847, 95% CI] kg/vessel-night, which is a 4.3% decrease since 2022/23 (831 [780–884, 95% CI] kg/vessel-night) and 7.7% above the TargRP (Figure 12).

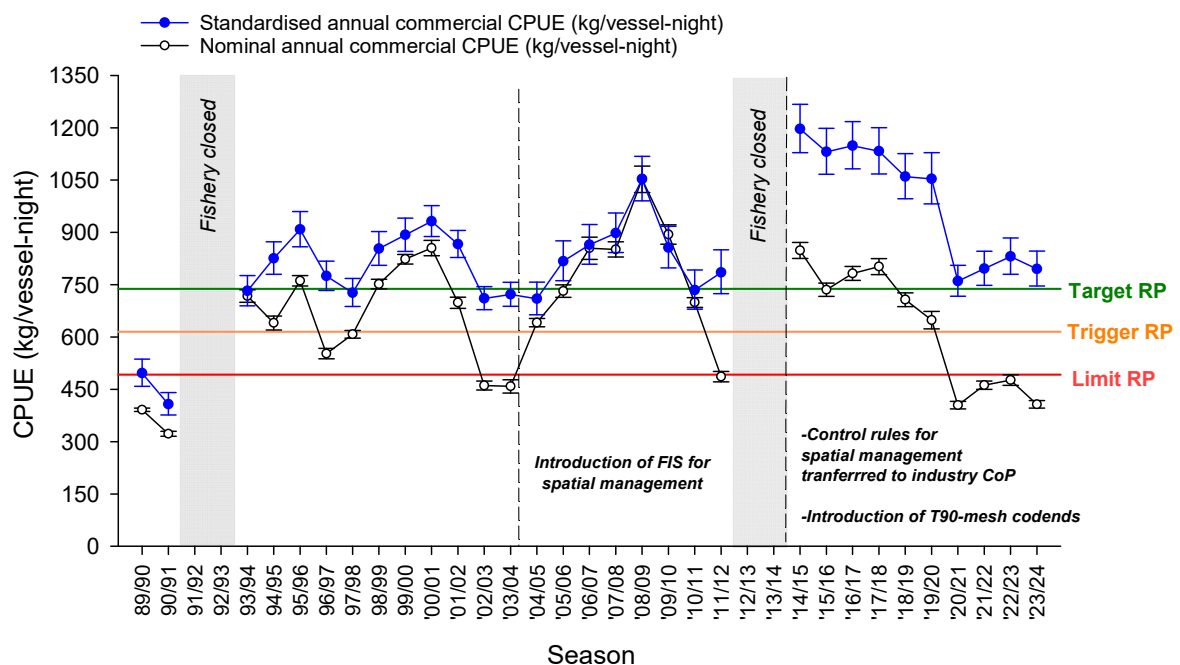


Figure 12. Comparison of standardised annual commercial CPUE and nominal annual commercial CPUE (kg/vessel-night) in the Gulf St Vincent Prawn Fishery from 1989/90–2023/24. Error bars are ± standard error for nominal CPUE, and upper and lower (95%) confidence intervals for standardised CPUE. Note, Reference Points (Target, Trigger and Limit RPs) are as per the Management Plan (2022) and are relevant only to standardised annual commercial CPUE.

3.2.3. Spatial patterns in catch and effort

From 2004/05 to 2011/12, FISs were used to spatially control the areas harvested in GSV leading to a decline in the number of blocks that were fished (Figure 13). From 2014/15, the number of surveys was reduced, control rules for spatial management were transferred and adopted into the SVGPBOA Industry Code of Practice (see Section 1.2.2), and the number of blocks that were fished subsequently increased. In 2023/24,

fishing took place in 36 blocks pre-Christmas (November–December) and 53 blocks in the remaining months of the fishing season (Figures 13 and 14).

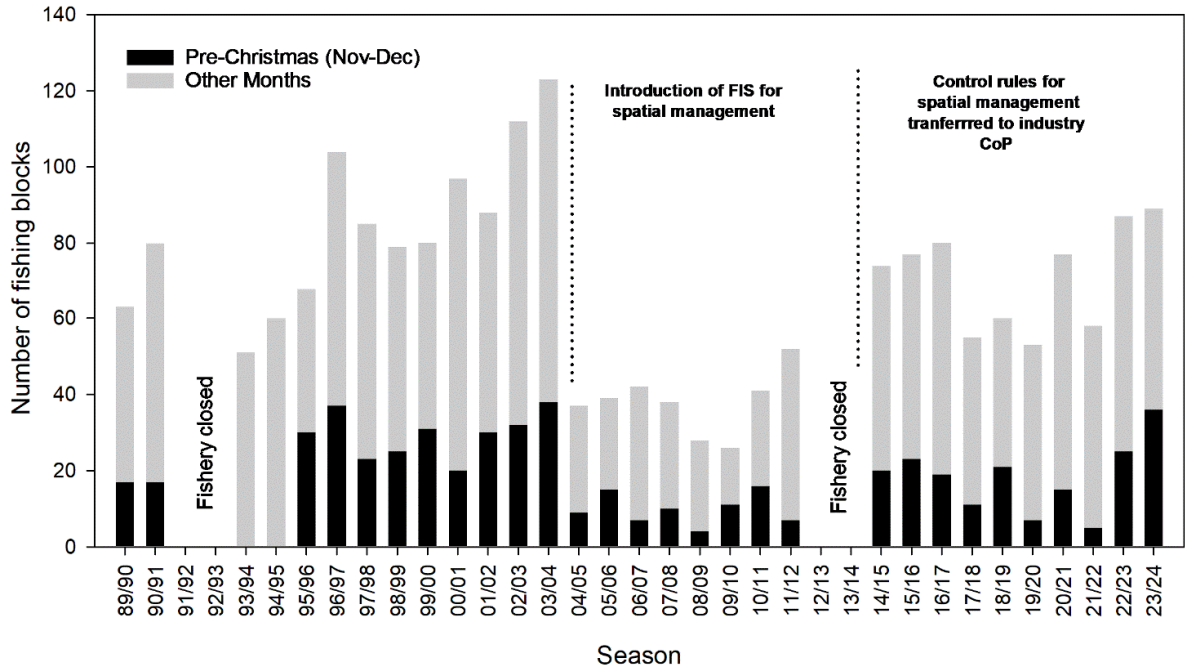


Figure 13. The number of blocks fished pre-Christmas (November and December) and all other months in the Gulf St Vincent Prawn Fishery from 1989/90–2023/24.

