Western Australian Marine Stewardship Council Report Series

Western Rock Lobster Resource

Addendum 1

May 2019

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1. Background

The West Coast Rock Lobster Fishery was certified under the Marine Stewardship Council (MSC) standard in 2000, and was the first fishery in the world to be MSC certified. Since then it has successfully been re-accredited in 2006, 2012 and 2017. This document provides an update on changes to the fishery for annual audits by the MSC certification body and the annual stock assessment update for quota setting of the western rock lobster resource. Unless otherwise stated, data contained here represents data up to and including the 2018 season. These datasets discussed here and synopsis of more comprehensive data can be found in de Lestang et. al. (2016) and Bellchambers et al. (2017).

2. Management Arrangements

The management arrangements for the 2019 season were:

- A total allowable commercial catch (TACC) of 6,300 tonnes (plus 1.5% due to water loss).
- Minimum legal size of 76 mm carapace length.
- No Maximum size limit.
- Exemption for the taking of setose lobsters.
- 100% of a pot entitlement units may be fished except during whale gear modifications period (May to October inclusive).

3. Stock Assessment

The annual stock assessment for the fishery is conducted in April/May each year, following the completion of the puerulus settlement season. The assessment entails updating and validation of all current data on puerulus settlement, breeding stock surveys, commercial monitoring, catch and effort and tag recaptures. The stock assessment model is updated and used to assess a number of future harvesting (TACC) scenarios. The model assumes that the current (2019) season's biological controls (minimum size at 76 mm and no maximum size or setose protection rules) are maintained in the assessment for the following five seasons. Projections of puerulus settlement are based on the conservative level of the 25^{th} percentile of the historical data range. The outputs from these analyses are provided below and provided to managers and industry stakeholders at annual management meetings.

3.1 Summary

The 2019 stock assessment indicates that the rock lobster resource is currently in a healthy condition and is being sustainably fished at current harvest rates. Future projections suggest that lobster biomass and levels of egg production will be maintained well above threshold levels over the subsequent five fishing seasons under the modelled range of TACC (6300-6800 t) and harvest rate levels will remain steady or decline. Outcomes of the stock assessment indicate that a moderate increase in the TACC would move it towards fishing at Maximum Economic Yield (MEY).

The Total Allowable Recreational Catch (TARC) was calculated as 5% of the AHL, which is based on a commercial harvest rate of 39% of the available legal biomass for the 2019 season. (39% is chosen as it approximates the MEY level of fishing Caputi et al. 2015). The resultant TARC for the 2019/20 fishing season is 490 t. Details of seasonal AHL, TARC, TACC and recreational catch are provided in Appendix A.

3.2 Harvest Strategy

The Harvest Strategy and Control Rules (HSCR - Fisheries Management Paper #264: (Department of Fisheries 2014) for the Western Rock Lobster Fishery (the Fishery) has been used as the basis for this assessment of the 2020 total allowable commercial catch (TACC).

This HSCR was used in the assessment of the 2015 - 2018 seasons' TACC. A review of this Harvest Strategy commenced in 2018 The objectives of the current HSCR are:

- Sustainability: To ensure that the egg production in each of the four Breeding Stock Management Areas of the Fishery remain above their respective threshold values for the next five years with a probability greater than 75%.
- Harvest: Once the Sustainability Objective has been satisfied, TACCs for the Fishery shall use the principle of Maximum Economic Yield to determine a range of TACCs that would optimise the economic performance of the Fishery by achieving the best catch and catch rates combination, and thereby providing high economic returns and greater amenity to the Fishery and the West Australian community.

The allocation principles used within the HSCR are:

- The TACC is to be split 50:50 between the northern (Zones A and B) and southern (Zone C) regions of the Fishery. This principle will be applied after the Sustainability and Harvest Objectives have been met.
- The TACC for the northern zone is to be further split 36:64 between A and B zones. This is consistent with the historic 10-year average between the 1998/99 and 2007/08 seasons and has been used as the basis for setting catch allocations since TACCs were introduced for each Zone.

A more detailed description of the stock assessment process including the biological and economic modelling used within the TACC setting processes is provided in Western Rock Lobster Resource Assessment Report (de Lestang et al., 2016). The assessment examines empirical data as well as the outputs from the stock assessment model.

3.3 Empirical Assessment

The empirical assessment examines a range of observed indices derived from Commercial Catch and Effort statistics, Catch Disposal Records (CDR), the Independent Breeding Stock Survey (IBSS) and the Puerulus Settlement monitoring. This assessment indicates that:

- **Standardised catch rates are at very high levels in all fishing zones (Fig. 1):** Catch rates are standardised to account for the high grading of legal lobsters, which began in the 2010/11 fishing season when the fishery moved to quota management. After moving to quota management the season was extended to 12 months. Variation in the soak time, location and timing of when catch has been landed are also standardised for, to remove the influence of variable monthly catchability and abundance. These biases have been removed by modelling the data with a generalised linear model (GLM) incorporating fishing season, depth, month, soak time and zone as factors. The average response for each season in each zone has been produced. In the two coastal zones (B and C), standardised catch rates are currently at or near record levels, while in Zone A, catch rates have begun to increase again after a drop from a record high in 2010. Causes of high catch rates include the improved recruitment, the large proportion of residual biomass left each season because of the conservative catch quotas and the removal of protection from setose and maximum size females.

