Rebuilding analysis for yelloweye rockfish (*Sebastes ruberrimus*) based on the 2017 stock assessment

by

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Summary

This rebuilding analysis is for the stock of yelloweye rockfish (*Sebastes ruberrimus*) in waters off California, Oregon and Washington. The analysis is based on the 2017 stock assessment. The 2017 assessment model estimated the yelloweye rockfish resource to be at 28.4% of the unexploited equilibrium spawning output at the beginning of 2017. This rebuilding analysis compares the results of applying a suite of potential management actions to the stock for 2019 and beyond, assuming Annual Catch Limits (ACLs) of 20 mt (adopted by the Pacific Fishery Management Council) being removed in 2017 and 2018 and assuming 65% of the ACL (13 mt) being removed in 2017 and 2018.

The results of the analysis show that the value for T_{MIN}, the median year for rebuilding to the target level in the absence of fishing since the year of declaration (2002), is 2025 (revised downward from 2037 in the 2011 rebuilding analysis). The estimated generation time has decreased by one year to 45 years compared to the 2011 analysis. In conjunction with T_{MIN}, the mean generation time dictates the revised estimate of T_{MAX} to be 2070 (decreased from 2083 in the 2011 analysis). The harvest rate in the current rebuilding plan (SPR_{TARGET}) is 76% and $T_{TARGET} = 2074$. The SPR = 76% harvest rate generates a P_{MAX} (probability of recovery by T_{MAX}) of 100% in the current model, (in the 2011 analysis it was 72.9%).

Fishing at the current SPR target (SPR = 76%) results in an increase from the 20 mt ACL in 2018 to 29 mt in 2019. This harvest rate has a 100% probability of recovery by the year 2027, a 100% probability of recovery by $T_{TARGET} = 2074$ (the current rebuilding target), and a 100% probability of recovery by $T_{MAX} = 2070$.

In general, the faster rebuilding times in the 2017 analysis compared to the 2011 analysis are associated with the higher estimates of recruitment compensation (i.e., steepness) and stock status in the 2017 assessment compared to the 2011 assessment.

Introduction

In 1998, the PFMC adopted Amendment 11 of the Groundfish Fishery Management Plan, which established a minimum stock size threshold of 25% of unfished biomass. Based on the 2001 stock assessment (Wallace 2001), the yelloweye rockfish (*Sebastes ruberrimus*) stock was determined to be "overfished" in 2002. The 2001 assessment included only the California and Oregon portions of the stock. The next assessment included the entire U.S. coastal population (Methot et al. 2002) and estimated that the stock was at 24% of unexploited spawning biomass in 2002. An updated rebuilding analysis was conducted (Methot and Piner 2002) and the estimated rebuilding parameters were adopted by the Pacific Fishery Management Council (PFMC 2004). Subsequent rebuilding analyses were conducted on the basis of the 2005 (Wallace et al. 2005), 2006 (Wallace et al. 2006), 2007 (Wallace 2008), and 2009 (Stewart et al. 2009) stock assessments.

The 2002 rebuilding analysis estimated that the mean generation time for yelloweye rockfish was 44 years, and that if no fishing occurred beginning in 2003 there would be a 50% chance of rebuilding by 2027. The estimated value for steepness (*h*) from the 2002 assessment was 0.437, and the degree of recruitment variability (σ_r) was assumed to be 0.4. Management alternatives with annual catch limits (ACLs; referred to as optimum yields or OYs at that time[1]) for 2003 between 22 and 27 mt were presented.

The 2005 rebuilding analysis (Tsou and Wallace 2005) was based on the updated stock assessment with estimates of steepness and recruitment variability that were unchanged from 2002. Mean generation time was again estimated to be 44 years, but the year in which a 50% chance of rebuilding was projected to be achieved was increased to 2036. The maximum allowable rebuilding time (T_{MAX}) was estimated to be 2071, and the probability of achieving this target under the target *F* of 0.0153 was 80%.

A full stock assessment and subsequent rebuilding analysis (Tsou and Wallace 2006) was conducted in 2006. The 2006 assessment included area-specific models and revised the assumed values for natural mortality (from 0.045 to 0.036), steepness (from 0.437 to 0.45) and the degree of recruitment variability (from 0.4 to 0.5). The 2006 assessment estimated the 2006 depletion level to be 17.7%, somewhat lower than previous analyses. As a result of these changes, the rebuilding plan estimated that the mean generation time was 50 years and that in the absence of fishing beginning in 2007 the coastwide yelloweye rockfish[1] stock would not rebuild to target levels with a 50% probability until 2046. The selected target SPR rate was 71.9%, with further reductions in the 2007 and 2008 ACL levels to 14.0 and 14.3 mt respectively if this rate were to be maintained. The results of this rebuilding analysis were included in Amendment 16-4 of the 2006 Pacific Coast Groundfish Fishery Management Plan (PFMC 2006) and the analysis involved re-evaluating and revising the yelloweye rockfish rebuilding plan so that the rebuilding periods are as short as possible, taking into account the status and biology of the species, the socioeconomic needs of West Coast fishing communities, and the interaction of the depleted species within the marine ecosystem. The Council ultimately adopted a 'ramp-

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[1] Optimum yield or OY was the annual catch limit prior to implementation of Amendment 23 in 2011, thereafter referred to as the annual catch limit or ACL. Both harvest limits were limits on total fishing mortality (landings plus dead discards).

down' from 2006 catch levels to those consistent with the SPR target of 71.9%, which led to ACLs in 2007 and 2008 of 23 and 20 mt.

The 2007 updated yelloweye rockfish assessment included several changes which led to an overall downward revision in the estimate of current spawning biomass and the level of relative depletion, compared to the 2006 assessment. The 2007 rebuilding plan was consistent with previous analyses in predicting that an extremely long period was needed to achieve target stock levels, and did not require a revision of the target reference points or strategy from the previous analysis. The median year to rebuild with no fishing mortality beginning in 2009 was estimated to be 2049. The median year to rebuild under the SPR target (71.9%) was estimated to be 2082. An SPR of 71.2% (slightly higher fishing mortality) was estimated to be possible and still achieve a 50% probability of recovery by the target year of 2084. Management alternatives were presented that included the 'ramp-down' from *status quo* ACL levels to those consistent with the SPR target of 71.9% by 2011, as well as immediate (2009) implementation of this level. The 'ramp-down' alternative provided in the 2007 rebuilding analysis consisted of 2009 and 2010 OYs of 17 and 14 mt respectively. Subsequent analysis indicated no change in the estimated year for rebuilding with a 50% probability for the option ultimately accepted by the Council of a 17 mt OY in both years.

In the 2009 assessment (Stewart et al. 2009), all major structural and parameter assumptions from previous stock assessments were revisited. Revised inputs included the weight-length relationship, the maturity schedule, and the addition of a fecundity relationship. Instead of fixed parameter values, natural mortality and steepness were estimated, as well as all growth parameters. Structural changes included use of a two-sex model, with explicit treatment of areas (California, Oregon and Washington) linked via a common stock-recruit relationship and the removal of stochastic recruitment variability over the limited period for which it had been estimated in previous assessments (1968-1992). Because a fecundity relationship was used for yelloweye rockfish specifying that spawning output per unit weight increases with fish weight, all reference to spawning output was in terms of eggs produced, instead of spawning biomass.

The 2009 rebuilding analysis (Stewart 2009) had relatively similar results to the 2007 rebuilding analysis in spite of being based on a substantially revised assessment model, and with the added complexity of integrating uncertainty over a matrix of 9 states of nature. The $SPR_{TARGET} = 71.9\%$ was retained, and the associated values of mean generation time, T_{TARGET}, T_{MIN}, and T_{MAX} all remained within 3 years of the values estimated in 2007. In 2010, a new $SPR_{TARGET} = 76\%$ was chosen. This was the SPR consistent with the status-quo catch of 17 mt and had an associated $T_{TARGET} = 2074$.

The 2011 stock assessment (Taylor and Wetzel 2011) was an update, and no major changes to the basic model framework, approach and major structural assumptions were made. The assessment included updated Oregon historical catches based on Karnowski et al. (2014). The update also converted the assessment to the newest version of Stock Synthesis available at the time (SS version 3.21d). The 2011 relative depletion estimate was 21%. Based on that update assessment, a new rebuilding analysis was conducted

(Taylor 2011). The $SPR_{TARGET} = 76\%$ was retained. The values of mean generation time remained within one year of the value estimated in 2009, while T_{TARGET}, T_{MIN}, and T_{MAX} were slightly lower than estimated in 2011.

Summary of the 2017 stock assessment

In the 2017 assessment (Gertseva and Cope 2017), major structural assumptions from previous stock assessments were revisited. The spatial structure of the assessment changed from a three- to a two-area model (California and Oregon/Washington combined). The model changed from a two-sex to a single sex model. The 2017 assessment estimated recruitment deviations (instead of taking recruits deterministically from the stock-recruit curve as in 2011), but used fixed values for stock-recruit steepness and natural mortality obtained from the meta-analytic studies (in the 2011 assessment those values were estimated). The 2017 assessment also updated parameters for weight-length relationships as well as the maturity schedule and fecundity. The estimated current (2017) status from the 2017 assessment is a depletion of 28.4%. This represents a small increase from the 2011 stock assessment, which estimated depletion in 2011 to be 21.4%.

Management performance under rebuilding

Yelloweye rockfish removals since 2002 represented a 95% reduction from average catches observed in the 1980s and 1990s, and total catch of yelloweye rockfish has remained below both the annual OFLs (referred to as the ABC prior to 2011) and ACLs (referred to as the optimum oield (OY) prior to 2011). Recent trends in total catch and commercial landings relative to the management guidelines are shown in Table 1.

Managers achieved this catch reduction by eliminating all retention of yelloweye rockfish in recreational fisheries, reducing commercial retention of yelloweye rockfish in the trawl fishery (to 200-300 pounds per bimonthly period), instituting broad spatial area closures, and creating new gear restrictions that have reduced trawling in rocky shelf habitats and the coincident catch of rockfish in shelf flatfish trawls.

Rebuilding calculations

This rebuilding analysis was conducted using software developed by A. Punt (version 3.12e, June 2012). Because the rebuilding software does not have the capability for modeling area-based dynamics consistent with those in Stock Synthesis, there are some differences in the rebuilding trajectory estimated here and that from the stock assessment. The steps followed were:

1. Define how virgin spawning output (SB_0) will be calculated.
2. Define how future recruitment will be generated.
3. Define the fishery selectivity and allocation to be applied during rebuilding.
4. Decide how to include uncertainty in input parameters from the stock assessment in the rebuilding analysis.
5. Recalculate rebuilding reference points from the most current assessment results:
   a) Calculate the projected year in which the stock would rebuild with a 50% probability if all future fishing mortality was eliminated ($T_{F=0}$).
   b) Calculate the projected year for a 50% probability of rebuilding from the year in which the stock was first declared overfished (T_{MIN}).

    c) Calculate the mean generation time.
    d) Calculate the maximum allowable rebuilding time (T_{MAX}).

6. Identify and analyze alternative harvest strategies for rebuilding.

The method of calculation was identical to that used in the 2011 rebuilding analysis although the range of years considered was shifted to reflect the 2017 assessment.

1. Definition of SB_0

The equilibrium spawning output level (SB_0) used in this rebuilding analysis is calculated via the stock-recruitment, growth, maturity and fecundity relationships in order to be consistent with assessment model results. This level is estimated to be 1139 million eggs in the assessment model, which dictates that the rebuilding target ($SB_{40\%}$) is 456 million eggs.

2. Generation of future recruitment

The estimated parameters of the stock recruitment relationship (unexploited equilibrium recruitment [natural log of R_0], and steepness [h]) are used to generate future recruitments in the rebuilding analysis. These values in the rebuilding analysis were informed by the 2017 stock assessment. The degree of recruitment variability (σ_r) of 0.5 was also consistent with 2017 assessment.

3. Fishery selectivity and allocation

The selectivity and weight at age used in the rebuilding analysis were obtained from the 2017 assessment. Following the approach used in the previous rebuilding analysis, the relative allocation of catch among fleets in this rebuilding analysis was informed using the allocation averaged over recent years (2012-2016). This choice provides some consistency between assessment model results and short term-forecasts from the rebuilding analysis.

4. Inclusion of uncertainty

Uncertainty is included in this rebuilding analysis via 1,000 random simulations of stochastic future recruitment strengths. The choice of 1,000 simulations was selected since it was shown that there was no appreciable change in results between 1,000 simulations and above.

5. Recalculate reference points

The value for T_{MIN}, the median year for rebuilding to the target level in the absence of fishing since the year of declaration (2002), is 2025 (revised downward from 2037 in the 2011 rebuilding analysis). The year of recovery in the absence of fishing from 2019 forward ($T_{F=0}$) was calculated by setting fishing mortality to zero from 2019 forward, and is equal to 2026.