Since the fishery reopened in 2014/15, a relatively high proportion of the catch has been taken in blocks located in the central and southern regions of GSV (season range: 63-92%) (Figure 14). In 2023/24, central regions (RG2, RG5, LIH) of GSV contributed to 52% of the catch and southern regions (RG3, RG4, DPH, SDH, INV) contributed to 40% of the catch. In 2023/24, the highest percentages of catch were recorded from RG5 (27.2%) and RG2 (23.7%). A total of ~57 t was reported from these regions (Figure 14). A total of 17.8 t was also recorded from the Deep Hole (DPH) in 2023/24, comprising ~16% of the total catch.

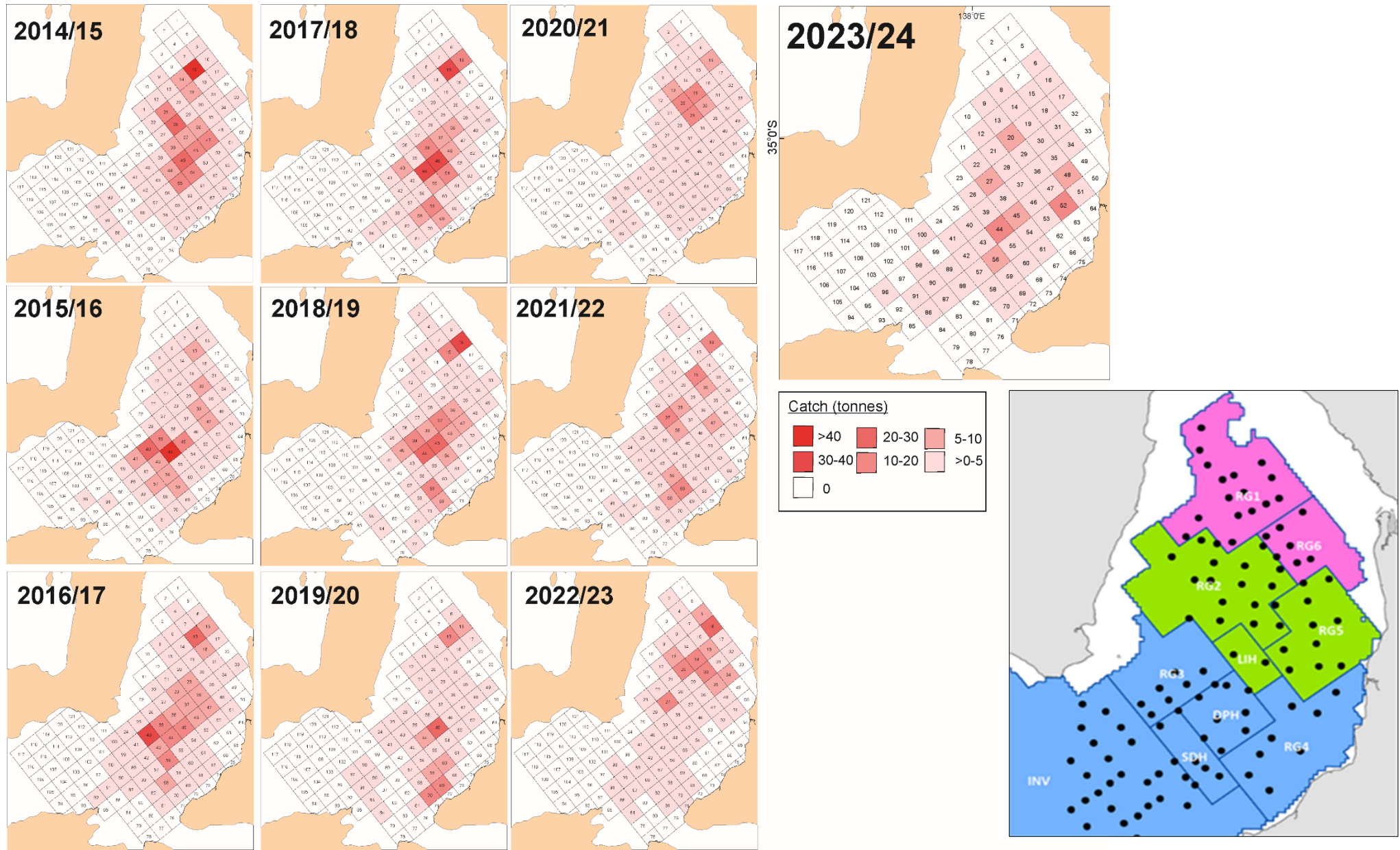


Figure 14. Annual catch per fishing block in the Gulf St Vincent Prawn Fishery from 2014/15–2023/24. Map on bottom right shows regions used to describe the spatial distribution of fishing (see Figure 4 for more detail).

3.2.4. Prawn size

Since 2005/06, when grade information was first collected through daily logbooks, the annual catch of Western King Prawn in the GSVPF has comprised, on average, 24% extra-large prawns, 38% large prawns, 23% medium prawns and 8% small prawns (Figure 15). Soft and broken prawns have historically comprised a relatively low percentage of the catch (average since 2005/06: $7.0 \pm 0.3\%$).