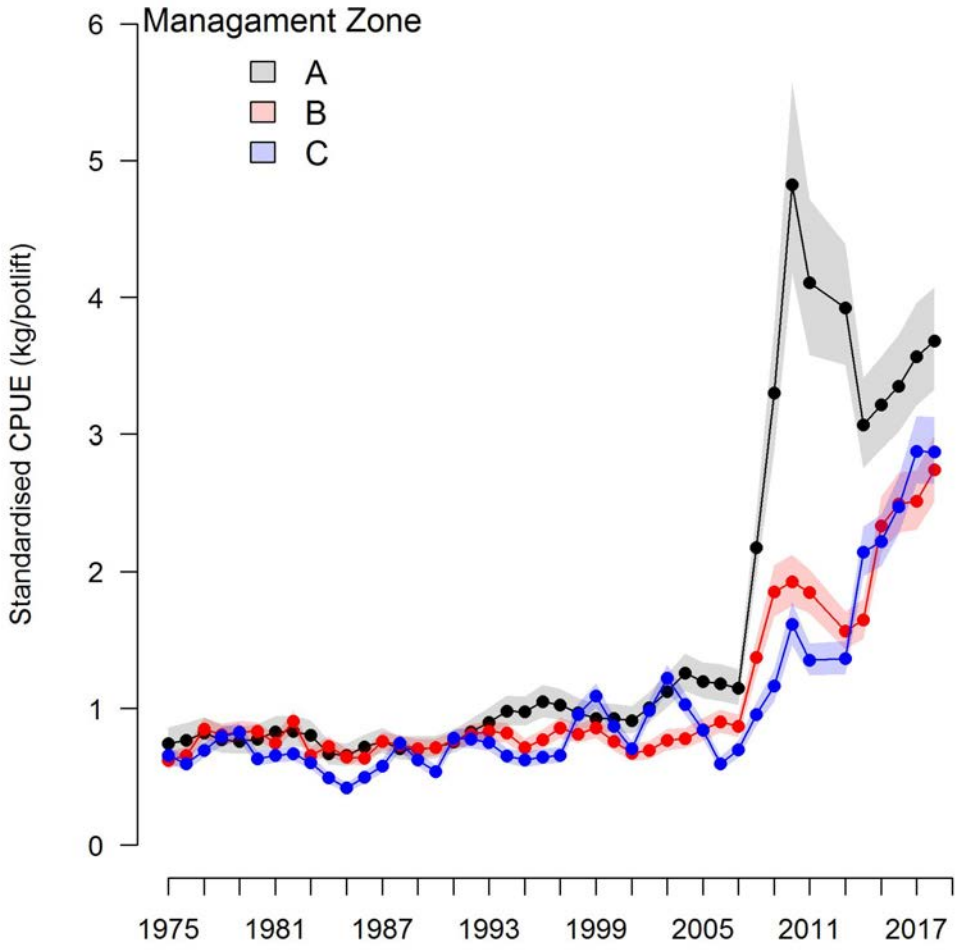

Figure 1. Standardised catch rates in the three fishing zones

- **Egg production is at very high levels throughout fishery (Fig. 2):** The 2018 fishery-independent breeding stock survey (IBSS) sites sampled showed steady or increasing catches from their previous year. Kalbarri, Jurien and Leeman were not sampled. Although the IBSS egg indices are standardised for swell and water temperature, not all inter-annual variation in catchability is removed. A FRDC funded project (started in 2017) is examining a range of biological / behavioral and environmental factors which may influence catchability. Initial analysis indicates that stock composition (numers of small and large lobsters), mating/spawning stage and sea floor temperatures during the surveys all have a marked effect on the catchability of the lobsters. These may be contributing to the high indices in 2012-13 when water temperatures were above average and lower indices in 2016-17 with cooler temperatures. Any bias determined will be used to adjust the time series in future analyses. Lobsters take about six/seven years to grow from puerulus into mature adults. With this time lag, lobsters that settled in 2011 and 2012, would be the dominant age classes that entered the breeding stock in 2019.

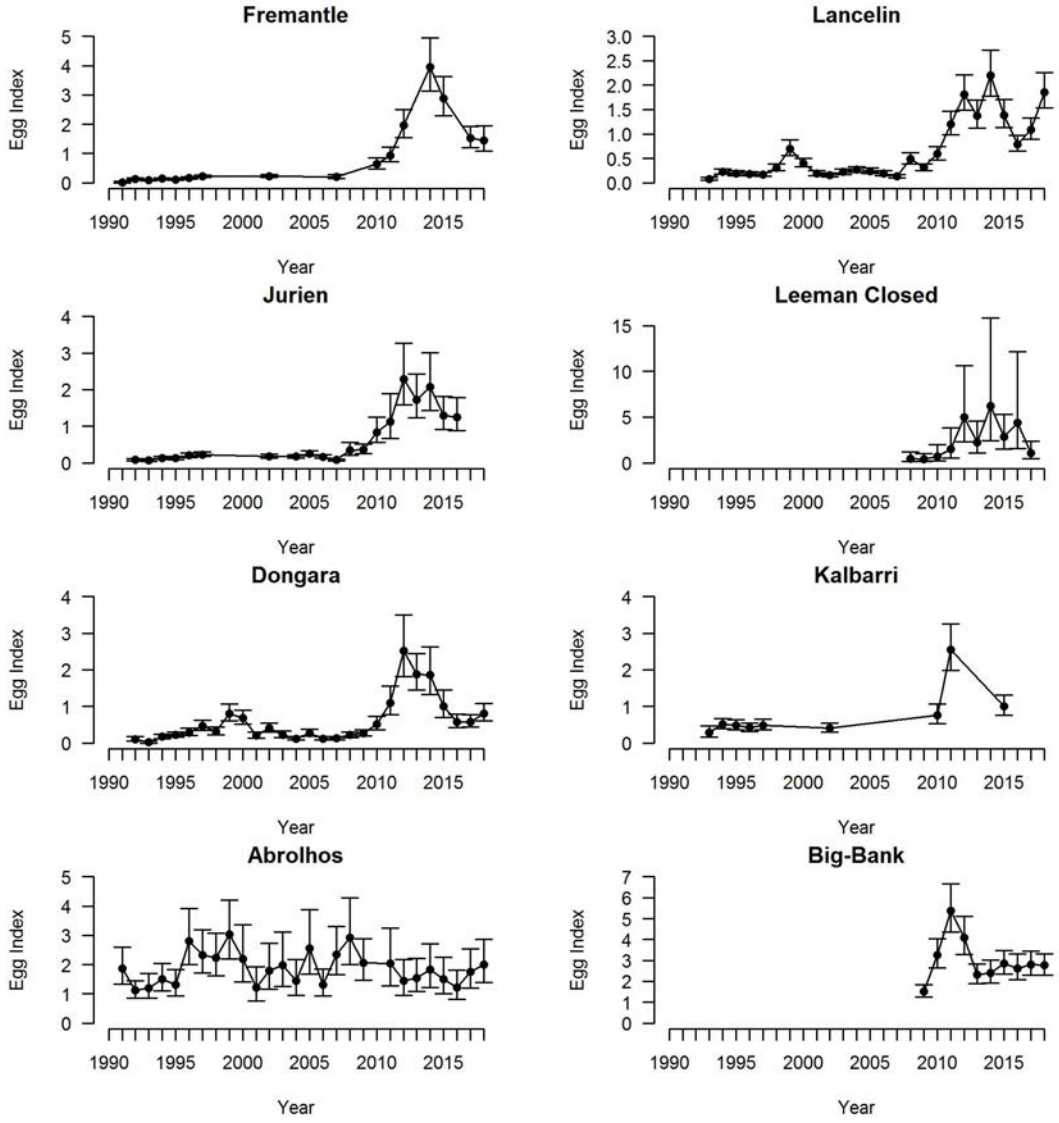

Figure 2. Independent Breeding Stock Survey egg production indices at eight locations

- **Recent recruitment (puerulus) into the fishery is average (Fig. 3):** In 2013/14 and 2016/17 the fishery received very high levels of recruitment, near long-term record highs. These good settlements should enter the fishery during the 2017 and 2020 seasons. The 2018/19 season was an average settlement in the north and below average in the south. These recruits will enter the fishery in 2022.