The estimated generation time has decreased by one year to 45 years compared to the 2011 analysis. In conjunction with T_{MIN}, the mean generation time dictates the revised estimate of T_{MAX}, 2070 (decreased from 2083 in the 2011 analysis). The Council

preferred alternative harvest rate from 2011 (SPR_{TARGET}) is 76%, and $T_{TARGET} = 2074$. The SPR = 76% harvest rate generates a P_{MAX} (probability of recovery by T_{MAX}) of 100% in the current model, (in the 2011 analysis it was 72.9%).

All reference points from Amendment 16-4, the 2009 and 2011 rebuilding analyses, and those recalculated here are summarized in Table 2.

6. Alternate rebuilding strategies

This rebuilding analysis considered a range of policy alternatives outlined in the rebuilding analysis Terms of Reference. The result of each of these alternatives is contingent on the actual ACL removed in 2017 and 2018, which are assumed to be 20 mt. The alternatives analyzed included:

1) Eliminate all harvest beginning in the next management cycle (i.e., estimate $T_{F=0}$),
2) Apply the harvest rate that would generate the ACL specified for the current year (i.e., the latest year specified in regulations),
3) Apply the spawning potential ratio or relevant harvest control rule in the current rebuilding plan,
4) Apply the harvest rate that is estimated to lead to a 50% probability of recovery by the current T_{TARGET},
5) Apply the harvest rate that is estimated to lead to a 50% probability of recovery by the T_{MAX} from the current cycle,
6) Apply the harvest rate that is estimated to lead to a 50% probability of recovery by the T_{MAX} from the previous cycle,
7) Apply the default (e.g. 40-10 or 25-5) harvest policy, and
8) Apply the ABC harvest rate (i.e., F_{MSY} less the uncertainty buffer).

We also explored a range of spawning potential ratios and ran the analysis, when we:

9) Apply the spawning potential ratio of 55%;
10) Apply the spawning potential ratio of 60%;
11) Apply the spawning potential ratio of 65%;
12) Apply the spawning potential ratio of 70%.

In addition, we explored the rebuilding projections while applying different SPR values under two catch scenarios:

a) Assuming that fisheries remove full ACLs;
b) Assuming that fisheries remove 65% of ACLs.

Finally, we explored an effect of lower values of stock-recruit steepness (*h*) on the yelloweye rockfish rebuilding projections, by running the rebuilding analyses using outputs of the alternative assessment models that assume steepness values of 0.4 and 0.509. These analyses were also run assuming that either full ACLs are taken by the fiheries or only 65% of the ACLs are removed in 2017 and beyond.

Results

Summary results for alternatives requested by the Terms of Reference are presented in Table 3a. Detailed results are presented in Table 4 to Table 7 and Figure 1 to Figure 3.

In scenarios with no or low levels of fishing (higher SPR values), the projected probability of rebuilding exhibited a knife-edge behavior, where probabilities of rebuilding increased steeply from 0% to 100% (Table 4). This occurs when the strong recent recruitment in the late 2000s (estimated by the assessment model) reaches the fishery. Under a low level of fishing, the stochastic runs performed as a part of the rebuilding analysis do not show much contrast in the rebuilt state, and the strong recruitment (with the higher recruitment compensation) dominates the behaviors, causing the stock go beyond the target reference point in the same year. With a higher level of fishing (lower SPR values), we do not see this knife-edge behavior (Scenarios 4-11 in Table 4).

In the absence of any future fishing mortality, the yelloweye rockfish stock is projected to have a 100% probability of recovery to the rebuilding target ($SB_{40\%}$) by 2026 (alternative 1). Fishing at the current SPR target (alternative 3, SPR = 76%) results in an increase from the 20 mt ACL in 2018 to 29 mt in 2019. This harvest rate has a 50% probability of recovery by the year 2027, a 100% probability of recovery by $T_{TARGET} = 2074$ (the current target year), and a 100% probability of recovery by $T_{MAX} = 2070$. The SPR that best matches the 20 mt ACL for 2017 and 2018 is 74.8%, indicating that under the updated estimates of stock dynamics, the current harvest rates are, by definition, close to the current target.

The detailed results from additional runs, that explore rebuilding alternatives under a range of SPR values, assuming either full or 65% of ACLs removed, are provided in Tables 8 through 11. Probability of recovery, depletion and OFLs for rebuilding alternatives under different values of stock-recruit steepness (h), assuming that full ACLs from the assessment model (with h=0.718) removed are provided in Table 12. Finally, results from rebuilding alternatives under different values of stock-recruit steepness (h), assuming either full or 65% of ACLs removed are provided in Tables 13 through 16.

In general, rebuilding times are faster associated with the higher estimates of recruitment compensation (i.e., steepness) and stock status in the 2017 assessment compared to the 2011 assessment.

Acknowledgements

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Tables

Table 1. Recent yelloweye rockfish Overfishing Limits (OFLs), Allowable Biological Catch (ABCs) and Annual Catch Limits (ACLs) relative to recent total landings and total dead catch*.

Years	OFL	ABC	ACL	Landings	Total Dead
2007	47	NA	23	12.84	12.84
2008	47	NA	20	9.3	9.3
2009	31	NA	17	11.7	11.7
2010	32	NA	17	6.72	6.72
2011	48	46	17	8.35	8.35
2012	48	46	17	11.17	11.17
2013	51	43	18	10.4	10.4
2014	51	43	18	8.82	8.82
2015	52	43	18	12.02	12.02
2016	52	43	19	9.59	9.59
2017	57	47	20	NA	NA

*The current OFL was called the ABC prior to 2011. The ABCs provided in this table for 2011-2017 refer to the new definition of ABC implemented with FMP Amendment 23. The current ACL was called the OY prior to 2011.

Table 2. Summary of rebuilding reference points for yelloweye rockfish from Amendment 16-4, the 2009 and 2011 rebuilding analyses, and recalculated values based on the 2017 assessment results.

Parameter	Amendment 16-4	2009 Rebuilding analysis	2011 Rebuilding analysis	2017 Rebuilding analysis
		Source		
SB_0	3322 [1]	994 [2]	1028 [2]	1139 [2]
Rebuilding target ($SB_{40\%}$)	1329 [1]	398 [2]	411 [2]	456 [2]
SB_{2017} (Millions eggs)	NA	NA	NA	323 [2]
T_{MIN}	2046	2044	2037	2025
Mean generation time	50	45	46	45
T_{MAX}	2096	2089	2083	2070
$T_{F=0}$ (begin in 2007)	2048	-	-	-
$T_{F=0}$ (begin in 2011)	-	2047	-	-
$T_{F=0}$ (begin in 2013)	-	-	2045	-
$T_{F=0}$ (begin in 2017)	-	-	-	2025
$T_{F=0}$ (begin in 2019)	-	-	-	2026
T_{TARGET}	2084	2087	2074	2074
SPR_{TARGET}	71.90%	71.90%	76%	76%
P_{MAX} for SPR target	80.00%	52.30%	72.90%	100%

[1]Spawning biomass
[2]Millions of eggs
T_{TARGET} and SPR_{TARGET} in 2017 are carryovers from the 2011 rebuilding analysis
TBD: To be determined at SSC meeting

Table 3a. Results of rebuilding alternatives based on selection of an SPR target or year for 50% probability of recovery, assuming that in 2017-2018 full ACLs of 20 mt were removed.

Run	1	2	3	4	5	6	7	8	9	10	11	12
	F in 2019 and after = 0	SPR ACL of 20 mt = 0.748	SPR = 76%	SPR that achieves 50% prob. recovery by T_{TARGET} (2074)	SPR that achieves 50% prob. recovery by 2017 T_{MAX} (2071)	SPR that achieves 50% prob. recovery by 2011 T_{MAX} (2083)	40:10 Harvest policy	ABC harvest rate	SPR = 55%	SPR = 60%	SPR = 65%	SPR = 70%
Basis												
2019 ACL (mt)	0.0	30.9	29.1	92.2	91.5	94.3	69.9	77.6	68.5	57.3	47.4	38.6
2019 OFL (mt)	81.2	81.2	81.2	81.2	81.2	81.2	81.2	81.2	81.2	81.2	81.2	81.2
2020 ACL (mt)	0.0	31.9	30.1	93.7	93.0	95.8	72.4	79.2	70.0	58.8	48.8	39.7
2020 OFL (mt)	84.5	83.9	83.9	82.5	82.6	82.5	83.1	82.8	83.1	83.3	83.5	83.7
50% prob. recovery by:	2026	2027	2027	2074	2071	2083	2041	2043	2035	2031	2029	2028
SPR_{TARGET}	100.0%	74.8%	76.0%	46.2%	46.4%	45.5%	54.4%	51.3%	55.0%	60.0%	65.0%	70.0%
Probability of recovery by recalculated 2011 reference points:												
2037 (T_{MIN})	100.0%	100.0%	100.0%	0.6%	0.9%	0.1%	26.9%	16.3%	66.4%	100.0%	100.0%	100.0%
2045 ($T_{F=0}$ from 2013)	100.0%	100.0%	100.0%	12.7%	13.7%	9.2%	64.4%	55.5%	90.3%	100.0%	100.0%	100.0%
2067 ($T_{SPR\ TARGET}$)	100.0%	100.0%	100.0%	43.0%	46.0%	36.8%	92.3%	90.0%	99.2%	100.0%	100.0%	100.0%
2074 (T_{TARGET})	100.0%	100.0%	100.0%	50.0%	52.9%	42.7%	95.1%	92.6%	100.0%	100.0%	100.0%	100.0%
2083 (T_{MAX})	100.0%	100.0%	100.0%	56.8%	59.9%	50.0%	97.5%	96.0%	100.0%	100.0%	100.0%	100.0%
Probability of recovery by recalculated 2017 reference points:												
2026 ($T_{MIN\ from\ 2019}$)	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
2027 ($T_{SPR\ TARGET\ from\ 2011}$)	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
2074 ($T_{TARGET\ from\ 2011}$)	100.0%	100.0%	100.0%	50.0%	52.9%	42.7%	95.1%	92.6%	99.5%	100.0%	100.0%	100.0%
2071 (T_{MAX})	100.0%	100.0%	100.0%	46.3%	50.0%	40.3%	93.9%	91.8%	99.7%	100.0%	100.0%	100.0%

Table 3b. Results of additional rebuilding alternatives requested by the GMT that assume that in 2017-2018 only 13 mt (65% of ACLs) were removed.

Run	1	2	3	4	5	6	7	8	10	11	12
	F in 2019 and after = 0	SPR ACL of 20 mt = 0.748	SPR = 76%	SPR that achieves 50% prob. recovery by T_{TARGET} (2074)	SPR that achieves 50% prob. recovery by 2017 T_{MAX} (2071)	SPR that achieves 50% prob. recovery by 2011 T_{MAX} (2083)	40:10 Harvest policy	ABC harvest rate	SPR = 60%	SPR = 65%	SPR = 70%
Basis											
2019 ACL (mt)	0.0	31.0	29.2	92.8	91.9	94.7	70.3	77.9	57.5	47.6	38.7
2019 OFL (mt)	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5
2020 ACL (mt)	0.0	32.0	30.2	94.3	93.5	96.2	72.8	79.5	59.0	48.9	39.9
2020 OFL (mt)	84.8	84.2	84.2	82.8	82.9	82.8	83.4	83.2	83.6	83.8	84.0
50% prob. recovery by:	2025	2027	2027	2074	2071	2083	2041	2043	2031	2029	2028
SPR_{TARGET}	100.0%	74.8%	76.0%	46.1%	46.4%	45.5%	54.3%	51.3%	60.0%	65.0%	70.0%
Probability of recovery by recalculated 2011 reference points:											
2037 (T_{MIN})	100.0%	100.0%	100.0%	0.8%	0.9%	0.3%	29.5%	18.2%	100.0%	100.0%	100.0%
2045 ($T_{F=0}$ from 2013)	100.0%	100.0%	100.0%	12.8%	13.9%	9.5%	65.3%	56.8%	100.0%	100.0%	100.0%
2067 ($T_{SPR\ TARGET}$)	100.0%	100.0%	100.0%	42.8%	46.1%	37.0%	92.5%	90.4%	100.0%	100.0%	100.0%
2074 (T_{TARGET})	100.0%	100.0%	100.0%	50.0%	53.0%	42.8%	95.3%	92.7%	100.0%	100.0%	100.0%
2083 (T_{MAX})	100.0%	100.0%	100.0%	56.7%	59.7%	50.0%	97.5%	96.1%	100.0%	100.0%	100.0%
Probability of recovery by recalculated 2017 reference points:											
2026 ($T_{MIN\ from\ 2019}$)	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
2027 ($T_{SPR\ TARGET\ from\ 2011}$)	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
2074 ($T_{TARGET\ from\ 2011}$)	100.0%	100.0%	100.0%	50.0%	53.0%	42.8%	95.3%	92.7%	100.0%	100.0%	100.0%
2071 (T_{MAX})	100.0%	100.0%	100.0%	46.4%	50.0%	40.4%	94.1%	91.9%	100.0%	100.0%	100.0%

Table 4. Probability of recovery for rebuilding alternatives for the years 2017-2036.

