Ref: 1348/15

Mr J McMath
Chief Executive Officer
Western Rock Lobster Council
PO Box 1605
FREMANTLE WA 6959

Dear John

CONSULTATION ON THE TOTAL ALLOWABLE COMMERCIAL CATCH IN THE WEST COAST ROCK LOBSTER MANAGED FISHERY – 15 JANUARY 2016 TO 14 JANUARY 2017

The Minister for Fisheries has approved consultation with the Western Rock Lobster Council (WRLC) pursuant to section 65(2) of the *Fish Resources Management Act* 1994 and clause 4 of the *West Coast Rock Lobster Managed Fishery Management Plan* 2012 (Management Plan) with respect to possible amendments to the Management Plan relating to Total Allowable Commercial Catches (TACCs) for the 2016 licensing period.

As you are aware, the approved Harvest Strategy and Control Rules (HSCR) requires that a Maximum Economic Yield (MEY)-based catch range is established as a basis for determining the TACC (unless the MEY-based range does not meet the sustainability objective).

As you would also be aware, the Supply-Price Relationship (SPR) used by the Department of Fisheries (Department) in setting the MEY range has been a matter of concern to some in industry. For this reason, and with the support of the WRLC, Economic Research Associates (ERA) was contracted with a view to developing an updated SPR. It is anticipated that the final ERA report will be available in the near future.

With regard to the 2016 season, the Department has updated the inputs to the biological model for the purposes of determining a catch which meets the sustainability objective.

In respect of the biological modelling it should be noted that:

- standardised catch rates are at record levels in Zone B and Zone C and are at very high levels in Zone A. Catch rates are predicted to continue to increase;
- egg production is at or close to record levels throughout the fishery and is predicted to continue increasing if similar harvest levels are maintained; and
- recruitment into the fishery continues to be significantly improved compared with that associated with previous record low puerulus settlements.

With regard to economic modelling, the ERA report cautions against using the current SPR to extrapolate beach prices that would be expected as a result of setting a TACC which is significantly greater than the current level. Therefore, a “weight of evidence” approach has been taken to establishing the 2016 MEY range for the purposes of consultation.

The outcomes of this assessment indicate that the MEY range for 2016 is likely to be higher than that for 2015. On this basis the range has been determined by increasing that provided in respect of the 2015 TACC setting process by 5%, giving a range of 6,660 tonnes to 8,022 tonnes.

The Department is of the view that moderate, incremental increases in the TACC are more likely to be consistent with achieving the MEY outcome from the above catch range than large increases. In this regard a TACC set at the lower end of the MEY range (i.e. 6,660 tonnes) would appear to be reasonable.

The WRLC’s recommendation on the 2016 TACC, based on the above range, is sought. It is understood that some in industry will consider that the TACC should be set at a level which is below the suggested MEY range. Should the WRLC believe that there are factors which have not been adequately considered in the MEY assessment which would support a lower TACC, these should be clearly outlined so that the Minister is fully informed when making his decision.

It would be appreciated if you could provide the WRLC’s views on the 2016 TACC by **14 August 2015**. If you require any further information, please contact Jo Kennedy on 9482 7338.

Yours sincerely

Dr Lindsay Joll
ACTING DEPUTY DIRECTOR GENERAL

22 June 2015

Cc: WAFIC

Government of **Western Australia**
Department of **Fisheries**

Total Allowable Catch Assessment for 2016 Western Rock Lobster season

Western Australian Fisheries and Marine Research Laboratories

June 2, 2015

Background

- Application of the Harvest Strategy and Control Rules (HSCR - Fisheries Management Paper #263: http://www.fish.wa.gov.au/Documents/management_papers/fmp264.pdf) for the Western Rock Lobster fishery has been formally adopted by the Minister for use over five years. This therefore has been used as the basis to set the 2016 total allowable commercial catch (TACC).
- This HSCR was used to determine the 2015 season's TACC.
- The objectives of the HSCR are:
  - Sustainability: To ensure that the egg production in Breeding Stock Management Areas of the Fishery remains above its threshold value 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 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 as set out in Harvest Strategy and Control Rules. 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 35.93% : 64.07% between A and B zones as set out in Harvest Strategy and Control Rules. 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.
- The TACC range generated based on the MEY principles for the 2015 season was 6343 to 7670 t.
- The fishery-wide TACC determined by the Minister, following input from the Western Rock Lobster Council, for the 2015 season was 6000 t. The zone specific levels were therefore set at 1080, 1920 and 3000 t in zones A, B and C, respectively.
- The total allowable recreational catch (TARC) for 2014/15 of 404 t was based on the IFM principles of a 5% share of the catch. This was based on the upper level of the TACC range as set out in Harvest Strategy and Control Rules.
- A more detailed description of the stock assessment process including the biological and economic modelling used within the TACC setting processes is provided in "Stock Assessment for the Western Rock Lobster Fishery" - Fisheries Research Report #217: http://www.fish.wa.gov.au/Documents/research_reports/frr217.pdf

Current situation

- The Western Rock Lobster (WRL) stock assessment model has been updated with all current data on puerulus settlement, breeding stock survey, commercial monitoring, catch and effort and tag recaptures (see Appendix for details on updates).

- The model assumes that the current (2015) season's biological controls (minimum size reduced to 76 mm and the removal of maximum size rule for the entire season and setose rule for part of the season) are maintained for the following five seasons.

- The Department of Fisheries (DoF) with support from the Western Rock Lobster Council, engaged market economists 'Economic Research Associates' (ERA) in late 2014 to derive an updated relationship between Western Rock Lobster landings and beach price (a supply-price relationship: SPR).

- The ERA report analysed recent trends in worldwide lobster export volumes and prices for exports to China, Western Australia's dominant export market. The report notes that, although TACC has effectively been constant, export volumes to China from Western Australia have grown since the ITQ was introduced as exports were diverted to China from other markets.

- The report uses monthly export data to examine how Western Rock Lobster export prices are influenced by export volumes, the price of substitute lobster such as Southern Rock from New Zealand and demand growth in China. It examines how export price drives beach price and the relationship between them. The analysis has shown that it is not possible to project, with a reasonable degree of certainty, the beach prices that would be expected from setting a TACC substantially different from current level. Primarily, this is because the variation in TACC in the recent data is insufficient to allow a meaningful statistical test of the required relationship.

- The analysis indicates that even though export volumes have grown, lobster export prices have not been significantly negatively affected. In $US, export prices for Western and Southern rock lobster have trended up over the period since the WA ITQ was instigated. The analysis finds that even the recent massive volume increases into China from the US have had only a marginal impact on the US export price.