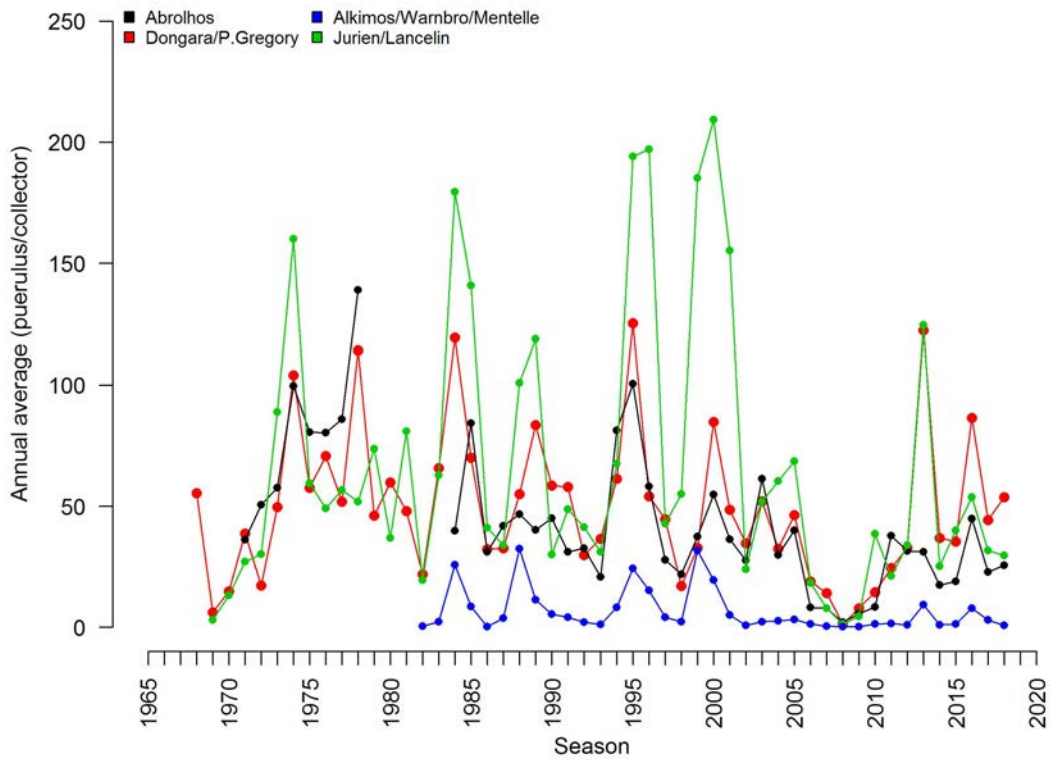

Figure 3. Regional puerulus settlement levels

- **Quota has been acheived and fishing effort and vessel numbers have declined (Fig. 4):** The TACC has been acheived each year. The fleet fishing for lobster decreased by one vessel in 2018, with 233 vessels actively (vessels having returned at least five CDRs within a season) fishing, with a corresponding slight decrease in total pot-lifts to 1.975 million in 2018.

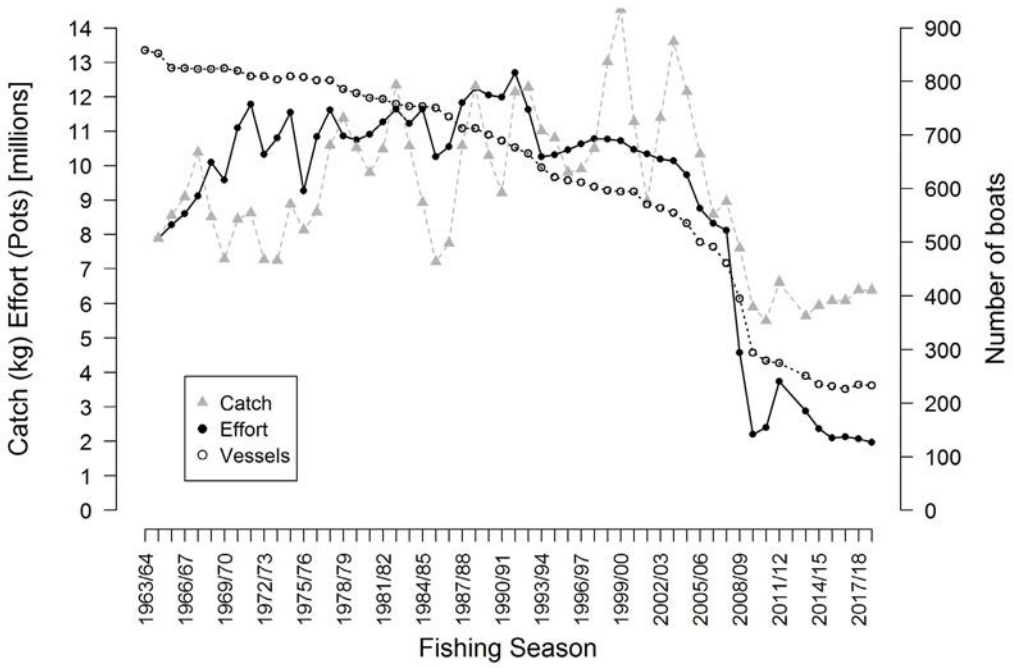

Figure 4. Catch (tonnes), effort (pot lifts) and the number of vessels.

3.4 Modelled Assessment

The Western Rock Lobster integrated assessment model is used to derive a number of indices highlighting the performance of the fishery. These indices are also projected five fishing seasons into the future (taking into account the puerulus settlement) to assess the likely implications of various TACC settings. The indices include catch rates, levels of egg production, legal biomass and harvest rates. This assessment indicates that:

- **Modelled catch rates are at very high levels in all fishing zones and generally predicted to increase over the five-year projection under current harvest levels (Fig. 5):** The peak in catch rates, shown mainly in Zone C in 2020 and 2021 seasons is the good settlement in 2016/17 entering legal size. After this, with the slightly lower levels of settlement, catch rates are predicted to fall slightly (Fig. 5).