Run	1	2	3	4	5	6	7	8	9	10	11	12
Basis	F in 2019 and after = 0	SPR ACL of 20 mt = 0.748	SPR = 76%	SPR that achieves 50% prob. recovery by T_{TARGET} (2074)	SPR that achieves 50% prob. recovery by 2017 T_{MAX} (2071)	SPR that achieves 50% prob. recovery by 2011 T_{MAX} (2083)	40:10 Harvest policy	ABC harvest rate	SPR = 55%	SPR = 60%	SPR = 65%	SPR = 70%
2017	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0%
2018	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0%
2019	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0%
2020	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0%
2021	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0%
2022	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0%
2023	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0%
2024	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0%
2025	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0%
2026	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0%
2027	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0%
2028	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	100%
2029	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0%	0%	87%	100%
2030	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0%	1%	100%	100%
2031	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0%	56%	100%	100%
2032	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.2%	0.0%	1%	97%	100%	100%
2033	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.8%	0.2%	9%	100%	100%	100%
2034	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%	3.9%	1.2%	27%	100%	100%	100%
2035	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%	9.8%	5.1%	45%	100%	100%	100%
2036	100.0%	100.0%	100.0%	0.1%	0.1%	0.0%	18.0%	9.7%	56%	100%	100%	100%

Table 4 (continued). Probability of recovery for rebuilding alternatives for the years 2037-2096.

Run	1	2	3	4	5	6	7	8	9	10	11	12
Basis	F in 2019 and after = 0	SPR ACL of 20 mt = 0.748	SPR = 76%	SPR that achieves 50% prob. recovery by T_{TARGET} (2074)	SPR that achieves 50% prob. recovery by 2017 T_{MAX} (2071)	SPR that achieves 50% prob. recovery by 2011 T_{MAX} (2083)	40:10 Harvest policy	ABC harvest rate	SPR = 55%	SPR = 60%	SPR = 65%	SPR = 70%
2037	100%	100%	100%	1%	1%	0%	27%	16%	66%	100%	100%	100%
2040	100%	100%	100%	4%	4%	2%	46%	36%	81%	100%	100%	100%
2044	100%	100%	100%	11%	12%	8%	61%	52%	89%	100%	100%	100%
2045	100%	100%	100%	13%	14%	9%	64%	56%	90%	100%	100%	100%
2046	100%	100%	100%	14%	15%	11%	67%	59%	92%	100%	100%	100%
2050	100%	100%	100%	21%	23%	16%	74%	68%	95%	100%	100%	100%
2055	100%	100%	100%	28%	30%	23%	82%	77%	97%	100%	100%	100%
2060	100%	100%	100%	34%	37%	28%	88%	84%	98%	100%	100%	100%
2067	100%	100%	100%	43%	46%	37%	92%	90%	99%	100%	100%	100%
2071	100%	100%	100%	46%	50%	40%	94%	92%	100%	100%	100%	100%
2074	100%	100%	100%	50%	53%	43%	95%	93%	100%	100%	100%	100%
2080	100%	100%	100%	55%	57%	48%	97%	95%	100%	100%	100%	100%
2083	100%	100%	100%	57%	60%	50%	98%	96%	100%	100%	100%	100%
2084	100%	100%	100%	58%	60%	51%	98%	96%	100%	100%	100%	100%
2087	100%	100%	100%	60%	64%	52%	98%	97%	100%	100%	100%	100%
2089	100%	100%	100%	62%	65%	54%	98%	98%	100%	100%	100%	100%
2096	100%	100%	100%	67%	70%	59%	99%	98%	100%	100%	100%	100%

Table 5. Median catches (mt) for rebuilding alternatives for the years 2017-2036.

Run	1	2	3	4	5	6	7	8	9	10	11	12
Basis	F in 2019 and after = 0	SPR ACL of 20 mt = 0.748	SPR = 76%	SPR that achieves 50% prob. recovery by T_{TARGET} (2074)	SPR that achieves 50% prob. recovery by 2017 T_{MAX} (2071)	SPR that achieves 50% prob. recovery by 2011 T_{MAX} (2083)	40:10 Harvest policy	ABC harvest rate	SPR = 55%	SPR = 60%	SPR = 65%	SPR = 70%
2017	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
2018	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
2019	0.0	30.9	29.1	92.2	91.5	94.3	69.9	77.6	68.5	57.3	47.4	38.6
2020	0.0	31.9	30.1	93.7	93.0	95.8	72.4	79.2	70.0	58.8	48.8	39.7
2021	0.0	32.9	31.0	95.1	94.3	97.1	74.8	80.6	71.5	60.2	50.0	40.9
2022	0.0	33.8	31.9	96.2	95.5	98.2	76.9	81.9	72.8	61.4	51.2	41.9
2023	0.0	34.7	32.7	97.1	96.4	99.0	78.8	83.0	73.9	62.6	52.3	42.9
2024	0.0	35.5	33.5	97.8	97.1	99.7	80.4	83.9	74.9	63.6	53.3	43.8
2025	0.0	36.2	34.2	98.4	97.8	100.3	81.9	84.7	75.8	64.5	54.2	44.7
2026	0.0	36.9	34.9	98.9	98.3	100.7	83.1	85.4	76.6	65.4	55.0	45.5
2027	0.0	37.6	35.5	99.3	98.7	101.1	84.2	86.1	77.3	66.2	55.8	46.2
2028	0.0	38.3	36.2	99.7	99.0	101.4	85.2	86.7	78.0	66.9	56.6	46.9
2029	0.0	38.9	36.8	99.9	99.3	101.6	86.1	87.2	78.7	67.6	57.3	47.6
2030	0.0	39.5	37.4	100.2	99.6	101.9	86.9	87.7	79.3	68.3	58.0	48.3
2031	0.0	40.1	37.9	100.4	99.8	102.1	87.6	88.2	79.9	69.0	58.7	49.0
2032	0.0	40.7	38.5	100.7	100.1	102.3	88.3	88.7	80.4	69.6	59.3	49.6
2033	0.0	41.2	39.0	100.9	100.4	102.5	88.9	89.0	80.9	70.2	59.9	50.2
2034	0.0	41.8	39.6	101.2	100.6	102.7	89.5	89.5	81.5	70.8	60.6	50.8
2035	0.0	42.3	40.1	101.4	100.9	102.9	90.0	89.9	82.0	71.4	61.2	51.3
2036	0.0	42.8	40.6	101.8	101.2	103.2	90.6	90.3	82.4	71.9	61.7	51.9

Table 5 (continues). Median catches (mt) for rebuilding alternatives for the years 2037-2096.

Run	1	2	3	4	5	6	7	8	9	10	11	12
Basis	F in 2019 and after = 0	SPR ACL of 20 mt = 0.748	SPR = 76%	SPR that achieves 50% prob. recovery by T_{TARGET} (2074)	SPR that achieves 50% prob. recovery by 2017 T_{MAX} (2071)	SPR that achieves 50% prob. recovery by 2011 T_{MAX} (2083)	40:10 Harvest policy	ABC harvest rate	SPR = 55%	SPR = 60%	SPR = 65%	SPR = 70%
2037	0.0	43.4	41.1	102.1	101.6	103.5	91.1	90.8	83.0	72.5	62.4	52.5
2040	0.0	44.9	42.6	102.9	102.4	104.3	92.6	92.0	84.4	74.1	64.0	54.1
2044	0.0	46.7	44.4	104.1	103.6	105.3	94.1	93.4	86.1	76.1	66.0	56.1
2045	0.0	47.1	44.8	104.4	104.0	105.7	94.4	93.7	86.5	76.5	66.5	56.6
2046	0.0	47.5	45.2	104.6	104.1	105.8	94.8	94.1	86.9	77.0	67.0	57.0
2050	0.0	49.3	46.9	105.5	105.1	106.7	96.4	95.7	88.7	78.9	69.0	59.0
2055	0.0	51.3	48.8	106.3	105.9	107.3	97.9	97.3	90.5	81.0	71.1	61.1
2060	0.0	53.0	50.5	107.1	106.7	108.1	99.2	98.8	92.2	82.8	73.0	62.9
2067	0.0	54.9	52.4	107.8	107.5	108.7	100.7	100.2	94.0	84.8	75.1	65.0
2071	0.0	55.8	53.2	108.2	107.9	109.1	101.0	100.6	94.5	85.6	76.0	65.9
2074	0.0	56.3	53.7	108.5	108.2	109.3	101.2	100.9	94.9	86.0	76.5	66.4
2080	0.0	57.4	54.9	109.0	108.7	109.9	102.0	101.8	95.9	87.2	77.7	67.6
2083	0.0	58.0	55.4	109.2	108.9	110.0	102.5	102.2	96.5	87.7	78.3	68.2
2084	0.0	58.1	55.5	109.2	108.9	110.0	102.8	102.6	96.7	88.0	78.4	68.3
2087	0.0	58.6	56.0	109.6	109.3	110.4	103.2	103.0	97.2	88.4	79.0	68.8
2089	0.0	58.9	56.3	109.5	109.2	110.2	103.3	103.1	97.4	88.8	79.2	69.1
2096	0.0	59.6	57.0	110.0	109.7	110.7	103.7	103.5	97.9	89.4	80.0	69.9

Table 6. Median spawning output (millions eggs) for rebuilding alternatives for the years 2017-2036.

Run	1	2	3	4	5	6	7	8	9	10	11	12
Basis	F in 2019 and after = 0	SPR ACL of 20 mt = 0.748	SPR = 76%	SPR that achieves 50% prob. recovery by T_{TARGET} (2074)	SPR that achieves 50% prob. recovery by 2017 T_{MAX} (2071)	SPR that achieves 50% prob. recovery by 2011 T_{MAX} (2083)	40:10 Harvest policy	ABC harvest rate	SPR = 55%	SPR = 60%	SPR = 65%	SPR = 70%
2017	323.1	323.1	323.1	323.1	323.1	323.1	323.1	323.1	323.1	323.1	323.1	323.1
2018	337.1	337.1	337.1	337.1	337.1	337.1	337.1	337.1	337.1	337.1	337.1	337.1
2019	351.5	351.5	351.5	351.5	351.5	351.5	351.5	351.5	351.5	351.5	351.5	351.5
2020	365.4	365.2	365.4	359.0	359.0	358.8	361.2	360.4	361.4	362.5	363.5	364.4
2021	379.5	379.1	379.5	366.4	366.5	366.0	370.9	369.4	371.3	373.6	375.6	377.5
2022	393.7	393.1	393.7	373.6	373.8	372.9	380.3	378.1	381.0	384.6	387.8	390.6
2023	407.7	406.9	407.7	380.3	380.6	379.5	389.2	386.5	390.5	395.3	399.6	403.5
2024	421.3	420.3	421.3	386.5	386.9	385.4	397.6	394.3	399.3	405.4	411.0	415.9
2025	434.3	433.1	434.3	391.9	392.3	390.5	405.0	401.4	407.4	414.9	421.6	427.7
2026	446.6	445.1	446.6	396.4	397.0	394.9	411.6	407.6	414.7	423.5	431.5	438.8
2027	458.1	456.4	458.1	400.1	400.8	398.4	417.3	412.9	421.1	431.3	440.6	449.0
2028	468.9	466.9	468.9	403.1	403.8	401.1	422.1	417.5	426.8	438.4	448.9	458.4
2029	479.0	476.7	479.0	405.5	406.3	403.3	426.3	421.5	431.8	444.7	456.5	467.2
2030	488.5	486.0	488.5	407.4	408.3	405.0	429.9	425.0	436.3	450.6	463.5	475.4
2031	497.6	494.8	497.6	408.9	409.9	406.3	433.1	428.1	440.4	456.0	470.2	483.2
2032	506.3	503.3	506.3	410.2	411.2	407.4	436.1	430.9	444.2	461.1	476.5	490.7
2033	514.7	511.5	514.7	411.3	412.4	408.4	438.7	433.5	447.8	465.9	482.5	497.8
2034	522.9	519.4	522.9	412.3	413.5	409.2	441.2	436.0	451.2	470.5	488.2	504.7
2035	530.9	527.1	530.9	413.3	414.5	409.9	443.5	438.4	454.5	474.9	493.8	511.4
2036	538.5	534.5	538.5	414.3	415.6	410.8	445.7	440.5	457.5	479.2	499.2	517.8

Table 6 (continues). Median spawning output (millions eggs) for rebuilding alternatives for the years 2037-2096.

