

West Coast Rock Lobster projections under zero catch and current levels of fishing mortality to investigate how this relates to Fmsy

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Projection under zero catches

In order to assess at what levels the rock lobster biomass would equilibrate if all catches (including poaching) were to cease, the current assessment models for each Super-area have been projected 100 years to 2115 under zero legal catches and zero poaching.

Projections were computed for 100 simulations with different selections from the distributions of the various uncertainty factors, as for normal OMP simulation testing. Thus, for example, future recruitment may exhibit log-normally distributed variation about three future scenarios (as for normal OMP simulation testing):

- i) Geometric mean of 1975-1998 recruitment (60% weight).
- ii) Highest recruitment estimated for the 1975-1998 period (10% weight).
- iii) Lowest recruitment estimated for the 1975-1998 period (30% weight).

Another important uncertain factor considered is future somatic growth which is not expected to bounce back to historical (pre-1990) levels.

Figure 1 shows the median, 5th and 95th percentile B75m/K trajectories/envelopes (with the bottom panel showing the period 2010+ only for clarity).

The exploitable male lobster depletion (B75m/K) for the resource as a whole equilibrates at a median of 0.08 (0.03 for the 5th %ile and 0.23 for the 95th %ile).

Projection into the future under current fishing proportion (F) values

Table 1 reports the current (2014) levels of total take (commercial offshore+nearshore+IR+recreational) as well as the average poaching amounts assumed for each Super-area. The latest assessment model estimate of B75m in 2014 is also provided. Given these values, the fishing proportion F(2014) value for each Super-area and the resource as a whole can be calculated as:

$$F(2014)=\text{Catch}(2014)/B75m(2014)$$

The resource in each Super-area is then projected ahead to 2115 by setting the total take from each area as $C(y)=F(2014)*B75m(y)$, i.e., effectively a constant fishing mortality harvest strategy. Table 1 also reports the results for these projections.

Discussion

We take $K(1910)$ to be the pre-exploitation equilibrium biomass of male lobsters over 75 mm carapace length, and $K(2115)$ as the corresponding biomass under current levels of recruitment. Results give:

- The median $B75m(2115)/K(1910)$ is 0.03
- The median $B75m(2115)/K(2115)$ is 0.39

The reason underlying these computations is to attempt to get some sense of how current fishing mortality levels (for all takes combined, including poaching) compare to F_{msy} . Given uncertainties about whether possible regime shifts have reduced present potential recruitment levels below those which pertained in 1910, when fishing is taken to have “commenced”, an approach is needed which effectively factors out the absolute magnitude of recruitment by working on what amounts to a per-recruit basis. Then by comparing $B75m(2115)/K(2115)$ values to customary proxies for F_{msy} based on such a per-recruit approach, one can draw some inferences about how current fishing mortality levels compare to F_{msy} .

Frequent proxies for F_{msy} adopted for groundfish on this basis correspond to values for spawning biomass per recruit relative to pristine (reflected here by $B75m(2115)/K(2115)$) generally fall in the range 30 – 40%. However for rock lobsters one would expect higher values of stock-recruit steepness than for groundfish, which suggests proxies below this range, though fishing proportion as considered here would slightly under-estimate fishing mortality. This suggests that F for west coast rock lobster is probably below F_{msy} if $B75m(2115)/K(2115)$ is above about 30%, though lower thresholds could also be argued.

The fact then that the current estimated median $B75m(2115)/K(2115)$ is 0.39 for the resource as a whole suggests that overall F is below F_{msy} for the SA west coast rock lobster resource.

At a Super-area level, this criterion would suggest that probably $F < F_{msy}$ at present for A3+4 and A7, the situation is unclear for A8+, but for A1+2 and A5+6 $F > F_{msy}$. Care must be taken in interpreting these results, however, as the OMP is at present in the process of moving TAC from A8+ to A5+6 to better balance the recovery prospects (and hence the F values) across the Super-areas.

Table 1: Result for projections where future $C(y)=F(2014)*B75m(2014)$ by Super-area and for the whole coast combined.

Super-area	Global TAC 2014 MT	Poaching 2014 MT	Total take (TAC+P) MT2014	B75m(2014) MT	F(2014)	B75m(2115) MT	K(1910) MT	B75m(2115)/K(1910)	K(2115) MT	B75m(2115)/K(2115)
A1+2	42	3.3	45.25	674	0.067	0.00000002	56571	0.0000	1459	0.000
A3+4	238	8.1	246.13	4785	0.051	3077	165412	0.0186	10042	0.306
A5+6	220	8.1	228.13	3663	0.062	179	255619	0.0007	8790	0.020
A7	72	45.5	117.5	3981	0.030	12106	142475	0.0850	15033	0.805
A8+	1229	720.0	1949	8412	0.232	7858	195830	0.0401	33262	0.236
Total	1801	785.0	2586.01	21515	0.120	25905	815907	0.0317	67358	0.385

Figure 1: Projections of B75m/K into the future till 2115 under the assumption of zero future catches (and poaching) from 2015+. The lower plot expands the upper from 2010 onwards.