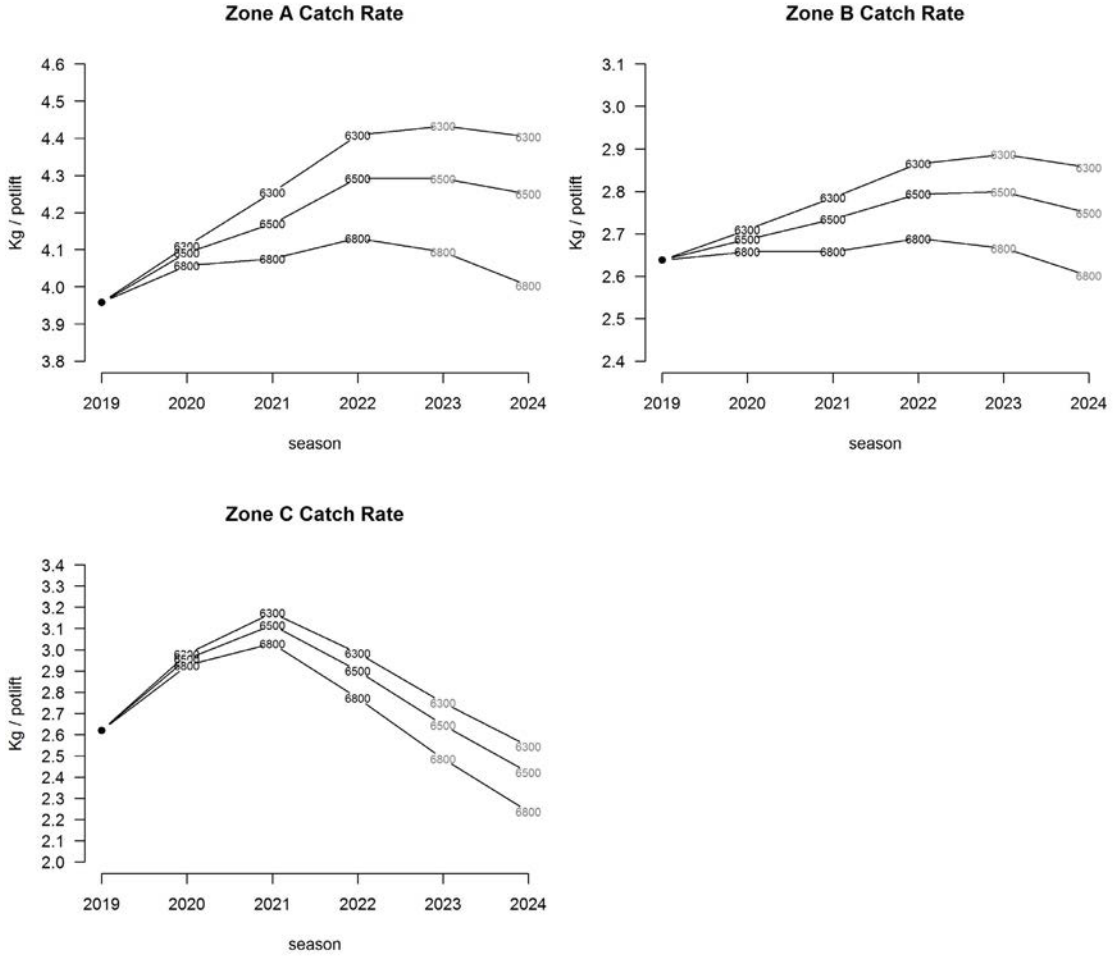

Figure 5. Model projected catch rates for different levels of fixed TACC for the total fishery

- **Modelled levels of egg production are at very high levels in all fishing zones and predicted to increase under current harvest levels over the five-year projection (Fig. 6):** In recent years levels of egg production have remained steady or dipped slightly due to a number of poor puerulus settlements (2008/09 and 2009/10) recently attaining the age at which they become mature. Recent management changes (removal of maximum size and setose) have also resulted in an increased targeting of breeding-age lobsters during the autumn/winter period prior to mating occurring. Under current management measures, egg production is projected to increase over future seasons due to the good puerulus settlement in 2013/14 starting to mature and enter the breeding stock. An increase in TACC may lead to a slight decline in egg production in the southern breeding stock management area but this will remain well above threshold levels.