- Most importantly, over this period, export revenues received have also grown. This is true for Western Australia, which has experienced volume and price increases, for New Zealand which has experienced price increases with stable volumes, but also for the US where despite large volume increases to China, the consequential modest price fall has meant that aggregate export revenue has increased. The conclusion is that over the period, growth in demand in China that has been the key to explaining price rises and revenue increases. Put simply, China has been able to absorb the increase in volumes from these major suppliers without damaging prices and revenues.

- The analysis confirms this finding through the estimation of the inverse demand curve for Western Australian exports. These results show that demand in China as proxied by monthly retail sales, is the most significant variable in explaining variation in export prices. The resultant demand equation implies a very high price elasticity of demand.

- The analysis concludes that the key to looking forward is the expected growth in demand in China. The ERA report concludes that, whilst recognizing that past trends do not automatically extrapolate, the analysis of export data to date does suggest that the most likely supply responses from major suppliers and demand growth in China, a modest increase in supply by any one exporter is unlikely to significantly affect the price.

- Since projecting the MEY analysis to levels substantially different from the current TACC is not recommended by the ERA report , DoF has updated its advice on the empirical information that is available using a "weight of evidence" approach, for use in the 2016 TACC deliberations and TARC calculations.

Empirical Assessment

The empirical assessment examines a range of observed indices developed from Commercial Catch and Effort statistics from fishers' Catch Disposal Records (CDR), the Independent Breeding Stock Survey (IBSS), Volunteer Research Log Books and the Puerulus Settlement monitoring. This assessment indicates:

- 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 and for variation in the timing of when catch has been landed (i.e. to remove the influence of variable monthly catchability and abundance). In the two coastal zones (B and C) standardised catch rates are currently at record levels, while in Zone A, although catch rates have declined slightly from over the past year, they are still at very high levels and far higher than in the coastal zones.

- Egg production is at or close to record levels throughout fishery (Fig. 2): The 2015 IBSS showed an increase in egg production at six of its seven sites. In Dongara, where egg production did not increase, it was still close to record levels and close to its previous year's estimate. It should be noted that, although these egg indices are standardised for water temperature and swell, not all interannual variation in catchability is removed from the index. Therefore individual points can be biased and the true pattern is indicated by the general trend of the index.

- Recruitment into the fishery is increasing (Fig. 3): Since 2008/09 puerulus recruitment in all locations has increased progressively. In 2013/14 the fishery received very high levels of recruitment, near long-term record highs. 2014/15 has seen a reduction in recruitment from the previous year's very high levels, although they were still above average levels of the last ten years. In the north of the fishery recruitment was equal to the long-term average level of settlement. The puerulus recruitment of 2013/14 will enter the fishery as juvenile red lobsters in Autumn 2017 and as white lobsters in Spring/Summer of 2017.

- Fishing effort and vessel numbers have declined (Fig. 4): Reduced number of potlifts and vessel numbers have resulted in a further reduction in fishery-wide costs.

- Legal biomass increased markedly in 2015: The proportion of the stock considered legal has increased substantially in 2015 due to the removal of protection to setose (1 July 2015 - 14 November 2015) and maximum sized females and a reduction in the minimum size (77 to 76 mm).

Model assessment

- Catch rates are high and are projected to increase further in subsequent seasons even at TACCs up to 1000 t above the current TACC (Fig. 5). Up to 2018 catch rates are influenced by known levels of puerulus settlement, with future years being based on puerulus settlement which has been conservatively assumed to be the lower of either the 25^{th} percentile or the previous year's settlement .

- Modelled egg production is at or close to record levels in all four Breeding Stock Management Areas (BSMA) of the fishery: Egg production has been increasing in all BSMA of the fishery and are projected to continue to increase at harvest rates similar to current levels (Fig. 6).

- The sustainability objective will be met by all TACC scenarios up to at least 8000 t (Fig. 6): Even at this higher TACC (8000 t) egg production levels in all regions of the fishery are projected to continue to increase over the subsequent five fishing seasons.

- The proportion of legal lobsters remaining unfished each year is at historic levels: In both regions (northern and southern regions) of the fishery more than 70% of the proportion of the legal biomass is currently not being exploited annually, which is a big increase on historical levels (Fig. 7). Even with an moderate increase in the TACC the harvest rates will remain at similar levels.

- The Supply-Price Relationship (SPR) used for setting the 2015 TACC has been updated with a more contemporary relationship.

- A strong SPR is evident during the tail end of the past two fishing seasons. This relationship develops when fishers run low on quota and hold catches back hoping for a price windfall. This has resulted in market demand not being met and a price response has ensued. These periods (the last 45 days of the 2013 and 2014 seasons) have been used to develop a new SPR (Fig. 8).

- This SPR is considered relatively conservative, as such it is similar to that used in previous years' economic modelling. Its projections most likely underestimate the true value of profits that can be made by moving towards MEY. Furthermore, any harvest rate considered associated with MEY based on this SPR is likely to be lower than the true value representing MEY (due to this SPRs conservative nature). The SPR assumes:
  - There will no significant changes to the supply chain.
  - The current demand in China does not significantly decline.
  - The pattern of landings that occurred in 2013 and 2014 fishing seasons continues.

- The current estimate of SPR has been compared to the SPR that would be required for the current TACC of 6000 t to be close to being at MEY (Fig. 9). If MEY was close to 6000 t the impacts on price from increased landings should have been twice as severe as was calculated by the current conservative emperical relationship. For example, the two relationships suggests that an increase in TACC of 10 t per week (≈500 t increase in the TACC) would result in a decline in beach price of $1.50 using the current SPR compared with $3.00 if the MEY was 6000 t.

- Projections based on the estimated SPR indicate that MEY catch levels are higher than the current TACC, i.e. the economic objective of targeting MEY will be met if the TACC is increased: An increase in TACC will increase profitability, for example, with a TACC of 6500 t producing an increased profit of over $9 million pa and an increase GVP of $21 million in 2016 over that produced from a TACC of 6000 t. Maintenance or a reduction in the current TACC (i.e. 6000 t or lower) will result in the fishery not achieving it's Harvest Strategy objective of targeting MEY.

Assessment summary

The information used to provide the research advice can be summarised as:

- Very good catch rates within all zones with record-high rates in Zones B and C.

