West Coast Prawn Fishery Harvest Strategy

JULY 2022

Government of South Australia
Department of Primary Industries and Regions

This harvest strategy is dedicated to the late Nick Paul who contributed significantly to the management of the West Coast Prawn Fishery over the last 25 years. Nick always maintained a constructive and optimistic approach towards the fishery, even during hard times.

West Coast Prawn Fishery Harvest Strategy

Contents

1.1 Background

This harvest strategy has been developed by industry and government through a working group including representatives of the Spencer Gulf and West Coast Prawn Fishermen's Association (SGWCPFA), the South Australian Research and Development Institute (SARDI) Aquatic Sciences and the Department of Primary Industries and Regions (PIRSA) Fisheries and Aquaculture and builds on the harvest strategy adopted in 2019. Key external stakeholders were consulted on the draft harvest strategy prior to finalization of the 2019 harvest strategy.

The harvest strategy has been developed on the basis that the management arrangements in place for the West Coast Prawn Fishery (WCPF) since 2007 have been adequate to maintain stocks despite periodic declines. The previous harvest strategy has been improved by the addition of performance indicators with reference points and decision rules for managing the fishery in times of reduced fishery performance and to account for persistent El Niño conditions that are known to impact fishery performance.

There are four regions within the WCPF: Venus Bay, Ceduna, Corvisart Bay and Coffin Bay (Figure 1). Data are collected and analysed, and the fishery is managed at this regional scale. The fishing season with respect to this harvest strategy is 1 March through to 31 December in each year with no commercial fishing in January or February.

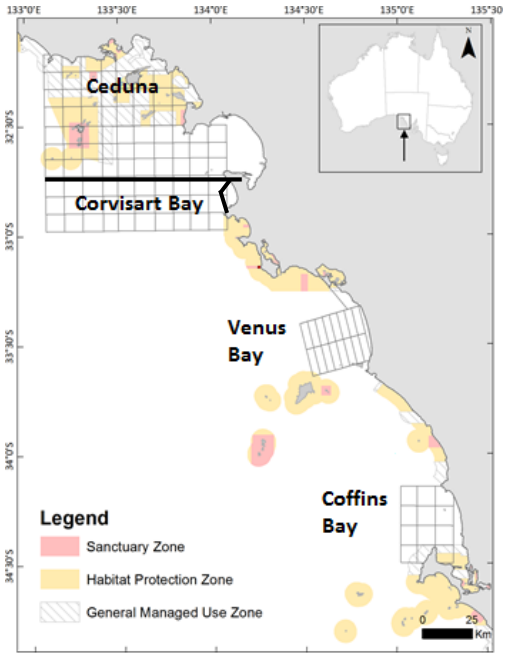


Figure 1: Map showing the research reporting blocks and fishing areas of the West Coast Prawn Fishery

Fishing usually takes place from March to December from the last quarter of the moon through to the first quarter of the moon. November and December coincide with the early spawning period for King Prawns. To minimise the possibility of recruitment overfishing, a conservative fishing strategy during this early spawning period is applied, reducing the area and the number of nights available for fishing. These arrangements are considered to be appropriate to maintain sustainable prawn stocks while allowing the fleet to take advantage of the higher relative price of smaller prawns for the Christmas market.

For the remainder of the fishing year more flexible arrangements are provided. This is because the location of the WCPF means that it is exposed to oceanic influences, including bad weather (swell and wind) and environmental impacts including changes to currents and water temperatures as a result of the El Niño-Southern Oscillation (ENSO) and cold upwelling events. ENSO events lead to enhanced upwelling, lowering the sea level and raising the thermocline (Middleton and Bye 2007). During El Niño events, wintertime shelf-edge currents and the warm Leeuwin Current which flows from north-west to south-east are reduced (Middleton and Bye 2007). There is evidence that ENSO events influence recruitment strength in the WCPF and that El Niño driven changes (low sea level height and cold water) have been identified as important drivers in structuring recruitment (Carrick and Ostendorf 2005; Carrick 2008). Given the WCPF is impacted by oceanic conditions, they rarely fish their allowable nights in the winter months. This can appear as poor fishing when considering the nights fished per season rather than the holistic knowledge of the nights lost due to bad weather. Additionally, it is thought the WCPF is less affected by moon phases as it operates in deeper waters in comparison to South Australia's two other prawn fisheries (e.g. Spencer Gulf and Gulf St Vincent Prawn fisheries).

Historically, Venus Bay is the largest and most productive fishing ground for the WCPF. Venus Bay is also considered to be an important area for egg production. As such, management arrangements have been put in place to restrict fishing for prawns in this area during the peak spawning period in November and December. The shallow estuarine waters adjacent to Ceduna are considered to be an important prawn nursery supporting recruitment into the fishery. Additional management arrangements for this area have been provided in circumstances when stock declines in the WCPF. Corvisart Bay is considered by industry to be different from the Ceduna grounds as it supports larger prawns than those in Ceduna. Coffin Bay is comparable to Corvisart Bay in terms of tonnage. Corvisart Bay is not considered to be a key recruitment or spawning ground for the WCPF. Industry consider smaller prawns migrate from Ceduna through Corvisart Bay to Venus Bay, particularly inshore. Historic data suggests there was limited fishing in Corvisart Bay in the 1990s in March/April and in 2016/17. Between 2008 and 2022, Corvisart Bay and Ceduna have only been fished in November and December.