From 2005/06 to 2010/11, the percentage of large and extra-large prawns in the catch decreased, and a corresponding increase in the proportion of small and medium prawns was recorded (Figure 15a, b). Following the re-opening of the fishery in 2014/15, extra-large (U6–U10 prawns per pound) and large (10/15 prawns per pound) prawns comprised 69% of the total catch (Figure 15a). The percentage of extra-large and large prawns in the catch then remained similar between 2014/15 and 2017/18 (66–69%). The percentage of extra-large and large prawns in the catch then decreased, comprising on average $54.0 \pm 0.9\%$ of the total catch between 2018/19 and 2023/24 (Figure 15a, Appendix 3). In 2023/24, extra-large and large prawns comprised 53% of the total catch, small and medium prawns comprised 41% of the total catch and soft and broken prawns comprised 6% of the total catch (Figure 15c, Appendix 3).

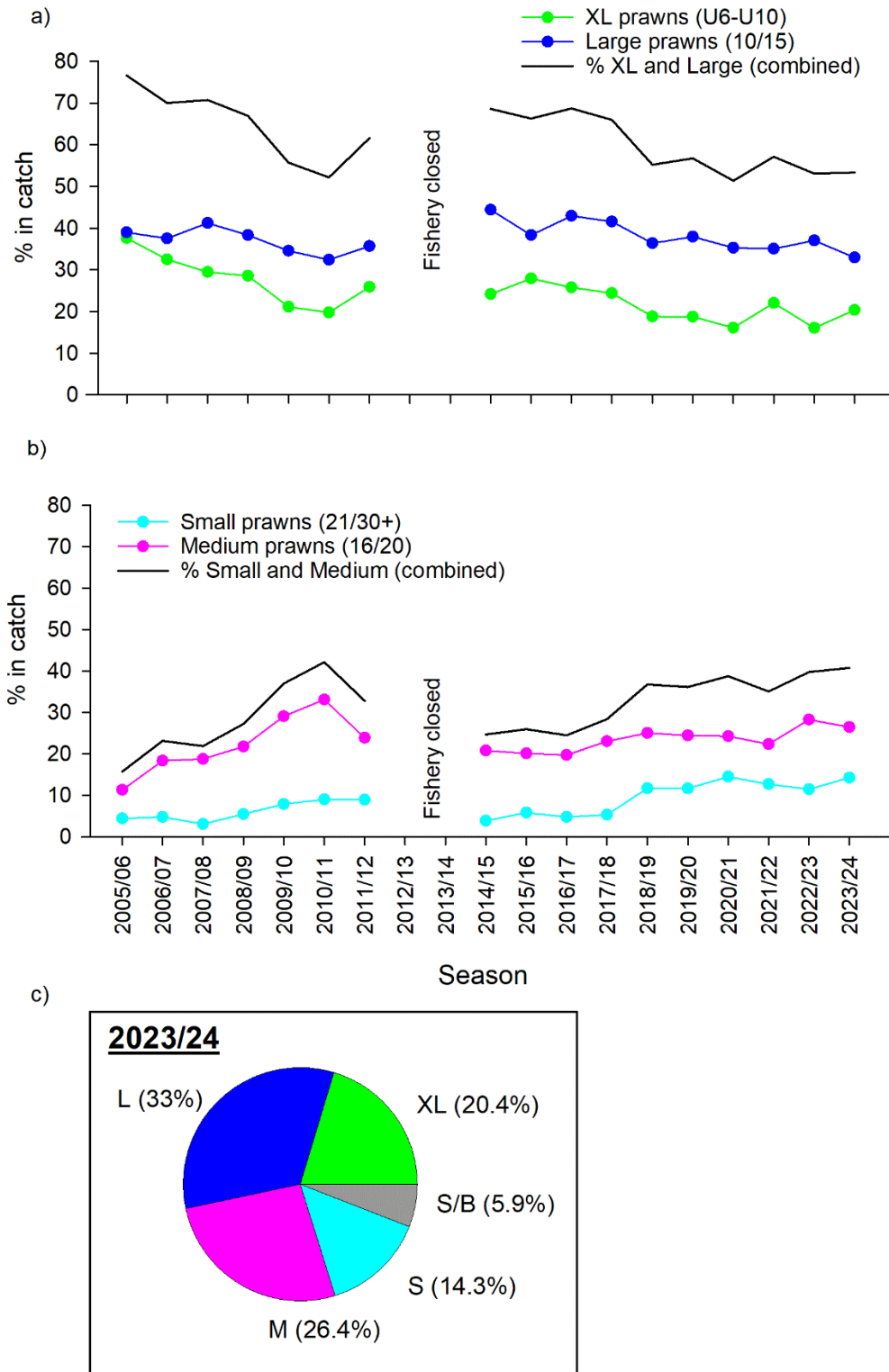


Figure 15. a) Temporal trends in harvest composition of extra-large (XL) and large prawns; and b) medium and small prawns (see Table 7 for prawn grade composition categories); c) Size-grade composition (%) of the 2023/24 season harvest of prawns in the Gulf St Vincent Prawn Fishery.

4. DISCUSSION

4.1. Information sources and data uncertainty

Information available for the assessment of the GSV Western King Prawn stock includes data from fishery-independent surveys from 2004/05 to 2023/24, and fishery catch and effort data since 1968, and are both considered high standard (Dichmont 2014). The current management plan for the fishery provides the decision rules for classifying the status of the Western King Prawn stock in GSV (PIRSA 2022). It uses limit, trigger and target reference points defined for two performance indicators relating to stock abundance (PIRSA 2022). The performance indicators are estimated from fishery-independent and fishery-dependent data.

4.1.1. Fishery-independent data

A fishery-independent survey program has been undertaken since December 2004 and is a key component in the assessment of status of the Western King Prawn stock in GSV. The methods used to collect the data have remained relatively consistent, despite adaptations to the survey program in recent years (see Section 2.1). Locations sampled in FISs have remained constant over time, and standardised FIS CPUE is considered the best available fishery-independent index of relative biomass. Under the harvest strategy in the current management plan, two surveys per year are undertaken to account for potential within-season fluctuations in prawn abundance (PIRSA 2022).

