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Report of the Technical Evaluation of Rockall haddock proposed harvest control rules – August 2011

International Council for the Exploration of the Sea

Conseil International pour l'Exploration de la Mer

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Contents

Background

ICES has received a request from NEACF to evaluate a proposal for the harvest control component of a long-term management plan for Rockall haddock and in particular to consider whether the plan is consistent with the precautionary approach (see Annex 1).

Two different management strategy evaluation (MSE) analyses were conducted to investigate the properties of the proposed HCRs (Needle and Mosqueira, 2011; Khlivnoy, 2011). The analysis conducted by Needle and Mosqueira (2011) is presented in Annex 2 and the evaluation presented by Khlivnoy (2011) in Annex3. Additional information provided during the RG/ADGHADDOK is presented in Annex 4

These evaluations have been subject to a peer review, the review report is available as Annex 5.

Annex 1 - NEAFC request on Rockall haddock MP evaluation

NEAFC requests ICES to evaluate the following proposal for the harvest control component of a long-term management plan for Rockall haddock and in particular to consider whether the plan is consistent with the precautionary approach and will provide for the sustainable harvesting of the stock. ICES will also suggest an alternative approach if necessary.

Draft EU-Russia proposal for harvest control component of a long-term management plan for haddock at Rockall

In the following, the TACs refer to total catches, not just landings.

1 Every effort shall be made to maintain a level of Spawning Stock Biomass (SSB) greater than Bpa and a minimum level of SSB greater than Blim.

2 For [20XX] and subsequent years the Parties agreed to set a TAC to be consistent with a fishing mortality rate of no more than [either Fpa (0.4) or Fmsy (0.3)] for appropriate age-groups, when the SSB in the end of the year in which the TAC is applied is estimated above Bpa.

3 The Parties agree that the TAC that results from the application of the fishing mortality referred to in paragraph 2 will be adjusted according to the following formula:

$$TACy = TACf + 0.2 * (TACy\text{-}1 - TACf)$$

where TACy is the TAC that is to be set by the management plan, TACy-1 is the TAC that was fixed the previous year and TACf is the TAC resulting from the provisions in paragraphs 1 and 2.

4. Where the SSB referred to in paragraph 2 is estimated to be below Bpa but above Blim the TAC shall not exceed a level, which will result in a fishing mortality rate equal to 0.3 − 0.2 ×(Bpa − SSB)/(Bpa − Blim). This consideration overrides paragraph 3.

5. Where the SSB referred to in paragraph 2 is estimated to be below Blim the TAC shall be set at a level corresponding to a total fishing mortality rate of no more than 0.1. This consideration overrides paragraph 3.

No later than 31 December [20XX], the parties shall review the arrangements in paragraphs 1 to 5 in order to ensure that they are consistent with the objective of the plan. This review shall be conducted after obtaining inter alia advice from ICES concerning the performance of the plan in relation to its objective.

Annex 2 – Needle and Mosqueira (2011) Working Document)

An evaluation of a proposed management plan for haddock in Division VIb (Rockall)

Working Paper to ACOM

Coby L. Needle[1] and Iago Mosqueira[2]

1st August 2011

Summary

On the basis of the simulations presented in this paper, it would appear that proposed EU-RF management plan for Rockall haddock is sustainable – that is, the risk of biomass falling below either of the specified biomass reference points over the future 20-year period is very low.

1.1 Introduction

Discussions between the European Union (EU) and the Russian Federation (RF) on possible joint management measures for the Rockall haddock fishery have been progressing for over ten years. Changes in the shape of the EU Exclusive Economic Zone in 1999 led to the renewal of the RF Rockall haddock fishery, and as this fishery has quite different characteristics from the (predominantly) Scottish and Irish fisheries already present in the area, it was clear that joint management would be both necessary and potentially difficult to implement. Meetings involving both scientists and fisheries managers from the EU and the RF have been held on an almost annual basis since 2001 to determine what is known about these fisheries, and how such information can best be used to develop a productive and sustainable management system.

Building on the history of Rockall fisheries and the supporting scientific work presented by Newton et al (2008), the EU-RF Working Group on Rockall haddock met four times during 2008-2010 and produced a state-of-the-art review of available data and scientific analyses pertaining to Rockall haddock (EU-RF 2009). At the fourth of these meetings, in Edinburgh during September 2010, a proposal for a joint EU-RF management plan for Rockall haddock was drafted. Following further refinements, a final version was presented to the appropriate NEAFC plenary meeting towards the end of 2010. The decision was taken there to forward the proposal to ICES for evaluation: the text of the request is given in Annex 1 below.

Although the request was received by ICES towards the end of 2010, technical difficulties with the evaluation and pressure of other work meant that the response to the request could not be included as part of the June 2011 advice release. The current paper provides a quantitative risk-based evaluation of the likely performance of the proposed management plan, although it does not cover all relevant issues as yet.

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Remaining problems are highlighted in the text and will be dealt with during any future revisions of the management plan (if implemented).

The evaluation was implemented in the R programming system (version 2.13.0: R Development Core Team 2011), using the most recent available versions of the FLR libraries (Kell *et al*. 2007).

1.2 Specific modelling issues for Rockall haddock

One of the authors (Needle) has extensive experience of developing management strategy evaluation (MSE) code for testing proposed plans for haddock in the North Sea (Needle 2008a,b) and West of Scotland (Needle 2010), while the other (Mosqueira) is a key member of the FLR development team and has been involved in a number of management plan evaluations (for example, STECF (2007) and subsequent analyses). The code used previously for haddock MSEs in Needle (2008a,b, 2010) could have been modified to run the Rockall haddock MSE, but it presented two significant problems. Firstly, much of it was bespoke code written to implement features that were not present in the early version of FLR that was available at the time, and such code would have been very difficult for reviewers to understand and check for errors. Recent developments in FLR have in any case rendered much of this bespoke code obsolete. Secondly, the previous code was not optimised for speed, and a single 100-iteration simulation run could take over 15 hours (thus limiting the scope of sensitivity analyses). The new version of FLR features a number of optimised analysis algorithms which reduce runtimes dramatically: the same 100-iteration simulation run now takes around 8 minutes.

For these reasons, the Rockall haddock MSE described here does not build on previous haddock MSEs, but rather on MSEs developed for other species using the development version of FLR (to be released in October 2011 as version 2.4). As is usually the case, the code for these MSEs could not be used without modification for Rockall haddock, due to specific features of the stock, assessment and proposed management plan, and further code development was required. However, the programming approach used in the new version of FLR is not particularly intuitive or easy to use, and the resulting code on which this paper is based cannot be guaranteed to be error-free. Furthermore, it does not implement all the features of the system that could be considered, particularly the presence of two different fleets with different catachability characteristics. It is our intention that the evaluation will be a live code that will develop in the future and be used for evaluations of subsequent revisions to the proposed management plan. It is worth noting that the North Sea haddock MSE (Needle 2008a,b) took over two years to develop, a much greater period of time that has been devoted thus far to the Rockall haddock MSE.

Recruitment

Recruitment dynamics for haddock in the North Sea and West of Scotland are characteristically sporadic: that is, there is a strong tendency in those stocks for very occasional large year-classes interspersed with several weak year-classes. Recruitment for Rockall haddock appears to have a stronger relationship with parental spawning stock biomass, as indicated by Figure 1. Therefore, a Ricker stock-recruit model was used to generate stochastic recruitments in the biological simulation model underpinning the evaluation. This model is given by

$$R_y = \alpha S_{y-1} \exp\left(-\beta S_{y-1}\right) \varepsilon_{y-1}^{R}$$

where R_y is recruitment at age 1 in year y, S_{y-1} is the parental spawning stock biomass in year y-1, α and β are fitted parameters, and $\varepsilon_{y-1}^{R} \sim N\left(0,\sigma_R^2\right)$ where $\sigma_R = 0.3$ is the assumed recruitment standard deviation. Within the knowledge production model, a simple three-year geometric mean of previous recruitment was used as the best estimate of incoming year-class strength. In the real assessment (ICES-WGCSE 2011), a survey-based RCT3 prediction is used to generate recruitment estimates for the intermediate year, while a long-term (1991 onwards) geometric mean is used for the quota year. These refinements could be included in a future revision of the MSE.

Stock assessment

The Rockall haddock assessment (ICES-WGCSE 2011) is carried out using the original MS-DOS implementation of XSA (Shepherd 1992, Darby and Flatman 1994). The version of the model provided with FLR (FLXSA) is functionally identical to XSA, and has the advantage that it can be built into MSE simulation loops. For this reason, FLXSA is used here to generate the simulated stock assessment on which management decisions are taken. The same run settings are used as for the XSA assessment is ICES-WGCSE (2011), namely:

- Assessment model: XSA
- Tuning indices: one survey index (SCOGFS)
- Time-series weights: none
- Catchability dependent for ages < 4
- Regression type: C
- Catchability plateau: 5
- Shrinkage standard error: 1.0
- Shrinkage age-year: 3 ages, 4 years
- Minimum standard error: 0.3
- Plus group: 7+
- Mean F age range: 2–5

The summary outputs from the FLXSA run on historical data are given in Figure 2 (stock summary) and 3 (residuals).

The assessment makes no explicit distinction between reported landings and estimated discards, which are summed together to give total catch. In the simulation forecast, the ratio of landings to discards for each age is assumed to be fixed. In previous work on MSEs for haddock (e.g. Needle 2008a), it has been demonstrated that this assumption can lead to problems (generally underestimation of SSB) with the simulated assessment, particularly when a large year-class is generated. This difficulty may still arise for Rockall haddock, but the magnitude of the effect is likely to be less as the quota is assumed to apply to total catch rather than just landings (see Annex 1). Hence the assumed split between landings and discards is less germane to the simulated stock dynamics.

The simulations were initialised using historical data, as follows:

- Means of the last three historical values were used in forward simulations for biological metrics such as weights-at-age, natural mortality, proportion mature-at-age, and proportion of F and M occurring before spawning.

- The actual 2010 quota (4997 tonnes) was used in generation of total catch for the first year of the simulation. Quotas in all subsequent years were the result of the applied management plan.
- Also in the first simulation year (2010), we use total catch (in other words, the quota) as the intended catch and "true" F as the intended F. In subsequent years these arise from the management plan.

Aside from these added complications, the simulation algorithm is functionally similar to that used for the North Sea haddock MSE (Needle 2008a), to which the reader is referred for details on such aspects as the target-*F* iterative loop and the sliding *F*-rule.

Research-vessel survey indices

The ICES assessment for Rockall haddock uses indices from one research-vessel survey (the Scottish Q3 groundfish survey), which has been conducted annually since 1991 (save for three years during which the survey did not take place). Figure 4 gives the time-series of the survey indices for each age, along with distributions of the same indices but with stochastic noise applied. For a survey index datum $I_{a,y}$ for age *a* in year *y*, in the *k*th iteration, the stochastic version is generated using

$$\tilde{I}_{a,y,k} = I_{a,y} e^{\varepsilon^I_{a,y,k} - \frac{1}{2}\sigma_I^2}$$

where $\varepsilon^I_{a,y,k} \sim N\left(0, \sigma_I^2\right)$ and $\sigma_I = 0.3$ is the assumed survey standard deviation. Figure 5 shows the resultant distributions of assessed mean fishing mortality, SSB and recruitment when *K* assessments are run using the *K* stochastically-generated survey index time-series.

Survey indices must also be generated for each year in the future simulations, to enable these to include stock assessments. The historical relationship between estimated abundance $N_{a,y}$ and $I_{a,y}$ survey indices for each age was generated by fitting straight lines to logged values,

$$\ln I_{a,y} = \gamma_a + \eta_a \ln N_{a,y}.$$

These relationships are illustrated in Figure 6. In each year *y* of each future simulation, the required survey indices were then generated using

$$I_{a,y,k} = \gamma_a e^{\eta_a N_{a,y,k}} \varepsilon_{a,y,k}.$$

Maximum fishing mortality

In the FLR implementation used here, true simulated fishing mortality has an upper bound of 2.0. This can be reached (very occasionally) in the simulations following (we think) a combination of an increasing trend in fishing mortality, limited scope to match quota to stock abundance (due to a constraint of interannual variation in quota), and a coincidental run of relatively low recruitments. This is not a common occurrence: for the 500 simulations with a target F of 0.3 reported below, the maximum F was reached for only 9 (0.018%) iterations. However, as Figure 8 shows, the high true F does not appear to be immediately reflected in a high assessed F, so it is not clear that managers would be aware of the effect were it to occur in reality. The summary results presented here do not include these outlying runs, as we do not yet fully understand why they happen in the simulations and they do not appear to be very realistic, but this is an *ad hoc* solution to the problem which needs to be readdressed in future work.

1.3 Results

The great advantage of the new FLR implementation used for this MSE is the speed with which each evaluation can be completed. Previous work (e.g. Needle 2008a) was limited to 50 iterations for each target *F*, whereas here we have been able to run 500 iterations for each *F* (and indeed 1000 iterations would have been quite possible). This greatly increases coverage of the range of simulated possibilities, and improves our confidence in our conclusions. Two values of target *F* were considered, and each iteration was run for 22 years into the future (being a standard 20 year simulation period, with two extra years to allow for quota-setting forecasts in the final simulation year).

Figure 7 gives a summary plots for one realisation of the simulation for which the target *F* = 0.3 (recall that 500 such realisations were run for each of two target *F* values used). Permitted quota follows an overall upwards trajectory with only minor fluctuations, with true landings and discards following suit according to the fixed relationship between them. True (or realised) mean *F* fluctuates around the target *F* level (0.3), although the assessed mean *F* is much closer to the target. The fluctuation is caused by a combination of the following factors.

a) Implementation lag. Each year of the simulation includes a two-year-ahead forecast, the result of which determines what quotas should be for the following year. However, these forecasts contain assumptions about recruitment, and if these are not accurate (as they generally won't be), the permitted quota may be too large or too small for the actual population to which it is applied. If the quota is taken regardless, this will result in realised mean F that is higher or lower than intended.

b) The TAC constraint. Fixing the amount by which quotas can change from year to year will also hinder achievement of the target F. In a situation of rising (or falling) stock size, the quota is not allowed to rise (or fall) commensurately, and realised mean F is affected as a result.