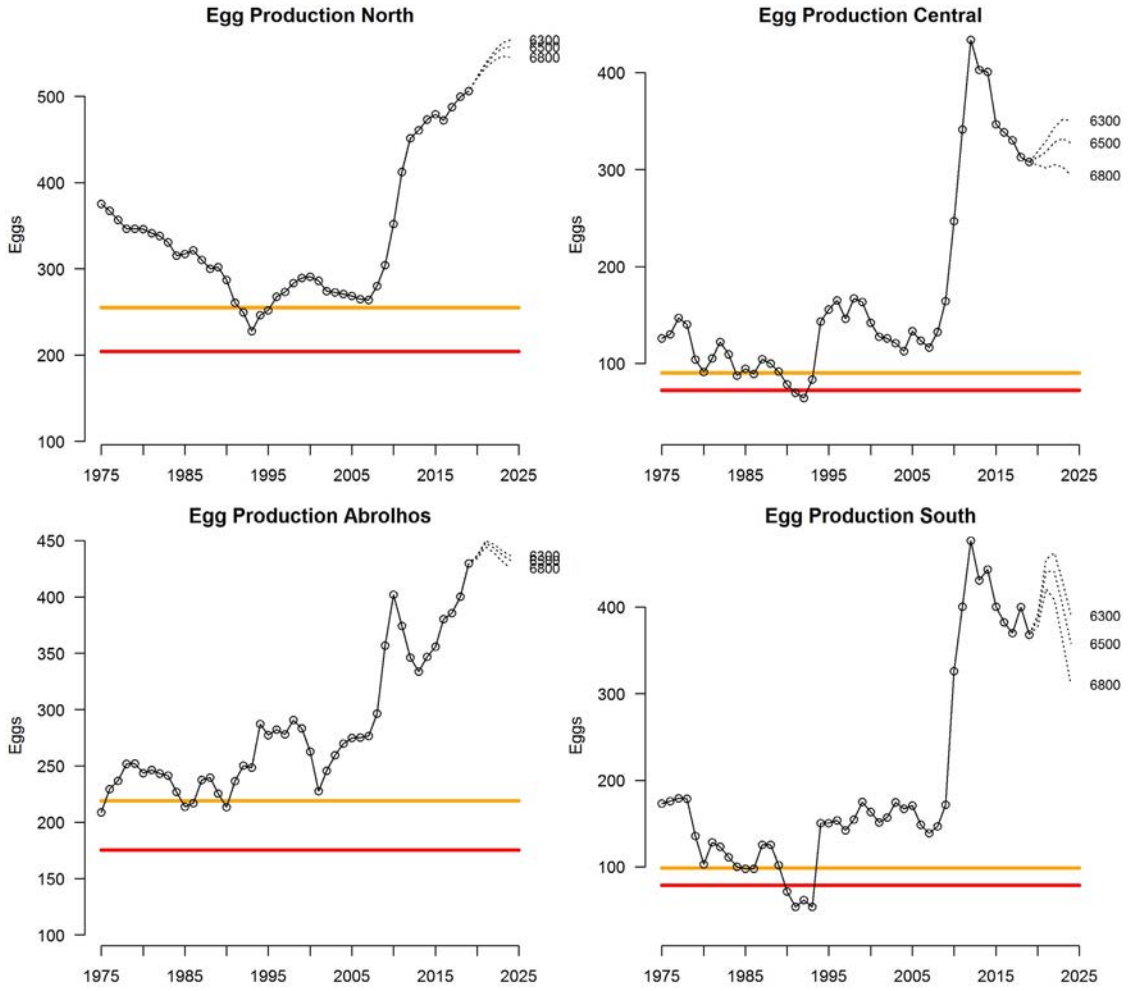

Figure 6. Model projected egg production for four modelled areas for different levels of TACC

- **Modelled legal biomass levels are at record high levels and predicted to increase further under current harvest rates (Fig. 8):** Model-derived estimates of legal biomass available has changed over time due to variation in the classification of a legal lobster (e.g. are setose lobster legal or not) and due to level of harvesting lobsters compared to the abundance which recruit to the fishery each season (Fig. 7).

  In the late 1970s the legal biomass of lobsters in the fishery was between 15,000 and 20,000 t. This biomass varied annually from changes in the levels of puerulus settlement 3-4 years previously as well as through a progressive increase in harvest rate. Historical low levels of legal biomass were reached during the 2000s at about 14,000 t. Catch and effort reductions in 2008 and 2009 and then a change in the classification of legal lobsters (maximum size and setose protection removed from 2014 - 2015) have resulted in a sharp increase in the biomass of legal lobsters. Currently estimates of the legal biomass are the highest on record and are projected to increase again as the good levels of puerulus settlement in 2016/17 enter the fishery.

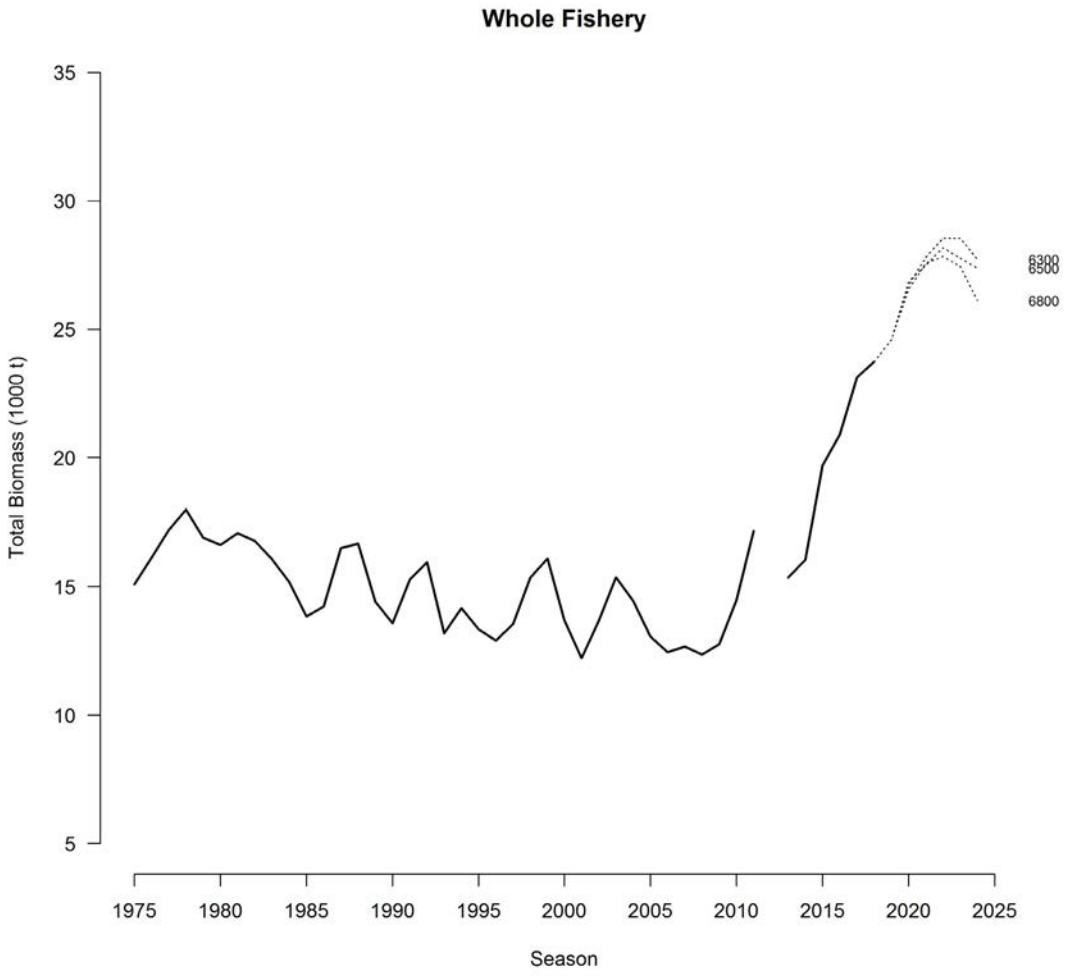

Figure 7. Model-estimated legal biomass and projected levels for different TACC.

- **Modelled harvest rates are at very low levels and predicted to remain steady or decline further under current harvest levels (Fig. 8):** Model-derived estimates of harvest rate are shown for each fishing season (Fig. 8). The harvest rate is the proportion of the legal biomass taken each season. Therefore a high value indicates that a greater proportion of legal lobsters are being captured, and less "residual" lobsters are being left. The break in the series is caused by the extended 2011/13 fishing season when the season start date changed to 15 January. This extension resulted in the following season being considered the 2013 season. Historically the fishery caught 70-80% of all legal lobsters each season, which did not include the majority of the breeding stock as mature females had additional levels of protection (e.g. setose and maximum size). In recent years the harvest rate has declined markedly down to about 30%. Under the TACCs modelled, these low levels of exploitation are projected to decline further as the good levels of puerulus settlement in 2016/17 enter the fishery and greater amounts of residual biomass are allowed to remain in the water each season.