4.1.2. Fishery-dependent data

The trends in standardised annual commercial CPUE estimated from data recorded in daily commercial logbooks resemble the trends in standardised FIS CPUE since 2004/05. However, there is some uncertainty associated with the time series of data collected from the fishery used to estimate commercial CPUE. The spatial distribution of fishing effort has changed over time due to changes in spatial management of the fishery. The introduction of four FISs per season between 2004/05 and 2010/11 likely increased catch efficiency during this time but the effects of surveys on catchability and resulting CPUE estimates remain difficult to quantify due to the potentially confounding effect of changes in stock biomass during this period. Also, estimates of standardised annual commercial CPUE are based on daily logbook data from 1989/90 because catch data available prior to this time are either not available or considered unreliable. Consequently, estimates of standardised CPUE from 1989/90 do not consider a period in the early development of the fishery when catches were considerably higher (1975/76–1983/84).

There is also some uncertainty associated with the calculation of prawn size from grade data that arises from: 1) data not being available from the entire fleet for all seasons; 2) differences in the grading among the vessels; and 3) uncertainty associated with the unvalidated grade data provided in logbooks (Dixon *et al.* 2012).

4.2. Context of the assessment and stock status

Since its inception in 1967, the GSVPF has gone through several cycles characterised by periods of increasing catch and CPUE, followed by subsequent declines in recruitment, catch, CPUE and fishery performance, and resulting closure periods (1991/92–1992/93 and 2012/13–2013/14) (Morgan and Cartwright 2013). In 2021, a bio-economic model developed for the GSVPF was updated with biological, catch and economic information, and used to inform the development of a new harvest strategy (Noell *et al.* 2015; PIRSA 2022). Model outputs indicated that the relative biomass of the Western King Prawn stock had fluctuated at or above 60% of unfished biomass ($0.6 B_0$) levels since the mid-1990s. The bioeconomic model was then used to predict levels of effort (TACE) that would on average hold the stock at a target level of 60% unfished biomass ($0.6 B_0$), and a limit level of 40% unfished biomass ($0.4 B_0$) that corresponds to Maximum Sustainable Yield (MSY). Under the harvest strategy, the status of the Western King Prawn stock in GSV is prescribed relative to the reference points for standardised commercial and FIS CPUE associated with these levels of biomass (PIRSA 2022).

Recent seasons of relatively small prawns, and reductions in catch and CPUE, signal a period of reduced fishery performance relative to when the fishery reopened in 2014/15. Such trends may be expected following a period of closure where the stock rebuilds to support high catch rates immediately after re-opening, and the current harvest strategy allows catch rates to decrease without triggering the relatively large reductions in effort (nights) applied under the previous harvest strategy (PIRSA 2017, 2022). This approach is different to those undertaken previously in the fishery and acknowledges: 1) historical fluctuations in catch and CPUE likely linked to variations in recruitment; 2) industry concerns relating to a recently smaller fleet size and reduced ability to locate areas of high prawn abundance; and 3) economic fishing limits being reached before stock sustainability is compromised (i.e. before limit reference points are breached).

In 2023/24, fishing was conducted over 275 of the 390 vessel-nights (TACE) determined from decisions rules within the harvest strategy (PIRSA 2022). A total of 77 of 80 pre-Christmas vessel-nights were fished. The total commercial catch of Western King Prawn in the GSVPF in 2023/24 was 112.0 t, with an additional 4.5 t taken in surveys. The 2023/24 commercial catch is the third lowest recorded since 1970/71 and 46% below the estimated mean annual catch since 2000/01.

Since 2018/19, standardised FIS CPUE has declined and was below the TargRP between 2020/21 and 2023/24. The 2023/24 estimate of 20.4 [16.1–25.6, 95% CI] kg/trawl-shot was the second lowest estimate on record but 10.3% above the trigger reference point (TrRP; 18.5 kg/trawl-shot). Estimates of nominal and standardised annual commercial CPUE have also declined. In the last four seasons, nominal commercial CPUE estimates were among the lowest on record and standardised annual commercial CPUE was <15% above the TargRP. In 2023/24, standardised annual commercial CPUE was 795 [746–847, 95% CI] kg/vessel-night, which is a 4% decrease since 2022/23 and 7.7% above the TargRP (PIRSA 2022).

The decreasing trends in prawn size estimated from the FISs and commercial prawn-grade data are indicative of changes in the stock size-structure of Western King Prawns in GSV and that prawns are being harvested at a smaller average size than that which produces maximum yield per recruit. These trends, coupled with the recent seasons of low catch and nominal CPUE, relatively low prawn prices nationally, and sustained inflationary pressures leading to higher input costs, have led to several years of poor economic performance in the fishery. BDO EconSearch (2023; 2024) reported a negative net economic returns in the fishery in 2019/20 (-\$1 million), 2020/21 (-\$1.4 million), 2021/22 (-\$0.4 million) and 2022/23 (-\$2.5 million).

Despite the trends in the information available for the fishery, the 2023/24 estimates of standardised FIS CPUE and standardised commercial CPUE are both above the TrRP for these performance indicators (PIRSA 2022). This indicates that the biomass of the GSVPF Western King Prawn stock in 2023/24 is at a level to ensure that, on average, future levels of recruitment are adequate (i.e. recruitment is not impaired). Consequently, when the two performance indicators are applied in the decision rules within the harvest strategy to determine the status of the Western King Prawn stock in GSV (Table 6), the stock is classified as **'sustainable'**.

4.3. Future research needs

How the current harvest strategy may affect stock productivity in the longer term is unknown and it is recommended that its effectiveness be reviewed within three years after its implementation (2025). This approach was supported by an external review of the harvest strategy in 2021 (Smith 2021). The decreasing trends in prawn size across the fishery also indicate that yield per recruit and economic return are potentially sub-optimal. Considering the relatively higher prices fetched by prawns in larger size-grades, further bio-economic modelling analyses may assist in identifying the costs/benefits of targeting certain size criteria of prawns through at-sea fishing strategies. More research is also required to understand spatial and temporal patterns of recruitment in GSV and its

relationship with fishing strategies. A pilot study undertaken in 2024 broadly assessed how recruitment may be affected by the interaction of oceanographic patterns and fishing during the main spawning period (November–December). This work could be enhanced by modelling to explicitly examine the links between fishing mortality, population biomass, egg production and larval settlement in different parts of the fishery under a range of environmental conditions (see McLeay et al. 2015).