Even with these fluctuations, the average *F* over the simulation period is consistently lower than the historical average. Recruitment strength remains around an average value in this run. SSB fluctuates in a manner similar (but opposite) to mean *F*, and for this iteration is always above B_{pa}.

In contrast, Figure 8 shows one of the few examples of an iteration for which true mean *F* hits the maximum value (2.0). Such an extreme discrepancy between true and assessed stock values for mean *F* and SSB is difficult to interpret, and (as mentioned above) such runs have all been removed from the overall analysis.

Staying with the same run (target *F* = 0.3), Figure 9 summarises all 491 simulation iterations (that is, all 500 iterations minus the 9 runs for which *F* became equal to 2.0 (see above for a discussion). The median values from these plots are the result of smoothing across different realisations of recruitments, and are therefore only useful as an *indication* of likely future events. Given this caveat, the simulations indicate that SSB is likely to rise initially before stabilising at or around 25 to 30 kt, mean *F* is likely to fluctuate considerably around the target level (but should in any case be able to remain low on average), and total catches will rise to a mean level of around 8 kt.

Figure 10 provides the same summary information for the run with target *F* = 0.4. Here there were 456 valid runs (91.2% of the total) for which *F* did not hit 2.0. The yield in these runs is similar to those for which the target *F* = 0.3 (at around 8 kt on average), but at the cost of a lower SSB (generally less than 20 kt). Recruitment is also similar to the previous case. We note that the true mean *F* for this analysis is much closer to the target *F* (0.4) than for the previous case (when the target *F* = 0.3).

We summarise **risk** from these simulations as follows. For each value of the target *F*, *w*e consider each iteration separately, and count the number of years in that iteration for which biomass was less than B_{pa} or B_{lim}. The results of this analysis for all nine evaluation runs are summarised in Table 1, and Figures 11 and 12. For both levels of the target *F*, the risk of biomass falling below either biomass reference points is **very low**. The number of years for which $B < B_{lim}$ in particular is significantly less than one, for both target *F* values.

Table 1. Summaries of risk (number of years in each iteration for which biomass is less than reference points, averaged over iterations) for each of the tested levels of the target *F*. Only valid iterations have been included here (that is, those for which *F* does not reach 2.0).

Run	Target F	Num years B < Bpa	Num years B < Blim
1	0.3	1.69	0.03
2	0.4	1.18	0.28

1.4 Conclusions

On the basis of the simulations presented in this paper, it would appear that proposed EU-RF management plan for Rockall haddock is sustainable – that is, the risk of biomass falling below either of the specified reference points over the future 20-year period is very low. Several caveats should be borne in mind, however, when considering this result.

The evaluation follows the example of the ICES stock assessment in *not* allowing explicitly for the presence of two fleets with very different characteristics. The simulations are based on an assessment and data which end in 2010, a year in which very few Russian (RF) vessels fished at Rockall (due in part to considerable fishing opportunities in the Barents Sea). The simulations are therefore based on a view of fishery dynamics which is overwhelmingly driven by the characteristics of the EU fleet. Should the RF fleet return to Rockall in significant numbers in the future, this view may not longer pertain. It is possible to model separate fleets in FLR, and this should be considered as a priority in any future revisions.

The evaluation is also limited by the general hindrances that affect all analyses of this type. There is no bioeconomic feedback loop in the simulation, so fishing practices at Rockall (and, importantly, the number of vessels that fish there) are assumed to affect stock dynamics only through the medium of quotas. In reality, increased prices for haddock might increase the number of vessels fishing at Rockall, and thereby have an effect on the risk estimates outlined in this paper – increased fuel costs could have the opposite effect. The proportions discarded-at-age are assumed to be fixed through time (and these are in any case generally extrapolations from the North Sea). Finally, the lack of a multispecies component to the analysis could (for some mixed-fishery vessels, at least) leads to difficulty in drawing firm conclusions.

Annex 3: Request to ICES from NEAFC

NEAFC requests ICES to evaluate the following proposal for the harvest control component of a long-term management plan for Rockall haddock and in particular to consider whether the plan is consistent with the precautionary approach and will provide for the sustainable harvesting of the stock. ICES will also suggest an alternative approach if necessary.

Draft EU-Russia proposal for harvest control component of a long-term management plan for haddock at Rockall

In the following, the TACs refer to total catches, not just landings.

1) Every effort shall be made to maintain a level of Spawning Stock Biomass (SSB) greater than Bpa and a minimum level of SSB greater than Blim.

2) For [20XX] and subsequent years the Parties agreed to set a TAC to be consistent with a fishing mortality rate of no more than [either Fpa (0.4) or Fmsy (0.3)] for appropriate age-groups, when the SSB in the end of the year in which the TAC is applied is estimated above Bpa.

3) The Parties agree that the TAC that results from the application of the fishing mortality referred to in paragraph 2 will be adjusted according to the following formula:

$$TAC_y = TAC_f + 0.2 * (TAC_{y-1} – TAC_f)$$

where TAC_y is the TAC that is to be set by the management plan, TAC_{y-1} is the TAC that was fixed the previous year and TAC_f is the TAC resulting from the provisions in paragraphs 1 and 2.

4) Where the SSB referred to in paragraph 2 is estimated to be below Bpa but above Blim the TAC shall not exceed a level, which will result in a fishing mortality rate equal to 0.3 − 0.2 ×(Bpa − SSB /(Bpa − Blim)). This consideration overrides paragraph 3.

5) Where the SSB referred to in paragraph 2 is estimated to be below Blim the TAC shall be set at a level corresponding to a total fishing mortality rate of no more than 0.1. This consideration overrides paragraph 3.

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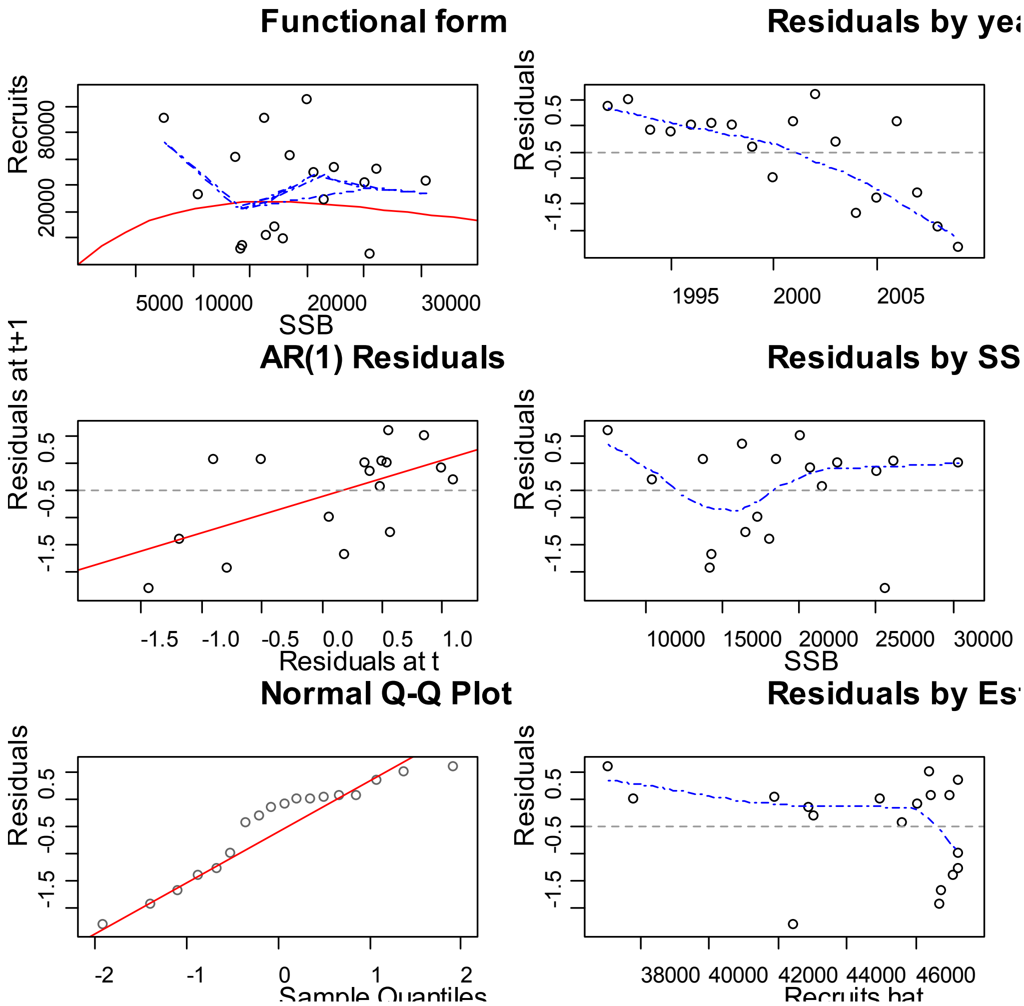

Figure 1. Diagnostics for Ricker stock-recruit model. The fitted Ricker curve is shown in the top-left plot (red line), along with comparative non-parametric loess smoothers (blue lines).

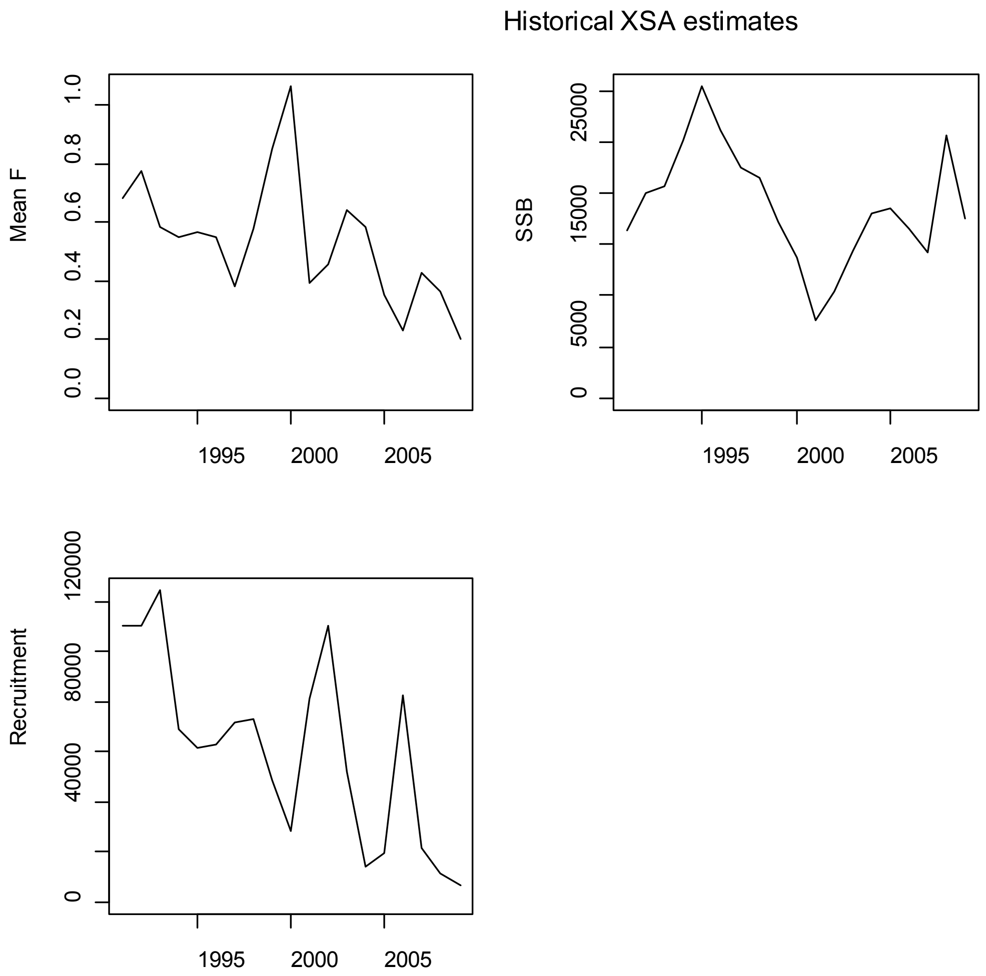

Figure 2. Summary results of the FLXSA assessment applied to historical Rockall haddock data.