Run	1	2	3	4	5	6	7	8	9	10	11	12
Basis	F in 2019 and after = 0	SPR ACL of 20 mt = 0.748	SPR = 76%	SPR that achieves 50% prob. recovery by T_{TARGET} (2074)	SPR that achieves 50% prob. recovery by 2017 T_{MAX} (2071)	SPR that achieves 50% prob. recovery by 2011 T_{MAX} (2083)	40:10 Harvest policy	ABC harvest rate	SPR = 55%	SPR = 60%	SPR = 65%	SPR = 70%
2037	545.8	541.6	545.8	415.2	416.5	411.5	447.5	442.4	460.2	483.0	504.2	523.9
2040	567.4	562.5	567.4	418.8	420.3	414.7	453.6	448.8	469.0	494.9	519.2	541.9
2044	595.1	589.2	595.1	423.4	425.1	418.8	461.0	456.7	480.0	510.0	538.3	565.0
2045	601.2	595.0	601.2	425.0	426.8	420.3	462.8	458.5	482.2	513.1	542.4	569.9
2046	607.7	601.4	607.7	426.5	428.3	421.7	464.2	460.0	484.8	516.5	546.7	575.3
2050	631.1	624.0	631.1	430.2	432.2	425.0	471.3	467.3	494.4	529.6	563.0	594.7
2055	661.6	653.6	661.6	434.7	436.9	429.1	480.0	477.0	507.0	546.4	584.3	620.6
2060	686.5	677.6	686.5	437.6	439.9	431.4	487.4	484.6	517.4	560.0	601.3	640.8
2067	716.1	706.0	716.1	442.5	444.9	435.9	495.8	493.5	528.6	575.2	620.8	664.8
2071	731.6	720.9	731.6	443.5	446.1	436.7	499.9	498.1	534.3	583.2	630.8	677.4
2074	741.6	730.6	741.6	444.8	447.4	437.7	501.0	499.3	536.9	587.7	636.8	685.2
2080	755.6	743.8	755.6	446.7	449.4	439.4	503.7	502.3	541.9	594.4	645.6	696.2
2083	763.7	751.6	763.7	447.6	450.4	440.2	506.1	504.5	544.1	598.0	650.9	702.7
2084	765.8	753.6	765.8	448.5	451.2	441.1	506.5	505.4	545.3	599.3	652.4	704.5
2087	773.2	760.7	773.2	449.1	451.9	441.6	508.9	507.6	548.5	602.8	657.1	710.7
2089	777.5	765.0	777.5	449.7	452.4	442.1	510.9	510.0	551.0	606.2	660.9	714.2
2096	790.8	777.6	790.8	450.8	453.6	442.9	513.2	512.5	555.0	612.4	668.4	724.0

Table 7. OFLs for rebuilding alternatives for the years 2017-2036.

Run	1	2	3	4	5	6	7	8	9	10	11	12
Basis	F in 2019 and after = 0	SPR ACL of 20 mt = 0.748	SPR = 76%	SPR that achieves 50% prob. recovery by T_{TARGET} (2074)	SPR that achieves 50% prob. recovery by 2017 T_{MAX} (2071)	SPR that achieves 50% prob. recovery by 2011 T_{MAX} (2083)	40:10 Harvest policy	ABC harvest rate	SPR = 55%	SPR = 60%	SPR = 65%	SPR = 70%
2017	75.2	75.2	75.2	78.7	78.7	78.7	75.2	75.2	75.2	75.2	75.2	75.2
2018	78.2	78.2	78.2	81.8	81.8	81.8	78.2	78.2	78.2	78.2	78.2	78.2
2019	81.2	81.2	81.2	84.9	84.9	84.9	81.2	81.2	81.2	81.2	81.2	81.2
2020	83.9	83.9	83.9	86.3	86.4	86.3	83.0	82.8	83.0	83.3	83.5	83.7
2021	86.5	86.4	86.5	87.6	87.6	87.5	84.7	84.3	84.7	85.2	85.7	86.1
2022	89.0	88.8	89.0	88.6	88.6	88.5	86.1	85.7	86.3	87.0	87.7	88.3
2023	91.3	91.1	91.3	89.4	89.5	89.2	87.4	86.8	87.6	88.6	89.6	90.4
2024	93.4	93.2	93.4	90.1	90.2	89.9	88.4	87.8	88.8	90.1	91.2	92.3
2025	95.4	95.2	95.4	90.7	90.8	90.4	89.4	88.6	89.9	91.4	92.8	94.1
2026	97.3	97.0	97.3	91.1	91.2	90.8	90.2	89.4	90.8	92.6	94.3	95.7
2027	99.2	98.8	99.2	91.5	91.6	91.1	90.9	90.0	91.7	93.8	95.6	97.3
2028	100.9	100.5	100.9	91.8	91.9	91.4	91.6	90.7	92.5	94.8	96.9	98.8
2029	102.6	102.2	102.6	92.0	92.2	91.6	92.2	91.2	93.3	95.8	98.2	100.3
2030	104.3	103.8	104.3	92.3	92.5	91.8	92.7	91.8	94.0	96.8	99.4	101.7
2031	105.9	105.3	105.9	92.5	92.7	92.0	93.2	92.3	94.7	97.7	100.5	103.1
2032	107.4	106.8	107.4	92.7	92.9	92.2	93.7	92.7	95.3	98.6	101.6	104.4
2033	108.9	108.3	108.9	93.0	93.2	92.4	94.2	93.1	95.9	99.4	102.6	105.6
2034	110.4	109.7	110.4	93.2	93.4	92.5	94.6	93.6	96.6	100.3	103.7	106.9
2035	111.8	111.1	111.8	93.4	93.7	92.8	95.1	94.1	97.2	101.1	104.7	108.1
2036	113.2	112.5	113.2	93.7	94.0	93.0	95.5	94.5	97.7	101.9	105.7	109.3

Table 7 (continues). OFLs for rebuilding alternatives for the years 2037-2096.

Run	1	2	3	4	5	6	7	8	9	10	11	12
Basis	F in 2019 and after = 0	SPR ACL of 20 mt = 0.748	SPR = 76%	SPR that achieves 50% prob. recovery by T_{TARGET} (2074)	SPR that achieves 50% prob. recovery by 2017 T_{MAX} (2071)	SPR that achieves 50% prob. recovery by 2011 T_{MAX} (2083)	40:10 Harvest policy	ABC harvest rate	SPR = 55%	SPR = 60%	SPR = 65%	SPR = 70%
2037	114.7	113.9	114.7	94.0	94.3	93.3	95.9	95.0	98.4	102.7	106.8	110.6
2040	118.8	117.9	118.8	94.8	95.1	94.0	97.1	96.2	100.1	105.0	109.7	114.0
2044	123.8	122.7	123.8	95.9	96.2	94.9	98.5	97.7	102.1	107.8	113.1	118.2
2045	125.0	123.8	125.0	96.2	96.5	95.3	98.8	98.0	102.5	108.4	113.9	119.1
2046	126.0	124.9	126.0	96.3	96.7	95.3	99.2	98.4	103.1	109.1	114.7	120.0
2050	130.9	129.6	130.9	97.2	97.6	96.2	100.8	100.1	105.2	111.8	118.1	124.2
2055	136.2	134.7	136.2	97.9	98.3	96.7	102.4	101.8	107.4	114.7	121.8	128.5
2060	140.8	139.2	140.8	98.7	99.1	97.4	103.8	103.4	109.4	117.3	125.0	132.4
2067	146.2	144.3	146.2	99.3	99.8	98.0	105.3	104.8	111.4	120.2	128.6	136.8
2071	148.6	146.6	148.6	99.7	100.2	98.3	105.6	105.2	112.1	121.3	130.1	138.7
2074	149.9	147.9	149.9	100.0	100.5	98.5	105.9	105.5	112.5	121.9	131.0	139.7
2080	153.1	151.0	153.1	100.4	100.9	99.0	106.7	106.5	113.8	123.5	133.0	142.3
2083	154.5	152.4	154.5	100.5	101.1	99.1	107.2	107.0	114.4	124.2	134.1	143.5
2084	155.0	152.8	155.0	100.6	101.1	99.1	107.5	107.3	114.7	124.6	134.3	143.9
2087	156.2	154.0	156.2	100.9	101.5	99.5	107.9	107.7	115.2	125.3	135.2	144.9
2089	157.1	154.8	157.1	100.8	101.4	99.3	108.1	107.8	115.5	125.8	135.6	145.5
2096	159.0	156.7	159.0	101.3	101.9	99.8	108.5	108.3	116.0	126.6	137.0	147.1

Table 8. Probability of recovery for rebuilding alternatives under different SPR values for the years 2017-2047, assuming either full or 65% of ACLs removed. For 65% ACL removal scenario, we selected SPR rates (listed on the top right panel) that produce approximately 65% of the full ACLs under different SPRs listed on the top left panel.

Run	Rebuilding cases under full ACL removals				Rebuilding cases under removals of 65% of ACL			
Year	SPR = 60%	SPR = 65%	SPR = 70%	SPR = 76%	SPR = 72%	SPR = 76%	SPR = 795%	SPR = 84%
2017	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
2018	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
2019	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
2020	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
2021	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
2022	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
2023	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
2024	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
2025	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
2026	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
2027	0.0%	0.0%	0.0%	100.0%	0.0%	100.0%	100.0%	100.0%
2028	0.0%	0.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2029	0.0%	87.4%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2030	1.4%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2031	55.5%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2032	96.7%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2033	99.5%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2034	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2035	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2036	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2037	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2038	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2039	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2040	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2041	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2042	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2043	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2044	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2045	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2046	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2047	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 8 (continues). Probability of recovery for rebuilding alternatives under different SPR values for the years 2048-2074, assuming either full or 65% of ACLs removed. For 65% ACL removal scenario, we selected SPR rates (listed on the top right panel) that produce approximately 65% of the full ACLs under different SPRs listed on the top left panel.

Run	Rebuilding cases under full ACL removals				Rebuilding cases under removals of 65% of ACL			
Year	SPR = 60%	SPR = 65%	SPR = 70%	SPR = 76%	SPR = 72%	SPR = 76%	SPR = 795%	SPR = 84%
2048	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2049	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2050	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2051	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2052	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2053	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2054	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2055	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2056	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2057	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2058	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2059	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2060	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2061	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2062	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2063	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2064	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2065	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2066	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2067	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2068	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2069	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2070	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2071	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2072	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2073	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
2074	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 9. Median catches (mt) for rebuilding alternatives under different SPR values for the years 2017-2047, assuming either full or 65% of ACLs removed. For 65% ACL removal scenario, we selected SPR rates (listed on the top right panel) that produce approximately 65% of the full ACLs under different SPRs listed on the top left panel.

Run	Rebuilding cases under full ACL removals				Rebuilding cases under removals of 65% of ACL			
Year	SPR = 60%	SPR = 65%	SPR = 70%	SPR = 76%	SPR = 72%	SPR = 76%	SPR = 79.5%	SPR = 84%
2017	20.0	20.0	20.0	20.0	13.0	13.0	13.0	13.0
2018	20.0	20.0	20.0	20.0	13.0	13.0	13.0	13.0
2019	57.3	47.4	38.6	29.1	35.4	29.2	24.1	18.1
2020	58.8	48.8	39.7	30.1	36.5	30.2	25.0	18.8
2021	60.2	50.0	40.9	31.0	37.6	31.1	25.8	19.4
2022	61.4	51.2	41.9	31.9	38.6	32.0	26.5	20.0
2023	62.6	52.3	42.9	32.7	39.5	32.8	27.3	20.6
2024	63.6	53.3	43.8	33.5	40.4	33.6	27.9	21.1
2025	64.5	54.2	44.7	34.2	41.2	34.3	28.6	21.6
2026	65.4	55.0	45.5	34.9	42.0	35.0	29.2	22.1
2027	66.2	55.8	46.2	35.5	42.7	35.6	29.8	22.6
2028	66.9	56.6	46.9	36.2	43.4	36.3	30.3	23.0
2029	67.6	57.3	47.6	36.8	44.1	36.9	30.9	23.5
2030	68.3	58.0	48.3	37.4	44.7	37.5	31.4	23.9
2031	69.0	58.7	49.0	37.9	45.3	38.0	31.9	24.3
2032	69.6	59.3	49.6	38.5	45.9	38.6	32.4	24.7
2033	70.2	59.9	50.2	39.0	46.5	39.1	32.9	25.1
2034	70.8	60.6	50.8	39.6	47.1	39.7	33.4	25.5
2035	71.4	61.2	51.3	40.1	47.6	40.2	33.8	25.9
2036	71.9	61.7	51.9	40.6	48.2	40.7	34.3	26.3
2037	72.5	62.4	52.5	41.1	48.8	41.2	34.7	26.7
2038	73.1	62.9	53.1	41.6	49.3	41.7	35.2	27.1
2039	73.6	63.5	53.6	42.1	49.8	42.2	35.6	27.4
2040	74.1	64.0	54.1	42.6	50.3	42.7	36.1	27.8
2041	74.6	64.5	54.6	43.0	50.8	43.1	36.5	28.1
2042	75.1	65.0	55.1	43.5	51.3	43.6	36.9	28.4
2043	75.6	65.5	55.6	43.9	51.8	44.0	37.3	28.8
2044	76.1	66.0	56.1	44.4	52.3	44.4	37.7	29.1
2045	76.5	66.5	56.6	44.8	52.7	44.9	38.1	29.4
2046	77.0	67.0	57.0	45.2	53.1	45.2	38.4	29.7
2047	77.5	67.5	57.5	45.6	53.6	45.7	38.8	30.0

Table 9 (continues). Median catches (mt) for rebuilding alternatives under different SPR values for the years 2048-2074, assuming either full or 65% of ACLs removed. For 65% ACL removal scenario, we selected SPR rates (listed on the top right panel) that produce approximately 65% of the full ACLs under different SPRs listed on the top left panel.