Improving catch efficiency through fishing gear modifications is a goal of modern commercial fisheries and offers an opportunity to reduce input costs and improve net economic return. However, opportunities to improve catch efficiency must consider stock sustainability. A project to assess trawl-gear efficiency and bycatch reduction in the GSVPF and SGPF is underway (FRDC Project - 2023/039). The GSV component of the project is assessing the effectiveness of trawl and net modifications for improving catch efficiency (reducing fuel use) and size-selectivity of prawn catches while reducing bycatch. The first gear trials are scheduled for the 2024/25 season. The fishery would also benefit from the design of a long-term bycatch monitoring program (including TEPS), research relating to product value adding, and assessing the impacts of climate change.

5. REFERENCES

BDO Econsearch (2023). Economic and Social indicators for the South Australian Gulf St Vincent Prawn Fishery 2021/22. A Report for the Department of Primary Industries and Regions. 56pp.

BDO Econsearch (2024). Economic and Social indicators for the South Australian Gulf St Vincent Prawn Fishery 2022/23. A Report for the Department of Primary Industries and Regions. 65pp.

Beckmann, C. L., Noell C. J. and Hooper, G. E. (2015). Status of the Gulf St Vincent Prawn *Penaeus (Melicertus) latisulcatus* Fishery in 2014/15. Fishery Status Report to PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2007/00174-4. SARDI Research Report Series No. 870. 25pp.

Beckmann, C. L. and Hooper, G. E. (2016). Gulf St Vincent Prawn *Penaeus (Melicertus) latisulcatus* Fishery in 2015/16. Fishery Assessment Report to PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2007/0082-6. SARDI Research Report Series No. 919. 44pp.

Boxshall, S., Xiao Y. and Williams H. (1999). Gulf St Vincent Prawn. Fishery Assessment Report to PIRSA. SARDI Aquatic Sciences, South Australian Fisheries Assessment Series 99/05.

Boxshall, S. and Williams H. (2000). Gulf St Vincent Prawn. SARDI Aquatic Sciences, South Australian Fisheries Assessment Series 00/05.

Boxshall, S. and Johnson J. (2001). Gulf St Vincent Prawn. SARDI Aquatic Sciences, South Australian Fisheries Assessment Series 01/05.

Broadhurst, M.K., Larsen R.B., Kennelly S.J. and McShane P. (1999). Use and success of composite square-mesh codends in reducing bycatch and in improving size-selectivity of prawns in Gulf St Vincent, South Australia. Fish. Bull. 97: 434–448.

Carrick, N.A. (2003). Spencer Gulf Prawn (*Melicertus latisulcatus*) Fishery. Fishery assessment report to PIRSA Fisheries. RD03/0079-2. Adelaide, South Australia: South Australian Research and Development Institute (Aquatic Sciences).

Copes, P. (1990). Resolution of current management problems in the prawn fishery of Gulf St Vincent. Report to the Minister of Fisheries of South Australia. 70p.

Dichmont, C. (2014). A review of the stock assessment methods, processes and outputs for the Gulf St Vincent Prawn Fishery. A report prepared for Primary Industries and Regions SA (PIRSA). CSIRO, Brisbane, Australia, 39 pp.

Dixon C.D. and Sloan S. (2007). Management Plan for the South Australian Gulf St Vincent Prawn Fishery. South Australian Fisheries Management Series. No. 53. Adelaide, South Australia: Primary Industries and Resources South Australia.

Dixon, C.D., Roberts S.D. and Hooper, G.E. (2011). Gulf St Vincent Prawn, *Penaeus (Melicertus) latisulcatus*, Fishery 2009/10. Fishery Assessment report to PIRSA Fisheries. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2007/000782-4. SARDI Research Report Series No. 526. 121pp.

Dixon, C.D., Hooper, G.E and Burch P. (2012). Gulf St Vincent Prawn, *Penaeus (Melicertus) latisulcatus*, Fishery 2010/11. Fishery Assessment Report to PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2007/000782-5.

Dixon, C., Raptis, J., Gorman, D., Roberts, S., Hooper, G., Bicknell, N., Sorokin, S., Newman, R., Noell, C., Benediktsson, T., Saint, J. and Hill, Wallace. (2013). A collaborative approach to novel bycatch research for rapid development, extension and adoption into a commercial trawl fishery. FRDC Project 2009/069. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2012/000250-1. SARDI Research Report Series No. 643. 47pp.

Flood, M., Stobutzki, I., Andrews, J., Begg, G., Fletcher, W., Gardner, C., Kemp, J., Moore, A., O'Brien, A., Quinn, R., Roach, J., Rowling, K., Sainsbury, K., Saunders, T., Ward, T., and Winning, M. (eds) (2012). Status of key Australian fish stocks reports 2012, Fisheries Research and Development Corporation, Canberra.

Flood, M., Stobutzki, I., Andrews, J., Ashby, C., Begg, G., Fletcher, R., Gardner, C., McDonald, B., Moore, A., Roelofs, A., Sainsbury, K., Saunters, T., Smith, T., Stewardson, C., Stewart, J., and Wise, B. (2014). Status of key Australian fish stock reports 2014. Fisheries Research and Development Corporation, Canberra.

Gorman, D. and Dixon, C. (2015). Reducing discards in a temperate prawn trawl fishery: a collaborative approach to bycatch research in South Australia. ICES J. Mar. Sci. 72 (9): 2609-2617.

Hooper G.E., Roberts S.D. and Dixon C.D. (2009). Gulf St Vincent prawn (*Melicertus latisulcatus*) fishery 2007/08 status report. Fishery status report to PIRSA Fisheries.