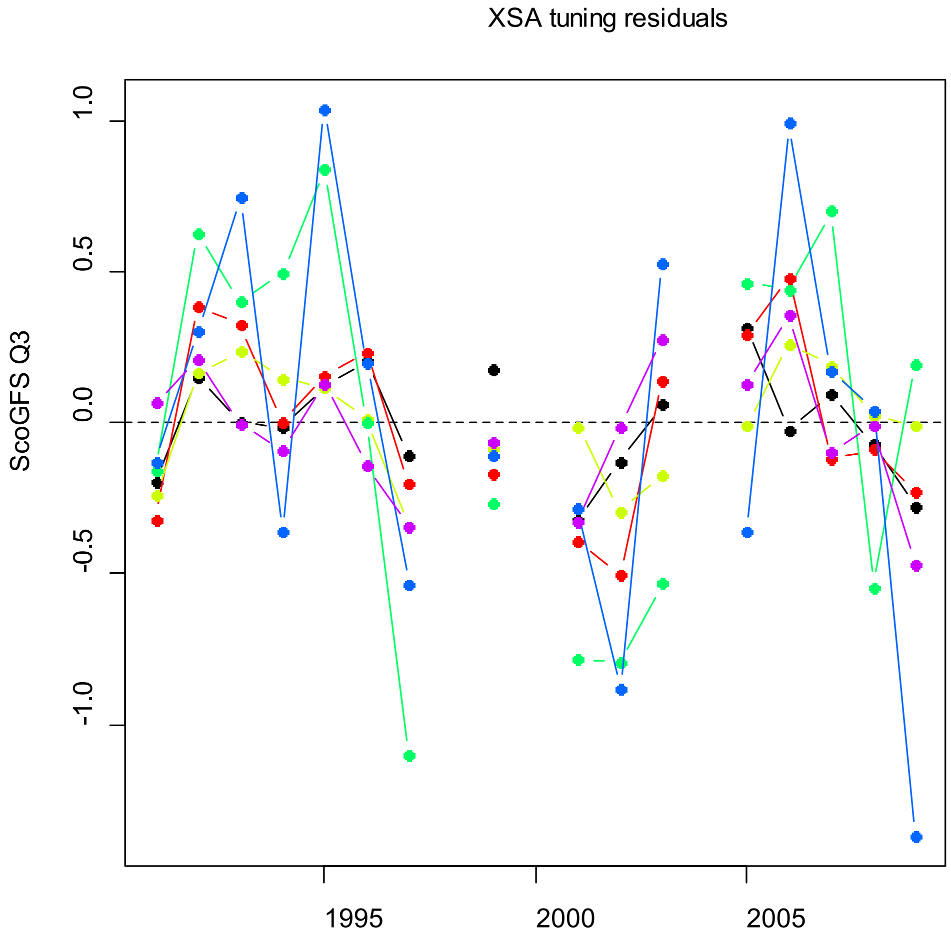

Figure 3. Survey-index catchability residuals from the FLXSA assessment applied to historical Rockall haddock data.

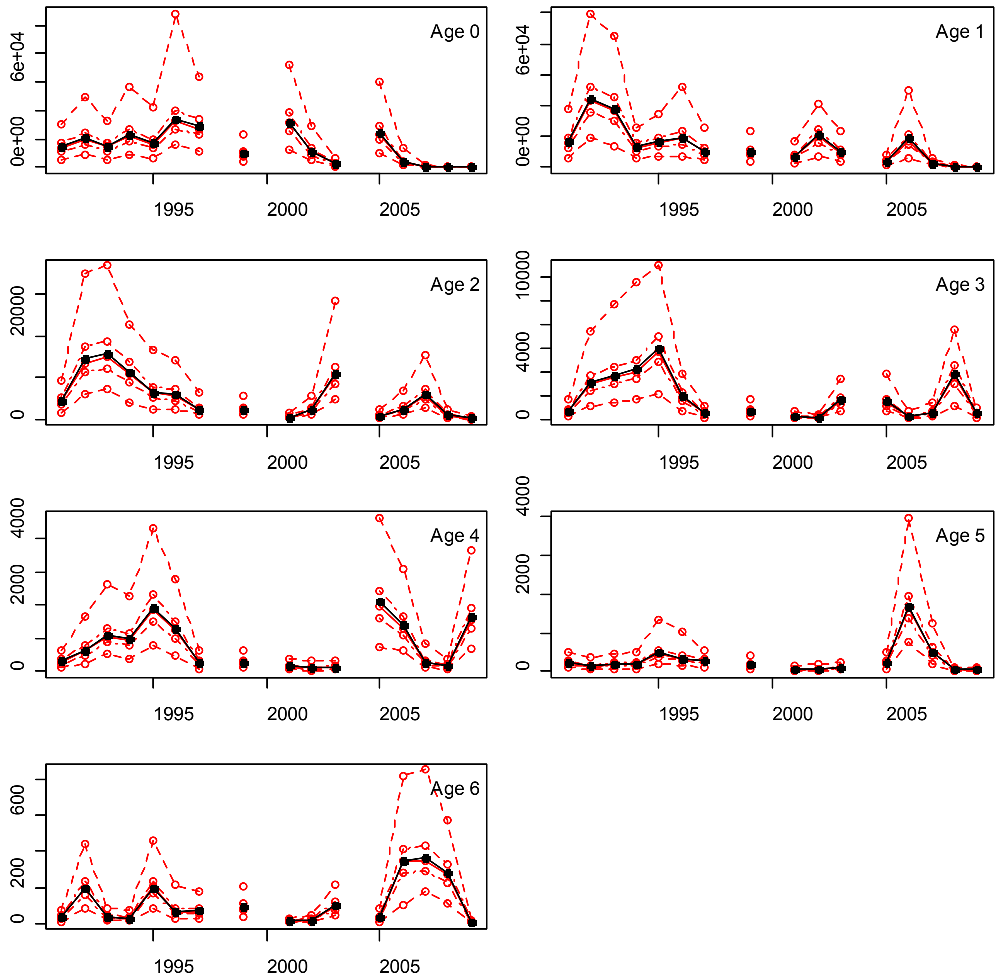

Figure 4. Time-series of research vessel survey indices by age. Black line: values used in the real assessment. Red lines: percentiles (5%, 25%, 50%, 75%, 95%) of distributions of survey indices to which a multiplicative error term has been applied.

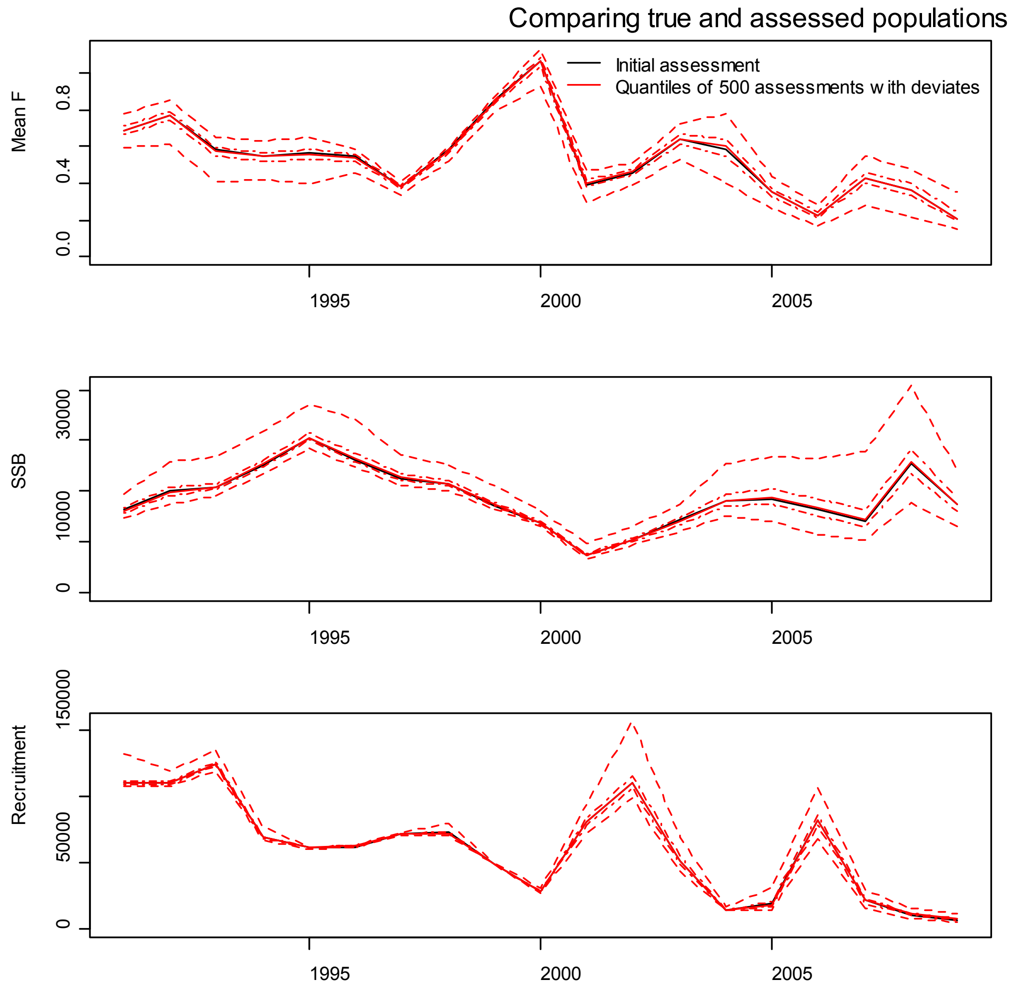

Figure 5. Comparison of summary population values from the standard ("true") assessment (black lines) with those from *K* = 500 iterations including stochastically-generated survey indices (red lines; 5%, 25%, 50%, 75% and 95% quantiles are shown).

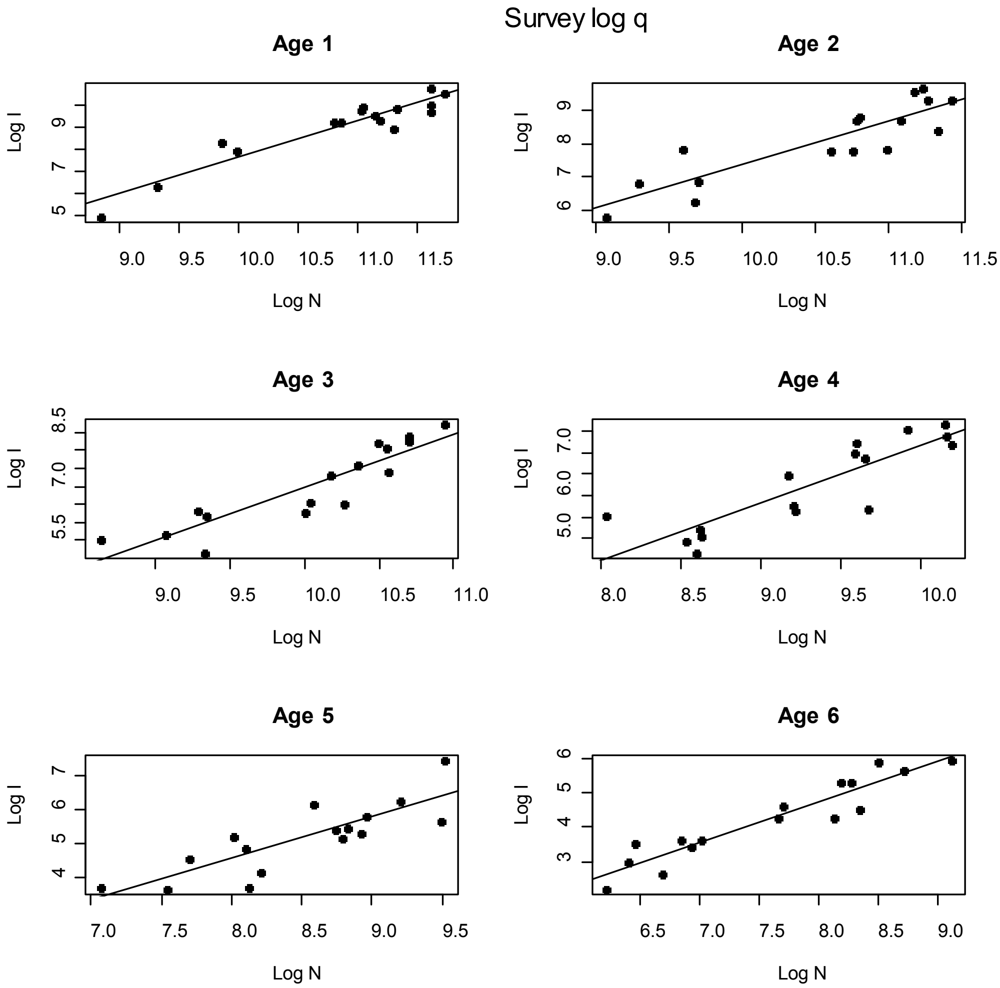

Figure 6. Scatterplots (by age) comparing the logged survey indices (log I) with the logged stock abundance estimates (log N) from the "true" historical assessment. Fitted lines give the best linear relationships.

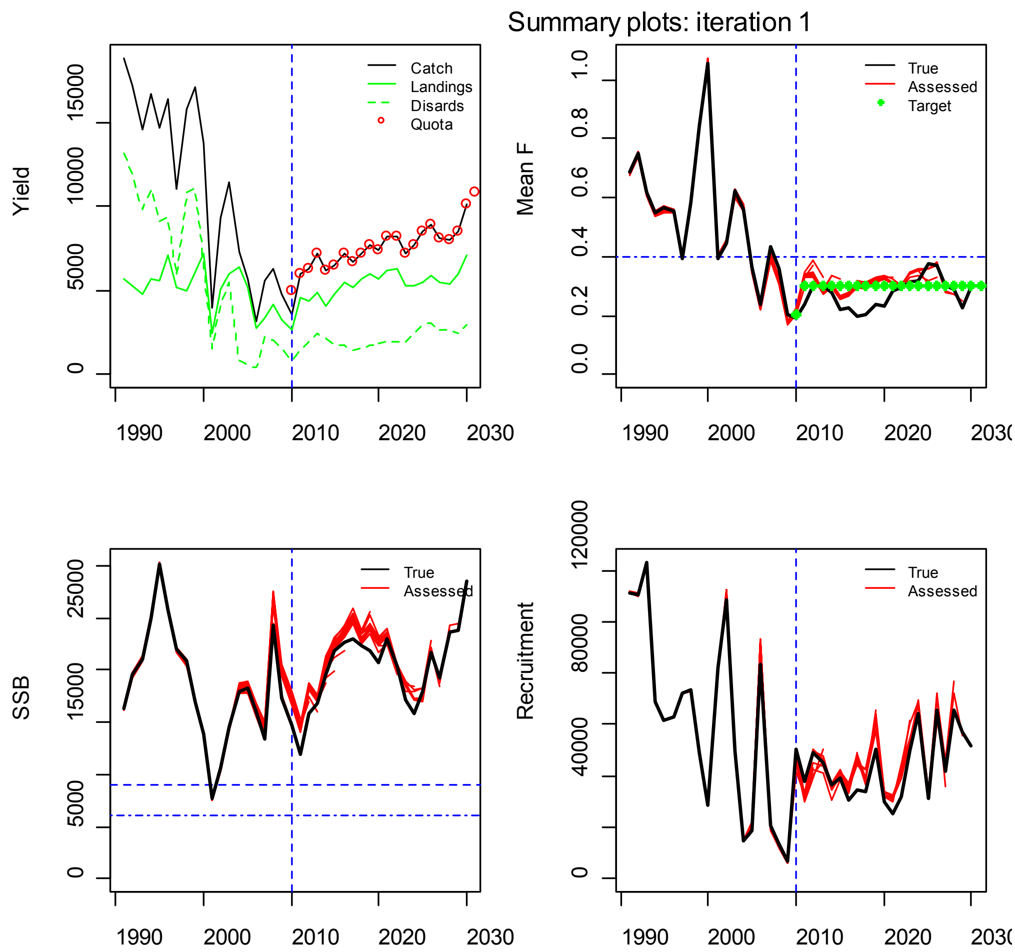

Figure 7. Summary plots for iteration 1 of the Rockall haddock MSE. Here the target *F* is 0.3. For all plots, the vertical blue line denotes the last historical year. Top left: total catch (black solid line), landings (green solid line) and discards (green dashed line). Red circles show the intended TAC for each year. Top right: time series of mean *F*, with true values in black while the assessed values from each year of the forward simulation are shown in red. Green dots indicate the intended mean *F*. The horizontal blue line shows the value of F_{pa}. The same colour scheme is used for SSB (bottom left; horizontal lines show B_{pa} and B_{lim}) and recruitment (bottom right).