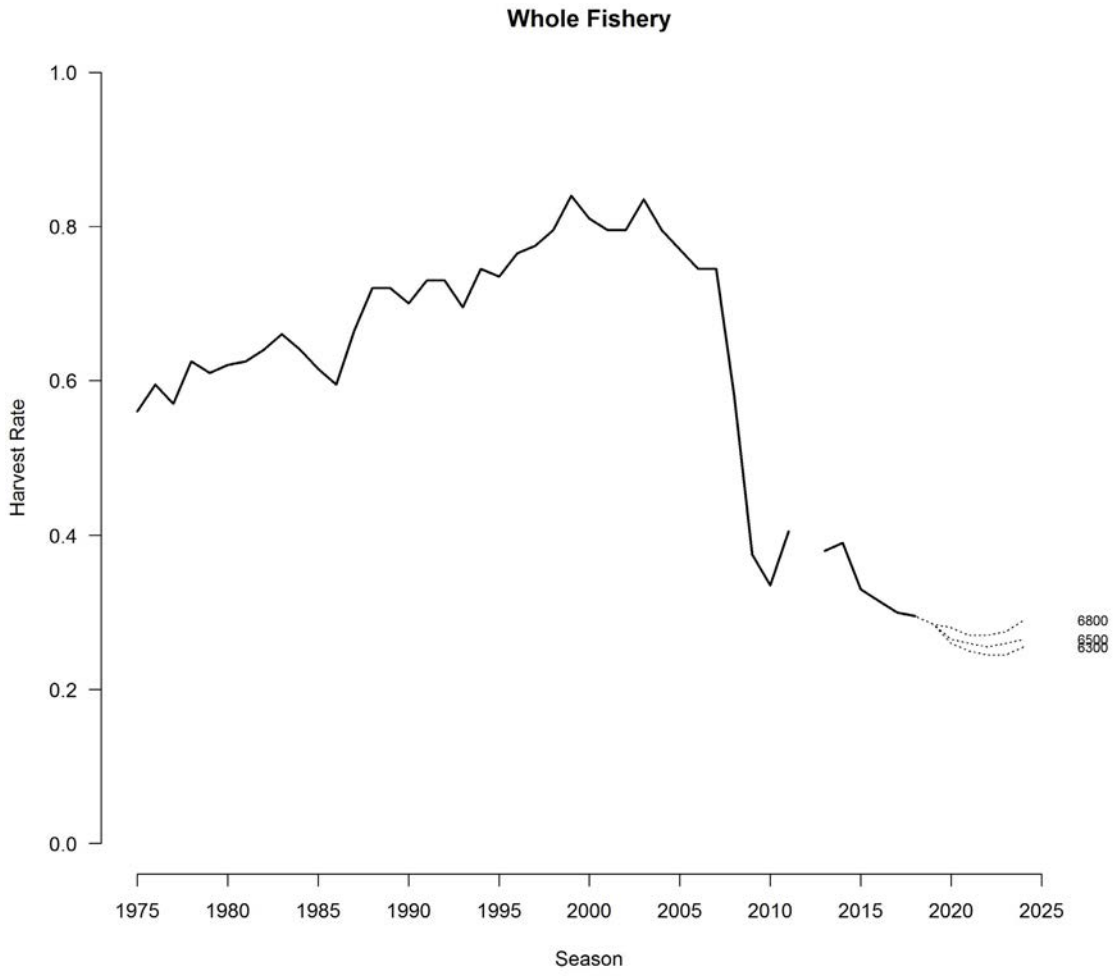

Figure 8. Model-estimated harvest rates and projected levels for different TACC.

3.5 Weight of Evidence Summary

- The TACC was achieved in 2018.
- Standardised catch rates are at very high levels in all fishing zones (Fig. 1).
- Egg production is at high levels throughout fishery (Fig. 2).
- Recruitment into the fishery is stable with the 2018/19 settlement being about average (Fig. 3).
- Fishing effort has stabilised (declined slightly) and harvest rates are at very low levels (Figs 4 and 8).
- TACC projections based on 6300 - 6800 t indicate that catch rates will remain high (Fig. 5), high egg production and biomass levels will continue under all TACC scenarios modelled (Figs 6 and 7) and harvest rates will remain low (Fig. 8).

Based on the above it is likely that increasing the TACC in 2019 would still result in economical catch rates and healthy levels of egg production and move towards the MEY level of fishing based on previous assessments of MEY (i.e. harvest rate of ~0.39).

4. Retained (non-target) species

4.1 By-product

Commercial lobster fishers are able to retain and sell southern rock lobster, octopus and champagne crabs that are caught as by-product of lobster fishing. All catch of these species must be detailed on their catch disposal record. These data are included in the stock assessments for the West Coast Deep Sea Crustacean Managed Fishery (champagne crab) and Interim Octopus Managed Fishery (octopus). The catches by the West Coast Rock Lobster Managed Fishery for the 2018 season are detailed in (Table 1).

Table 1. Species and quantity of by-product (kg) retained during the 2018 fishing season.

Species	Catch (kg)
Octopus	12438
Champagne crab	1170
Southern Rock Lobster	17

4.2 Bait usage

The fishery used approximately 3177 tonnes of bait in the 2018 season. The majority of bait used (69.2%) was "out of scope" with regard to MSC assessment as they were either bait of terrestrial origin (e.g. pig fat), or fish processing waste products such as heads or frames which would otherwise be discarded. Of those baits which are "in scope", only Blue Mackerel from New Zealand comprised more than 5% of the weight of rock lobster landed in the 2018 season (Table 2).

Table 2. Identity, origin, type and amount of bait (kg) used during the 2018 fishing season, and its percentage by weight of the landed western rock lobster catch.

Bait	Origin	Type	Amount	Status	Percentage of WRL Catch
Blue Mackerel	New Zealand	Whole	843295	in scope	13.16
Salmon	Western Australia	Cutlets	77412	in scope	1.21
Blue Mackerel	Taiwan	Whole	36680	in scope	0.57
Kahawai	New Zealand	Whole	22225	in scope	0.35
Hoki	New Zealand	Heads	1335357	out of scope	20.83
Orange Roughy	New Zealand	Heads	469235	out of scope	7.32
Alfonsino	New Zealand	Heads	141822	out of scope	2.21
Pork Fat	Western Australia		86280	out of scope	1.35
Kahawai	New Zealand	Heads	69614	out of scope	1.09
Salmon	Western Australia	Heads	27228	out of scope	0.42
Tuna	Thailand	Heads	18000	out of scope	0.28
Silver Warehou	New Zealand	Heads	18000	out of scope	0.28
Blue Mackerel	New Zealand	Heads	13260	out of scope	0.21
Jack Mackerel	New Zealand	Heads	11060	out of scope	0.17
Barracuda	New Zealand	Tails	5660	out of scope	0.09
Blue Mackerel	New Zealand	Tails	1380	out of scope	0.02
Blue Mackerel	Taiwan	Heads	620	out of scope	0.01

The proportion of Blue Mackerel from New Zealand has decreased to 0.27 of the total bait used in the fishery for the 2018 season (Figure 9).