Run	Rebuilding cases under full ACL removals				Rebuilding cases under removals of 65% of ACL			
Year	SPR = 60%	SPR = 65%	SPR = 70%	SPR = 76%	SPR = 72%	SPR = 76%	SPR = 795%	SPR = 84%
2048	78.0	68.0	58.0	46.0	54.1	46.1	39.2	30.4
2049	78.5	68.5	58.5	46.5	54.6	46.6	39.6	30.7
2050	78.9	69.0	59.0	46.9	55.0	47.0	40.0	31.0
2051	79.5	69.5	59.5	47.3	55.5	47.4	40.3	31.3
2052	79.9	69.9	59.9	47.7	55.9	47.8	40.7	31.6
2053	80.4	70.4	60.3	48.1	56.3	48.2	41.1	31.9
2054	80.7	70.9	60.8	48.5	56.8	48.6	41.4	32.2
2055	81.0	71.1	61.1	48.8	57.0	48.9	41.7	32.5
2056	81.4	71.5	61.4	49.1	57.4	49.2	42.0	32.7
2057	81.7	71.8	61.8	49.5	57.8	49.5	42.3	33.0
2058	82.1	72.2	62.1	49.8	58.1	49.8	42.5	33.2
2059	82.5	72.6	62.5	50.1	58.4	50.2	42.9	33.4
2060	82.8	73.0	62.9	50.5	58.8	50.5	43.1	33.7
2061	83.2	73.3	63.2	50.8	59.1	50.8	43.5	33.9
2062	83.4	73.7	63.5	51.0	59.4	51.1	43.7	34.1
2063	83.6	73.9	63.7	51.3	59.7	51.3	43.9	34.3
2064	84.0	74.2	64.0	51.5	59.9	51.6	44.2	34.5
2065	84.3	74.6	64.4	51.9	60.3	51.9	44.4	34.8
2066	84.6	74.9	64.7	52.2	60.6	52.2	44.7	35.0
2067	84.8	75.1	65.0	52.4	60.9	52.4	44.9	35.2
2068	85.2	75.5	65.3	52.6	61.2	52.7	45.2	35.4
2069	85.3	75.6	65.6	52.9	61.5	53.0	45.5	35.6
2070	85.5	75.8	65.7	53.1	61.6	53.1	45.6	35.7
2071	85.6	76.0	65.9	53.2	61.8	53.3	45.7	35.9
2072	85.7	76.1	66.0	53.4	61.9	53.4	45.9	36.0
2073	85.8	76.3	66.2	53.6	62.1	53.6	46.0	36.1
2074	86.0	76.5	66.4	53.7	62.2	53.7	46.2	36.3

Table 10. Median spawning output (millions eggs) for rebuilding alternatives under different SPR values for the years 2017-2047, assuming either full or 65% of ACLs removed. For 65% ACL removal scenario, we selected SPR rates (listed on the top right panel) that produce approximately 65% of the full ACLs under different SPRs listed on the top left panel.

Run	Rebuilding cases under full ACL removals				Rebuilding cases under removals of 65% of ACL			
Year	SPR = 60%	SPR = 65%	SPR = 70%	SPR = 76%	SPR = 72%	SPR = 76%	SPR = 79.5%	SPR = 84%
2017	323.1	323.1	323.1	323.1	323.1	323.1	323.1	323.1
2018	337.1	337.1	337.1	337.1	337.8	337.8	337.8	337.8
2019	351.5	351.5	351.5	351.5	352.9	352.9	352.9	352.9
2020	362.5	363.5	364.4	365.4	366.2	366.8	367.3	368.0
2021	373.6	375.6	377.5	379.5	379.7	381.0	382.0	383.3
2022	384.6	387.8	390.6	393.7	393.2	395.2	396.8	398.8
2023	395.3	399.6	403.5	407.7	406.5	409.2	411.5	414.2
2024	405.4	411.0	415.9	421.3	419.4	422.9	425.8	429.3
2025	414.9	421.6	427.7	434.3	431.6	435.9	439.5	443.8
2026	423.5	431.5	438.8	446.6	443.0	448.2	452.5	457.6
2027	431.3	440.6	449.0	458.1	453.7	459.7	464.7	470.7
2028	438.4	448.9	458.4	468.9	463.6	470.5	476.1	483.0
2029	444.7	456.5	467.2	479.0	472.8	480.5	486.9	494.7
2030	450.6	463.5	475.4	488.5	481.5	490.1	497.2	505.8
2031	456.0	470.2	483.2	497.6	489.7	499.1	506.9	516.4
2032	461.1	476.5	490.7	506.3	497.5	507.8	516.4	526.8
2033	465.9	482.5	497.8	514.7	505.0	516.2	525.5	536.7
2034	470.5	488.2	504.7	522.9	512.4	524.4	534.3	546.5
2035	474.9	493.8	511.4	530.9	519.4	532.3	543.0	556.0
2036	479.2	499.2	517.8	538.5	526.3	539.9	551.3	565.1
2037	483.0	504.2	523.9	545.8	532.7	547.2	559.3	574.0
2038	487.2	509.4	530.1	553.2	539.3	554.5	567.3	582.9
2039	491.0	514.2	536.0	560.3	545.6	561.6	575.0	591.5
2040	494.9	519.2	541.9	567.4	551.8	568.7	582.8	600.1
2041	499.1	524.3	548.1	574.7	558.4	576.0	590.7	608.9
2042	502.9	529.2	553.9	581.8	564.6	583.0	598.4	617.4
2043	506.4	533.6	559.3	588.4	570.3	589.6	605.7	625.5
2044	510.0	538.3	565.0	595.1	576.4	596.3	612.9	633.5
2045	513.1	542.4	569.9	601.2	581.7	602.3	619.7	641.3
2046	516.5	546.7	575.3	607.7	587.5	608.9	626.7	648.9
2047	520.1	550.8	580.2	613.7	592.7	614.8	633.3	656.4

Table 10 (continues). Median spawning output (millions eggs) for rebuilding alternatives under different SPR values for the years 2048-2074, assuming either full or 65% of ACLs removed. For 65% ACL removal scenario, we selected SPR rates (listed on the top right panel) that produce approximately 65% of the full ACLs under different SPRs listed on the top left panel.

Run	Rebuilding cases under full ACL removals				Rebuilding cases under removals of 65% of ACL			
Year	SPR = 60%	SPR = 65%	SPR = 70%	SPR = 76%	SPR = 72%	SPR = 76%	SPR = 79.5%	SPR = 84%
2048	523.5	555.3	585.6	620.0	598.4	621.1	640.2	664.1
2049	526.2	559.1	590.3	625.8	603.3	626.8	646.7	671.2
2050	529.6	563.0	594.7	631.1	608.1	632.1	652.4	677.9
2051	532.9	567.3	600.0	637.4	613.7	638.4	659.2	685.0
2052	536.6	571.7	605.3	643.5	619.2	644.5	666.1	692.9
2053	539.6	575.4	610.0	649.7	624.2	650.6	672.9	700.3
2054	543.0	579.7	615.2	655.5	629.8	656.5	679.0	707.3
2055	546.4	584.3	620.6	661.6	635.4	662.5	685.7	714.3
2056	549.5	588.0	624.8	666.9	639.9	667.7	691.6	721.5
2057	552.8	591.8	629.1	672.4	644.7	673.3	697.8	728.5
2058	555.4	595.1	634.1	678.2	649.8	679.0	703.9	734.8
2059	556.8	597.5	636.8	681.6	652.9	682.5	708.3	740.5
2060	560.0	601.3	640.8	686.5	657.2	687.3	713.5	745.4
2061	561.9	603.8	644.2	691.3	660.7	692.1	718.7	751.4
2062	564.5	606.9	647.7	695.3	664.5	696.0	722.8	756.3
2063	567.0	610.1	651.6	700.0	668.6	700.7	728.1	762.0
2064	569.4	613.0	655.6	705.0	673.0	705.7	733.2	767.5
2065	571.9	616.1	658.8	708.9	676.4	709.6	738.1	773.5
2066	573.8	619.1	662.6	713.0	680.2	713.7	742.1	777.6
2067	575.2	620.8	664.8	716.1	682.9	716.8	746.1	782.8
2068	578.0	623.8	668.0	719.8	685.9	720.4	750.0	787.3
2069	579.9	626.5	671.7	724.6	690.1	725.2	755.0	792.6
2070	581.4	628.8	674.9	728.5	693.4	729.1	759.4	797.7
2071	583.2	630.8	677.4	731.6	696.3	732.2	762.9	801.8
2072	585.3	633.8	681.1	735.3	700.1	735.8	767.1	806.1
2073	586.6	635.5	683.4	739.2	702.7	739.7	771.5	811.8
2074	587.7	636.8	685.2	741.6	704.8	742.2	774.2	814.7

Table 11. OFLs for rebuilding alternatives under different SPR values for the years 2017-2047, assuming either full or 65% of ACLs removed. For 65% ACL removal scenario, we selected SPR rates (listed on the top right panel) that produce approximately 65% of the full ACLs under different SPRs listed on the top left panel.

Run	Rebuilding cases under full ACL removals				Rebuilding cases under removals of 65% of ACL			
Year	SPR = 60%	SPR = 65%	SPR = 70%	SPR = 76%	SPR = 72%	SPR = 76%	SPR = 79.5%	SPR = 84%
2017	75.2	75.2	75.2	75.2	75.2	75.2	75.2	75.2
2018	78.2	78.2	78.2	78.2	78.4	78.4	78.4	78.4
2019	81.2	81.2	81.2	81.2	81.5	81.5	81.5	81.5
2020	83.3	83.5	83.7	83.9	84.1	84.2	84.3	84.5
2021	85.2	85.7	86.1	86.5	86.5	86.8	87.1	87.3
2022	87.0	87.7	88.3	89.0	88.8	89.3	89.6	90.0
2023	88.6	89.6	90.4	91.3	91.0	91.6	92.0	92.6
2024	90.1	91.2	92.3	93.4	93.0	93.7	94.3	95.0
2025	91.4	92.8	94.1	95.4	94.8	95.7	96.5	97.4
2026	92.6	94.3	95.7	97.3	96.6	97.6	98.5	99.6
2027	93.8	95.6	97.3	99.2	98.3	99.5	100.5	101.7
2028	94.8	96.9	98.8	100.9	99.9	101.2	102.4	103.7
2029	95.8	98.2	100.3	102.6	101.4	102.9	104.2	105.7
2030	96.8	99.4	101.7	104.3	102.9	104.6	106.0	107.7
2031	97.7	100.5	103.1	105.9	104.3	106.2	107.7	109.6
2032	98.6	101.6	104.4	107.4	105.7	107.7	109.4	111.4
2033	99.4	102.6	105.6	108.9	107.0	109.2	111.0	113.2
2034	100.3	103.7	106.9	110.4	108.4	110.7	112.6	114.9
2035	101.1	104.7	108.1	111.8	109.6	112.1	114.1	116.6
2036	101.9	105.7	109.3	113.2	110.9	113.5	115.7	118.3
2037	102.7	106.8	110.6	114.7	112.3	115.0	117.3	120.1
2038	103.6	107.8	111.7	116.1	113.5	116.4	118.8	121.8
2039	104.3	108.7	112.8	117.5	114.7	117.7	120.3	123.4
2040	105.0	109.7	114.0	118.8	115.9	119.1	121.7	125.0
2041	105.7	110.5	115.0	120.0	116.9	120.3	123.0	126.5
2042	106.4	111.4	116.1	121.4	118.1	121.6	124.5	128.0
2043	107.1	112.3	117.1	122.6	119.2	122.8	125.8	129.5
2044	107.8	113.1	118.2	123.8	120.3	124.0	127.2	131.0
2045	108.4	113.9	119.1	125.0	121.3	125.2	128.5	132.5
2046	109.1	114.7	120.0	126.0	122.3	126.2	129.6	133.8
2047	109.8	115.6	121.1	127.3	123.4	127.5	130.9	135.1

Table 11 (continues). OFLs for rebuilding alternatives under different SPR values for the years 2048-2074, assuming either full or 65% of ACLs removed. For 65% ACL removal scenario, we selected SPR rates (listed on the top right panel) that produce approximately 65% of the full ACLs under different SPRs listed on the top left panel.