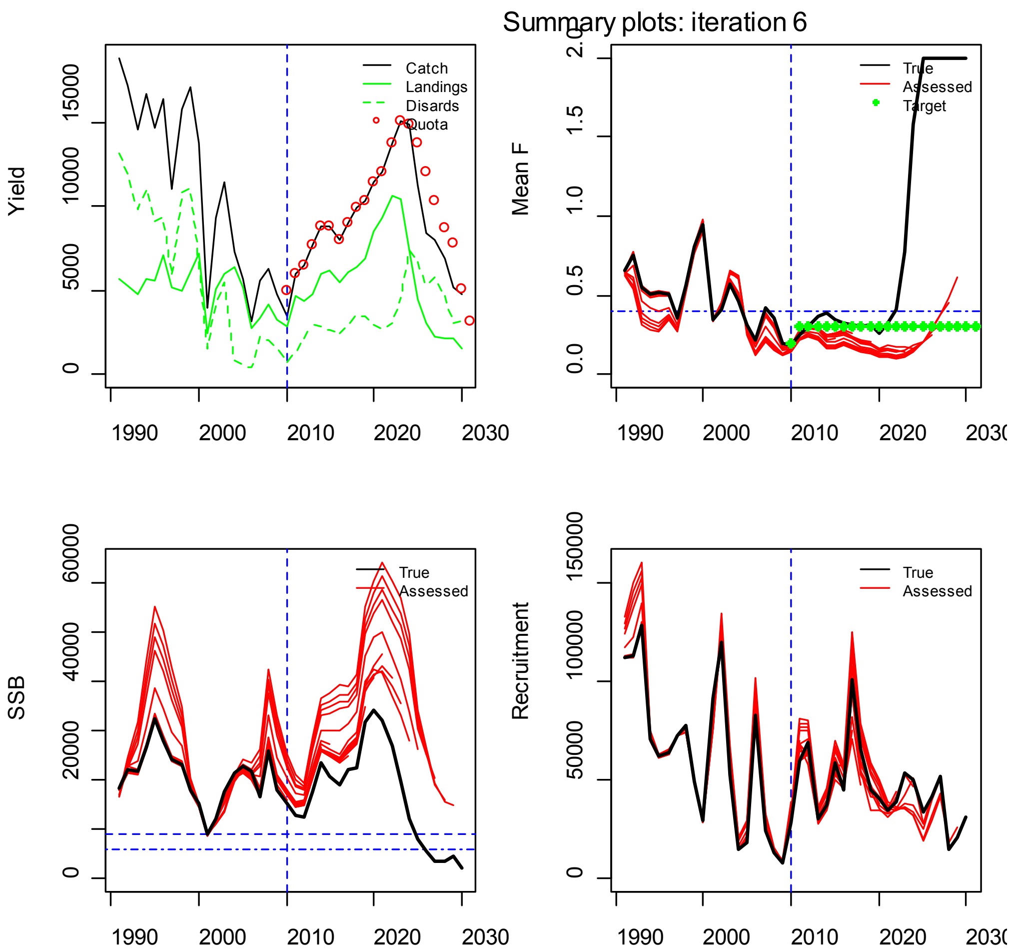

Figure 8. Summary plots for iteration 6 of the Rockall haddock MSE. See caption to Figure 7 for details.

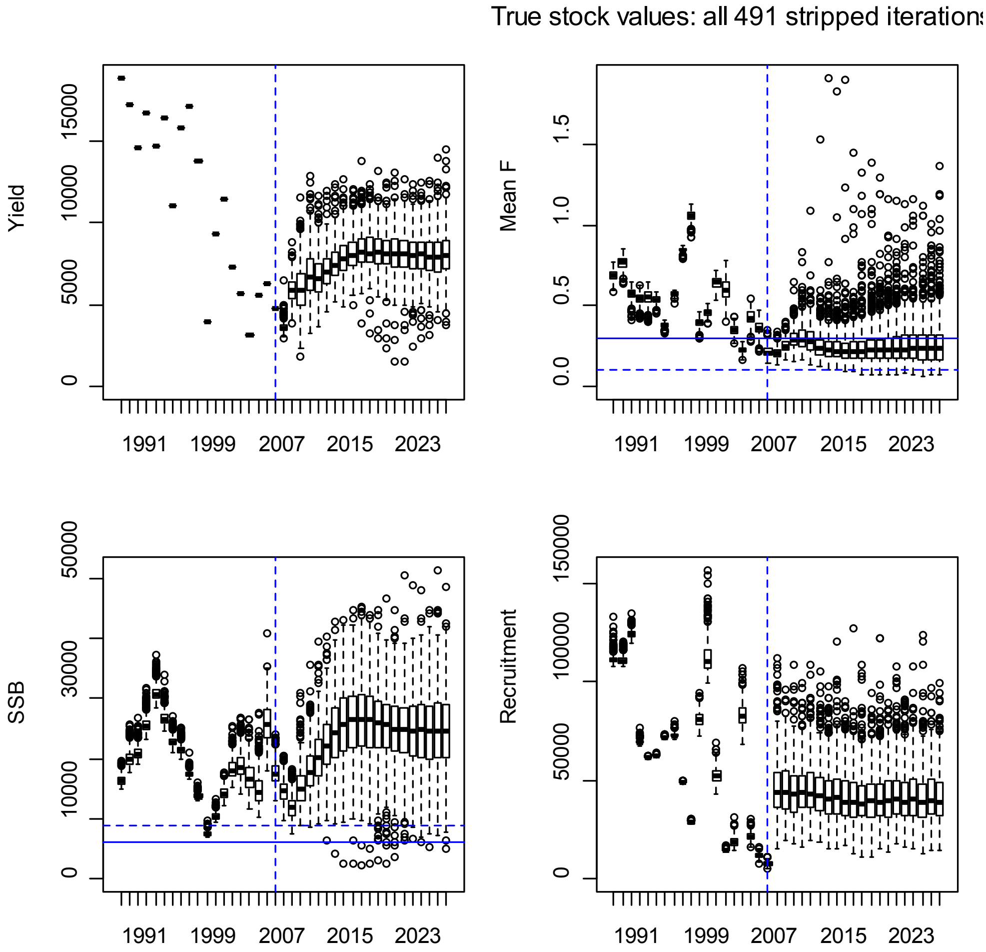

Figure 9. Summary plots true population values from the 491 valid simulation iterations (that is, all those without maximised *F*), with target *F* = 0.3. The short horizontal lines indicate the medians, the boxes the quartiles (25th and 75th percentiles), and the whiskers the 5th and 95th percentiles. Outliers are shown by open circles. The line on the top-right plot shows the target *F* (upper) and *F* = 0.1 (lower), while those on the bottom-left plot show B_{pa} (upper) and B_{lim} (lower). Vertical dashed blue lines show the last historical year.

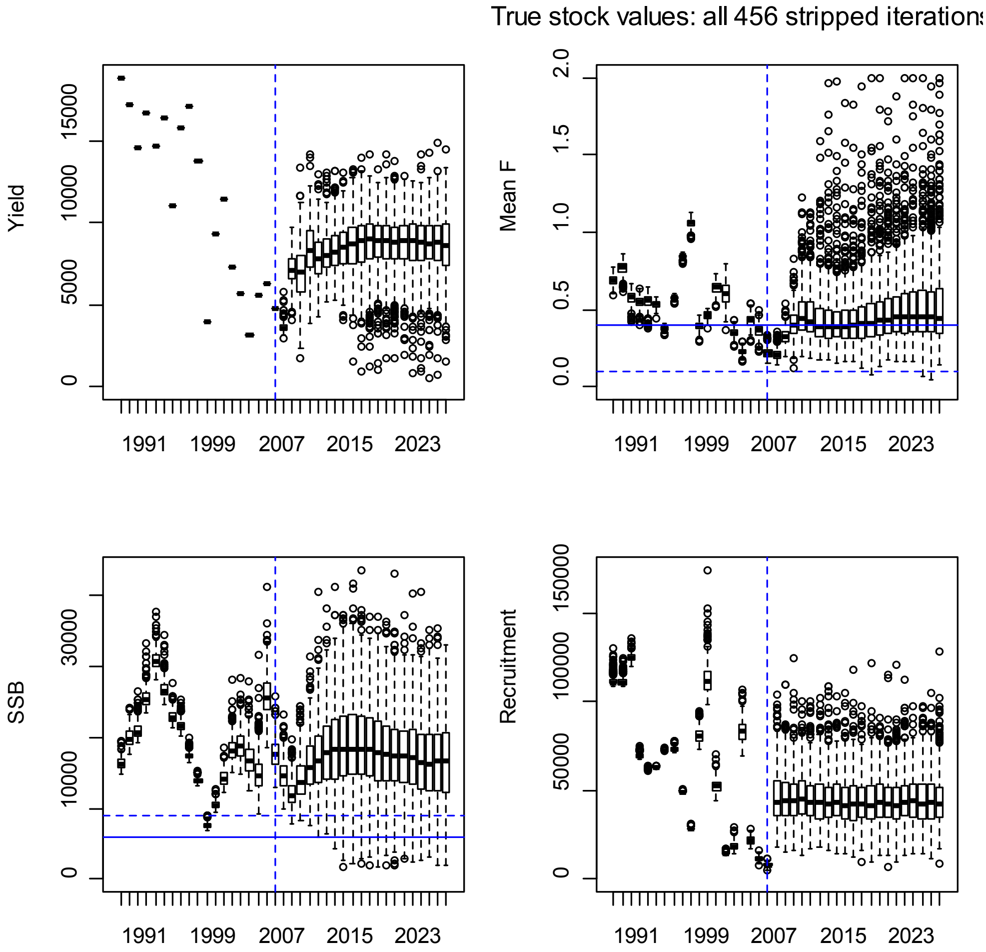

Figure 10. Summary plots true population values from the 456 valid simulation iterations (that is, all those without maximised *F*), with target *F* = 0.4. The short horizontal lines indicate the medians, the boxes the quartiles (25th and 75th percentiles), and the whiskers the 5th and 95th percentiles. Outliers are shown by open circles. The line on the top-right plot shows the target *F* (upper) and *F* = 0.1 (lower), while those on the bottom-left plot show B_{pa} (upper) and B_{lim} (lower). Vertical dashed blue lines show the last historical year.

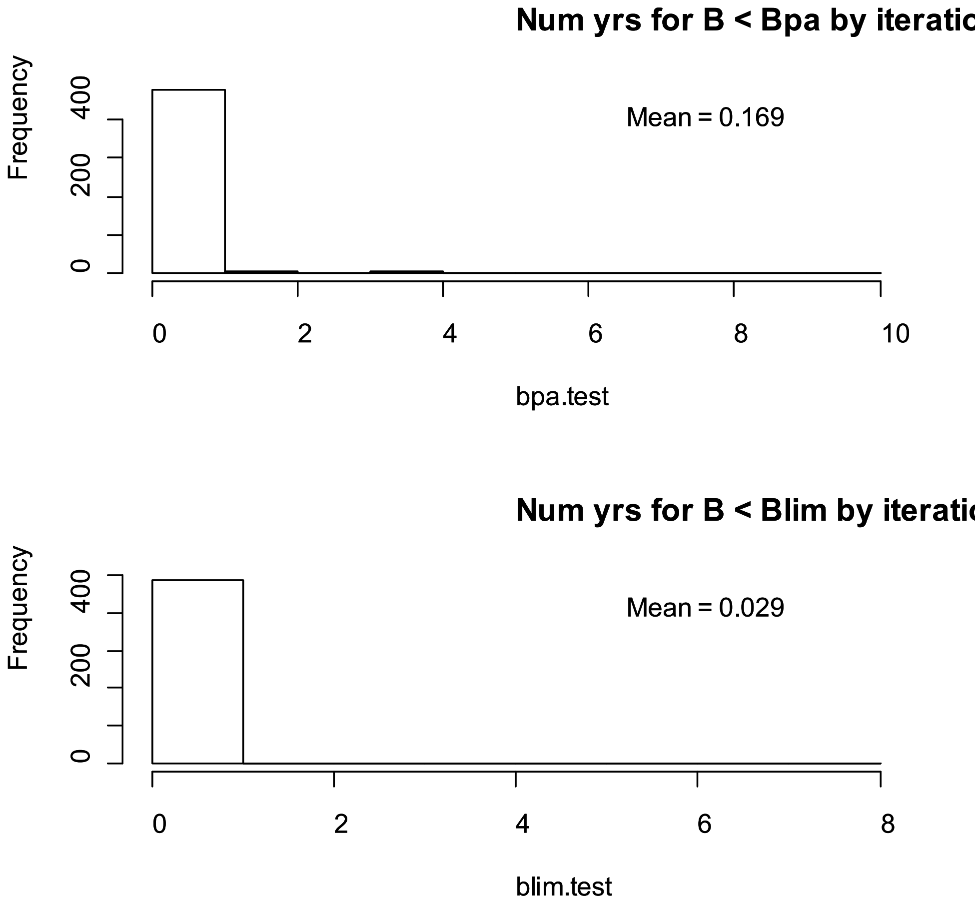

Figure 11. Histograms of the number of years within each iteration (target F = 0.3, 491 valid runs only) in which SSB $B < B_{pa}$ (upper) or $B < B_{lim}$ (lower). The average number of years (out of a maximum total of 20) is given for each case.