Harvest levels up to the time when this harvest strategy was developed in 2019 were considered to be consistent with maximum sustainable yield. This position is inferred from the comparison with the first harvesting period (1970 to 1975) where catches ranged from 150 to 290 t, with an average of around 200 t harvested by 12 vessels. Effort over this period ranged from 6,000 to 10,000 trawl hours each year. While it is unclear whether the decline in 1976 was caused by overfishing or environmental factors, catches in the fishery have been well below these levels since the number of licences was capped at three in 1979.

The primary measures used to determine stock status in the WCPF are nominal catch rates recorded and fishery-dependent data, and average nominal catch rates obtained from fishery-independent surveys. Catch rate data are considered a proxy for relative abundance; however, due to the small scale of the fishery, standardisation of catch rates to account for other factors which may influence abundance has not been undertaken.

Modelling work undertaken for the two larger prawn fisheries indicates that there has been little change in fishing power since 1991 (Noell et al. 2015).

A review of this harvest strategy in 2021-2022 captured minor amendments to the 2019 harvest strategy, including providing for fishing in Corvisart Bay between March and October, removing the November fishery-independent survey (FIS) and amending the winter FIS, and allowing for a transition from 50 to 75 nights mid-season if the fishery is classified as Depleting. These amendments are reflected in this updated harvest strategy.

1.2 Defined operational objectives

The primary aim of this harvest strategy is to maintain sustainability of the Western King Prawns (hereafter referred to as prawns) in the area of the WCPF. This is achieved through management arrangements that aim to reduce the capture of large amounts of small prawns and protection of spawning prawns during peak spawning periods. This harvest strategy also considers economic efficiency by allowing for flexible fishing arrangements and account for unfavorable environmental conditions associated with persistent El Niño events.

Goal: Maintain ecologically sustainable prawn biomass taking into account environmental conditions.

Operational objective: Maintain the average catch rate (commercial and Fishery Independent Surveys (FIS) combined) at or above 36.00 kg/hr in all years except when an El Niño event is identified in the assessment period as described in section 1.3.1.

1.3 Performance Indicators

Performance Indicators used in this harvest strategy include:

- Total Prawn Abundance
  - Average Catch Rate = commercial catch per unit effort (CPUE) (at least three months of commercial fishing between March and September) and average Venus Bay Fishery Independent Survey (FIS) CPUE from March and June surveys.
- El Niño - Southern Oscillation (ENSO) Outlook status
  - Monthly ENSO outlook status as determined by the Bureau of Meteorology.

1.3.1 Reference points

Average Catch Rate

	Average Catch Rate
Target Reference Point	72.00 kg/hr (2.64 lb/min)
Trigger Reference Point	54.00 kg/hr (1.95 lb/min)
Limit Reference Point	36.00 kg/hr (1.32 lb/min)

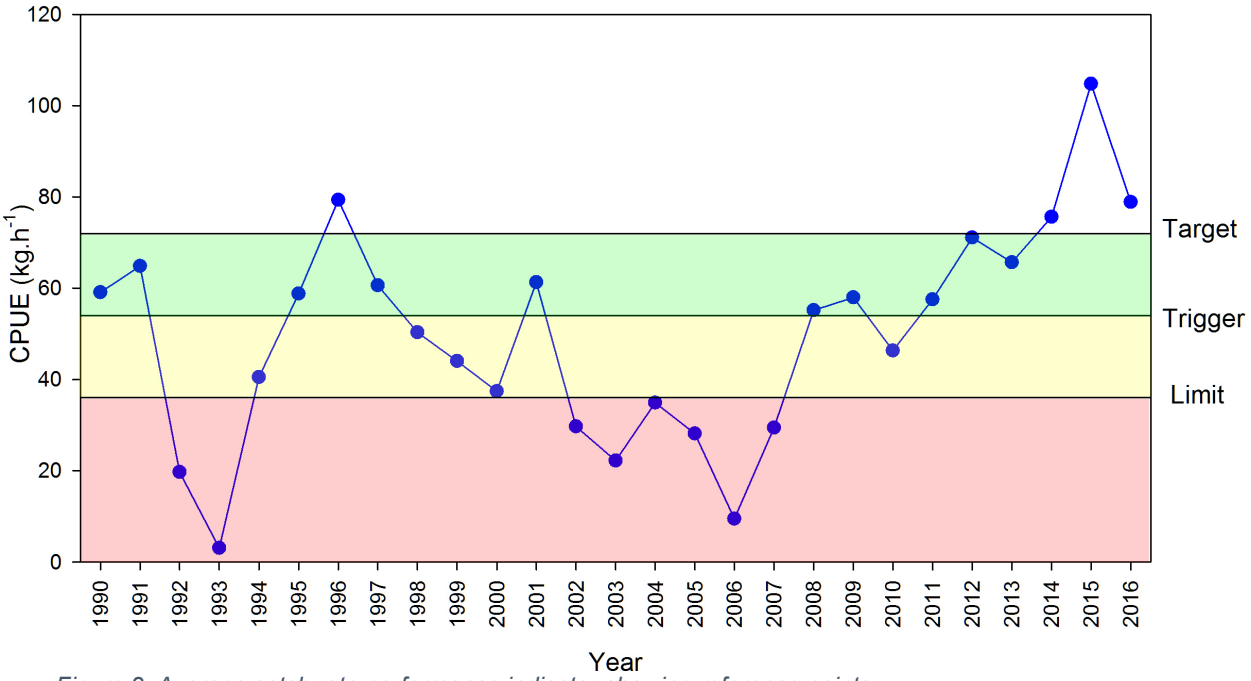


Figure 2: Average catch rate performance indicator showing reference points

ENSO Outlook Status

In this harvest strategy an El Niño event for a fishing season will be considered to be in place when three or more consecutive months are declared as El Niño by the Bureau of Meteorology in the previous 24 months ending 30 September of the fishing season being assessed. A summary of historical El Niño events is provided at Appendix 2.