Run	Rebuilding cases under full ACL removals				Rebuilding cases under removals of 65% of ACL			
Year	SPR = 60%	SPR = 65%	SPR = 70%	SPR = 76%	SPR = 72%	SPR = 76%	SPR = 79.5%	SPR = 84%
2048	110.5	116.5	122.1	128.5	124.5	128.7	132.3	136.7
2049	111.2	117.3	123.1	129.8	125.6	130.0	133.7	138.2
2050	111.8	118.1	124.2	130.9	126.6	131.1	134.9	139.6
2051	112.6	119.1	125.2	132.1	127.7	132.3	136.2	141.0
2052	113.2	119.8	126.0	133.2	128.6	133.4	137.4	142.4
2053	113.9	120.6	127.0	134.4	129.6	134.5	138.7	143.8
2054	114.4	121.3	128.0	135.5	130.7	135.6	139.8	145.0
2055	114.7	121.8	128.5	136.2	131.3	136.4	140.8	146.2
2056	115.4	122.5	129.4	137.2	132.2	137.3	141.7	147.2
2057	115.8	123.1	130.0	138.1	133.0	138.3	142.7	148.3
2058	116.3	123.7	130.8	138.9	133.7	139.0	143.6	149.3
2059	116.8	124.3	131.5	139.9	134.5	140.0	144.7	150.4
2060	117.3	125.0	132.4	140.8	135.4	141.0	145.7	151.4
2061	117.8	125.6	133.1	141.7	136.1	141.8	146.7	152.7
2062	118.2	126.1	133.7	142.5	136.8	142.6	147.4	153.5
2063	118.5	126.6	134.2	143.1	137.4	143.3	148.3	154.5
2064	119.0	127.1	134.8	143.9	138.0	144.0	149.0	155.4
2065	119.5	127.7	135.6	144.8	138.8	144.9	150.0	156.5
2066	119.8	128.2	136.3	145.6	139.5	145.7	150.9	157.6
2067	120.2	128.6	136.8	146.2	140.1	146.3	151.6	158.3
2068	120.7	129.2	137.5	147.0	140.8	147.1	152.4	159.2
2069	120.9	129.6	138.0	147.8	141.5	147.9	153.4	160.2
2070	121.1	129.9	138.4	148.2	141.8	148.3	153.9	160.9
2071	121.3	130.1	138.7	148.6	142.2	148.7	154.4	161.5
2072	121.4	130.3	139.0	149.0	142.5	149.1	154.8	162.1
2073	121.6	130.6	139.4	149.5	142.9	149.6	155.4	162.7
2074	121.9	131.0	139.7	149.9	143.3	150.0	155.9	163.2

Table 12. Probability of recovery, depletion and OFLs for rebuilding alternatives under different values of stock-recruit steepness (h) for the years 2017-2047, assuming that full ACLs from the assessment model (with h=0.718) removed.

Year	Catch (mt) set to ACL in 2017 and 2018. Catches for 2019 forward calculated using current rebuilding SPR of 76% applied to the base model	assessment model, h=0.718			h=0.509			h=0.4		
		Probability of recovery	Depletion	OFL	Probability of recovery	Depletion	OFL	Probability of recovery	Depletion	OFL
2017	20	0.0%	28.4%	75	0%	19.3%	49.36	0%	14.4%	36.73
2018	20	0.0%	29.6%	78	0%	20.0%	50.79	0%	14.8%	37.46
2019	29	0.0%	30.9%	81	0%	20.6%	52.15	0%	15.2%	38.14
2020	30	0.0%	32.1%	84	0%	21.2%	53.22	0%	15.5%	38.54
2021	31	0.0%	33.3%	87	0%	21.8%	54.16	0%	15.7%	38.84
2022	32	0.0%	34.6%	89	0%	22.3%	54.98	0%	15.9%	39.05
2023	33	0.0%	35.8%	91	0%	22.8%	55.72	0%	16.1%	39.16
2024	33	0.0%	37.0%	93	0%	23.3%	56.40	0%	16.3%	39.21
2025	34	0.0%	38.1%	95	0%	23.7%	57.03	0%	16.4%	39.21
2026	35	0.0%	39.2%	97	0%	24.1%	57.64	0%	16.4%	39.17
2027	36	100.0%	40.2%	99	0%	24.5%	58.23	0%	16.5%	39.12
2028	36	100.0%	41.2%	101	0%	24.8%	58.82	0%	16.4%	39.06
2029	37	100.0%	42.1%	103	0%	25.0%	59.40	0%	16.4%	39.00
2030	37	100.0%	42.9%	104	0%	25.3%	59.98	0%	16.4%	38.94
2031	38	100.0%	43.7%	106	0%	25.5%	60.57	0%	16.3%	38.90
2032	38	100.0%	44.5%	107	0%	25.7%	61.11	0%	16.3%	38.84
2033	39	100.0%	45.2%	109	0%	26.0%	61.72	0%	16.2%	38.77
2034	40	100.0%	45.9%	110	0%	26.2%	62.31	0%	16.2%	38.75
2035	40	100.0%	46.6%	112	0%	26.4%	62.90	0%	16.1%	38.71
2036	41	100.0%	47.3%	113	0%	26.7%	63.51	0%	16.1%	38.68
2037	41	100.0%	47.9%	115	0%	26.9%	64.19	0%	16.0%	38.68
2038	42	100.0%	48.6%	116	0%	27.2%	64.78	0%	16.0%	38.67
2039	42	100.0%	49.2%	117	0%	27.4%	65.40	0%	16.0%	38.62
2040	43	100.0%	49.8%	119	0%	27.7%	66.01	0%	15.9%	38.61
2041	43	100.0%	50.5%	120	0%	28.0%	66.64	0%	15.9%	38.55
2042	43	100.0%	51.1%	121	0%	28.2%	67.28	0%	15.9%	38.52
2043	44	100.0%	51.7%	123	0%	28.5%	67.94	0%	15.8%	38.48
2044	44	100.0%	52.2%	124	0%	28.8%	68.56	0%	15.8%	38.43
2045	45	100.0%	52.8%	125	0%	29.0%	69.14	0%	15.8%	38.36
2046	45	100.0%	53.4%	126	0%	29.3%	69.81	0%	15.7%	38.30
2047	46	100.0%	53.9%	127	0%	29.6%	70.45	0%	15.7%	38.20

Table 12 (continues). Probability of recovery, depletion and OFLs for rebuilding alternatives under different values of stock-recruit steepness (h) for the years 2048-2074, assuming that full ACLs from the assessment model (with h=0.718) removed.

Year	Catch (mt) set to ACL in 2017 and 2018. Catches for 2019 forward calculated using current rebuilding SPR of 76% applied to the base model	assessment model, h=0.718			h=0.509			h=0.4		
		Probability of recovery	Depletion	OFL	Probability of recovery	Depletion	OFL	Probability of recovery	Depletion	OFL
2048	46	100.0%	54.4%	128	0%	29.9%	71.16	0%	15.7%	38.17
2049	46	100.0%	54.9%	130	0%	30.1%	71.86	0%	15.6%	38.13
2050	47	100.0%	55.4%	131	0%	30.4%	72.53	0%	15.6%	38.09
2051	47	100.0%	56.0%	132	0%	30.7%	73.28	0%	15.5%	38.03
2052	48	100.0%	56.5%	133	0%	31.0%	73.94	0%	15.5%	37.93
2053	48	100.0%	57.0%	134	0%	31.3%	74.57	0%	15.5%	37.83
2054	49	100.0%	57.6%	135	0%	31.6%	75.26	0%	15.4%	37.74
2055	49	100.0%	58.1%	136	0%	31.9%	75.77	0%	15.4%	37.61
2056	49	100.0%	58.5%	137	1%	32.2%	76.33	0%	15.3%	37.39
2057	49	100.0%	59.0%	138	1%	32.5%	76.84	0%	15.3%	37.22
2058	50	100.0%	59.5%	139	2%	32.8%	77.44	0%	15.2%	37.00
2059	50	100.0%	59.8%	140	2%	33.1%	77.96	0%	15.1%	36.81
2060	50	100.0%	60.3%	141	2%	33.3%	78.61	0%	15.0%	36.65
2061	51	100.0%	60.7%	142	3%	33.5%	79.23	0%	14.9%	36.49
2062	51	100.0%	61.0%	142	4%	33.8%	79.82	0%	14.8%	36.34
2063	51	100.0%	61.5%	143	5%	34.0%	80.38	0%	14.7%	36.10
2064	52	100.0%	61.9%	144	5%	34.3%	81.03	0%	14.6%	35.88
2065	52	100.0%	62.2%	145	7%	34.6%	81.58	0%	14.6%	35.65
2066	52	100.0%	62.6%	146	8%	34.8%	82.13	0%	14.5%	35.40
2067	52	100.0%	62.9%	146	10%	35.1%	82.61	0%	14.4%	35.22
2068	53	100.0%	63.2%	147	11%	35.3%	83.14	0%	14.3%	34.96
2069	53	100.0%	63.6%	148	13%	35.6%	83.86	0%	14.1%	34.64
2070	53	100.0%	64.0%	148	15%	35.8%	84.31	0%	14.0%	34.38
2071	53	100.0%	64.2%	149	17%	36.1%	84.94	0%	13.9%	34.04
2072	53	100.0%	64.5%	149	18%	36.3%	85.45	0%	13.8%	33.76
2073	54	100.0%	64.9%	150	20%	36.6%	85.92	0%	13.7%	33.51
2074	54	100.0%	65.1%	150	22%	36.8%	86.44	0%	13.5%	33.24

Table 13. Probability of recovery for rebuilding alternatives under different values of stock-recruit steepness (h) for the years 2048-2074, assuming either full or 65% of ACLs removed.

Run	Rebuilding cases under full ACL removals			Rebuilding cases under removals of 65% ACLs		
Year	assessment model, h=0.718	h=0.509	h=0.4	assessment model, h=0.718	h=0.509	h=0.4
2017	0.0%	0%	0.0%	0.0%	0.0%	0.0%
2018	0.0%	0%	0.0%	0.0%	0.0%	0.0%
2019	0.0%	0%	0.0%	0.0%	0.0%	0.0%
2020	0.0%	0%	0.0%	0.0%	0.0%	0.0%
2021	0.0%	0%	0.0%	0.0%	0.0%	0.0%
2022	0.0%	0%	0.0%	0.0%	0.0%	0.0%
2023	0.0%	0%	0.0%	0.0%	0.0%	0.0%
2024	0.0%	0%	0.0%	0.0%	0.0%	0.0%
2025	0.0%	0%	0.0%	0.0%	0.0%	0.0%
2026	0.0%	0%	0.0%	100.0%	0.0%	0.0%
2027	100.0%	0%	0.0%	100.0%	0.0%	0.0%
2028	100.0%	0%	0.0%	100.0%	0.0%	0.0%
2029	100.0%	0%	0.0%	100.0%	0.0%	0.0%
2030	100.0%	0%	0.0%	100.0%	0.0%	0.0%
2031	100.0%	0%	0.0%	100.0%	0.0%	0.0%
2032	100.0%	0%	0.0%	100.0%	0.0%	0.0%
2033	100.0%	0%	0.0%	100.0%	0.0%	0.0%
2034	100.0%	0%	0.0%	100.0%	0.0%	0.0%
2035	100.0%	0%	0.0%	100.0%	0.0%	0.0%
2036	100.0%	0%	0.0%	100.0%	0.0%	0.0%
2037	100.0%	0%	0.0%	100.0%	0.0%	0.0%
2038	100.0%	0%	0.0%	100.0%	0.0%	0.0%
2039	100.0%	0%	0.0%	100.0%	0.0%	0.0%
2040	100.0%	0%	0.0%	100.0%	0.0%	0.0%
2041	100.0%	0%	0.0%	100.0%	0.0%	0.0%
2042	100.0%	0%	0.0%	100.0%	0.0%	0.0%
2043	100.0%	0%	0.0%	100.0%	0.1%	0.0%
2044	100.0%	0%	0.0%	100.0%	0.4%	0.0%
2045	100.0%	0%	0.0%	100.0%	1.1%	0.0%
2046	100.0%	0%	0.0%	100.0%	2.0%	0.0%
2047	100.0%	0%	0.0%	100.0%	5.1%	0.0%

Table 13 (continues). Probability of recovery for rebuilding alternatives under different values of stock-recruit steepness (h) for the years 2048-2074, assuming either full or 65% of ACLs removed.