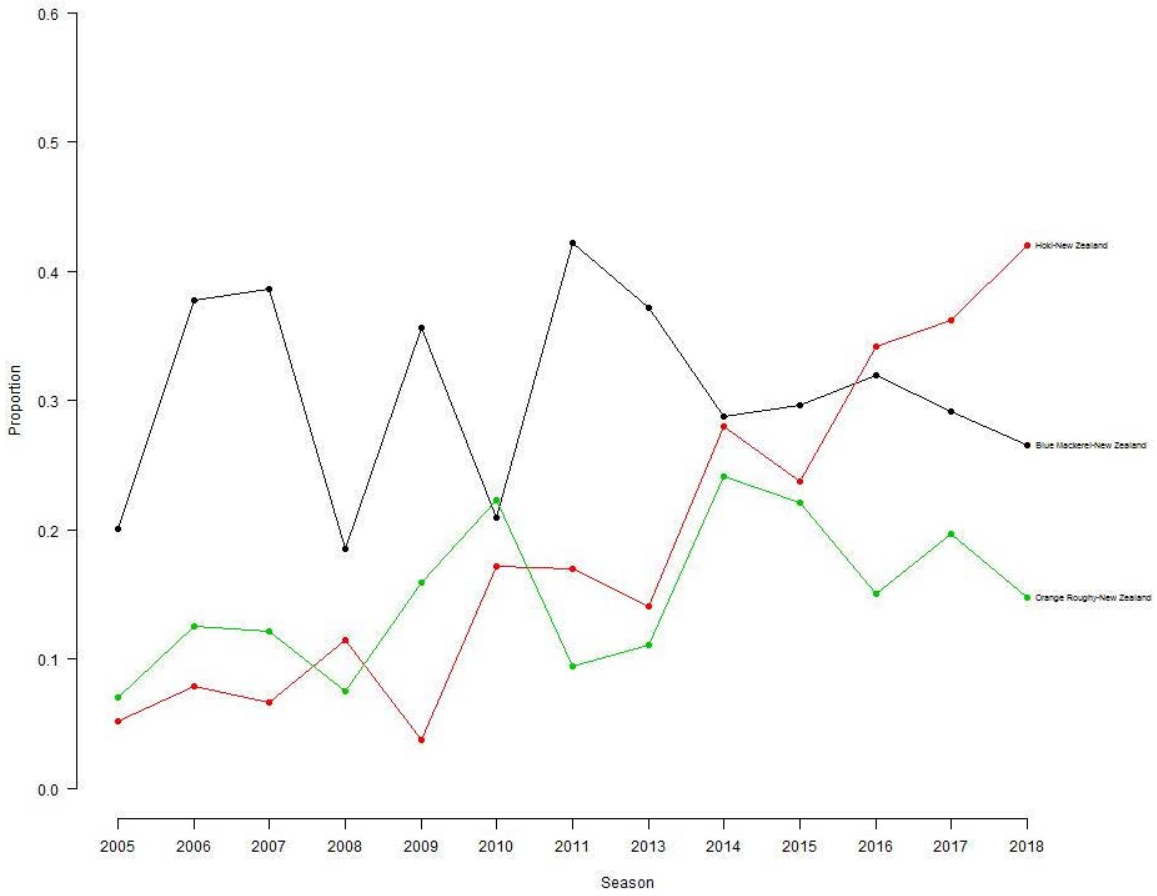

Figure 9. Proportional bait usage by season for the three most commonly used bait species.

5. By-catch (non-ETP) species

All by-catch reported during the 2018 fishing season in catch disposal records has been summarised to combine, where possible, the same species under a common name. For example, “Bluebone”, “Baldys” and “Groper” have all been pooled under the common name of “Baldchin Groper”.

The greatest biomass of by-catch was the Baldchin Groper, which contributed 58% of all by-catch (2354.6 kg). The second greatest biomass of by-catch was the Pink Snapper, which contributed 15.3% of all by-catch (622.7 kg). It should be noted that not all by-catch caught is retained, with much of it being returned alive (Table 3).

Table 3. Common name, quantity (kg) and its respective proportion of the total by-catch caught during the 2018 fishing season.

Common.Name	Total(kg)	Proportion	Common.Name	Total(kg)	Proportion
Baldchin Groper	2355	58.0	Spangled Emperor	19.5	0.48
Pink Snapper	623	15.3	Leatherjacket	17.9	0.44
Wobbegong Shark	254	6.3	Rockcods	2.5	0.06
Redthroat Emperor	238	5.9	Parrotfishes	1	0.02
Breaksea Cod	193	4.8	Scorpionfishes	0.7	0.02
Cuttlefish	168	4.1	Western Wirrah	1	0.02
West Australian Dhufish	99	2.4	Flatheads	0.4	0.01
Crabs	88	2.2			

6. Endangered, threatened and protected (ETP) species

6.1 Sea Lions

Drowning of Australian sea lion pups in western rock lobster pots instigated the implementation of sea lion exclusion devices (SLED) in areas where these interactions were occurring. Historical levels were just over three sea lions per season. In 2018 there were 0 interactions recorded. The performance measure for the fishery is that there is no increase in the rate of capture of sea lions. In 2017 there were 0 interactions recorded.

Therefore, **the fishery met this performance measure**.

Compliance checks are undertaken on the adherence of fishers to SLED regulations. In 2018 there were 75 checks of gear for SLED compliance. This resulted in 1 Infringement of a commercial fisher, 3 Warnings of commercial fishers, 1 Infringement of a recreational fisher and, 2 Warnings of recreational fishers being issued.

6.2 Dusky Shark

To address concerns over the impact of entanglement of the Dusky shark (*Carcharhinus obscurus*) population from discarded bait bands, a state-wide ban on bait bands on fishing vessels was implemented on the 15 November 2011. An ecological risk assessment (ERA) re-assessed this issue after the implementation of the state-wide ban as a negligible risk (Stoklosa 2013). Compliance checks are undertaken on the adherence of fishers to bait band regulations. In 2018 there were 636 vessels checked for bait band compliance. This resulted in 3 Warnings of recreational fishers and, 2 Infringements of commercial fishers being issued.