1.4 Monitoring strategy

1.4.1 Commercial fishing

Commercial CPUE is derived from catch and effort data reported in the South Australian Western King Prawn Fishery Daily Logbook throughout the fishing season provided to SARDI. SARDI report on the performance indicators for the fishery in an Advice Note prior to the beginning of the next fishing season as well as assessing stock status in regular stock status or assessment reports.

1.4.2 Fishery Independent Surveys

Two fishery-independent surveys (FIS') are conducted annually in the fishery generally between the last quarter of the moon and the new moon (dark of the moon), according to the schedule in Table 1. The methods for conducting FIS are described in Heldt and Beckmann (2021). FIS' are conducted using industry vessels with independent observers; spot surveys are fishery-dependent surveys without observers. The FIS at Venus Bay in March and June are included in the calculation of the average catch rate as the main spawning area for the WCPF prawn resource. Ceduna is considered the main area of recruitment and March is considered to be the peak recruitment period. The outcomes of the Ceduna surveys in March are not explicitly used in this harvest strategy as the time

series is limited. The survey results in Ceduna, particularly the inshore survey shots, may be considered for use as a recruitment index in the future when sufficient data are available.

Prawn abundance in Coffin Bay fluctuates from year to year and commercial fishing is not always conducted in this area. Commercial catch rates in Coffin Bay are considered sufficient to monitor trends in prawn abundance in this area when fishing occurs.

The fishery previously undertook a November FIS. This November FIS ceased in 2021 as the survey did not directly influence harvest strategy outcomes. The November survey can be used to reopen the fishery or provide additional data points if other surveys are not conducted as per Table 1. The November survey may be undertaken at the expense of the industry, to evaluate the option to transition from one strategy within season if requested by industry.

Table 1: Schedule of FIS

Month	Region	
March	Venus Bay	Ceduna (2 nights)
June	Venus Bay	
November	Venus Bay (if required)	

1.4.3 At-sea monitoring

Management of fishing strategies is informed from data collected at the conclusion of each night of commercial fishing from all vessels that have fished on that night and reported to a nominated person. Data reported each fishing night includes the estimate of total nightly catch per vessel and average bucket count per vessel by midday each day following a fishing night, including on nights when fishing is not conducted during a fishing run. A minimum of three bucket counts must be undertaken on each fishing vessel for each night of fishing and the average reported to the nominated person.

1.4.4 Industry and stakeholder input

Catch rate occasionally requires annual interpretation as a measure of fishery performance due to the influences of various external factors that may not necessarily be related to stock abundance. Industry will be given an opportunity to provide factual and credible evidence to support the impacts of these external factors on catch rate each year in recommending management arrangements for the following fishing season.

The external factors to be considered by the representative consultative process include, but are not limited to:

- market failures and market influences
- environmental influences, such as upwelling events, prevailing currents, etc
- other factors impacting on profitability e.g. fluctuations in fuel prices
- fishing practices

- climate change.

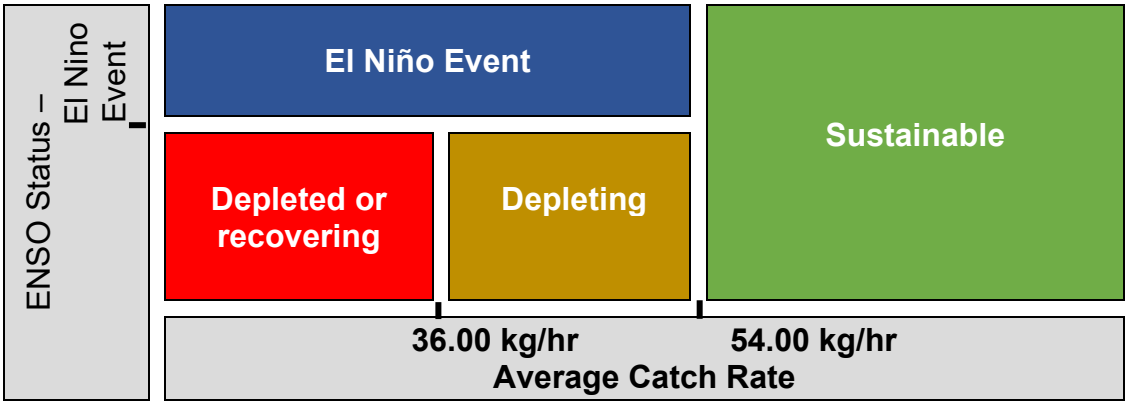
Comments should be provided through the SGWCPFA to PIRSA concurrently with the delivery of the harvest strategy Advice Note (before 30 November each year). PIRSA may consider and acknowledge input from industry relating to the subject matter outlined in the harvest strategy in setting management arrangements for a fishing season.

1.5 Assessment of fishery performance

The stock status classification for the fishery is aimed to be consistent with the National Status of Fish Stocks framework (Piddocke et al. 2022).