- Improved puerulus settlement in recent years will move into the fishery during 2016-2018 further improving catch rates

- The changes in biological controls in minimum and maximum size and setose have increased legal biomass
- Catch rates are projected to increase in all zones over next 3 years if harvest rates remain below 0.4.
- The proportion of the legal biomass not being harvested (≈70%) is at record high levels.
- Egg production is high throughout the fishery and is projected to be maintained or increased at projected levels of fishing.
- Prices for lobsters (including southern rock lobsters) in USD has increased in recent years. Preliminary assessment of the 2015 season indicates that prices have been maintained despite the increase in landings for the same period last year.
- Exchange rate decline since last year's assessment has further improved the price in AUD.
- The decline in fishing effort and number of boats operating has reduced the costs of fishing.

Research Advice

- All factors indicate that the harvest rates associated with MEY in 2016 will be larger than those associated with the 2015 fishing season.
- Given the lack of a precise SPR for significant deviations in catch from current levels, DoF considers a 5% increase in the MEY range identified for the 2015 season (i.e. 6343 to 7670 increasing to 6660 to 8022) would represent a conservative increase in the TACC in the direction towards MEY.
- Based on the experiences in many other quota fisheries in WA, a ≈10% increase in the TACC to 6,660 tonnes (i.e. the lower end of the MEY range estimate) may represent the maximum level of increase that is desirable to industry, given current data limitations .
- Consistent with the Harvest Strategy, the recreational catch allocation (TARC) would be based on the upper limit of this MEY-based range at 8022 t. This would result in the TARC being set at 422 t.

Empirical data used in the assessment

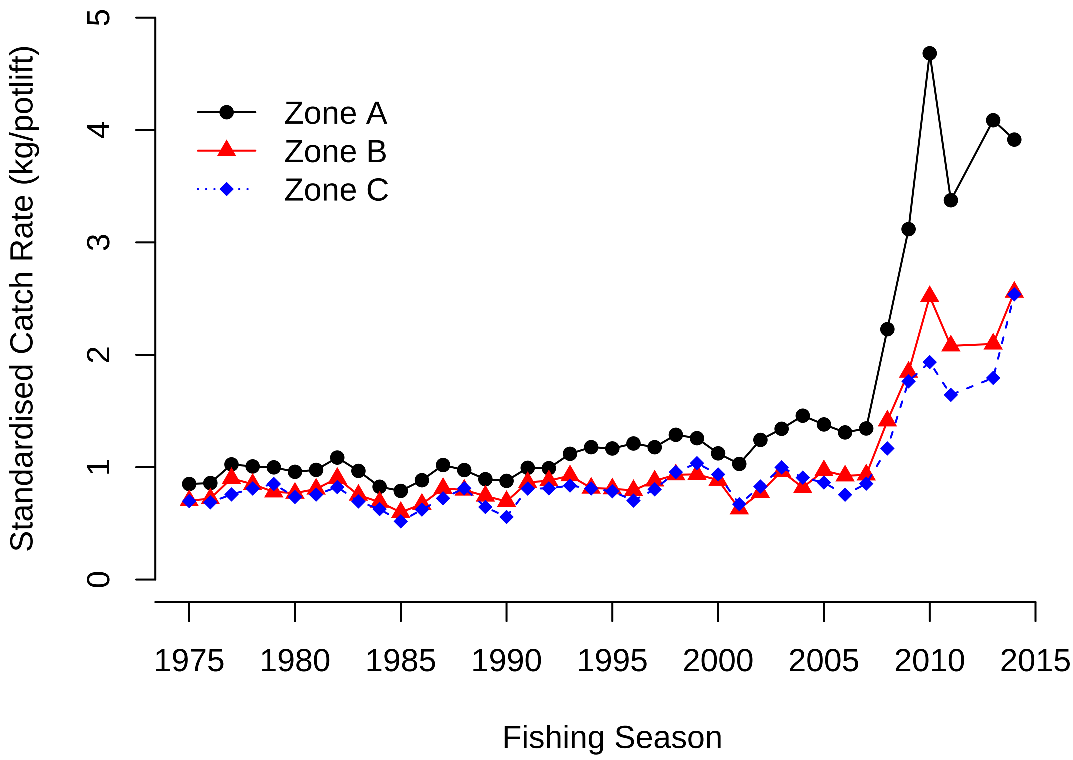

Figure 1: Standardised catch rates of legal lobsters by Zone

Catch rates have been standardised to account for the introduction of high grading legal lobsters which began in the 2010/11 season (Fig. 1). The average rate of high grading over this period is ≈15%. Catch rates have also been standardised to remove the monthly influence of variable abundance and catchability as well biases introduced into the index by changes in fishers behaviour. For example in some years, large amounts of quota, especially in deep water A zone, have been taken in during periods of high catch rates, thus biasing the annual catch rate estimate. These biases has been removed by modelling the data with a general linear model that incorporates fishing season, depth, month and zone as factors. The average response for each season in each zone has been produced.