SARDI Aquatic Sciences Publication No. F2007/001074-2, Research Report Series No 328.

Kangas M. (1999). Postlarval and juvenile western king prawns *Penaeus latisulcatus* Kishinouye studies in Gulf St Vincent, South Australia with reference to the commercial fishery. PhD thesis, University of Adelaide.

Kangas, M. I. and Jackson, B. (1997). Gulf St Vincent Prawn Fishery. South Australian Fisheries Assessment Series, Report No. 99/05. Adelaide, South Australia: South Australian Research and Development Institute (Aquatic Sciences).

King, M. G. (1977). The biology of the western king prawn, *Penaeus latisulcatus* Kishinouye, and aspects of the fishery in South Australia. MSc Thesis, University of Adelaide.

Knuckey, I.T., Kompas, T. and Bodsworth A. (2011). Review of the Gulf St Vincent Prawn Fishery. Ocean Grove, Victoria: Cobalt MRM Pty Ltd. Report for PIRSA Fisheries and Aquaculture- September 2011. (Internal report).

McLeay, L., Doubell, M., Roberts, S., Dixon, C., Andreacchio, L., James, C., Luick, J. and Middleton, J. South Australian Research and Development Institute (Aquatic Sciences) (2015). Prawn and crab harvest optimisation: a bio-physical management tool. Final Report to the Fisheries Research and Development Corporation. Adelaide, June. 80pp.

McLeay, L.J., Beckmann, C. L. and Hooper, G. E. (2017). Gulf St Vincent Prawn *Penaeus (Melicertus) latisulcatus* Fishery 2016/17. Fishery Assessment Report to PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2007/000782-7. SARDI Research Report Series No. 972. 48pp.

McLeay, L.J and Hooper, G. E. (2018). Gulf St Vincent Prawn *Penaeus (Melicertus) latisulcatus* Fishery 2017/18. Fishery Assessment Report to PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2007/000782-8. SARDI Research Report Series No. 999. 44pp.

McLeay, L.J and Hooper, G. E. (2019). Gulf St Vincent Prawn *Penaeus (Melicertus) latisulcatus* Fishery 2018/19. Fishery Assessment Report to PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2007/000782-9. SARDI Research Report Series No. 1034. 47pp.

McLeay, L.J and Hooper, G. E. (2020). Gulf St Vincent Prawn *Penaeus (Melicertus) latisulcatus* Fishery 2019/20. Fishery Assessment Report to PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2007/000782-10. SARDI Research Report Series No. 1073. 44p.

McLeay, L.J (2021). Effects of different codend mesh-sizes (57 mm and 51 mm) on catch in the Gulf St Vincent Prawn Fishery. Report to Saint Vincent Gulf Prawn Boat Owner's Association Inc. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2021/000036-1. SARDI Research Report Series No. 1086. 20pp.

McLeay, L.J and Hooper, G. E. (2021). Gulf St Vincent Prawn *Penaeus (Melicertus) latisulcatus* Fishery 2020/21. Fishery Assessment Report to PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2007/000782-11. SARDI Research Report Series No. 1114. 45p.

McLeay, L.J. and Hooper, G.E. (2022). Gulf St Vincent Prawn *Penaeus (Melicertus) latisulcatus* Fishery 2021/22. Fishery Assessment Report to PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2007/000782-12. SARDI Research Report Series No. 1153. 46pp.

McLeay, L.J. and Hooper, G.E. (2023). Gulf St Vincent Prawn *Penaeus (Melicertus) latisulcatus* Fishery 2022/23. Fishery Assessment Report to PIRSA Fisheries and Aquaculture. South Australian Research and Development Institute (Aquatic and Livestock Sciences), Adelaide. SARDI Publication No. F2007/000782-13. SARDI Research Report Series No. 1204. 47pp.

McShane, P. (1996). Transfer of by-catch reduction technology to South Australian prawn fisheries. FRDC Report 96/254.02

Morgan, G. (1995). Assessment, management and research support for the Gulf St Vincent Prawn Fishery. South Australian Fish. Man. Series 12.

Morgan, G. and Cartwright G. (2013). Review of the Gulf St Vincent Prawn Fishery management Framework. Adelaide, South Australia. (Internal report).

NASA (2022). [NASA Horizons Web-interface](#). Accessed 8 September 2022.

National Pest and Disease Outbreaks (2023). [White Spot Disease](#). Accessed 9 August 2023.

Noell, C.J., O'Neill, M.F., Carroll, J.D. and Dixon, C.D. (2015). A bio-economic model for South Australia's prawn trawl fisheries. Final Report. Prepared by the South Australian Research and Development Institute (Aquatic Sciences), Adelaide. CRC Project No. 2011/750. 115pp.

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.

Roelofs, A., Piddocke, T., Ashby, C., Conron, S., Hartmann, K., Hesp, A. Hone, P., Jacobsen, I., Jesson-Kerr, M., Mayfield, S., Stewart, J., Usher, M., Woodhams, J., and Wright, D., (eds) (2024), Status of Australian Fish Stocks Reports 2024, Fisheries Research and Development Corporation, Canberra. [What are the Status of Australian Fish Stock Reports](#)

PIRSA (2014). Revised framework for longer-term management of the Gulf St Vincent Prawn Fishery. PIRSA Fisheries and Aquaculture. Adelaide. Internal document.

PIRSA (2017). Management Plan for the South Australian Commercial Gulf St Vincent Prawn Fishery. Paper number 74. PIRSA Fisheries & Aquaculture. 70 pp.

PIRSA (2022). [Management Plan for the South Australian Commercial Gulf St Vincent Prawn Fishery](#). 40pp.

R Core Team (2024). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. (<https://www.r-project.org/index.html>)

Roberts S.D., Dixon C.D. and Hooper G.E. (2007a). Gulf St Vincent Prawn (*Melicertus latisulcatus*) Fishery 2005/06. Fishery Assessment report to PIRSA Fisheries. SARDI Aquatic Sciences Publication No. F2007/000782-1, Research Report Series No 253.