The following status reference levels consider the performance of the fishery with regard to total prawn abundance and environmental conditions related to ENSO. The classification provided in Table 2 will be used to guide the classification of the status of the fishery in any fishing season, noting that in some years other information will be included in the status classification in a weight of evidence approach such as upwelling events, prevailing currents or changes in fishing practices. This approach will allow for classification to be set appropriately in years, for example, when the fishery is rebuilding following an El Niño event.

Table 2: Stock status of the West Coast Prawn Fishery



1.6 Setting management arrangements

1.6.1 Fishing season arrangements

SARDI will provide advice on average catch rate (FIS and commercial CPUE) up to 30 September, stock status and ENSO data relevant to a fishing season to SGWCPFA by 30 November.

SGWCPFA will consider the WCPF performance indicators, the harvest strategy decision rules and industry comments about the fishery from the previous season and make a recommendation to PIRSA on management arrangements for the following fishing season for the WCPF by 31 December. If the recommendation is not consistent with the decision rules in this harvest strategy, information to support the recommendation should also be provided with the recommendation.

PIRSA considers the recommendation of the SGWCPFA, WCPF performance indicators, the harvest strategy decision rules, industry comments, SARDI advice and objects of the *Fisheries Management Act 2007* to set the management arrangements for the following fishing season. A decision on setting management arrangements for the WCPF will generally be made before 31 January prior to the beginning of the fishing season and no later than 28/29 February. PIRSA will inform the SGWCPFA and WCPF licence holders of the decision as soon as practicable.

1.6.2 Within-season fishing strategies

Fishing strategies will be set prior to the commencement of commercial fishing for each fishing run. For months when the new moon falls late in the month preceding, or early in the following month, fishing may commence in that month through to the new moon in the following month.

Fishing strategies involve two phases – a 'development phase' that sets the initial fishing arrangements, and a 'management phase' where at-sea decision rules maintain fishing operations during a fishing run.

1.6.2.1 Fishery strategy development

The SGWCPFA Management Committee will recommend a fishing strategy to PIRSA at least two business days prior to the beginning of a fishing run including the fishing area/s (Coffin Bay, Venus Bay, Corvisart Bay and/or Ceduna) to be opened to fishing and the maximum number of fishing nights.

A notice describing the fishing strategy will be communicated to all licence holders prior to the commencement of the fishing run.

1.6.2.2 Fishing strategy management

Once fishing has commenced during a run, the fishing strategy is maintained by the fishing fleet by monitoring the fleet against the at-sea decision rules appropriate for the fishing strategy.

Management of fishing strategies is informed from 'average nightly catch rate' and 'average nightly bucket counts' collected during each commercial fishing night. Catch information will be monitored from the best records of catch available in appropriate timeframes, as required by PIRSA. Data may be as reported by skippers or, if available, by electronic reporting from vessels (Table 3).

If minimum requirements for prawn size (bucket counts) are not met on any night in an area of fishing, fishing in the area shall cease and fishing vessels move to another location. If the prawn size is not met on the next night of fishing, fishing in that area will cease for the remainder of that fishing run. The at-sea decision rules for prawn size described by bucket counts are provided in Table 3.

Table 3: At-sea decision rules for managing fishing runs. Fleet catch is average nightly catch per vessel per night. Bucket count is number of prawns per 7kg (pp7kg)

		Ceduna	Coffin Bay	Venus Bay	Corvisart Bay
March, April & May	Average catch (kg)	>300	>300	>300	>300
	Bucket count (pp7kg)	<270	<240	<250	<250
	Consecutive nights	2	2	2	2
	Catch Cap				6 tonnes
June to October	Average catch (kg)	>300	>300	>300	>300
	Bucket count (pp7kg)	<270	<240	<240	<270
	Consecutive nights	2	2	2	2
	Catch Cap				6 tonnes
November & December	Average catch (kg)	>300	>300	No fishing	>300
	Bucket count (pp7kg)	<270	<240		<270
	Consecutive nights	2	2		2

If minimum requirements for the average nightly fleet catch rates are not met over two consecutive nights in an area, fishing in that area (or for the whole fishery) will cease for the remainder of that fishing run. The at-sea decision rules for average nightly fleet catch rates are provided in Table 3.

A catch cap for Corvisart Bay has been set for fishing between March and October as described in Table 3. The fishery will monitor the average allowable catch data from total catch reported to a nominated person the morning after fishing is completed. Once the fleet reach an average of 6 tonnes, the vessels must cease fishing for the remainder of the fishing run. If the reported cumulative average catch is within 50kg of the 6 tonne catch cap fishing will not be permitted for another night (due to the cap being expected to be reached during the next night's fishing).

Any changes to the fishing strategy required to meet at-sea decision rules will be communicated to all licence holders and skippers, the SGWCPFA and PIRSA Fisheries and Aquaculture by the nominated person.

1.6.3 Sustainable Fishery

If the average catch rate is at or above the trigger reference point described at section 1.3.1 the following decision rules will apply for setting management arrangements for the following fishing season.

Decision Rules:

For a fishery classified as Sustainable, fishing strategies will be developed consistent with the decision rules described in Table 4.

Fishing during fishing runs will be maintained consistent with the at-sea decision rules described in Table 3.