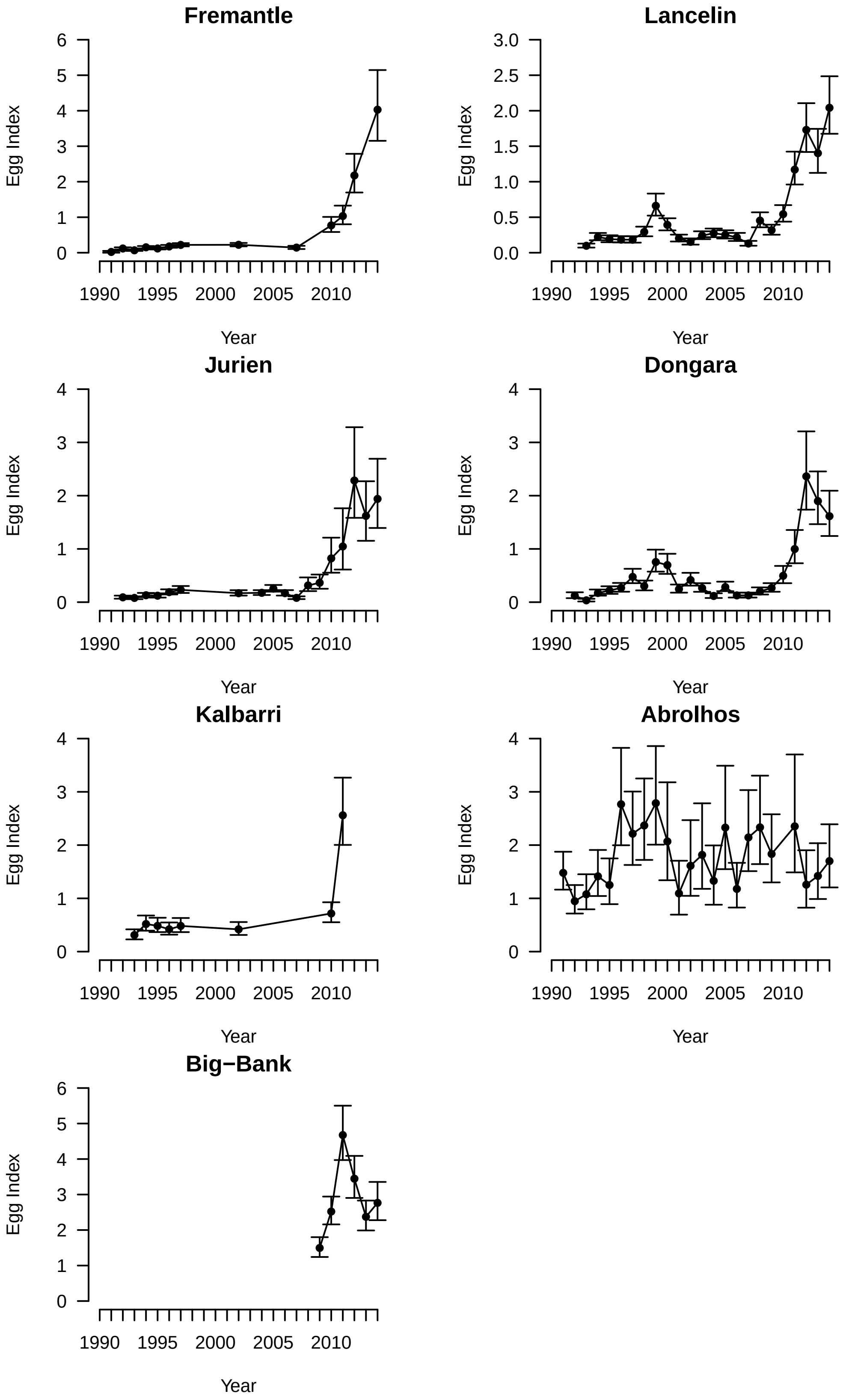

Figure 2: IBSS egg production indices

Mean ±1 s.d. of egg production from seven areas of the fishery determined from data collection during the annual IBSS (Fig 2). Missing values represent years when that site was not sampled. Egg indices are standardised for changes in water temperature, swell height and sub-location.

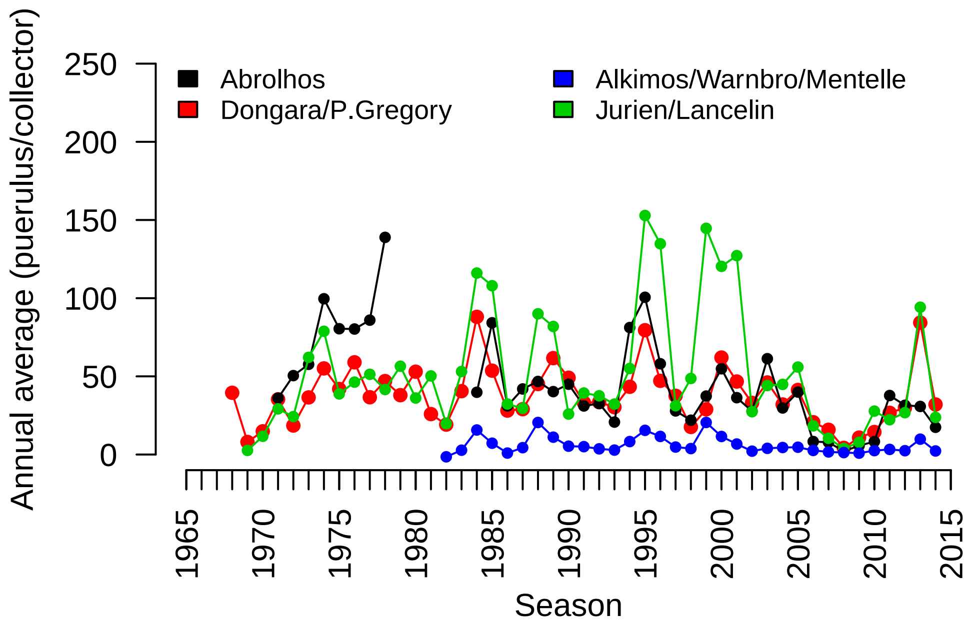

Figure 3: Regional puerulus settlement levels

Standardised regional levels of puerulus settlement (Fig 3). Settlement levels have been standardised to account for a change in fibre type and missing months.

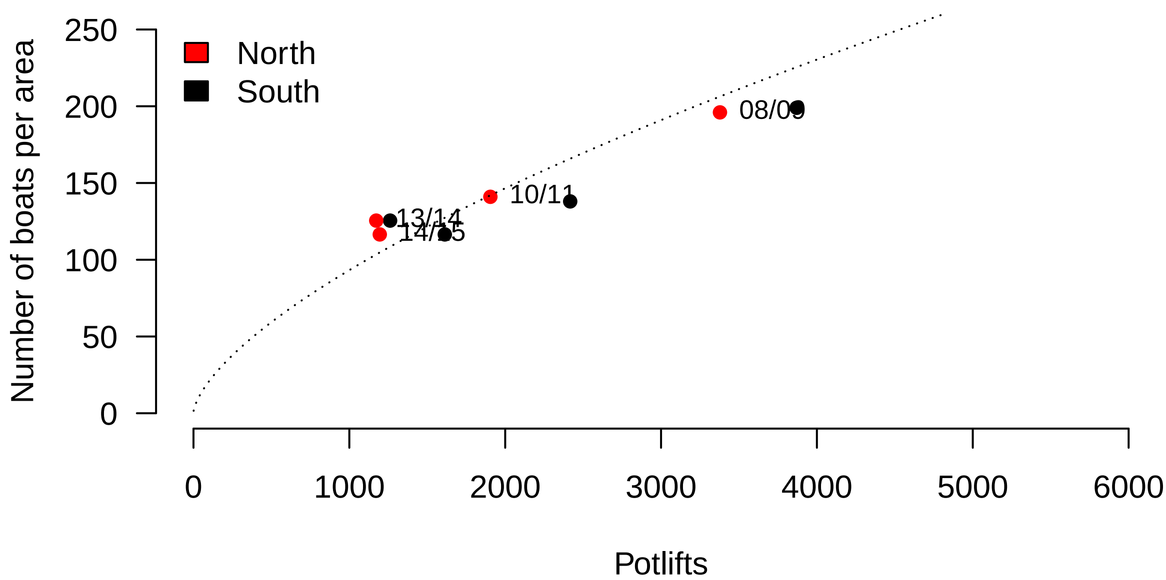

Figure 4: Effort-Vessel numbers relationship

Relationship between the number of pot lifts and number of vessels in the northern (Zones A and B) and southern (Zone C) regions of the fishery since moving to quota (Fig 4). As effort has declined within the fishery the numbers of active vessels has also decreased. Four recent years (years shown on plot) of potlift and information on vessel numbers has shown that this decline is relatively consistent.