6.3 Whales

The largest population of humpback whales (*Megaptera novaeangliae*) in the southern hemisphere (Leaper et al. 2008) migrates along the West Australian coast annually. Traditionally this population has had a small interaction with the western rock lobster fishery. Entanglements between 1990 and 2010 ranged from 0 to 6, averaging just over 1 entanglement annually. However in 2011 there was an increase in whale entanglements which ultimately peaked with 17 in 2013 as a result of increased fishing during the whale migration period when the season was extended to 12 months.

In July 2014 a series of gear modifications were introduced to mitigate entanglements between humpback whales and western rock lobster gear. These modifications are implemented during the whale migration period (May-October) each year since. The performance measure for this fishery is that entanglements in western rock lobster gear is within historic range. In 2018 there were 8 entanglements recorded, and therefore, **the fishery did not meet this performance measure** (Figure 10). Due to the increased number of entanglements in the 2018 season, additional management options are currently being discussed with industry for potential implementation in the 2019 season.

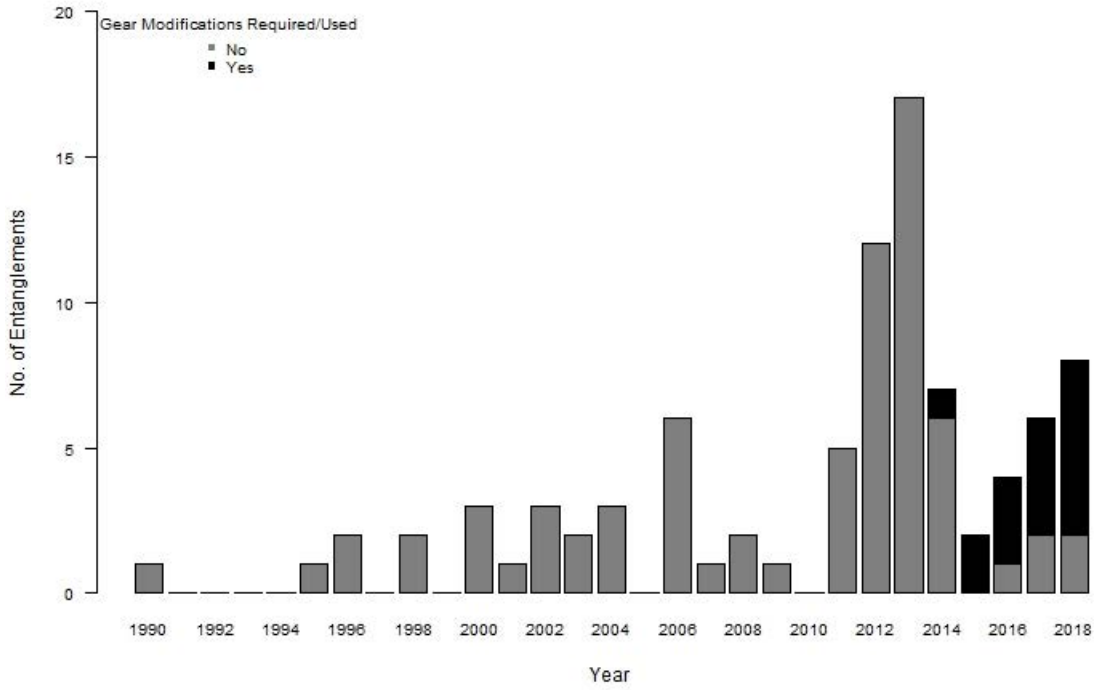

Figure 10. Annual number of entanglements of whales in western rock lobster gear when gear modifications were not (grey) or were (black) required. Gear modifications were introduced in June 2014, midway through the migration season.

Compliance checks are undertaken on the adherence of fishers to whale gear mitigation regulations. In 2018 there were 219 checks of vessels for whale gear modification compliance. This resulted in 2 Warnings of commercial fishers and, 5 Infringements of commercial fishers being issued.

7. Ecosystem Effects of Fishing

A number of components of the ecosystem are monitored to assess any potential impact on the removal of lobsters on ecosystem function. These include target species abundance and demography, invertebrate communities, habitat structure and fish communities and occur throughout the re-certification period (5 year cycle), such that each component of the ecosystem is assessed at least once during this period (Table 4). Only those components of the ecosystem, which were surveyed since the previous assessment or audit are reported below.

Table 4. Research plan for conducting ecosystem related monitoring during the 4th re-certification period for the Western Rock Lobster Managed Fishery

Year	Activities
2016/17	Target Species & Fish Communities
2017/18	Target Species & Invertebrate Communities
2018/19	Target Species & Habitat Strucuture
2019/20	Target Species & Fish Communities
2020/21	Target Species & Invertebrate Communities

7.1 Target Species

Catch rate surveys occurred inside the Leeman closure in 2017 as part of an FRDC funded project looking at western rock lobster catchability. There was no potting outside of the closure in 2017 with which to compare catches from inside. The next survey of areas inside and outside of the Leeman closure is planned for 2019.

7.2 Fish Communities

Fish community analysis was due to be undertaken during this financial year (Table 4). However, due to changes to Departmental priorities, sampling was not conducted. Sampling is now scheduled to occur during the 2019/20 financial year, with invertebrate community sampling being combined with habitat structure analyses in 2020/21.

8. Appendix A

Table A1. Annual Harvest Level (AHL), Total Allowable Catch (TAC), Total Allowable Commercial Catch (TACC), Total Allowable Recreational Catch (TARC), commercial and recreational catch for commercial (15 January to 14 January) and recreational (15 November to 30 June) seasons.

Note: during 2018 the recreational fishing season was extended to year round. The recreational catch listed for 2017/18 encompasses the old season structure (15 November to 30 June). Work is being conducted to align the commercial and recreational seasons for comparable reporting and to collect year-round recreational catch estimates.

Commercial season	AHL	TAC	TACC	Commercial catch	Recreational Season	TARC	Recreational catch
2014/15	7760	6247	5859	5946	2013/14	388	249
2015/16	8080	6404	6000	6086	2014/15	404	330
2016/17	8440	6422	6000	6087	2015/16	422	381
2017/18	9600	6780	6300	6394	2016/17	480	456
2018/19	10120	6806	6300	6392	2017/18	506	472
2019/20	9800	6790	6300		2018/19	490	

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