Fishing in Covisart Bay between March and October is prohibited in an area east of a line described by the following coordinates defined as degrees decimal minutes and are based on the World Geodetic System 1984 (WGS 84):

1. *32°45.254'S 134°5.781'E*
2. *32°47.018'S 134°.2.088'E*
3. *32°54.344'S 134°3.613'E*

Table 4: Decision rules for developing fishing strategies for a Sustainable fishery. Caps on the maximum fishing nights are the maximum number of fishing nights for the fleet where one or more fishing vessels fish on any night during a fishing run.

Month	Maximum fishing nights		Fishing areas
January	No Fishing		
February	No Fishing		
March	14 nights		Ceduna, Coffin Bay, Venus Bay, Corvisart Bay
April	14 nights		Ceduna, Coffin Bay, Venus Bay, Corvisart Bay
May	14 nights (Fishing does not usually occur)		Ceduna, Coffin Bay, Venus Bay, Corvisart Bay
June	14 nights		Ceduna, Coffin Bay, Venus Bay, Corvisart Bay
July	14 nights		Ceduna, Coffin Bay, Venus Bay, Corvisart Bay
August	14 nights		Ceduna, Coffin Bay, Venus Bay, Corvisart Bay
September	14 nights		Ceduna, Coffin Bay, Venus Bay, Corvisart Bay
October	14 nights (Fishing does not usually occur)		Ceduna, Coffin Bay, Venus Bay, Corvisart Bay
November	7	Or 14 combined nights in November or December	Ceduna, Coffin Bay and Corvisart Bay
December	7		
TOTAL	**98 nights**		

***Meta Rules**:*

In years where environmental conditions have substantially reduced the number of fishing nights (i.e. less than average) in the usual fishing months (March, April, June, July, August and September), AND the fishery has not been classified as Environmentally Limited described in section 1.3.1, May and/or October may be fished up to 14 nights maximum in each of those months providing that the total number of fishing nights for the fishing season does not exceed 98 fishing nights in total.

In years when the maximum number of fishing nights in the months of March and April are not fished, a maximum of two fishing nights from each of these months may be transferred to be used in months later in the year, with the exception of November and December providing that the total number of fishing nights for the fishing season does not exceed 98 fishing nights in total.

1.6.4 Depleting Fishery

A depleting (transitional) fishing strategy is required when the average catch rate is below the trigger reference point but at or above the limit reference point described in section 1.3.1. Depleting fishing strategies reduce the total fishing nights allowed for the season, restrict fishing in the Ceduna area and fishing in October.

If Depleting fishing strategies are required, the following decision rules will apply for setting management arrangements for the following fishing season.

Decision Rules:

For a fishery classified as Depleting *the maximum number of fishing nights for the fishing season is set out in Table 5.*

Fishing strategies during the fishing season will be developed consistent with the rules set out in Table 6.

Fishing during fishing runs will be maintained consistent with the at-sea decision rules described in Table 3.

Fishing in Covisart Bay between March and October is prohibited in an area east of a line described by the following coordinates defined as degrees decimal minutes and are based on the World Geodetic System 1984 (WGS 84):

1. *32°45.254'S 134°5.781'E*
2. *32°47.018'S 134°.2.088'E*
3. *32°54.344'S 134°3.613'E*

Table 5: Decision rules for setting total fishing nights for Depleting *WCPF. Caps on the maximum season fishing nights are the maximum number of fishing nights for the fleet where one or more fishing vessels fish on any night during a fishing run.*

Catch Rate	Maximum season fishing nights
≥ 36.00 <45.00 kg/hr	50 nights
≥ 45.00 kg/hr	75 nights

Table 6: Decision rules for developing fishing strategies for a Depleting fishery. Caps on the maximum fishing nights are the maximum number of fishing nights for the fleet where one or more fishing vessels fish on any night during a fishing run.

Month	Maximum fishing nights		Fishing areas
January	No Fishing		
February	No Fishing		
March	14		Coffin Bay, Venus Bay, Corvisart Bay
April	14		Coffin Bay, Venus Bay, Corvisart Bay
May	14 (Fishing does not usually occur in May)		Coffin Bay, Venus Bay, Corvisart Bay
June	14		Coffin Bay, Venus Bay, Corvisart Bay
July	14		Coffin Bay, Venus Bay, Corvisart Bay
August	14		Coffin Bay, Venus Bay, Corvisart Bay
September	14		Coffin Bay, Venus Bay, Corvisart Bay
October	No Fishing		
November	7	Or 14 combined nights in November or December	Coffin Bay and Corvisart Bay
December	7		
SEASON TOTAL	**50 or 75 nights** (see Table 5)		

Meta Rule:

In years when the maximum number of fishing nights in the months of March and April are not fished, a maximum of two fishing nights from each of these months may be transferred to be used in months later in the year, with the exception of November and December providing that the total number of fishing nights for the fishing season does not exceed the number of fishing nights allocated to the fishery or that season (50 or 75 nights).

In a season when the fishery has been classified as depleting and limited to 50 nights, if the March and June or March (or June) and November (if opted for) FIS combined surveys' average catch rate is greater than or equal to 40kg/hour, the fishery may operate for 75 nights (as per Table 7).

1.6.5 Depleted Fishery

If average catch rate is below the limit reference point described at Section 1.3.1 appropriate management arrangements to recover stocks are required.

Decision Rules:

The fishery will be closed until information becomes available from FIS that indicate stocks in particular areas are sufficient to support fishing.

Reopening of the fishery will be guided by the rules set out in Section 1.6.7.