Model outputs used in the assessment

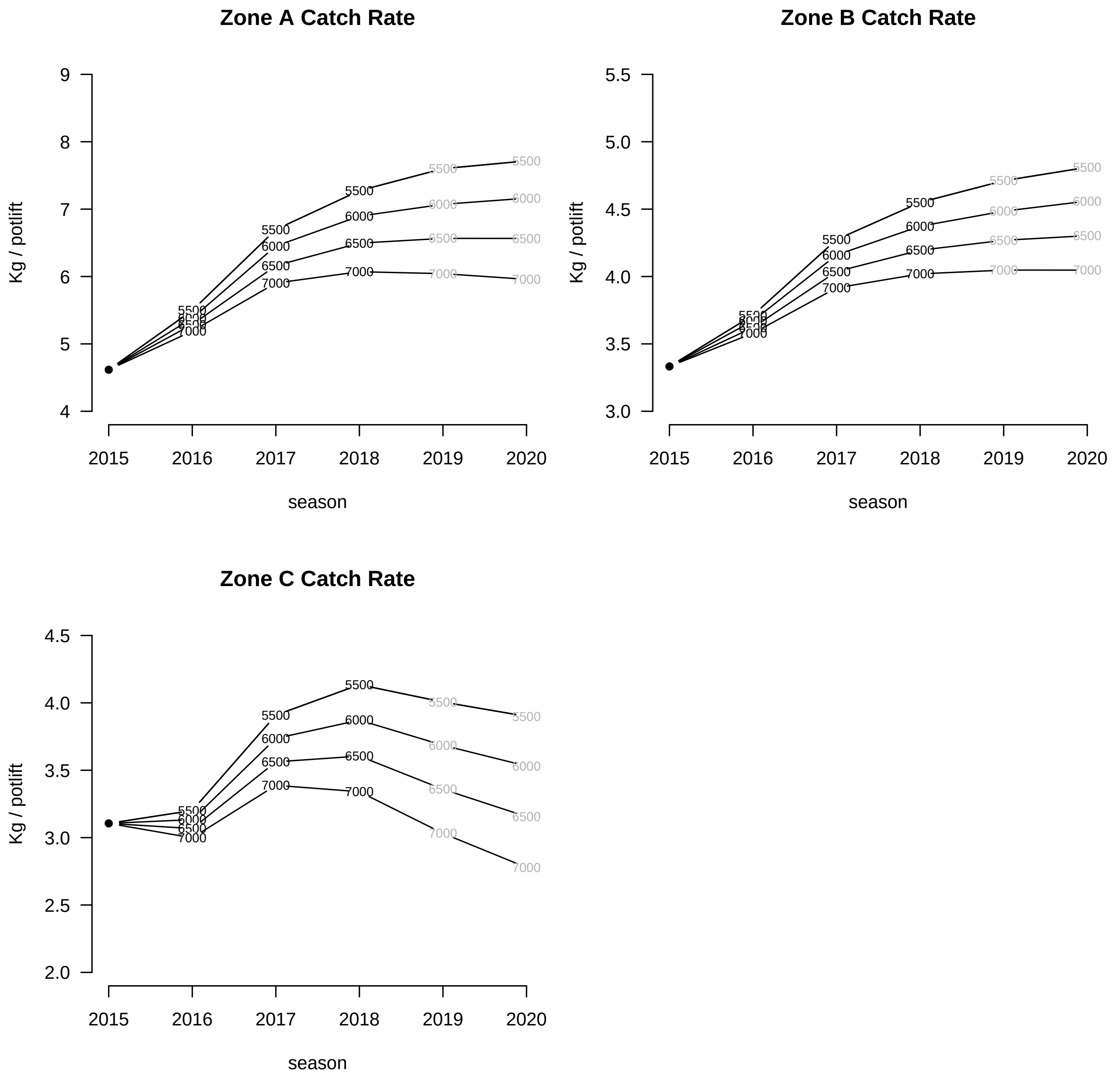

Figure 5: Model projected catch rates

Model derived catch rates in the three management zones of the fishery (Fig. 5). A range of projections are shown, representing different levels of TACC. The numbers associated with the various projections represent the overall annual TACC. These catch rates take into account high grading and therefore represent the average annual catch rate after high grading has occurred.

Up to 2018 catch rates are influenced by known levels of puerulus settlement and are identified by the black numbers, with future years being based on puerulus settlement which has been conservatively assumed to be the lower of either 25^{th} percentile or the previous years settlement (these estimates are identified by the grey numbers). These projections assume that future years remain similar to the most recently completed fishing season in terms of:

- Effort distribution.
- The proportion of legal catch discarded (high graded).
- Environmental conditions (Water temperatures and swell).