Run	Rebuilding cases under full ACL removals			Rebuilding cases under removals of 65% ACLs		
Year	assessment model, h=0.718	h=0.509	h=0.4	assessment model, h=0.718	h=0.509	h=0.4
2048	100.0%	1%	0%	100.0%	9.4%	0.0%
2049	100.0%	1%	0%	100.0%	13.5%	0.0%
2050	100.0%	2%	0%	100.0%	19.9%	0.0%
2051	100.0%	4%	0%	100.0%	27.1%	0.0%
2052	100.0%	6%	0%	100.0%	34.4%	0.0%
2053	100.0%	9%	0%	100.0%	42.5%	0.0%
2054	100.0%	13%	0%	100.0%	50.5%	0.0%
2055	100.0%	17%	0%	100.0%	57.8%	0.0%
2056	100.0%	22%	0%	100.0%	65.9%	0.0%
2057	100.0%	27%	0%	100.0%	72.1%	0.0%
2058	100.0%	32%	0%	100.0%	77.5%	0.0%
2059	100.0%	39%	0%	100.0%	83.1%	0.0%
2060	100.0%	45%	0%	100.0%	87.4%	0.0%
2061	100.0%	50%	0%	100.0%	90.5%	0.0%
2062	100.0%	55%	0%	100.0%	92.9%	0.0%
2063	100.0%	61%	0%	100.0%	94.7%	0.0%
2064	100.0%	66%	0%	100.0%	96.2%	0.0%
2065	100.0%	71%	0%	100.0%	97.1%	0.0%
2066	100.0%	76%	0%	100.0%	97.9%	0.0%
2067	100.0%	79%	0%	100.0%	98.3%	0.0%
2068	100.0%	82%	0%	100.0%	99.0%	0.0%
2069	100.0%	85%	0%	100.0%	99.4%	0.1%
2070	100.0%	87%	0%	100.0%	99.5%	0.2%
2071	100.0%	89%	0%	100.0%	99.5%	0.4%
2072	100.0%	90%	0%	100.0%	99.6%	0.4%
2073	100.0%	92%	0%	100.0%	99.9%	0.4%
2074	100.0%	94%	0%	100.0%	99.9%	0.8%

Table 14. Median catches (mt) for rebuilding alternatives under different values of stock-recruit steepness (h) for the years 2048-2074, assuming either full or 65% of ACLs removed.

Run	Rebuilding cases under full ACL removals			Rebuilding cases under removals of 65% ACLs		
Year	assessment model, h=0.718	h=0.509	h=0.4	assessment model, h=0.718	h=0.509	h=0.4
2017	20.0	20.0	20.0	13.0	13.0	13.0
2018	20.0	20.0	20.0	13.0	13.0	13.0
2019	29.1	18.8	13.7	18.1	11.7	8.6
2020	30.1	19.3	14.0	18.8	12.1	8.8
2021	31.0	19.7	14.2	19.4	12.4	8.9
2022	31.9	20.1	14.4	20.0	12.6	9.1
2023	32.7	20.4	14.6	20.6	12.9	9.2
2024	33.5	20.8	14.8	21.1	13.2	9.4
2025	34.2	21.1	14.9	21.6	13.4	9.5
2026	34.9	21.4	15.0	22.1	13.6	9.6
2027	35.5	21.8	15.2	22.6	13.9	9.7
2028	36.2	22.1	15.3	23.0	14.1	9.8
2029	36.8	22.4	15.5	23.5	14.4	9.9
2030	37.4	22.7	15.6	23.9	14.6	10.0
2031	37.9	23.0	15.8	24.3	14.8	10.2
2032	38.5	23.4	15.9	24.7	15.1	10.3
2033	39.0	23.7	16.0	25.1	15.3	10.4
2034	39.6	24.0	16.2	25.5	15.6	10.5
2035	40.1	24.3	16.4	25.9	15.8	10.7
2036	40.6	24.7	16.6	26.3	16.1	10.8
2037	41.1	25.1	16.7	26.7	16.3	10.9
2038	41.6	25.4	16.9	27.1	16.6	11.1
2039	42.1	25.8	17.1	27.4	16.8	11.2
2040	42.6	26.1	17.3	27.8	17.1	11.4
2041	43.0	26.4	17.5	28.1	17.3	11.5
2042	43.5	26.8	17.7	28.4	17.6	11.6
2043	43.9	27.2	17.9	28.8	17.9	11.8
2044	44.4	27.5	18.1	29.1	18.1	12.0
2045	44.8	27.8	18.2	29.4	18.4	12.1
2046	45.2	28.2	18.4	29.7	18.7	12.3
2047	45.6	28.6	18.6	30.0	18.9	12.4

Table 14 (continues). Median catches (mt) for rebuilding alternatives under different values of stock-recruit steepness (h) for the years 2048-2074, assuming either full or 65% of ACLs removed.

Run	Rebuilding cases under full ACL removals			Rebuilding cases under removals of 65% ACLs		
Year	assessment model, h=0.718	h=0.509	h=0.4	assessment model, h=0.718	h=0.509	h=0.4
2048	46.0	29.0	18.9	30.4	19.2	12.6
2049	46.5	29.3	19.1	30.7	19.5	12.8
2050	46.9	29.7	19.3	31.0	19.8	12.9
2051	47.3	30.1	19.5	31.3	20.1	13.1
2052	47.7	30.5	19.7	31.6	20.4	13.3
2053	48.1	30.9	20.0	31.9	20.6	13.4
2054	48.5	31.2	20.2	32.2	20.9	13.6
2055	48.8	31.5	20.4	32.5	21.1	13.8
2056	49.1	31.9	20.6	32.7	21.4	13.9
2057	49.5	32.2	20.8	33.0	21.7	14.1
2058	49.8	32.5	21.0	33.2	21.9	14.2
2059	50.1	32.9	21.2	33.4	22.2	14.4
2060	50.5	33.3	21.4	33.7	22.4	14.6
2061	50.8	33.6	21.6	33.9	22.7	14.7
2062	51.0	33.9	21.8	34.1	22.9	14.9
2063	51.3	34.3	22.0	34.3	23.2	15.1
2064	51.5	34.6	22.2	34.5	23.5	15.3
2065	51.9	35.0	22.4	34.8	23.7	15.4
2066	52.2	35.3	22.6	35.0	24.0	15.6
2067	52.4	35.6	22.9	35.2	24.2	15.8
2068	52.6	35.9	23.1	35.4	24.5	16.0
2069	52.9	36.3	23.3	35.6	24.7	16.1
2070	53.1	36.6	23.5	35.7	25.0	16.3
2071	53.2	36.8	23.7	35.9	25.2	16.5
2072	53.4	37.1	23.9	36.0	25.4	16.6
2073	53.6	37.4	24.1	36.1	25.6	16.8
2074	53.7	37.7	24.3	36.3	25.8	16.9

Table 15. Median spawning output (millions eggs) for rebuilding alternatives under different values of stock-recruit steepness (h) for the years 2017-2047, assuming either full or 65% of ACLs removed.

Run	Rebuilding cases under full ACL removals			Rebuilding cases under removals of 65% ACLs		
Year	assessment model, h=0.718	h=0.509	h=0.4	assessment model, h=0.718	h=0.509	h=0.4
2017	323.1	219.9	165.5	323.1	219.9	165.5
2018	337.1	227.3	169.8	337.8	228.0	170.6
2019	351.5	234.8	174.1	352.9	236.3	175.6
2020	365.4	242.5	179.0	368.0	244.7	181.0
2021	379.5	250.1	183.6	383.3	253.2	186.3
2022	393.7	257.6	188.1	398.8	261.5	191.4
2023	407.7	264.9	192.3	414.2	269.7	196.2
2024	421.3	271.8	196.1	429.3	277.4	200.7
2025	434.3	278.2	199.5	443.8	284.8	204.7
2026	446.6	284.1	202.5	457.6	291.6	208.4
2027	458.1	289.5	205.1	470.7	298.0	211.6
2028	468.9	294.6	207.4	483.0	304.1	214.6
2029	479.0	299.3	209.5	494.7	309.7	217.4
2030	488.5	303.9	211.5	505.8	315.2	220.0
2031	497.6	308.3	213.4	516.4	320.6	222.5
2032	506.3	312.7	215.3	526.8	325.9	225.0
2033	514.7	317.1	217.2	536.7	331.3	227.5
2034	522.9	321.4	219.1	546.5	336.6	230.1
2035	530.9	325.9	221.1	556.0	342.0	232.7
2036	538.5	330.3	223.2	565.1	347.4	235.4
2037	545.8	334.7	225.2	574.0	352.7	238.1
2038	553.2	339.4	227.5	582.9	358.4	241.0
2039	560.3	344.1	229.8	591.5	364.0	243.9
2040	567.4	348.9	232.2	600.1	369.8	247.0
2041	574.7	353.9	234.7	608.9	375.8	250.2
2042	581.8	358.9	237.3	617.4	381.8	253.4
2043	588.4	363.8	239.9	625.5	387.7	256.7
2044	595.1	368.8	242.5	633.5	393.8	260.0
2045	601.2	373.5	245.0	641.3	399.5	263.1
2046	607.7	378.5	247.7	648.9	405.6	266.6
2047	613.7	383.8	250.5	656.4	411.7	270.0

Table 15 (continues). Median spawning output (millions eggs) for rebuilding alternatives under different values of stock-recruit steepness (h) for the years 2048-2074, assuming either full or 65% of ACLs removed.

Run	Rebuilding cases under full ACL removals			Rebuilding cases under removals of 65% ACLs		
Year	assessment model, h=0.718	h=0.509	h=0.4	assessment model, h=0.718	h=0.509	h=0.4
2048	620.0	389.0	253.3	664.1	418.0	273.7
2049	625.8	393.7	255.9	671.2	423.9	277.0
2050	631.1	398.7	258.7	677.9	430.0	280.5
2051	637.4	404.1	261.7	685.0	436.5	284.2
2052	643.5	409.6	264.8	692.9	443.1	288.2
2053	649.7	414.7	267.6	700.3	449.3	291.9
2054	655.5	420.4	270.8	707.3	456.3	295.9
2055	661.6	426.1	274.0	714.3	463.0	299.9
2056	666.9	431.0	277.1	721.5	469.1	303.8
2057	672.4	436.5	280.0	728.5	475.7	307.7
2058	678.2	441.7	283.3	734.8	482.4	311.8
2059	681.6	446.1	285.9	740.5	487.7	315.2
2060	686.5	451.2	288.7	745.4	493.8	318.8
2061	691.3	455.8	291.6	751.4	499.7	322.6
2062	695.3	460.6	294.4	756.3	505.6	326.4
2063	700.0	465.9	297.2	762.0	511.8	330.0
2064	705.0	470.9	300.4	767.5	518.1	334.1
2065	708.9	475.1	302.9	773.5	523.7	337.6
2066	713.0	480.1	306.1	777.6	529.7	341.7
2067	716.1	485.1	308.8	782.8	535.5	345.1
2068	719.8	489.3	311.8	787.3	540.9	349.2
2069	724.6	495.0	314.7	792.6	547.7	353.1
2070	728.5	499.0	317.7	797.7	553.1	356.8
2071	731.6	503.5	320.6	801.8	558.9	360.6
2072	735.3	508.2	324.4	806.1	564.2	365.3
2073	739.2	513.3	327.3	811.8	570.5	369.3
2074	741.6	517.8	330.0	814.7	576.1	373.0

Table 16. OFLs for rebuilding alternatives under different values of stock-recruit steepness (h) for the years 2017-2047, assuming either full or 65% of ACLs removed.