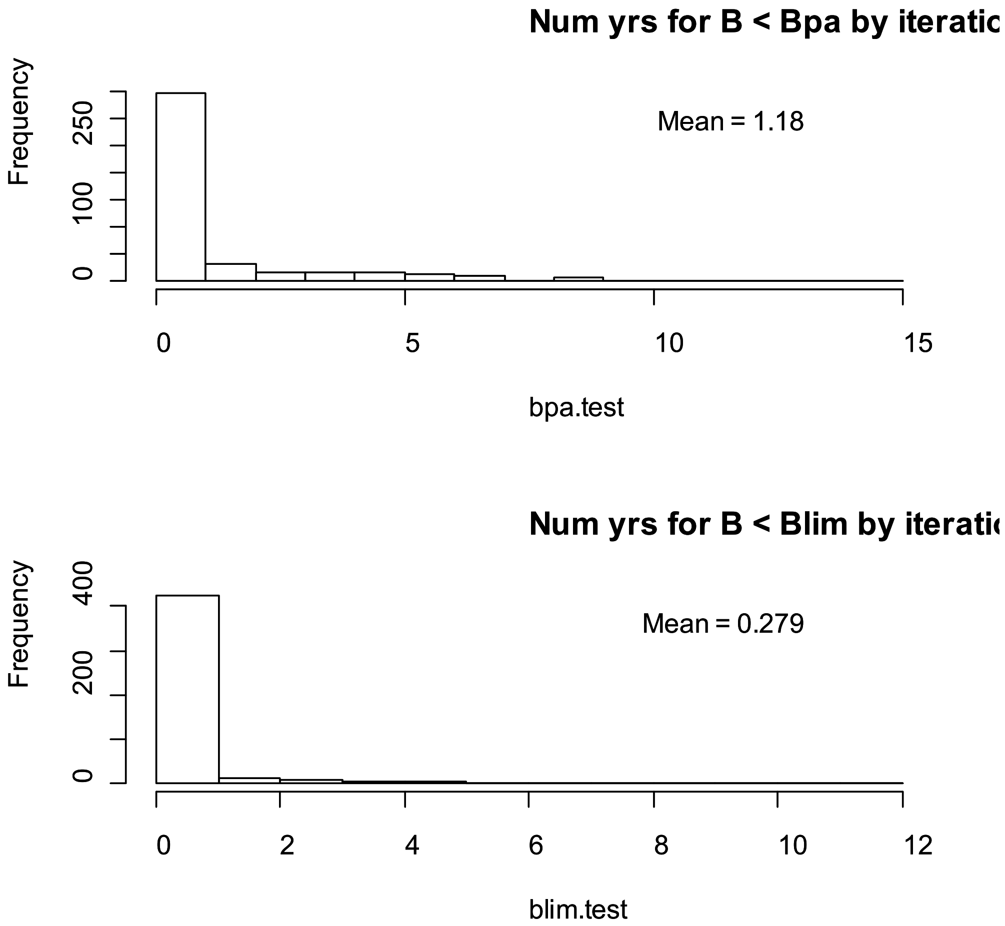

Figure 12. Histograms of the number of years within each iteration (target F = 0.4, 456 valid runs only) in which SSB $B < B_{pa}$ (upper) or $B < B_{lim}$ (lower). The average number of years (out of a maximum total of 20) is given for each case.

Annex 4 - Khlivnoy (2011) Working Document

Draft

The analysis of EU-Russia proposal for harvest control component

of a long-term management plan for haddock at Rockall

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(PINRO)

Introduction

Haddock fishery at the Rockall bank has a long history. Post-war, the importance of the Rockall fishery has fluctuated and the total international landings amounted to 370 000 t. Fishing mortality levels have historically been high but have decreased since 2005. In 2006 and 2009-2010, mortality reached the lowest estimate for the recent 20 years.

The Rockall haddock is characterized by wide interannual fluctuations in abundance, mainly influenced by the rate of egg and larva survival, which, most probably in its turn, depends on the environmental conditions in the spawning period (Jones, 1982; Khlivnoy, 2005; Vinnichenko, Khlivnoy, 2006; Filina, Khlivnoy, Vinnichenko, 2009; Anon., 2009; ICES, 2010; ICES, 2010a). Abundant year-classes appear in the years with both high and low spawning stock. Recruitment for the last four years has been low despite a large SSB. The minimum size of the spawning stock was registered in 2001-2002, when it was beyond the safe biological limits, that, despite faulty estimation, afforded ICES the ground to recommend the reduction in the catch rate to a possible low level. Due to the appearance of above-average year-classes in 2000–2001 and 2005, the haddock stock has increased over the subsequent few years. The recruitments since 2007 are estimated to be extremely weak and there is a high probability that SSB will decrease to levels below Bpa in 2013.

The international landings of haddock are characterized by significant year-to-year variations that are caused by economic reasons and population abundance dynamics. Last years the landings amounted to 3000-6000 t.

The discard rate in the past was as high as 52–87% by numbers by results of discards trips (ICES, 2004; Newton et al., 2004; Khlivnoy, 2004; Khlivnoy, 2006; Anon., 2009). Last years the discards are significantly reduced as a result of the small number of young haddock in population. The discard ratio is around 47% in 1991–2009 and 34% in the recent period (1999–2009). Discards are not reflected in the fisheries statistics that leads to underestimation of total catch. Discards decrease precision of the estimation and entail uncertainties in projection of the stock state. Having few data on reported discards it would be problematic to determine the true size of haddock catch.

It is the opinion of the ICES and NEAFC that it would be beneficial to develop and introduce into fisheries practiccal measures aimed at preventing discards of haddock (ICES, 2010; ICES, 2010a). Elaboration of such measures complies with recommendations under the UNGA Resolution 61/105 that urges states to take action to reduce or eliminate fish discards (UNGA Resolution 61/105, 2007, Chapter VIII, item 60).

In 2010 European Community and Russian Federation have proposed draft the plan for harvest control component of a long-term management plan for haddock at Rockall. NEAFC requests ICES to evaluate this component of the long-term management plan for Rockall haddock (Annex 1).

Methodology for evaluation of harvest control rules

Evaluation of harvest control rules (HCR) was done using simulation model for the population. The following issues for evaluation of harvest control rules were resolved:

- Choice of population model and initial values for simulations
- Inclusion of uncertainty in model
- Choice of harvest control rules for use in the evaluation:
  - the construction of F rules
  - the reduction in F when SSB<Bpa
  - the probability of SSB< Bpa
  - the probability of SSB<Blim
  - the limit on year-to-year variation in catches
  - the reduction in interannual variation in catches when SSB<Bpa
- Comparison of the measures proposed in HCR and other management rules.

The population model was used in the evaluation. Model used the functions VPA (Baranov equation, Popes approximation etc. and Ricker stock-recruitment relationship). The simulations were carried out using the EXCEL.

Included in model were recruitment residuals and assessment errors (the simulations were carried with take into account errors).

Uncertainties in HCR

There is accurate data on the landings only. Discards samples are very poor. There were not annual discards samplings and yield (total catch) had to be simulated. Discards are not reflected in the fisheries statistics that leads to underestimation of total catch and entails uncertainties in projection of the stock state. Furthermore, there are ways of evading TACs including discarding and misreporting. The main uncertainty in the assessment and forecast is estimation of discards. The results of any evaluation of the HCR for haddock at Rockall are applicable only for the existing practice of establishment of quotas on the basis of landings.

Model settings

For all runs 100 iterations for 28 years (2011-2039) were made. The simulations were made for F=0.2, F=0.3, F=0.4 and F=0.5.

Two scenarios of interannual adjusting of TAC were tested:

15 % the limit on year-to-year variation in catches

and proposed in HCR: TACy = TACf + 0.2 * (TACy-1 – TACf).

Limitations for interannual adjusting of TAC were tested also.

Where the SSB in the end of the year is estimated to be below Bpa but above Blim the TAC a fishing mortality rate was taken equal to:

0.5 − 0.4 ×(Bpa − SSB /(Bpa − Blim) for Ftarget=0.5

0.4 − 0.3 ×(Bpa − SSB /(Bpa − Blim) for Ftarget=0.4

0.3 − 0.2 ×(Bpa − SSB /(Bpa − Blim) for Ftarget=0.3

0.2 − 0.1 ×(Bpa − SSB /(Bpa − Blim) for Ftarget=0.2

Input data

The input data for the simulations are used as for Haddock VIb assessment is WGCSE. The chosen population model was:

Recruitment: age 1

Plus group: 7+

Fbar: 2–5

Maturation	
age 1	0
age 2	0
age 3	1
age 4	1
age 5	1
age 6	1
age 7+	1

Natural mortality at age: 0.2.

For long-term forecasting discards and landings, the proportion of discards/landings at age in 1999–2009 was used.

For long-term simulations mean values for the period 1991-2010 were used for stock weights and catch weights

Start Year for runs: 2010

Stock-recruitment relationship

The segmented regression approach with a stochastic term was chosen to generate recruitments. The Ricker stock-recruitment relationship was used. The Ricker recruitment function gives recruitment according to the following function (1):

$R=A*SSB_{y-1}*\exp(-SSB_{y-1}/K)$ (1)

where A and K are constants, SSBy-1 is the spawning stock biomass (tonnes) in year y-1.

Taking into account the recruitment residuals the number of recruits Rsum was modeled using the following equation (2):

$Rsum = R\cdot\exp(\varepsilon_{y-1})$ (2)

where R is the number of recruits by Ricker stock-recruitment relationship, ε is the recruitment residuals in year y-1.

The observed residuals obtained from the results of WGCSE stock assessment lie in the range of -2.053 to 1.02. The residuals for the recruitment simulation were modeled using method of random numbers in the range of -2.053 to 1.02.

The following values of the constants A=16.7 and K=9940.1 were used. The Ricker recruitment stock-recruitment dependence and the recruitment analysis are shown in Figure 1.

Assessment errors

Year-to-year variations of TSB obtained from the results of stock assessment lie in the range of -0.66 to 1.28. The assessment errors for the simulations were modelled using method of random numbers in this range.

Results

32 scenarios of catch rules were simulated. For each run 2800 simulations (100 iteration for 28 years) were made. The results of runs are shown in Table 1. More details of runs are presented in Annex 2.

The probabilities of cases for which SSB is below reference points Bpa (9000 t) for scenarios of 15 % limitation on year-to-year variation in TAC ranged from 3.7 to 16.0%. For proposed in HCR plans equation TACy = TACf + 0.2 * (TACy-1 – TACf) it was from 3.1 to 14.6%.

The probabilities of cases for which SSB is below reference points Blim (6000 t) for 15 % limitation in TAC were 0.0 to 1.18%. In the latter simulation (Ftarget=0.5) three cases were derived when stock collapse was projected.

In the proposed HCR equation the risk of SSB decrease below Blim (6000 t) was found to be low (0.0-0.214%).

There are some details which are not fixed in proposed HCR:

1. What is the procedure to be applied if a stock after using paragraph 2 of HCR is above Bpa but will be below Bpa after applying of paragraph 3 (i.e. TACy >TACf when SSB were before Bpa). Neglecting of this fact leads to the decreasing of SSB below Bpa.
2. Is it necessary to apply interannual adjusting of TAC if SSBy-1 is below Bpa? Applying of limitation of TAC if SSBy-1 is below Bpa leads to a reduction of catches when SSB has high level.

These restrictions of interannual adjusting of TAC were used for some scenarios of runs.

The restriction 1 in which adjusting of TAC is not used if SSBy+1<Bpa resulted in a significant reduction in the probability of risk of decreasing SSB below Blim. And the risk of decreasing SSB below Blim (6000 t) was 0.0% for Ftarget=0.2-0.4 (for all methods of interannual adjusting of TAC).

The restriction 2 in which adjusting of TAC is not used if SSBy-1<Bpa was found to be more important in cases of 15% TAC adjustment.

Application of both restrictions gave a low probability of decreasing SSB below Blim.

For final runs scenarios with limitation on year-to-year variation in TAC which was proposed in HCR plans equation TACy = TACf + 0.2 * (TACy-1 – TACf) and restriction 1 in which adjusting of TAC not used if SSBy+1<Bpa were used. These scenarios give low risk of decreasing SSB below Bpa (5.4% Ftarget =0.3, 9.0% Ftarget =0.3) and below Blim (0.0% Ftarget =0.3-0.4) and high recruitment level. The annual landings (median) for F=0.3-0.4 are at 4034-4368 t and SSB at 15161- 17257 t (Table 2).

Summary plots of the final runs are shown in Figure 2 and Figure 3.

Conclusions

The scenarios with limitation on year-to-year variations in TAC which are proposed in HCR plans (equation TACy = TACf + 0.2 * (TACy-1 – TACf)) and restriction in which adjusting of TAC not used if SSBy+1<Bpa give low risk of decreasing SSB below Bpa and Blim and high recruitment level for both Ftarget 0.3 and 0.4.

The limitations in which adjusting of TAC is not used if SSBy+1<Bpa resulted in a significant reduction in the probability of risk of decreasing SSB below Blim. This limitation needs to be includes in the proposed HCR.