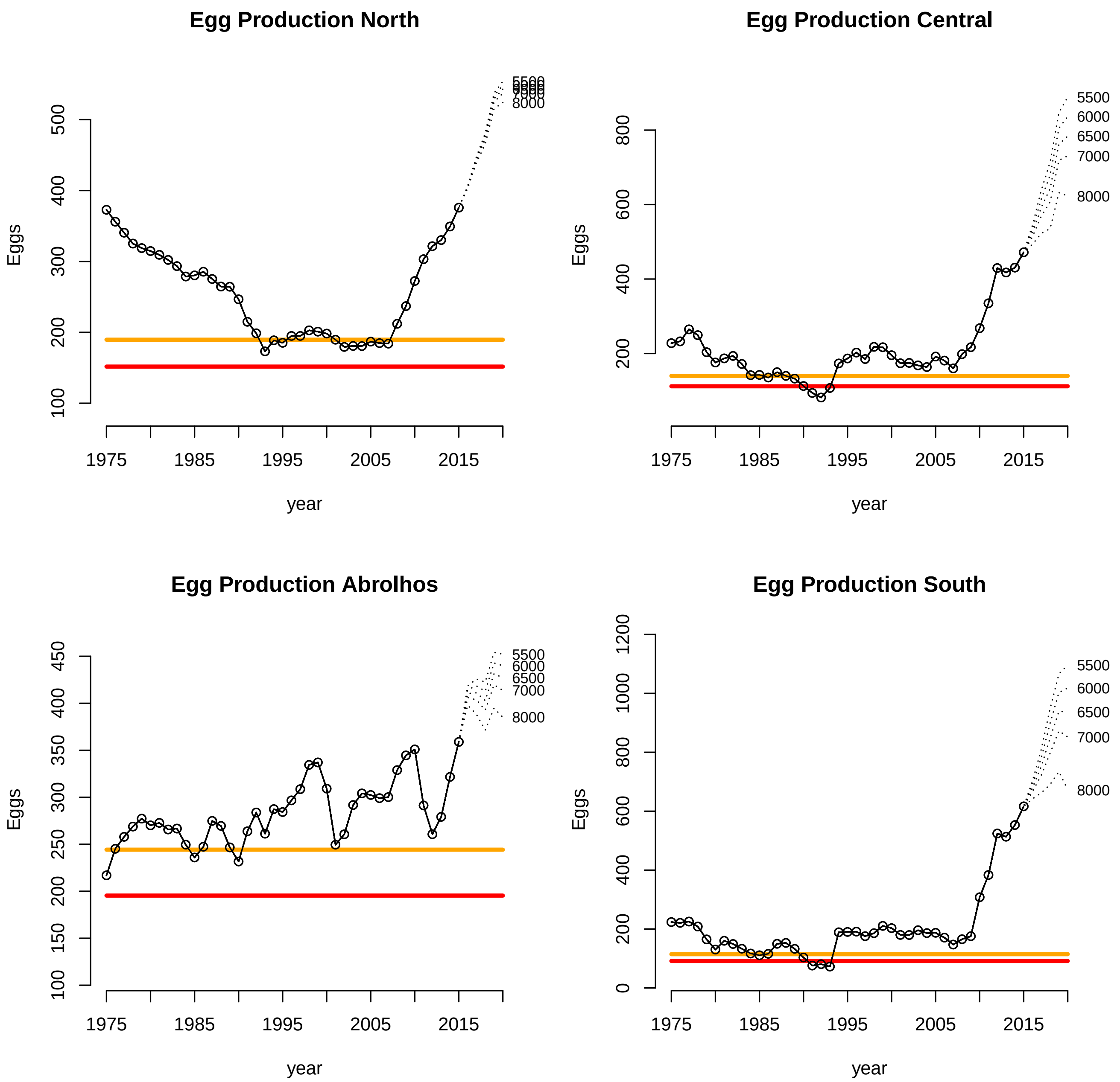

Figure 6: Model projected egg production

Model derived estimates of egg production in the four Breeding Stock Management Areas (BSMA) (Fig. 6). Historical levels are identified by open circles, while projections are represented by dotted lines. Numbers associated with each dotted line identify the whole of fishery TACC for that scenario. Horizontal orange and red lines represent threshold and limit reference levels.

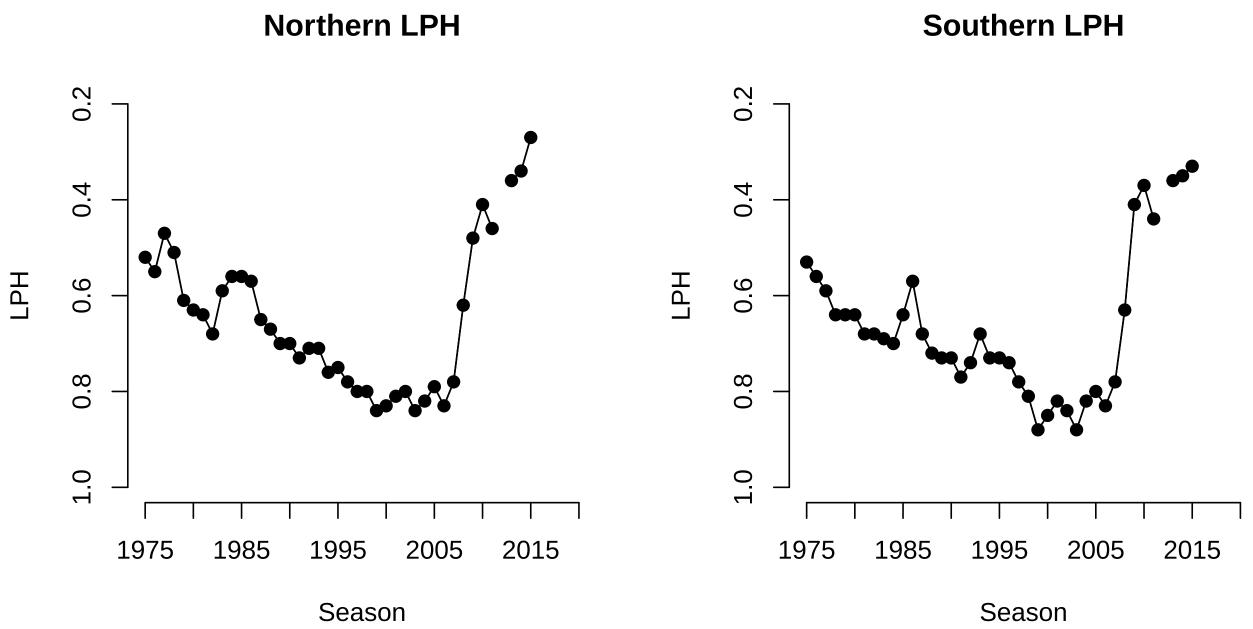

Figure 7: Model estimated harvest rates

Model derived estimates of harvest rate for each fishing season in the northern (Zones A and B) and southern (Zone C) regions of the fishery (Fig. 7). The break in the series is caused by the extended 2011/13 fishing season. This extension resulted in the following season being considered the 2013 season. Note the harvest rate figures have been inverted to aid readers in seeing the trend as positive: this is identified on the y-axes.