Run	Rebuilding cases under full ACL removals			Rebuilding cases under removals of 65% ACLs		
Year	assessment model, h=0.718	h=0.509	h=0.4	assessment model, h=0.718	h=0.509	h=0.4
2017	75.2	49.4	36.7	75.2	49.4	36.7
2018	78.2	50.8	37.5	78.4	50.9	37.6
2019	81.2	52.2	38.1	81.5	52.5	38.4
2020	83.9	53.4	38.9	84.5	53.9	39.3
2021	86.5	54.6	39.5	87.3	55.2	40.1
2022	89.0	55.7	40.1	90.0	56.5	40.8
2023	91.3	56.7	40.6	92.6	57.7	41.4
2024	93.4	57.7	41.1	95.0	58.8	42.0
2025	95.4	58.6	41.5	97.4	59.9	42.5
2026	97.3	59.5	41.9	99.6	60.9	43.0
2027	99.2	60.4	42.3	101.7	62.0	43.6
2028	100.9	61.2	42.7	103.7	63.1	44.1
2029	102.6	62.1	43.1	105.7	64.1	44.6
2030	104.3	63.0	43.5	107.7	65.2	45.1
2031	105.9	63.9	43.9	109.6	66.3	45.6
2032	107.4	64.8	44.3	111.4	67.3	46.1
2033	108.9	65.7	44.7	113.2	68.4	46.7
2034	110.4	66.6	45.2	114.9	69.5	47.2
2035	111.8	67.6	45.6	116.6	70.6	47.8
2036	113.2	68.5	46.1	118.3	71.7	48.4
2037	114.7	69.5	46.6	120.1	72.9	49.1
2038	116.1	70.4	47.1	121.8	74.0	49.7
2039	117.5	71.4	47.6	123.4	75.2	50.3
2040	118.8	72.3	48.1	125.0	76.3	51.0
2041	120.0	73.4	48.6	126.5	77.5	51.6
2042	121.4	74.4	49.2	128.0	78.7	52.3
2043	122.6	75.3	49.7	129.5	79.8	53.0
2044	123.8	76.3	50.3	131.0	81.0	53.7
2045	125.0	77.3	50.8	132.5	82.2	54.3
2046	126.0	78.3	51.3	133.8	83.4	55.0
2047	127.3	79.3	51.9	135.1	84.6	55.7

Table 16 (continues). OFLs for rebuilding alternatives under different values of stock-recruit steepness (h) for the years 2048-2074, assuming either full or 65% of ACLs removed.

| Run	Rebuilding cases under full ACL removals			Rebuilding cases under removals of 65% ACLs		
Year	assessment model, h=0.718	h=0.509	h=0.4	assessment model, h=0.718	h=0.509	h=0.4
2048	128.5	38.4	52.6	136.7	85.9	56.5
2049	129.8	38.9	53.1	138.2	87.1	57.2
2050	130.9	39.4	53.8	139.6	88.4	58.0
2051	132.1	39.9	54.4	141.0	89.7	58.8
2052	133.2	40.4	55.0	142.4	90.9	59.6
2053	134.4	40.9	55.6	143.8	92.2	60.3
2054	135.5	41.4	56.2	145.0	93.4	61.1
2055	136.2	41.8	56.7	146.2	94.4	61.8
2056	137.2	42.3	57.3	147.2	95.6	62.5
2057	138.1	42.7	57.9	148.3	96.8	63.2
2058	138.9	43.2	58.4	149.3	97.9	63.9
2059	139.9	43.6	59.0	150.4	99.1	64.7
2060	140.8	44.1	59.6	151.4	100.3	65.5
2061	141.7	44.6	60.1	152.7	101.4	66.2
2062	142.5	45.0	60.7	153.5	102.5	67.0
2063	143.1	45.4	61.3	154.5	103.7	67.7
2064	143.9	45.9	61.9	155.4	104.9	68.5
2065	144.8	46.4	62.5	156.5	106.0	69.2
2066	145.6	46.8	63.1	157.6	107.0	69.9
2067	146.2	47.2	63.7	158.3	108.2	70.7
2068	147.0	47.6	64.3	159.2	109.3	71.6
2069	147.8	48.1	64.9	160.2	110.4	72.3
2070	148.2	48.5	65.5	160.9	111.5	73.1
2071	148.6	48.8	66.0	161.5	112.5	73.8
2072	149.0	49.2	66.7	162.1	113.4	74.6
2073	149.5	49.5	67.2	162.7	114.3	75.3
2074	149.9	49.9	67.7	163.2	115.2	76.0
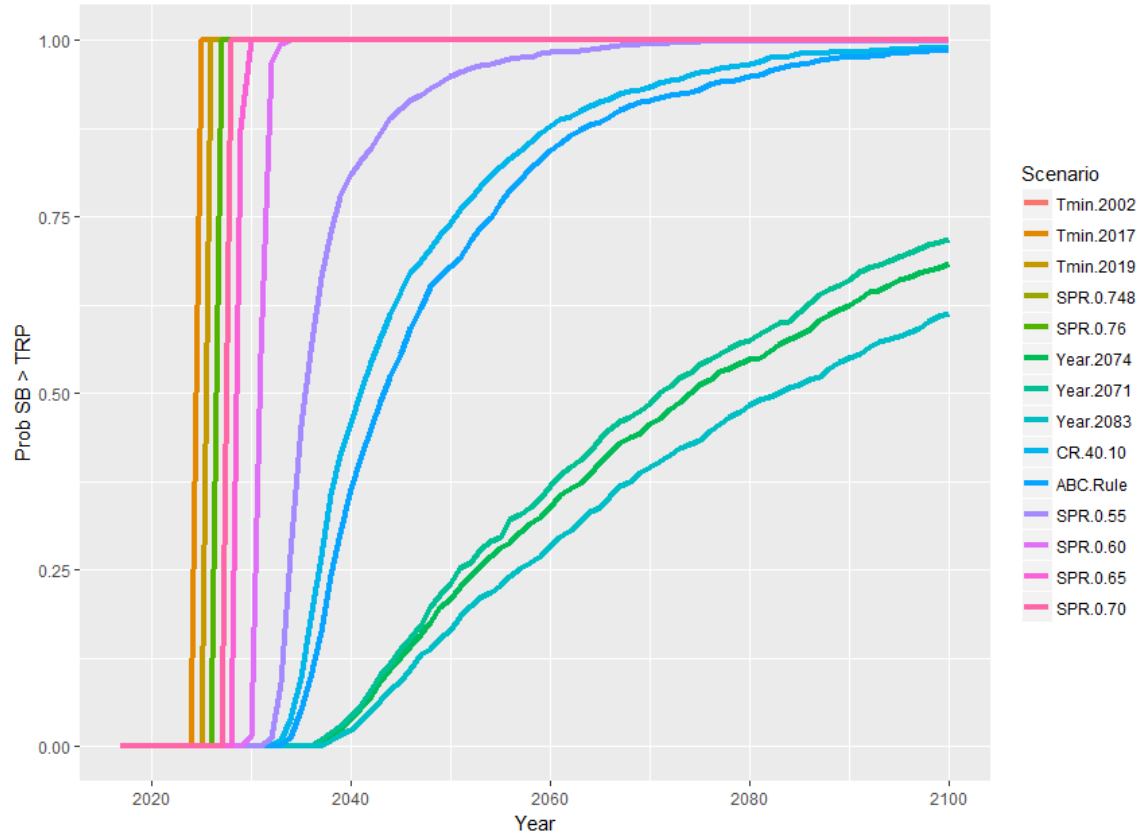
Figure 1. Probability of recovery for all rebuilding alternatives (SPR-based and year-based alternatives combined).
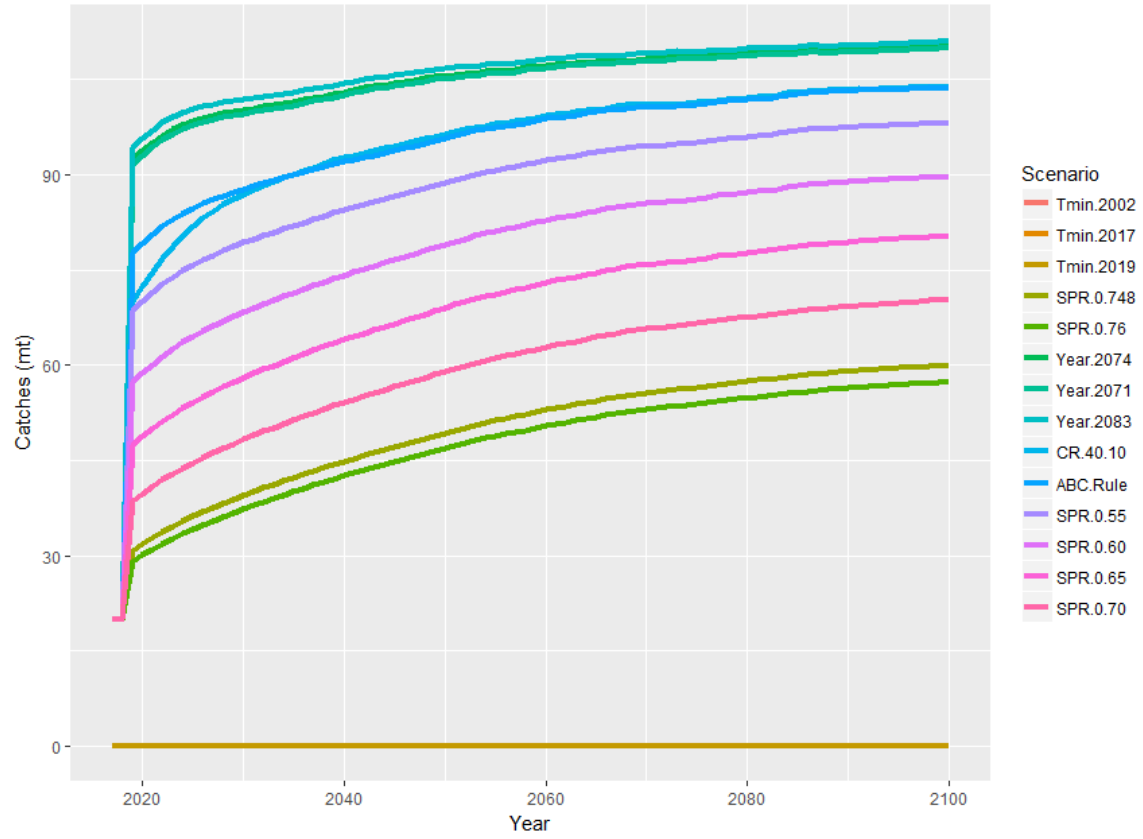
Figure 2. Projected median catch (mt) for rebuilding alternatives (SPR-based and year-based alternatives combined).
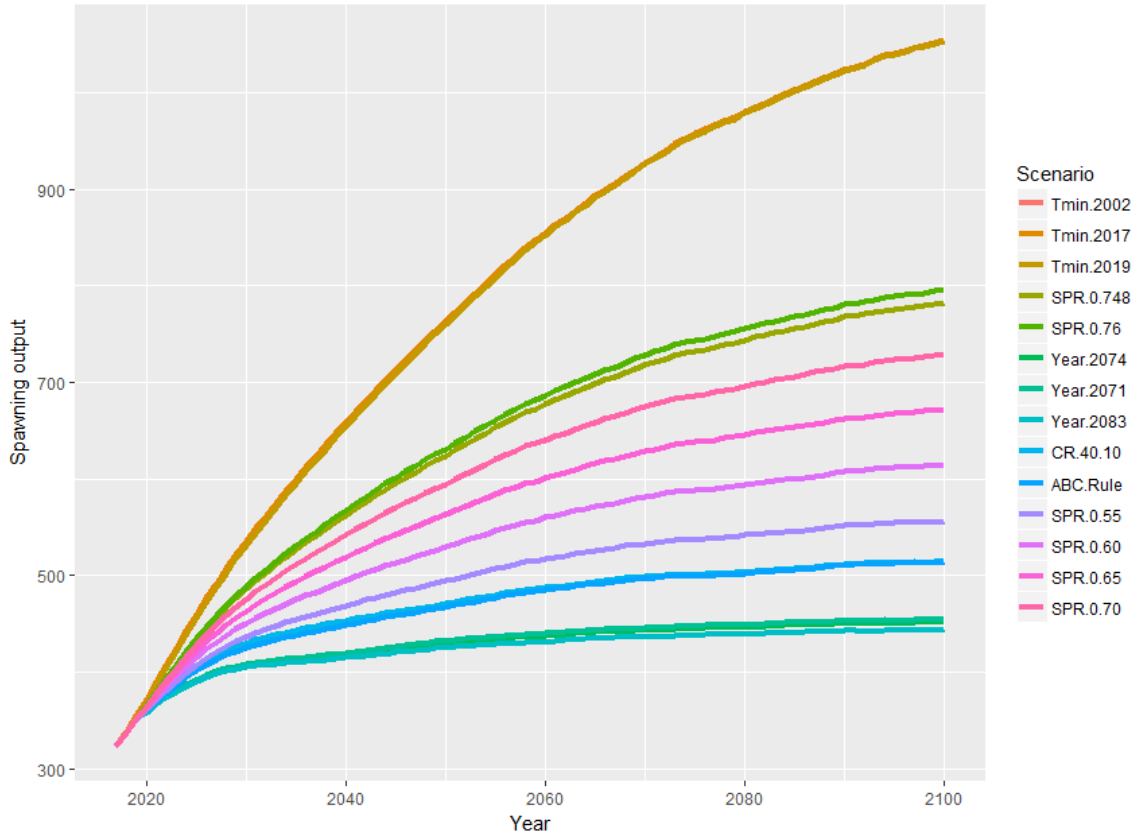
Figure 3. Projected median spawning output (millions of eggs) for rebuilding alternatives (SPR-based and year-based alternatives combined).