The discard rate in the past was as high as 52–87% by numbers by results of discards trips. Discards are not reflected in the fisheries statistics that leads to underestimation of total catch and consequently of fishing mortality rates. Discards decreas precision of estimates and entails uncertainties in projection of the stock state.

Results of discards trip show that fish with the length of 20-35 cm prevail in catches. The EU minimum legal landing size of 30 cm for haddock forces discarding of fish smaller than 30 cm. It would be wrong to assume that the increase in quotas would reduce the discards.

The setting of the quota at the level of the total catch will result in a significant yield increase compared to TAC. Landings will reach the level of quotas, which will be defined as the total catch, including discards. There are ways of evading TACs including high rates of unreported discarding and misreporting. This can cause collapse of the stock.

It would be beneficial to develop and introduce into fisheries practice measures aimed at preventing discards of haddock (ICES, 2010). Elaboration of such measures complies with recommendations under the UNGA Resolution 61/105 that urges states to take action to reduce or eliminate fish discards (UNGA Resolution 61/105, 2007, Chapter VIII, item 60). As a first stage, it is necessary to work out measures to reduce discards.

In ICES practice TACs of Rockall haddock are established on the basis of projected catches disaggregated into landing and discard components (ICES, 2010; ICES, 2010a).

At present it is impossible to control the total catch. It is needed to disaggregate the TAC into two components: landings and discards. At the same time to prevent the uncontrolled fishing it is needed to develop recommendations on TACs on the basis of landings as only landings are available for control.

Proposal for HCR

Draft EU-Russia proposal for harvest control component of a long-term management plan for haddock at Rockall

In the following, the TACs refer to total catches, not just landings. The TAC must be disaggregated into two components: the landings and the discards. The catch limit for the fishery must be set on the basis of landings.

1. Every effort shall be made to maintain a level of Spawning Stock Biomass (SSB) greater than Bpa and a minimum level of SSB greater than Blim.
2. For [20XX] and subsequent years the Parties agreed to set a TAC to be consistent with a fishing mortality rate of no more than [either Fpa (0.4) or Fmsy

(0.3)] for appropriate age-groups, when the SSB in the end of the year in which the TAC is applied is estimated above Bpa.

3. The Parties agree that the TAC that results from the application of the fishing mortality referred to in paragraph 2 will be adjusted according to the following formula:

   TACy = TACf + 0.2 * (TACy-1 - TACf)

   where TACy is the TAC that is to be set by the management plan, TACy-1 is the TAC that was fixed the previous year and TACf is the TAC resulting from the provisions in paragraphs 1 and 2.

   This paragraph is not applied, when the SSB calculated in paragraph 3 is below Bpa.

4. Where the SSB referred to in paragraph 2 is estimated to be below Bpa but above Blim the TAC shall not exceed a level, which will result in a fishing mortality rate equal to 0.3 − 0.2 ×(Bpa − SSB /(Bpa − Blim) for target F=0.3 or equal to 0.4 − 0.3 ×(Bpa − SSB /(Bpa − Blim) for target F=0.4. This consideration overrides paragraph 3.
5. Where the SSB referred to in paragraph 2 is estimated to be below Blim the TAC shall be set at a level corresponding to a total fishing mortality rate of no more than 0.1. This consideration overrides paragraph 3.

No later than 31 December [20XX], the parties shall review the arrangements in paragraphs1 to 5 in order to ensure that they are consistent with the objective of the plan. This review shall be conducted after obtaining inter alia advice from ICES concerning the performance of the plan in relation to its objective.

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Table 1. Results of long- term stochastic simulations. Probabilities of SSB<Bpa, SSB<Blim and median values of SSB, yield, landings, recruitment and fishing mortality.

F target	Method for interannual adjusting of TAC	Limitations for interannual adjusting of TAC		SSB<Bpa		SSB<Blim		Recruits N* *10-3	SSB t	F	Yield (landings+discards)	Landings t	Total landings t
		SSBy+1<Bpa**	SSBy-1<Bpa***					Percentile	Percentile	Percentile	Percentile	Percentile	Percentile
				N	%	N	%	50	50	50	50	50	50
0,2	15 % fluctuation	No	No	112	4,000	2	0,071	17872	22261	0,164	4551	3279	99996
0,2	15 % fluctuation	No	Yes	117	4,179	3	0,107	19015	21432	0,180	4870	3463	104620
0,2	15 % fluctuation	Yes	No	103	3,679	0	0,000	17838	22287	0,163	4534	3254	99996
0,2	15 % fluctuation	Yes	Yes	107	3,821	0	0,000	18992	21438	0,180	4850	3439	104147
0,2	$TAC_y = TAC_f + 0.2 * (TAC_{y-1} - TAC_f)$	No	No	86	3,071	0	0,000	19757	21203	0,191	4891	3491	107267
0,2	$TAC_y = TAC_f + 0.2 * (TAC_{y-1} - TAC_f)$	No	Yes	87	3,107	0	0,000	19837	21170	0,193	4904	3497	107414
0,2	$TAC_y = TAC_f + 0.2 * (TAC_{y-1} - TAC_f)$	Yes	No	86	3,071	0	0,000	19757	21203	0,191	4891	3491	107198
0,2	$TAC_y = TAC_f + 0.2 * (TAC_{y-1} - TAC_f)$	Yes	Yes	87	3,107	0	0,000	19837	21170	0,193	4904	3497	107358
0,3	15 % fluctuation	No	No	168	6,000	3	0,107	19995	19156	0,220	5472	3668	114157
0,3	15 % fluctuation	No	Yes	195	6,964	4	0,143	22544	17318	0,264	6153	4072	121206
0,3	15 % fluctuation	Yes	No	158	5,643	0	0,000	20074	19142	0,220	5441	3655	113783
0,3	15 % fluctuation	Yes	Yes	180	6,429	0	0,000	22461	17376	0,261	6103	4033	120817
0,3	$TAC_y = TAC_f + 0.2 * (TAC_{y-1} - TAC_f)$	No	No	153	5,464	0	0,000	22748	17253	0,279	6123	4050	122858
0,3	$TAC_y = TAC_f + 0.2 * (TAC_{y-1} - TAC_f)$	No	Yes	159	5,679	0	0,000	23023	17121	0,282	6136	4069	123055
0,3	$TAC_y = TAC_f + 0.2 * (TAC_{y-1} - TAC_f)$	Yes	No	152	5,429	0	0,000	22741	17257	0,279	6119	4043	122858
0,3	$TAC_y = TAC_f + 0.2 * (TAC_{y-1} - TAC_f)$	Yes	Yes	159	5,679	0	0,000	23024	17121	0,282	6135	4065	123055
0,4	15 % fluctuation	No	No	254	9,071	12	0,429	20779	17125	0,254	5768	3670	112811
0,4	15 % fluctuation	No	Yes	341	12,179	15	0,536	24955	14946	0,343	7038	4360	128825
0,4	15 % fluctuation	Yes	No	219	7,821	0	0,000	20758	17122	0,257	5728	3706	114567
0,4	15 % fluctuation	Yes	Yes	280	10,000	0	0,000	24897	15226	0,336	6896	4299	128000
0,4	$TAC_y = TAC_f + 0.2 * (TAC_{y-1} - TAC_f)$	No	No	263	9,393	2	0,071	25995	15151	0,358	6925	4374	129681
0,4	$TAC_y = TAC_f + 0.2 * (TAC_{y-1} - TAC_f)$	No	Yes	278	9,929	2	0,071	26218	14967	0,365	6992	4423	129903
0,4	$TAC_y = TAC_f + 0.2 * (TAC_{y-1} - TAC_f)$	Yes	No	252	9,000	0	0,000	25970	15161	0,358	6920	4368	129573
0,4	$TAC_y = TAC_f + 0.2 * (TAC_{y-1} - TAC_f)$	Yes	Yes	271	9,679	0	0,000	26218	14993	0,364	6985	4418	129768
0,5	15 % fluctuation	No	No	290	10,357	11	0,393	20751	16508	0,248	5268	3536	107743
0,5	15 % fluctuation	No	Yes	446	15,929	33*	1,179	26732	13284	0,397	7528	4453	129710
0,5	15 % fluctuation	Yes	No	273	9,750	2	0,071	20801	16508	0,252	5367	3590	108646
0,5	15 % fluctuation	Yes	Yes	403	14,393	2	0,071	26821	13495	0,397	7364	4482	129437
0,5	$TAC_y = TAC_f + 0.2 * (TAC_{y-1} - TAC_f)$	No	No	388	13,857	6	0,214	28159	13355	0,424	7605	4576	132392
0,5	$TAC_y = TAC_f + 0.2 * (TAC_{y-1} - TAC_f)$	No	Yes	410	14,643	6	0,214	28500	13176	0,435	7684	4636	132727
0,5	$TAC_y = TAC_f + 0.2 * (TAC_{y-1} - TAC_f)$	Yes	No	379	13,536	5	0,179	28154	13369	0,423	7577	4561	132392
0,5	$TAC_y = TAC_f + 0.2 * (TAC_{y-1} - TAC_f)$	Yes	Yes	403	14,393	5	0,179	28503	13206	0,434	7659	4620	132660

*- including 3 cases of the collapse of stock, **- adjusting of TAC not used if SSBy+1<Bpa, ***- adjusting of TAC not used if SSBy-1<Bpa including 3 cases of the collapse of stock

Table 2. Results of the final simulations. Probabilities of SSB<Bpa, SSB<Blim and median values of SSB, yield, landings, recruitment and fishing mortality.

F target	Method for interannual adjusting of TAC	Limitations for interannual adjusting of TAC		SSB<Bpa		SSB<Blim		Recruits N* *10-3	SSB t	F	Yield	Landings t
		SSBy+1<Bpa**	SSBy-1<Bpa***					Percentile	Percentile	Percentile	Percentile	Percentile
				N	%	N	%	50	50	50	50	50
0,2	$TAC_y = TAC_f + 0.2 * (TAC_{y-1} - TAC_f)$	Yes	No	86	3,071	0	0,000	19757	21203	0,191	4891	3491
0,2	$TAC_y = TAC_f + 0.2 * (TAC_{y-1} - TAC_f)$	Yes	Yes	87	3,107	0	0,000	19837	21170	0,193	4904	3497
0,3	$TAC_y = TAC_f + 0.2 * (TAC_{y-1} - TAC_f)$	Yes	No	152	5,429	0	0,000	22741	17257	0,279	6119	4043
0,3	$TAC_y = TAC_f + 0.2 * (TAC_{y-1} - TAC_f)$	Yes	Yes	159	5,679	0	0,000	23024	17121	0,282	6135	4065
0,4	$TAC_y = TAC_f + 0.2 * (TAC_{y-1} - TAC_f)$	Yes	No	252	9,000	0	0,000	25970	15161	0,358	6920	4368
0,4	$TAC_y = TAC_f + 0.2 * (TAC_{y-1} - TAC_f)$	Yes	Yes	271	9,679	0	0,000	26218	14993	0,364	6985	4418
0,5	$TAC_y = TAC_f + 0.2 * (TAC_{y-1} - TAC_f)$	Yes	No	379	13,536	5	0,179	28154	13369	0,423	7577	4561
0,5	$TAC_y = TAC_f + 0.2 * (TAC_{y-1} - TAC_f)$	Yes	Yes	403	14,393	5	0,179	28503	13206	0,434	7659	4620

- adjusting of TAC not used if SSBy+1<Bpa, *- adjusting of TAC not used if SSBy-1<Bpa including 3 cases of the collapse of stock

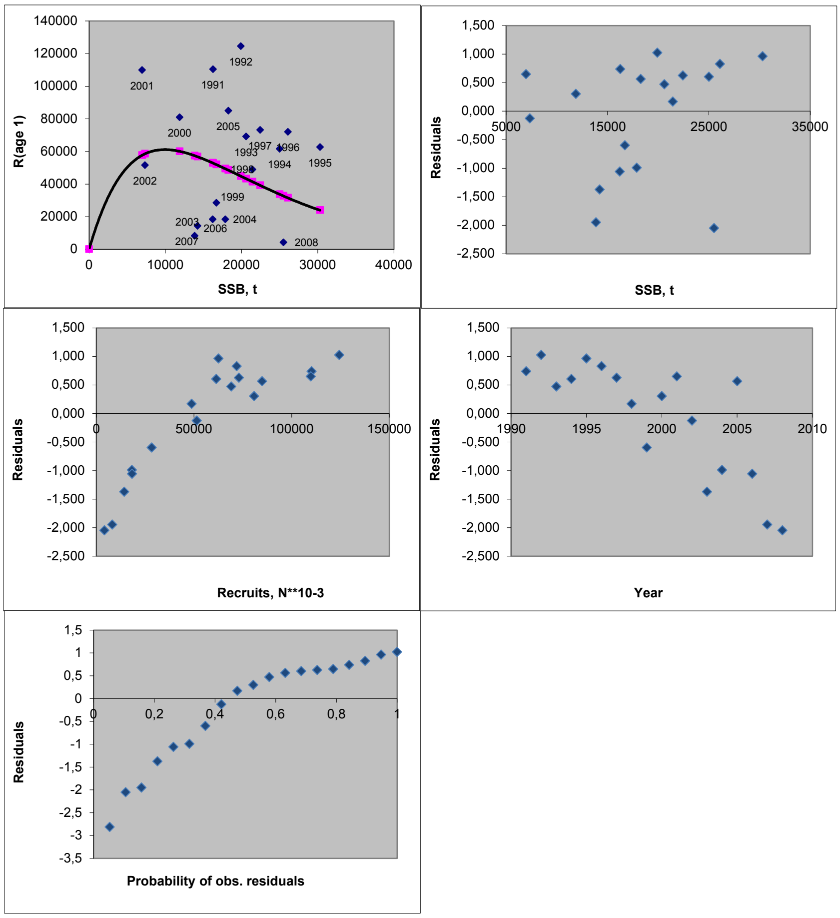


Figure 1. The Ricker recruitment stock-recruitment dependence and the recruitment analysis.