1.6.6 Environmentally Limited Fishery

During periods when an El Niño event is considered to be in place the WCPF will be identified as being Environmentally Limited, prawn abundance and/or distribution may be affected. While it is noted that prawn stocks may be affected by the environmental conditions rather than fishing impacts it is considered precautionary to ensure management arrangements are appropriate for the stock abundance during these periods. In the event that the WCPF is classified as Environmentally Limited the following decision rules will apply.

Decision Rules*:*

In the first year the fishery is classified as Environmentally Limited as described in section 1.3.1 the maximum number of fishing nights for the fishing season would be the same as for the previous fishing season with the exceptions that no fishing will occur in the Ceduna area and no fishing will occur in October in any area of the fishery.

If the fishery has been classified as Environmentally Limited for two or more consecutive years and the Catch Rate is ≥36.00 kg/hr but <54 kg/hr the management arrangements related to a classification as Depleting *will be implemented and the arrangements described in Section 1.6.4.*

If the fishery has been classified as Environmentally Limited for two or more consecutive years and the Catch Rate is <36.00 kg/hr the management arrangements related to a classification as Depleted will be implemented and the fishery will be closed.

1.6.7 Reopening the fishery

The fishery could be reopened based on the results from FIS conducted in Venus Bay in March, June and/or November in the following manner.

***Decision Rules**:*

Following a closure, the fishery may be reopened if:

° March FIS catch rate in Venus Bay ≥30 kg/hr (1.10 lb/min) - the fishery may be opened in March and/or April

° June FIS catch rate in Venus Bay ≥30 kg/hr (1.10 lb/min) the fishery may be opened in June, July, August, and/or September

° October/November survey in Venus Bay ≥50 kg/hr (1.83 lb/min) the fishery may be opened in November and/or December.

Fishing will be restricted to a maximum of 7 nights in any month in March, April, June, July, August or September, unless the March and June FIS CPUE are both ≥30kg/hr (the trigger limit), when a maximum of 10 nights in June, July, August or September will be allowed.

Fishing in November and December will be restricted to a total of 7 nights for the two months combined and will only be allowed in Coffin Bay or Corvisart Bay.

No commercial fishing shall occur in Ceduna in any month.

Conducting FIS in years when the fishery is closed would require an industry independent observer on board and analyses of the survey data by SARDI with the costs to be covered by the industry.

1.6.8 Management arrangements based on FIS CPUE only

In years of limited amounts of commercial fishing (less than three months of fishing), management arrangements for the following year may be determined with a reduced data set based on FIS catch rates (CPUE) from Venus Bay.

Decision Rules:

A minimum of two FIS from Venus Bay are required to set management arrangements for the following year.

The total number of fishing nights for a fishery based on FIS CPUE from Venus Bay will be set consistent with Table 7.

Table 7: Decision rules for setting a number of fishing nights based on data from Venus Bay FIS only.

Available Surveys	Number Surveys	**Required average CPUE kg/hr (lb/min)**		
March, June and November	3	≥35 kg/hr (≥1.28 lb/min)	<35 kg/hr≥18 kg/hr (<1.28 lb/min≥0.66 lb/min)	<18 kg/hr (<0.66 lb/min)
March and June Only	2	≥30kg/hr (≥1.10 lb/min)	<30 kg/hr≥15 kg/hr (<1.10 lb/min≥0.55 lb/min)	<15kg/hr (<0.55 lb/min)
November and June or March Only	2	≥40kg/hr (≥1.46 lb/min)	<40kg/hr≥20kg/hr (<1.46 lb/min≥0.73 lb/min)	<20kg/hr <(0.73 lb/min)

Fishing Arrangements			
Number fishing nights	75 nights restricted fishing	50 nights restricted fishing	Fishery closed
No survey	Fishery will remain closed		

1.7 Review of the harvest strategy

This harvest strategy is to be implemented for a period of ten years, unless replaced with a formal management plan. A review of this harvest strategy will be conducted at the fifth anniversary of its adoption, if a review has not been completed before this time. A review of this harvest strategy may be undertaken at any time if new documented and verifiable information becomes available. At the time of reviewing this harvest strategy, there was interest in reviewing the survey locations for the FIS. This review may result in changes to the FIS survey locations, with a flow-on effect on the appropriateness of the performance indicator reference points derived from the FIS. A review of the harvest strategy in this circumstance would be considered.

1.8 Definitions

Fishing night: a night of fishing when one or more fishing vessels conducts fishing activity.

Fishing strategy: the rules that guide fishing operations during a fishing run including the maximum number of nights, bucket counts and average vessel catch rates.

Fishing run: a period of fishing activity between quarters of the lunar cycle that include a new moon. Fishing may start two nights before the last quarter of the moon and finish two nights after the last quarter of the moon.

Bucket count: measure of prawn size derived from the number of prawns in a 7 kg sample (pp7kg) reported during at-sea monitoring of each commercial fishing night. The bucket count will be the average of three separate bucket counts per vessel per night.

El Niño event: An El Niño event for a fishing season will be considered to be in place when three or more consecutive months are declared as El Niño by the Bureau of Meteorology in the previous 24 months ending 30 September of the fishing season being assessed.

Fishery Independent Survey (FIS): a fishery independent survey undertaken in November, March and June to assess the stock status.

Spot survey: a fishery dependent survey conducted without an independent observer on board.