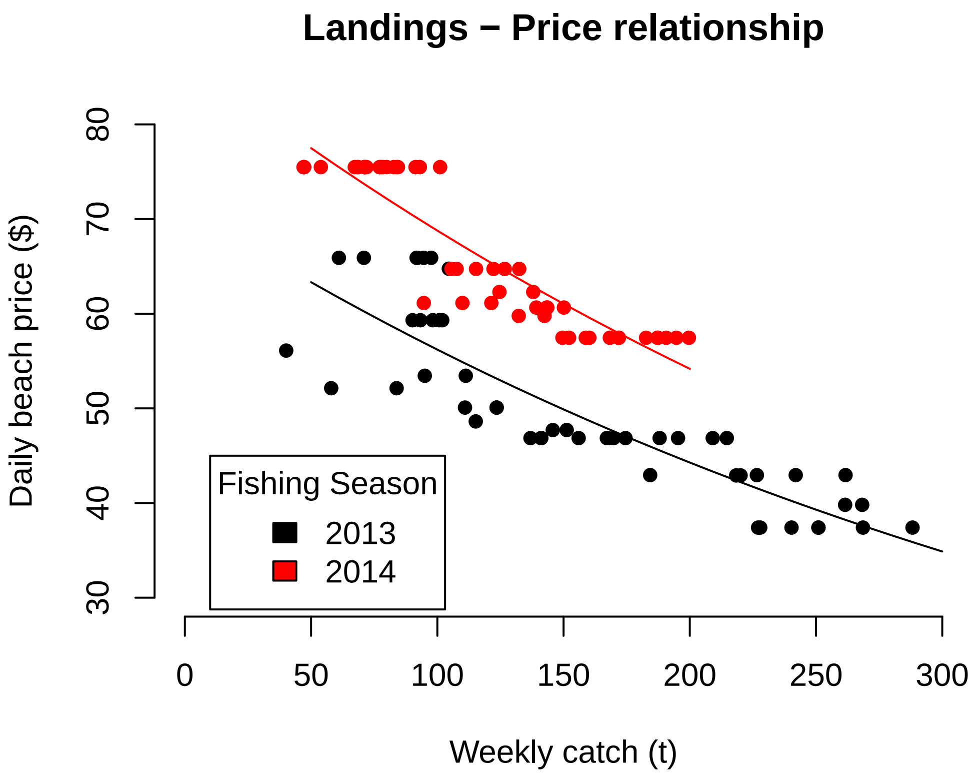

Figure 8: Supply-Price Relationship: SPR

Relationship between the weekly landings and daily beach price paid to fishers during the last 45 days of the 2013 and 2014 fishing seasons (Fig 8). This analysis shows that the total catch during the preceding week during these periods has the greatest short-term influence on beach price. This analysis also shows that, even through the average price paid in 2014 was significantly greater than that paid in 2013, the proportional response in beach price to changes in landings was identical between years. This similarity indicates that the response measured is relatively consistent and could thus be used to estimate the response expected to occur in subsequent years. This relationship was adjusted before being applied to annual data.

- The model has been reparameterised to represent annual catches rather than weekly catches.
- Since the data for the model is derived from a time of the year when prices and demand are relatively high, the average beach price has been adjusted downwards so that it produces an annual estimated price for 2014 of $61 to match the reported average.

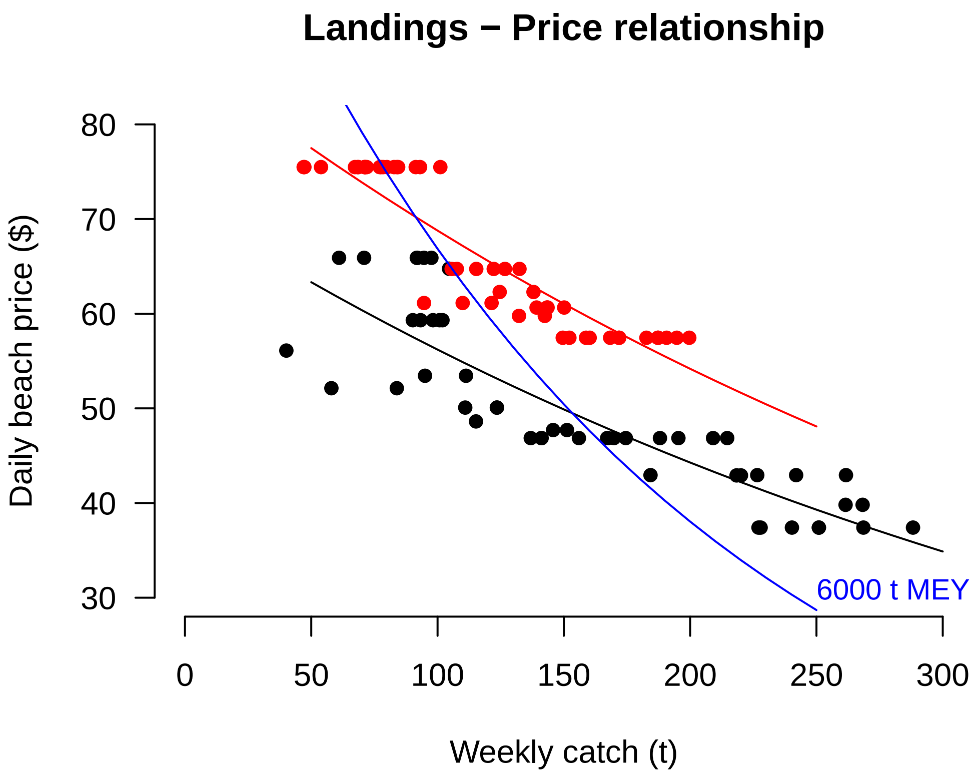

Figure 9: Supply-Price Relationship: Estimated vs required relationship for 6000 t to represent MEY

Comparison of two SPRs, one based on observed data from the past two fishing seasons (2013:black and 2014:red) i.e. from Fig. 8 and the second relationship derived as to what the SPR would have to be if fishing for a TACC of 6000 t represented fishing at MEY (Blue, Fig 9).