Roberts S.D., Dixon C.D. and Hooper G.E. (2007b). Gulf St Vincent Prawn (*Melicertus latisulcatus*) Fishery 2006/07 Status Report. Fishery status report to PIRSA Fisheries. SARDI Aquatic Sciences Publication No. F2007/001074-1, Research Report Series No 254.

Roberts S.D., Dixon C.D. and Hooper G.E. (2008). Gulf St Vincent Prawn (*Melicertus latisulcatus*) Fishery 2006/07. Fishery Assessment report to PIRSA Fisheries. SARDI Aquatic Sciences Publication No. F2007/000782-2, Research Report Series No 300.

Roberts S.D., Dixon C.D. and Hooper G.E. (2009). Gulf St Vincent Prawn, *Penaeus (Melicertus) latisulcatus*, Fishery 2007/08. Fishery Assessment report to PIRSA Fisheries. SARDI Aquatic Sciences Publication No. F2007/000782-3, Research Report Series No 382.

Roberts, S.D., Deveney, M. and Sierp, M. (2010). Biosecurity and disease status of prawn nurseries in South Australia. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication Number F2010/000593-1. SARDI Research Report Series No. 449. 35p.

Roberts, S.D., Dixon, C.D. and Andreacchio L. (2012). Temperature dependent larval duration and survival of the western king prawn, *Penaeus (Melicertus) latisulcatus* Kishinouye, from Spencer Gulf, South Australia. J. Exp. Mar. Biol. Ecol. 411: 14–22.

Smith, T. (2021). Independent scientific review of proposed harvest strategy options for the Gulf St Vincent Prawn Fishery. Internal report to PIRSA.

Stewardson, C., Andrews, J., Ashby, C., Haddon, M., Hartmann, K., Hone, P., Horvat, P., Mayfield, S., Roelofs, A., Sainsbury, K., Saunders, T., Stewart, J., Stobutzki, I. and Wise, B. (2016). Status of Australian Fish Stocks Reports 2016. Fisheries Research and Development Corporation, Canberra.

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.

Svane, I. (2003). Gulf St Vincent Prawn Fishery (*Melicertus latisulcatus*). Fishery assessment report to PIRSA for the Prawn Fishery Management Committee, October 2003. SARDI Aquatic Sciences RD03/0063-2.

Svane, I. and Johnson J. (2003). Gulf St Vincent Prawn (*Melicertus latisulcatus*) Fishery. Fishery assessment report to PIRSA. SARDI Aquatic Sciences RD03/0063.

Svane, I. and Roberts S.D. (2005). Gulf St Vincent Prawn Fishery (*Melicertus latisulcatus*). Fishery assessment report to PIRSA. SARDI Aquatic Sciences RD03/0063–3.

Tanner, J.E. (2003). The influence of prawn trawling on sessile benthic assemblages in Gulf St Vincent, South Australia. Can. J. Fish. Aquat. Sci. 60: 517–526.

Tanner, J.E. and Deakin, S. (2001). Active habitat selection for sand by juvenile western king prawns, *Melicertus latisulcatus* (Kishinouye). J. Exp. Mar. Biol. Ecol. 261: 199–209.

Xiao Y. (2004). Use of generalized linear models in analyzing the catch and effort data on the western king prawn *Penaeus latisulcatus* Kishinouye in the Gulf St Vincent, Australia. Fisheries Research 68: 67-82.

Xiao, Y. and McShane, P. (1998). Gulf St Vincent Prawn Fishery. SARDI South Australian Fishery Assessment Series 98/05.

Xiao, Y. and McShane, P. (2000). Estimation of instantaneous rates of fishing and natural mortalities from mark-recapture data on the western king prawn *Penaeus latisulcatus* in the Gulf St Vincent, Australia, by conditional likelihood. Trans. Am. Fish. Soc. 129: 1005-1017.

Zacharin, W. (1997). Management plan for the South Australian Gulf St Vincent prawn fishery. South Australian Fishery Management Series. Paper No. 30.

6. APPENDICES

Appendix 1. Monthly distribution of commercial (and survey) catch in the Gulf St Vincent Prawn Fishery from 1989/90–2023/24.

Season	Nov	Dec	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Total
1989/90	35.8	9.4	-	47.8	33.6	42.3	-	-				168.8
1990/91	-	5.3	-	48.0	36.0	31.9	13.1	-				134.3
1991/92	-	-	-	-	-	-	-	-				-
1992/93	-	-	-	-	-	-	-	-				-
1993/94	-	-	-	97.9	69.3	41.2	17.0	-				225.4
1994/95	-	-	26.0	60.9	52.4	8.0	-	-				147.3
1995/96	30.7	48.3	-	65.5	46.4	67.1	-	-				258.0
1996/97	37.9	25.7	-	34.8	41.9	45.0	24.7	-				209.9
1997/98	43.8	31.7	15.8	81.3	53.7	40.5	-	-				266.9
1998/99	69.8	30.5	-	65.6	99.7	48.1	22.5	-				336.2
1999/00	19.3	82.6	27.3	71.0	76.3	91.7	32.0	-				400.2
2000/01	65.9	60.6	-	84.3	86.9	72.4	14.8	-				384.9
2001/02	8.8	94.0	-	58.5	80.6	62.1	18.1	-				322.1
2002/03	4.0	60.1	11.5	72.8	46.6	37.0	-	-				231.9
2003/04	-	13.9	-	28.9	69.5	57.7	2.5	-				172.5
2004/05	-	43.5 (2.0)	-	50.1 (2.4)	40.9 (2.0)	46.7 (2.4)	27.2	-				208.4 (8.8)
2005/06	-	21.2 (1.9)	-	13.6 (2.5)	64.1 (3.6)	40.4 (2.5)	35.5	-				174.9 (10.5)
2006/07	-	26.5 (1.6)	-	51.5 (2.9)	86.1 (3.7)	45.3 (4.5)	-	-				209.4 (12.7)
2007/08	-	30.2 (2.5)	-	63.5 (3.3)	69.6 (4.2)	65.8 (4.5)	-	-				229.0 (14.4)
2008/09	36.5	(3.2)	-	56.3 (4.0)	53.1 (4.1)	126.7 (4.1)	-	-				272.6 (15.4)
2009/10	-	31.4 (2.3)	-	24.7 (2.6)	109.2 (4.3)	58.3 (3.9)	-	-				223.6 (13.0)
2010/11	-	31.9 (2.5)	-	6.9 (2.9)	43.3 (3.0)	68.5 (2.6)	27.6	-				178.3 (11.0)
2011/12	16.0*		-	25.0	38.0 (2.0)	37.2 (2.1)	8.8*					125.0 (4.2)
2012/13	-	-	-	-	-	-	-	-				-
2013/14	-	-	-	-	-	(1.9)	-	-				(1.9)