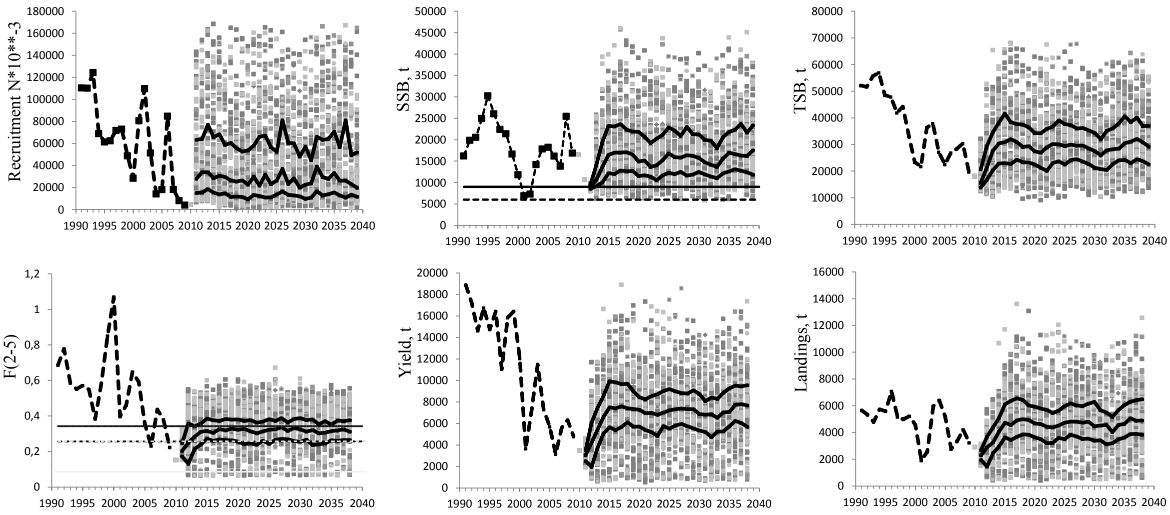


Figure 2. Results of simulation with Ftarget 0.4, limitation on year-to-year variation in TAC by equation TACy = TACf + 0.2 * (TACy-1 – TACf) and restriction 1 in which adjusting of TAC not used if SSBy+1<Bpa were used. Solid lines is 25-th, 50-th and 75-th percentiles.

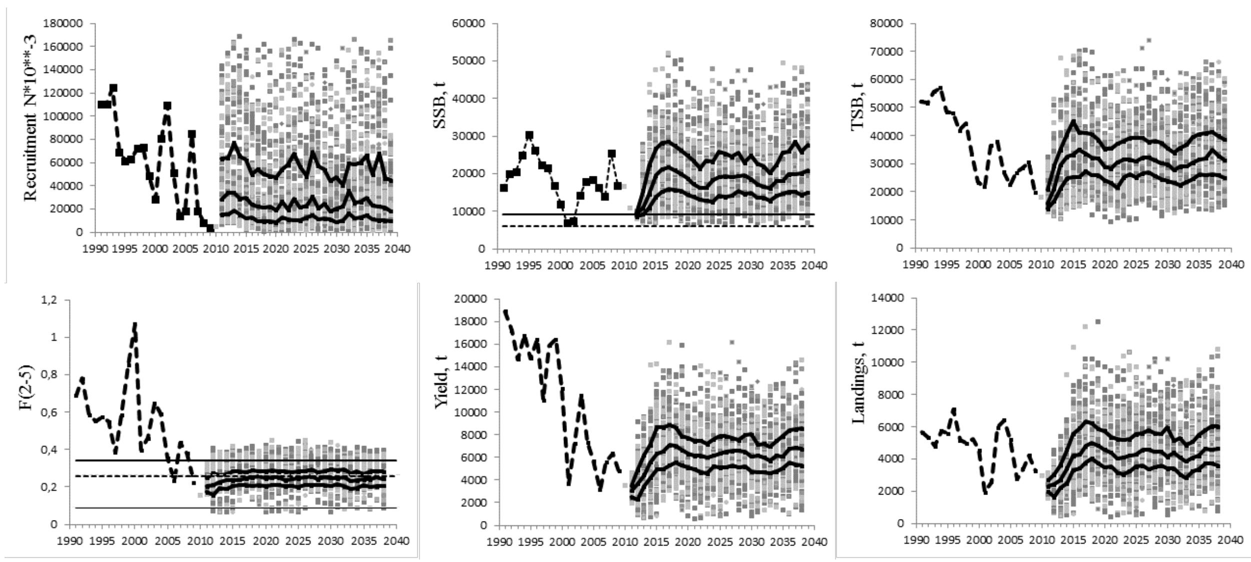


Figure 3. Results of simulation with Ftarget 0.3, limitation on year-to-year variation in TAC by equation TACy = TACf + 0.2 * (TACy-1 – TACf) and restriction 1 in which adjusting of TAC not used if SSBy+1<Bpa were used. Solid lines is 25-th, 50-th and 75-th percentiles.

Annex 5 Draft EU-Russia proposal for harvest control component of a long-term management plan for haddock at Rockall

In the following, the TACs refer to total catches, not just landings.

1. Every effort shall be made to maintain a level of Spawning Stock Biomass (SSB) greater than Bpa and a minimum level of SSB greater than Blim.
2. For [20XX] and subsequent years the Parties agreed to set a TAC to be consistent with a fishing mortality rate of no more than [either Fpa (0.4) or Fmsy (0.3)] for appropriate age-groups, when the SSB in the end of the year in which the TAC is applied is estimated above Bpa.
3. The Parties agree that the TAC that results from the application of the fishing mortality referred to in paragraph 2 will be adjusted according to the following formula:

   TACy = TACf + 0.2 * (TACy-1 - TACf)

   where TACy is the TAC that is to be set by the management plan, TACy-1 is the TAC that was fixed the previous year and TACf is the TAC resulting from the provisions in paragraphs 1 and 2.

4. Where the SSB referred to in paragraph 2 is estimated to be below Bpa but above Blim the TAC shall not exceed a level, which will result in a fishing mortality rate equal to 0.3 − 0.2 ×(Bpa − SSB /(Bpa − Blim). This consideration overrides paragraph 3.
5. Where the SSB referred to in paragraph 2 is estimated to be below Blim the TAC shall be set at a level corresponding to a total fishing mortality rate of no more than 0.1. This consideration overrides paragraph 3.

No later than 31 December [20XX], the parties shall review the arrangements in paragraphs1 to 5 in order to ensure that they are consistent with the objective of the plan. This review shall be conducted after obtaining inter alia advice from ICES concerning the performance of the plan in relation to its objective.

Annex 6 Tables 1 - 7

Table 1. Results of long- term stochastic simulations. Probabilities of SSB<Bpa, SSB<Blim and values of SSB, yield, landings, recruitment and fishing mortality. Settings: F target=0.3, 15 % the limit on year-to-year variation in catches, no addition restriction in variation of catches