Ceduna: Defined as the fishing zone North of S32° 43.000’

Corvisart Bay: The area within the Ceduna fishing zone south of 32°40’S defined as fishing blocks 358 – 378 excluding an area east of a line defined by the following coordinates defined as degrees decimal minutes and are based on the World Geodetic System 1984 (WGS 84)::

1. 32°45.254’S 134°5.781’E
2. 32°47.018’S 134°.2.088’E
3. 32°54.344’S 134°3.613’E

1.9 Flow Diagram West Coast Prawn Fishery Harvest Strategy

1 APPENDIX – JUSTIFICATION OF HARVEST STRATEGY PERFORMANCE INDICATORS

1.1 ENSO

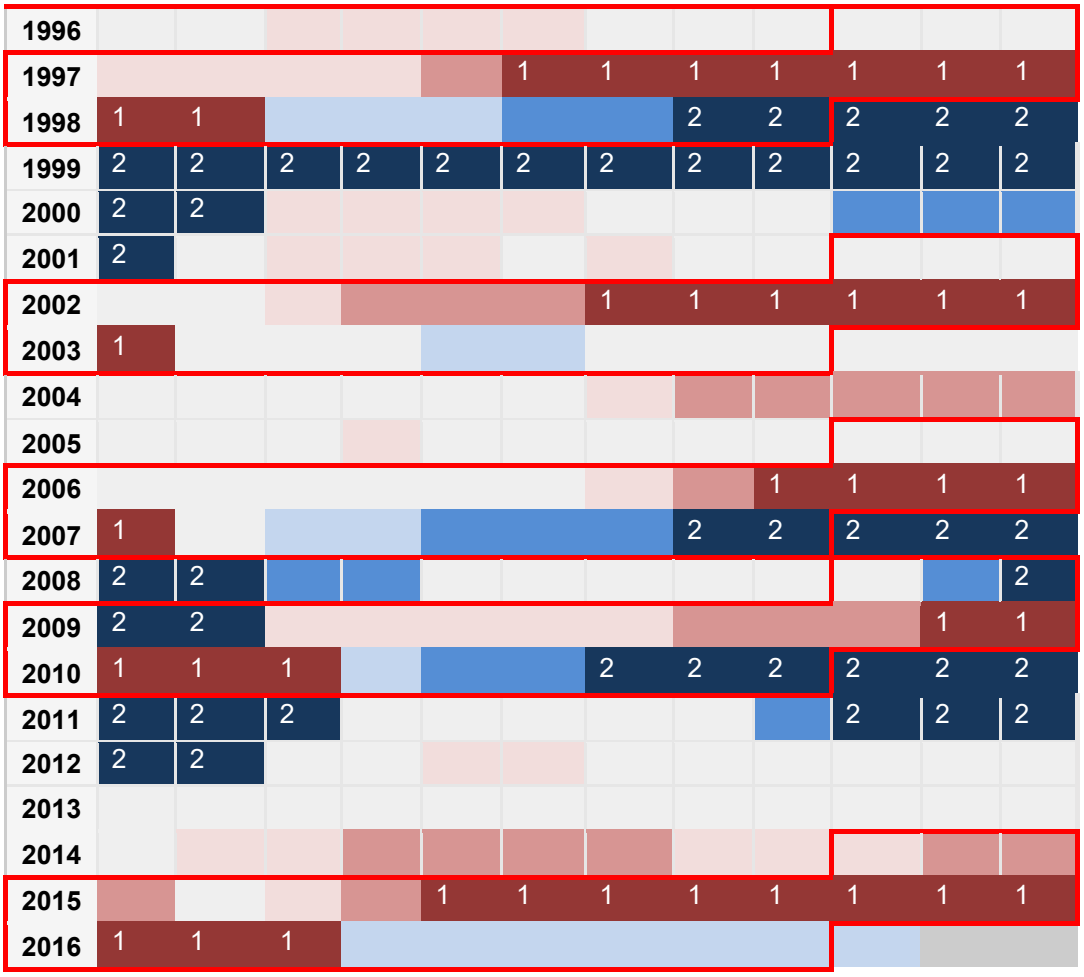
ENSO is the oscillation between El Niño and La Niña conditions. The status of the ENSO Outlook is determined using set criteria[1] and expert analysis by climatologists at the Bureau of Meteorology. The status relates to ENSO as it transitions between phases of El Niño, Neutral and La Niña.

For the context of this harvest strategy, an El Niño event for a fishing season will be considered to be in place when three or more consecutive months are declared as El Niño by the Bureau of Meteorology in the previous 24 months ending 30 September of the fishing season being assessed (the assessment period). For example, in assessing the status of the 2010 fishing season the ENSO assessment period would have been from October 2008 to September 2010. During this period there were five consecutive months of El Niño classification and it would have been considered that an El Niño event had occurred.