Season	Nov	Dec	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Total
2014/15	40.7	16.4	-	65.9	56.8	44.5 (2.8)	25.2*					249.4 (2.8)
2015/16	20.1*		-	54.4	49.8	32.4 (4.1)	42.7	18.4				217.8 (4.1)
2016/17	21.2	24.6	-	29.8	40.2	49.3 (2.9)	59.4*	-				224.6 (2.9)
2017/18	58.0*		-	25.2	60.0	49.2 (3.5)	44.3*	-				236.6 (3.5)
2018/19	17.6	25.9	-	25.0	52.2	32.0 (2.5)	43.0	16.5				212.2 (2.5)
2019/20	38.7*		-	30.8	33.2	17.5 (2.0)	12.2*					132.3 (2.0)
2020/21		11.5	-	26.8	27.3	18.3 (2.2)	20.5	5.0				109.3 (2.2)
2021/22	0.3	12.9		18.8 (1.1)	25.7	33.9 (2.5)	42.0	4.9	-	-	-	138.7 (3.7)
2022/23	23.9 (1.1)	26.7		24.0 (1.7)	29.9	32.0 (2.0)	13.2	2.5	0.2	-	4.0	156.4 (4.8)
2023/24	26.3 (1.0)	9.2		14.0 (1.6)	21.2	19.0 (1.9)	18.9	3.4				112.0 (4.5)

*Data between 1989/90 and 2019/20 amalgamated across more than one month due to confidentiality (<5 licence holders). Data from gear trials not included. Survey catches () since 2011/12 comprise catches from both T90- and diamond-mesh net.

Appendix 2. Summary of catch (tonnes), effort (vessel nights), nominal commercial CPUE (kg/night) and 2023/24-season standardised commercial CPUE (kg/night). Note, CPUE calculations are for data from the period 1 November–31 July in each fishing season.

Season	Commercial catch (t)	Effort (vessel-nights)	Nominal annual commercial CPUE (kg/vessel-night)	2023/24-standardised annual commercial CPUE (kg/vessel-night)
1989	168.8	431	392	497
1990	134.3	417	322	407
1991	<i>Fishery closed</i>			
1992	<i>Fishery closed</i>			
1993	225.4	314	718	732
1994	147.3	230	640	826
1995	258.0	339	761	909
1996	209.9	380	552	775
1997	266.9	439	608	727
1998	336.2	447	752	853
1999	400.2	486	823	893
2000	384.9	450	855	932
2001	322.1	461	699	866
2002	231.9	503	461	711
2003	172.5	376	459	722
2004	208.4	325	641	710
2005	174.9	239	732	818
2006	209.4	245	855	865
2007	229.0	269	851	898
2008	272.6	259	1053	1053
2009	223.6	250	894	856
2010	178.3	255	699	735
2011	125.0	257	486	785
2012	<i>Fishery closed</i>			
2013	<i>Fishery closed</i>			
2014	249.4	294	848	1197
2015	217.8	296	736	1131
2016	224.6	287	783	1149
2017	236.6	295	802	1133
2018	212.2	300	707	1060
2019	132.3	204	649	1053
2020	109.3	270	405	761
2021	138.7	300	462	796
2022	156.4	330	477	831
2023	112.0	275	407	795

Appendix 3. Size-grade composition (t) of annual harvests in the Gulf St Vincent Prawn Fishery from 2005/06–2023/24. Grades include; soft and broken (SB), small (S), medium (M), large (L) and extra-large (XL). Note: grade weight totals are estimated from daily fishing logbooks and are not adjusted relative to Catch Disposal Records (CDRs).

SEASON	XL	XL-Split			L	M	S	SB
		U6	U8	U10				
					10/15	16/20	20+	
2005/06	29.0				30.1	8.7	3.4	5.9
2006/07	46.0				53.1	26.0	6.8	9.7
2007/08	40.2				56.1	25.6	4.2	10.1
2008/09	50.4				67.6	38.4	9.7	10.4
2009/10	36.2				59.3	49.9	13.6	12.6
2010/11	26.2				42.9	43.9	12.0	7.6
2011/12	25.6				35.4	23.7	8.8	5.6
2012/13								
2013/14								
2014/15	57.1	2.5	17.8	36.8	104.8	49.1	9.1	15.9
2015/16	57.3	3.6	22.1	31.6	78.7	41.3	11.9	16.0
2016/17	53.4	3.0	18.2	32.2	88.9	40.9	9.9	14.1
2017/18	52.3	2.4	19.3	30.6	89.0	49.4	11.4	12.1
2018/19	38.7	1.9	14.9	21.9	74.9	51.5	24.1	16.6
2019/20	24.6	1.0	9.5	14.0	49.6	32.0	15.3	9.3
2020/21	17.6	0.5	6.2	10.8	38.5	26.5	15.8	10.8
2021/22	30.4	4.0	11.5	15.0	48.3	30.8	17.5	10.8
2022/23	24.1	0.7	6.0	17.3	55.5	42.4	17.2	10.8
2023/24	23.6	1.3	8.8	13.4	38.1	30.6	16.5	6.9