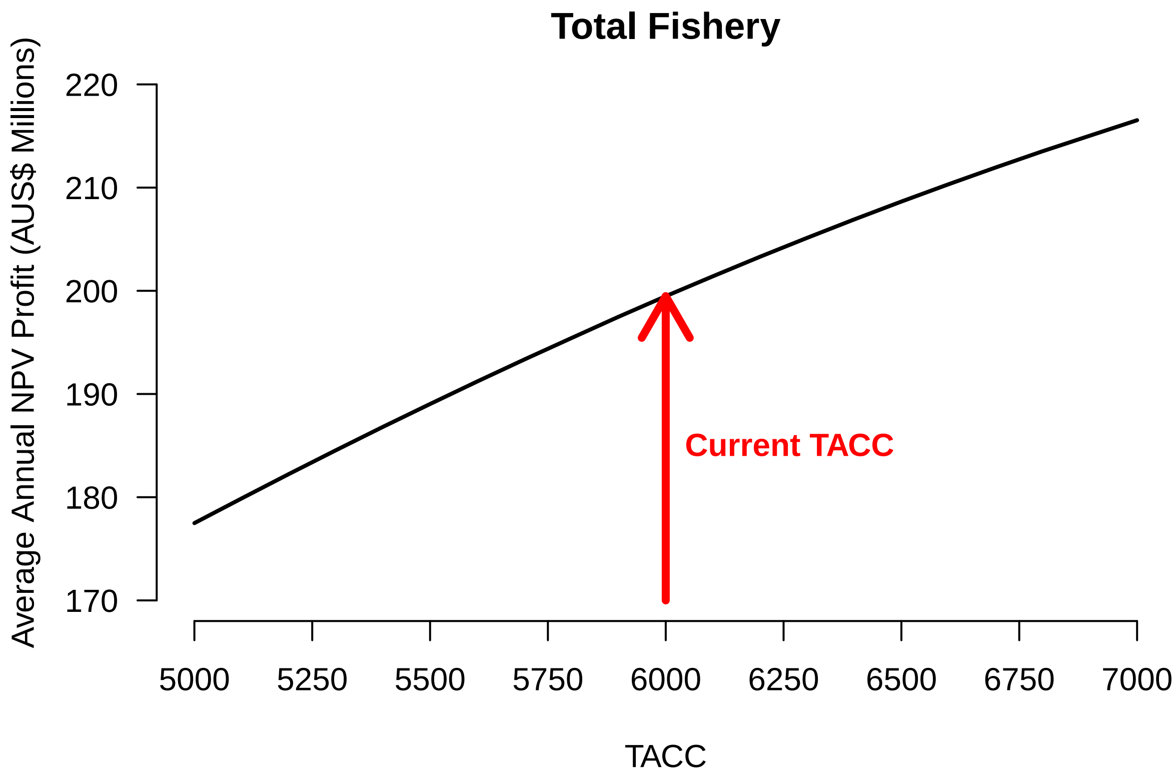

Figure 10: Current TACC relative to MEY

The Net Present Value (NPV) curve relative to a range of TACCs for the whole Western Rock Lobster fishery is shown based on the estimated SPR relationship for 2014 in Fig. 8 (Fig. 10). The current TACC (red) is shown. This analysis indicates that an increase in TACC would move the fishery closer to MEY and that an increase in TACC from 6000 to 7000 t would increase overall annual discounted profits by ≈$17 Million AU pa.

Table 1. Outputs from various TACC scenarios

TACC	A	B	C	HR North	HR South	cpue.N	cpue.S	GVP	NPV.Profit
5000	910	1590	2500	0.20	0.26	4.09	3.27	322	177
5100	928	1621	2550	0.20	0.26	4.08	3.26	326	179
5200	946	1653	2600	0.21	0.27	4.07	3.24	331	182
5300	964	1685	2650	0.21	0.27	4.06	3.22	336	184
5400	982	1717	2700	0.21	0.28	4.05	3.22	341	186
5500	1001	1749	2750	0.22	0.28	4.03	3.20	345	189
5600	1019	1780	2800	0.22	0.29	4.02	3.18	350	191
5700	1037	1812	2850	0.23	0.29	4.01	3.18	354	193
5800	1055	1844	2900	0.23	0.30	4.00	3.16	359	195
5900	1073	1876	2950	0.23	0.30	3.99	3.15	363	197
6000	1092	1908	3000	0.24	0.31	3.98	3.13	367	199
6100	1110	1939	3050	0.24	0.31	3.96	3.13	372	201
6200	1128	1971	3100	0.25	0.32	3.95	3.11	376	203
6300	1146	2003	3150	0.25	0.32	3.94	3.09	380	205
6400	1164	2035	3200	0.25	0.33	3.93	3.07	384	206
6500	1183	2067	3250	0.26	0.33	3.92	3.07	388	208
6600	1201	2098	3300	0.26	0.34	3.91	3.05	392	210
6700	1219	2130	3350	0.27	0.34	3.89	3.03	396	211
6800	1237	2162	3400	0.27	0.35	3.89	3.02	400	213
6900	1255	2194	3450	0.27	0.35	3.87	3.02	404	215
7000	1274	2226	3500	0.28	0.36	3.87	3.00	408	216

The above table of outputs shows the value of a number of indices resulting from a range of TACCs. A, B and C represent the breakdown of the TACC into management zones. HR north and south represent the 2016 harvest rates to be expected in either region. Cpue.N and Cpue.S represent model estimated 2016 catch rates in the northern and southern regions. GVP represents the total fisheries Gross Value of Product in $AU (Total catch x expected beach price) in 2016, while the NPV profit represents the annual profit (earnings - costs) averaged over the following five fishing season, with future fishing seasons (i.e. 2017+) being discounted by 5% pa.

Appendix

Notes on 2015 Model build

- The minimum size limit has been changed to 76 mm and the maximum size limit removed in the 2015 and future seasons.
- Setose protection is removed form July 1 to November 14 in the 2015 and future seasons.
- A new efficiency level has been added for season 2013 onwards. This is to recognise the change to a 12 months season and the settling in of the new quota style of fishing. This should remain relatively stable for the following few seasons as long as there are not significant changes to management. Therefore this level of efficiency will cover the next few years as well.

Data updates

- Puerulus data. Updated with 2014/15 settlement season. For the majority of model regions the 2015/16 settlement season has been estimated as the same as the 2014 level because the 2014 values were lower than the corresponding 25^{th} percentile estimates over the whole time series (1975 - 2014). This was not the case in regions 7, 8, 9 and 11. In these regions the 2014/15 estimate was higher than the corresponding 25^{th} percentile, therefore the 25^{th} percentile estimate has been applied instead.
- Commercial Catch and Effort data. Updated with 2014 data. Only catch which fell within the 2014 year and January 1-14 2015 was added. The most recent 12 months of effort distribution data (15 January 2014 - 14 January 2015) was used to project effort distribution into the future.
- Commercial length frequency data. Updated with 2014 seasons observed compositions.
- IBSS catch rates. Limited to all lobsters $\geq$ 75 mm cl has been updated to include all 2014 IBSS data.
- IBSS length frequency data. Updated with all 2014 IBSS data.
- Tag-recapture data. Updated in 2013. Following the recent tag-recapture project, this data set will be updated in early 2016.

Economic model

- Costs have been increased at CPI (3.0 percent) based on the ABS stats: `http://www.abs.gov.au/ausstats/abs@.nsf/mf/6401.0?opendocument`
- NPV discount rate changed from 10% to 5%

2015 Modelling Process

- The model is fitted with all parameters.
- The diagnostics files are produced and saved. This file contains the parameters used, their phases, the likelihood weights and the parameter estimates.

- The last six years of effort data (2009/10-2011/13, 2013-2015) are then adjusted (pro-rata between zone) so the resultant estimated catches fit the observed catches exactly. This process ensures that in recent years the correct amount of biomass is removed from the model.

- Effort in the future five fishing seasons (2016-2020) is adjusted to predefined TACC levels to develop relationships between TACC and effort and egg production. This process refits the model to pro rata adjusted levels of future effort (the within season distribution of effort remains the same) so the resultant target TACC is achieved. TACC values from 5500 to 8000 in 50 t increments are fitted.

- The MEY analysis uses the above data as input.