Table 8: ENSO outlook summary from the Bureau of Meteorology. Years that El Nino event would be considered to be in place are bordered in red.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1980												
1981												
1982							1	1	1	1	1	1
1983	1	1									2	2
1984	2					2	2					
1985						2						
1986											1	1
1987	1	1	1	1	1	1	1	1	1	1	1	1
1988	1	1				2	2	2	2	2	2	2
1989	2	2	2									
1990												
1991						1	1	1	1	1	1	1
1992	1	1	1	1	1	1						
1993					1	1						
1994										1	1	1
1995	1	1							2	2	2	2

[1] See http://www.bom.gov.au/climate/enso/outlook/#tabs=Criteria for criteria for determining ENSO outlook. status



1.2 Catch Rate

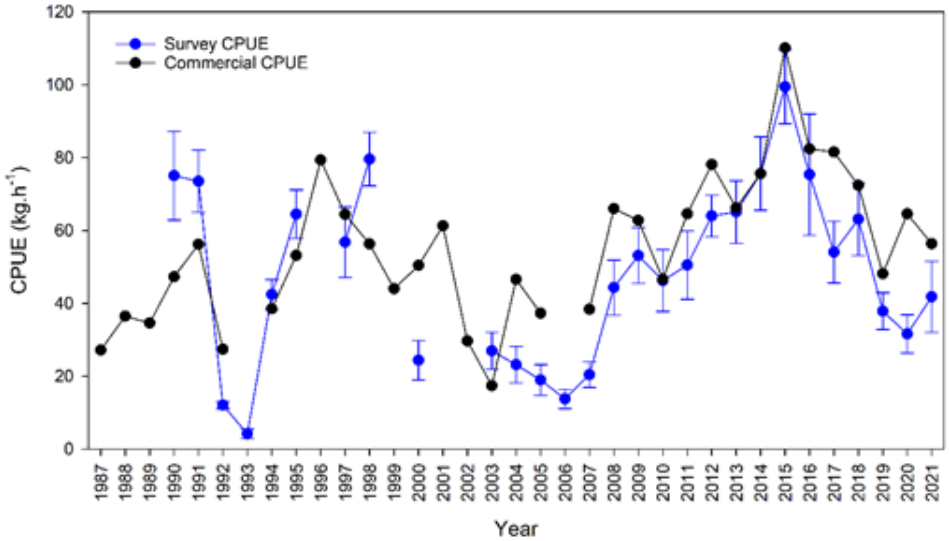


Figure 3: Annual commercial catch rate from March to September and average FIS catch rate (± standard error) from Venus Bay during February/March and June/July.

As commercial CPUE may be influenced by factors not related to abundance, the inclusion of survey CPUE provides additional confidence given the standardised protocols which have been applied. Venus Bay was chosen as it has been surveyed most consistently and is considered the most productive region in the fishery. The trends in commercial and average FIS CPUE from Venus Bay are similar for the period 1987 to 2021 (Figure 3) and these indicators are considered to reflect prawn abundance in the WCPF. It was considered favourable to use both commercial catch rate and the FIS catch rate from Venus Bay averaged over March and June surveys with equal weighting in the harvest strategy.

In consideration of the availability of commercial CPUE and FIS data for informing determination of management arrangements for fishing in the following year (beginning on 1 March) it was considered necessary to restrict the months of commercial CPUE and FIS to be included in the average catch rate to commercial CPUE for March to September inclusive, and February/March and June/July FIS.

The target reference level was set at the mean catch rate (commercial CPUE and FIS) between 1990 and 2016 when catch rate was >59 kg/hr (i.e. 1990, 1991, 1996, 1997, 2001, 2012 - 2018). This target catch rate was selected as a level the fishery is aiming to be performing at or above. The resulting target reference level (72 kg/hr) is assumed to be set at a proxy level for maximum economic yield (MEY) the Limit Reference point has been set at 50% of the Target, consistent with bench mark harvest strategies.

*Table 9: Average catch rate from 1987 to 2021. VBCPUE means CPUE from February and June FIS at Venus Bay. NA means not available. Com means commercial. * Average catch rate>59kg/hr used to calculate the target reference point. Figures in red indicate incomplete data.*

Year	Com CPUE Mar-Sep (kg.hr^{-1})	Months fished (Mar-Sep)	VBCPUE kg.hr^{-1} (Feb/Mar and Jun/Jul)	Average catch rate
1987	27.19	2	NA	27.19
1988	36.50	5	NA	36.50
1989	34.61	6	NA	34.61
1990	47.28	7	70.90 (Feb only)	59.09*
1991	56.19	6	73.51	64.85*
1992	27.41	2	12.01	19.71
1993	NA	0	3.06	3.08
1994	38.51	6	42.46 (June only)	40.49
1995	53.15	6	64.40	58.78
1996	79.35	6	NA	79.35*
1997	64.43	7	56.81 (Feb only)	60.62*
1998	56.32	6	44.3	50.31
1999	44.03	5	NA	44.03
2000	50.42	7	24.4 (Feb only)	37.41
2001	61.30	6	NA	61.30*
2002	29.69	3	NA	29.69

2003	17.43	2	26.97 (Jul only)	22.20
2004	46.60	1	23.18 (June only)	34.89
2005	37.30	4	18.98	28.14
2006	NA	0	9.45	9.45
2007	38.38	1	20.43	29.40
2008	65.99	6	44.30	55.15
2009	62.78	7	53.14	57.96
2010	46.61	6	46.05	46.33
2011	64.57	7	50.47	57.52
2012	78.11	6	64.01	71.06*
2013	66.24	6	65.08	65.66*
2014	75.60	7	75.61	75.61*
2015	110.09	6	99.47	104.78*
2016	82.40	7	75.35	78.88*
2017	81.53	7	54.01	67.77*
2018	72.40	6	63.12	67.76*
2019	48.13	7	37.88	43.01
2020	64.57	5	31.53	48.05
2021	55.69	6	41.69	48.69
			TARGET	71.39 (72.00 $kg.hr^{-1}$)
			TRIGGER (75%)	53.54 (54.00 $kg.hr^{-1}$)
			LIMIT (50%)	35.70 (36.00 $kg.hr^{-1}$)