			Recruits *1000			TSB			SSB			F			Catch (landing+discards),t			Landing,t			Landing,t
Iteration N	SSB<Bpa (N)	SSB<Blim (N)	25 Percent	50 Percentil	75 Percent	25 Percent	50 Percent	75 Percent	25 Percent	50 Percent	75 Percent	25 Percent	50 Percent	75 Percent	25 Percent	50 Percent	75 Percent	25 Percent	50 Percent	75 Percent	Total
1	2	0	12376,4	28536,505	51043,18	23477,82	32572,97	41682,51	13424,37	16274,81	28010,78	0,177811	0,222217	0,327472	4398,925	5460,742	6588,625	2873,254	3594,47	5080,389	115467,8
2	1	0	15016,76	28422,571	49555,68	27113,32	31733,65	36073,66	16233,54	19809,77	23825,01	0,205936	0,24624	0,316015	4383,058	6313,821	7157,385	2931,577	4337,073	5079,437	115444,6
3	3	0	10173,02	20433,387	34975,97	19622,1	37053,9	46505,26	13220,14	23016,6	30404,92	0,069919	0,173394	0,261308	2051,802	3497,974	6751,257	1669,824	3070,501	4492,81	97982,84
4	2	0	11552,51	25078,178	54644,88	22425,2	29405,52	33930,81	14028,75	18056,21	21769,99	0,202285	0,251632	0,292918	4413,565	5193,158	6580,373	2892,323	3765,234	4696,656	118637,3
5	1	0	7169,257	12521,603	42924,79	22207,03	33317,79	41505,86	12802,49	20003,11	32604,24	0,108202	0,155757	0,248602	2884,847	4019,935	5628,978	1974,784	3052,697	4222,792	92855,52
6	3	0	7472,984	11385,387	32264,09	18216,31	32023,87	39363,8	10909,11	17453,6	30192,01	0,110921	0,166892	0,241481	2323,941	4064,588	5860,709	1853,498	3070,332	4773,712	92224,94
7	0	0	5107,94	11162,726	40051,86	27209,93	35530,42	42462,27	14771,87	22054,53	31255,56	0,056386	0,193913	0,255328	2114,713	3849,986	6149,761	1848,6	3386,535	4279,625	91077,66
8	0	0	7698,547	36320,385	55927,52	24447,91	36517,36	50474,12	14254,15	18287,02	32304,99	0,167844	0,239189	0,286947	4590,276	6321,361	7994,398	2931,577	4452,893	5852,464	127845,3
9	3	0	4821,397	17185,373	35141,07	23842,5	35334,52	39693,2	12816,54	25356,92	30645,91	0,152875	0,211648	0,258382	3400,459	5557,306	6951,228	2577,382	3746,086	5183,254	114070,7
10	0	0	10023,46	24830,324	57406,57	27856,08	33248,44	45351,42	14914,82	20418,81	31134,18	0,217947	0,232628	0,269678	5254,512	6423,726	8906,253	3314,108	4004,579	6577,45	142399,2
11	0	0	5457,475	17560,773	41322,28	26231,51	38493,56	49336,45	13151	20488,96	37959,15	0,152875	0,201865	0,268279	4066,557	6184,726	7995,265	2748,136	4389,846	6462,633	132059,7
12	1	0	8040,118	15233,233	52663,81	31196,23	39214,89	45021,02	16871,19	27618,37	39584,94	0,070231	0,143241	0,192666	2326,275	3537,974	5685,941	1964,634	2826,774	3944,724	94751,03
13	0	0	6649,005	12120,65	47685,98	24568,92	37001,24	49104,95	13474,22	22438,27	33791,35	0,070322	0,184952	0,2207	2667,981	4057,666	5282,415	2386,325	2883,568	3783,45	89231,72
14	1	0	11027,93	31468,837	61376	29943,07	36796,69	41670,5	14677,96	21672,25	29267,77	0,217265	0,281829	0,317877	5872,923	6995,456	7863,766	3474,23	4699,216	5757,442	135358,9
15	1	0	8358,995	12645,312	49426,2	20831,92	26979,51	36118,53	10764,45	16307,52	22369,8	0,220162	0,252275	0,306803	4497,672	5622,08	6909,894	2849,879	3798,491	4986,514	117008,5
16	2	0	8077,587	15138,615	32479,34	21066,94	29602,94	38116,97	12141,22	17041,82	25700,5	0,101182	0,211914	0,272024	2869,947	4232,786	5554,705	2090,691	3014,65	4235,423	88636,45
17	3	0	12607,09	22913,307	41651,65	21205	27934,07	32047,68	11495,49	17393,42	21231,76	0,259128	0,292347	0,346599	4819,224	5731,708	6743,186	2989,096	4281,373	4999,714	118943,4
18	1	0	13947,59	23130,646	41462,24	20112,19	31828,18	35589,38	11606,18	18631,27	22598,64	0,20682	0,262061	0,326195	4003,35	5889,201	6909,793	2699,981	4277,897	4729,456	113808,8
19	0	0	10968,11	17251,494	49912,84	22847,18	27224,49	32951,09	13545,17	17511,16	22779,28	0,157318	0,223336	0,301842	3742,779	4944,311	5760,549	2664,134	3362,54	4242,79	98849,46
20	0	0	12162	23818,648	56817,28	28068,96	32335,43	35775,28	16677,36	20196,98	23803,38	0,218377	0,245098	0,267804	5294,822	5745,549	6171,343	3644,141	4103,99	4315,676	114517,2
21	3	0	9835,089	30231,873	58748,89	28627,43	32764,62	45135,67	15862,84	20701,08	27745,91	0,214012	0,246909	0,30475	5471,85	6389,596	7700,91	3420,75	4375,651	5773,875	133903,2
22	2	0	4666,826	11325,144	39145,18	18562,47	32531,91	45605,16	11154,39	21868,2	32389,55	0,067928	0,088231	0,143915	1516,225	2774,952	4220,355	1192,879	1953,2	2935,161	79878,5
23	1	0	15416,53	27779,894	48832,73	26250,07	30714,01	36318,78	16516,01	19575,97	23119,81	0,23546	0,256506	0,276845	5091,535	6187,437	6604,965	3386,785	4129,061	4900,263	119297,8
24	2	0	9944,263	16833,473	39149,01	18334,41	27367,12	38149,61	11636,88	16135,75	26351,53	0,194349	0,241768	0,274008	3497,974	5308,404	6997,875	2413,063	3569,865	4529,365	107943,8
25	2	0	10791,13	18148,318	60014,24	22954,4	34437,78	38792,09	10679,97	18871,68	27395,48	0,213479	0,260671	0,310804	3928,699	6486,31	7261,935	2683,618	4477,163	5416,849	120291,6
26	1	0	8610,944	17645,896	38385,42	25738,49	33512,94	42059,34	15092,65	22049,91	35597,89	0,073363	0,156725	0,283355	2559,051	4401,06	5820,402	2095,148	3077,626	4392,467	95251,41
27	0	0	7571,069	26870,045	56875,31	30716,43	34752,77	40535,2	16957,3	24407,12	29964,72	0,148696	0,19965	0,269368	4066,034	6367,731	7322,89	3079,349	4485,472	5159,304	121617,7
28	2	0	8016,929	14362,836	40050,92	26667,72	29380,38	34292,33	15696,18	16984,13	22644,9	0,064605	0,190126	0,241183	1779,758	3497,974	5138,079	1501,466	2931,577	3690,085	77889,19
29	4	0	5311,227	12441,603	47265,06	22301,56	39049,65	45349,11	12343,76	25616,72	35957,24	0,139604	0,173702	0,249504	3581,774	4736,896	7019,754	2623,234	3264,014	5057,19	115283,3
30	3	0	14435,69	25013,238	51498,15	26196,94	34443,41	42871,08	15048,73	20050,16	26605,36	0,194694	0,250199	0,334542	5115,354	6378,592	7158,963	3040,056	4082,262	5282,141	129494,2
31	1	0	4967,957	18872,971	40447,77	25562,43	33853,7	43629,43	12605,72	20256,25	33719,56	0,162177	0,185265	0,232846	3392,291	4989,561	5910,211	2179,374	3057,661	4530,978	104883,8
32	0	0	10887,86	35679,602	54369,34	27267	31066,48	35328,27	14161,98	18990,61	22825,44	0,229031	0,26586	0,32783	5247,827	6035,001	6468,223	3352,019	4060,142	4866,413	119806,4
33	1	0	9620,301	20949,432	45201,49	26280,92	34441,02	37651,73	13703,54	22866,64	29842,29	0,08428	0,18551	0,251923	2422,031	3910,29	6685,242	1860,411	2968,303	4504,945	99838,45
34	3	0	7309,122	13366,073	37975,79	24627,1	36296,38	42968,34	13932,66	22693,03	35980,61	0,110039	0,164212	0,242299	3207,304	4877,909	6419,002	2455,872	3108,402	5022,928	104489,3
35	4	0	10063,12	17155,145	32724,34	18331,09	23439,2	33027,51	10670,53	16036,46	23489,35	0,066042	0,213294	0,285539	1615,079	3587,803	4651,764	1271,561	2550,642	3252,471	76668,82
36	1	0	13756,64	27879,25	50642,47	26055,76	31579,14	40057,03	15935,73	19348,43	26328,4	0,152875	0,246703	0,291227	3881,138	5843,987	6906,067	2931,577	3943,919	4933,733	111325,9
37	7	1	4807,73	12978,373	30082,64	16524,79	33462,43	48394,24	9664,282	15374,17	37086,32	0,100717	0,134604	0,192368	2421,67	3497,974	4870,843	1579,091	2435,184	3856,251	87969,46
38	2	0	4762,424	14639,651	41469,17	22736,2	33219,89	44365,48	12093,87	21369,64	39604,17	0,077626	0,122146	0,196154	2284,629	3497,974	5006,555	1407,926	2931,577	4037,198	86834,31
39	1	0	12113,67	25148,163	49192,36	22517,69	25866,05	36152,06	12951,94	15537,94	20116,61	0,205142	0,256936	0,317807	4262,548	4943,45	6414,891	2978,663	3340,488	3860,314	107078,7
40	0	0	15746,56	23443,559	43140,47	23260,7	33833,63	41445	13809,13	19680,56	26212,86	0,176856	0,242438	0,265945	3503,851	5520,059	7176,689	2560,932	4094,525	5179,703	109787,1
41	4	0	10708,49	30005,418	46127,18	22525,68	30427,69	37844,39	11106,27	17922,05	26571,08	0,194485	0,252059	0,304089	4209,364	6110,303	7188,592	2931,577	3958,633	5775,311	118918,9
42	2	0	7131,169	24703,073	53301,87	24257,81	30279,73	39023,35	14542,51	18219,36	27968,51	0,118484	0,194206	0,232619	2694,771	4016,144	5472,436	2096,438	2992,782	3754,322	91464,52
43	2	0	4794,204	24305,26	65711,76	26713,54	38927,52	52823,31	15538,81	22626,22	35796,46	0,152875	0,188214	0,212642	4276,491	5588,689	6507,492	2795,388	3722,673	5058,591	122248,9
44	2	0	12990,85	31013,151	54365,17	26279,06	30453,57	34583,45	15257,14	18079,96	22960,64	0,212745	0,259638	0,298291	5503,555	6065,979	6818,918	3710,602	4105,319	4808,15	127162,1
45	1	0	13693,91	26479,577	58093,59	29424,42	33987,07	35758,86	14905,51	19080,93	25815,43	0,207245	0,283142	0,325816	4097,92	6633,143	7721,538	2958,525	4430,152	5457,316	125749,1
46	0	0	5277,935	20247,354	38455,81	23811,65	33693,81	42256,58	12524,81	21055,43	33914,92	0,088014	0,130612	0,216296	2596,115	3759,918	4972,492	1766,861	2931,577	3611,278	86518,81
47	1	0	8519,531	22235,147	76693,65	24992,27	33247,25	40858,26	13269,19	19846,08	25715,86	0,223675	0,27148	0,334052	5267,878	6953,259	7710,5	3417,238	4081,375	5768,57	130299,4
48	2	0	8435,101	13728,411	35321,18	28159,25	33119,8	42671,47	14947,76	20287,02	30900,44	0,09754	0,233874	0,276254	3432,652	5103,17	6003,73	2405,318	3978,126	4542,865	101644,9
49	1	0	9270,571	34392,539	50817,79	23370,5	34031,3	46993,94	12602,92	16839,47	32135,04	0,177614	0,213833	0,308908	4623,207	6114,192	7402,058	2819,368	3960,93	6087,297	125014
50	0	0	7782,54	25227,617	57038,87	25322,06	33613,97	37552,73	15595,7	22148,24	25488,83	0,213198	0,226412	0,260303	4214,864	6240,733	6784,246	2931,577	4362,161	5055,082	117902,6
51	6	0	6343,557	18192,478	44954	19599,79	31590,51	53566,87	9181,655	19130,82	14597,45	0,137569	0,200945	0,295518	3497,974	5838,329	7780,498	2301,203	3493,14	2931,577	130914,4
52	1	0	9368,523	29361,534	41924,65	26335,95	34116,72	43322,95	12663,58	19484,9	29428,1	0,160615	0,216092	0,32066	4066,449	5675,181	7103,095	2773,841	4009,836	5188,142	119417,7
53	3	0	8234,162	16229,163	45613,34	21047,58	35582,61	43731,45	11307,22	21829,81	32244,19	0,1798	0,211419	0,252075	3847,647	5797,824	6815,495	2668,805	3736,759	5681,058	117753,8
54	3	1	5990,956	18364,987	42846,36	26767,86	32777,9	39131,73	16624,32	23147	31028,47	0,061652	0,138514	0,173162	1531,477	3497,974	6440,178	1269,424	2591,924	4186,356	101395,4
55	0	0	15542,9	23709,515	41883,88	21927,89	28732,65	35099,91	11870,96	17179,53	24037,15	0,209434	0,243168	0,300677	4243,707	6195,636	6965,48	2931,577	4025,957	4937,202	125602,6
56	2	0	8725,238	11443,732	43416,06	23715,71	31686,73	36981,32	15905,02	21907,95	28597,18	0,072564	0,181139	0,231136	2256,374	3960,375	5887,712	1846,015	2948,467	4201,998	90862,4
57	3	0	9355,971	16059,909	33075,64	25981,9	33904,5	41904,63	15927,64	27265,38	31301,23	0,066719	0,152875	0,214657	1896,135	3813,805	5043,758	1686,267	2931,577	3472,301	82403,88
58	2	0	9633,85	20327,416	42046,68	20066,99	31094,33	39097	10985,78	18674,02	26606,11	0,141765	0,207958	0,270776	3495,029	5528,835	7372,098	2255,203	3962,41	5339,051	118748,1
59	1	0	10032,88	23827,603	57115,57	25011,61	31883,26	40212,5	13567,81	19977,63	26392,28	0,188149	0,228772	0,320771	4345,898	6173,342	8164,245	2915,802	4347,71	5464,815	133133,3
60	1	0	11096,92	20302,395	36027,79	27633,01	38387,13	45095,28	12964,05	20790,06	32796,83	0,076504	0,217315	0,299939	2188,321	4401,495	7106,906	1725,11	3726,903	4357,538	101513,8
61	1	0	8836,514	21513,957	51165,24	27384,68	36281,52	41063,05	14519,93	24843,23	33448,65	0,07567	0,190508	0,270147	3132,976	4807,413	6217,439	2561,958	3373,127	4823,366	102421
62	1	0	13629,75	24653,94	49251,2	27274,81	30427,97	40064,87	15414,8	19790,27	25222,47	0,208671	0,241345	0,311174	5056,541	5987,578	7918,572	3373,309	4115,283	5678,911	129677
63	2	0	8954,885	18048,911	33939,95	23077,73	30483,86	34480,05	13021,67	17938,15	24017,63	0,213522	0,260155	0,304846	4959,42	5886,63	6610,559	2977,661	4159,418	5012,201	113623,5
64	1	0	15187,75	31006,541	44182,19	22946,34	28820,65	38066,79	13823,94	19089,5	23024,33	0,178455	0,223848	0,252944	3497,974	4855,772	6364,667	2605,67	3309,228	4362,336	105740,6
65	3	0	9692,516	14964,288	47053,94	17813,43	26151,99	41809,52	10832,73	14179,85	26373,81	0,087778	0,198634	0,326909	2315,954	3497,974	6693,227	1550,458	2529,941	4265	93155,53
66	2	0	13068,26	22952,623	47419,28	25608,39	31615,25	36349,97	14843,48	20729,87	24762,64	0,152875	0,195277	0,250067	3311,156	5035,855	6310,506	2327,992	3559,674	4684,669	105627,7
67	1	0	4681,978	10983,548	66112,52	27760,5	42829,03	51295,78	16096,6	26931,61	40452,29	0,122757	0,162718	0,202657	3497,974	4923,826	6511,759	2270,684	3401,753	5393,901	109575,9
68	1	0	8080,431	16638,371	49517,21	27149,35	35195,93	40442,02	13752,16	22204,4	29876,91	0,075419	0,211133	0,273691	3209,876	4771,845	6255,926	2475,944	3480,803	4385,696	98620,08
69	1	0	10784,15	22301,944	42588,76	21310,31	27673,22	33010,21	13152,36	16807,95	22904,7	0,193731	0,222629	0,260723	3679,877	5032,611	5478,689	2743,357	3380,777	4033,523	97995
70	1	0	7645,788	15706,118	43186,69	22495,69	27156,38	34396,59	13241,16	18424,66	23384,23	0,153927	0,205656	0,238802	3987,631	4585,776	5956,587	2778,739	3030,962	3982,832	111773,6
71	1	0	13280,2	27494,492	49776,45	26582,56	31323,02	36933,77	15184,08	19952,68	23702,72	0,209901	0,247345	0,31586	5312,417	5878,619	6774,219	3402,741	3991,46	5052,999	123929,8
72	1	0	8558,832	25121,224	38825,11	24130,99	30064,48	41400,75	15190,34	18096,18	30739,97	0,088711	0,181235	0,261022	3156,704	4422,77	6166,806	2266,917	3039,46	4015,978	98649,83
73	3	0	8201,141	26885,734	42306,27	30457,45	35016,13	44305,94	16142,07	24575,23	30176,65	0,175143	0,218624	0,300583	3965,301	6600,295	8728,891	3008,989	4427,42	6216,401	132945,8
74	2	0	9466,811	22954,29	53513,79	29788,73	33929,71	43441,8	17461,43	22962,14	30216,04	0,171808	0,233064	0,270517	5284,594	6429,237	6988,875	3303,111	4582,301	5362,239	128856,3
75	0	0	9781,123	19254,427	45592,62	22408,22	30922,68	37380,97	13621,61	16253,19	27780,85	0,134816	0,235715	0,341399	3498,056	5125,104	6589,454	2472,148	3725,653	4802,003	104792,6
76	5	0	8968,401	14959,034	50730,32	18139,8	30338,69	48769,64	9518,33	15112,19	30045,12	0,170954	0,211187	0,287136	3460,17	5262,486	7802,318	2373,002	2931,577	6393,216	117372,5
77	1	0	8807,383	19801,137	66096,45	27795,02	32347,23	34846,86	14616,6	18702,14	23975,75	0,243731	0,267987	0,296835	5467,136	6288,185	6580,998	3735,492	4183,38	4689,345	122409,1
78	4	0	8912,157	15098,785	21778,34	18198,38	23862,13	28877,11	10698,94	15704,97	20189,06	0,09794	0,137578	0,243365	1872,308	3459,83	4682,884	1525,704	2261,018	3454,223	79078,32
79	2	0	7478,485	15056,578	48981,09	26256,58	33822,22	40506,05	15795,7	22937,91	28371,37	0,138672	0,200803	0,264735	3935,331	5234,612	6158,367	2931,577	3954,978	4739,009	111278,2
80	0	0	5798,391	14340,571	62660,54	28273,03	39383,41	52558,93	13800,94	20658,09	36695,13	0,120541	0,205134	0,260248	2902,925	6337,039	7509,133	1890,377	3813,334	5728,376	116160,7
81	0	0	16430,07	35433,674	61446,79	30515,35	35163,37	37691,61	16728,19	20883,07	25090,41	0,237962	0,262523	0,292152	5891,97	6775,766	7180,277	3767,363	4525,41	5318,881	133293,3
82	2	0	12034,4	21003,817	47246,95	27302,53	35677,63	40998,33	14610,97	19588,66	30845,36	0,142413	0,23602	0,326763	2913,02	5788,435	7816,565	2332,914	3716,923	5640,246	116517,3
83	1	0	10660,18	26654,215	39802,86	24504,8	27452,01	32534,65	14015,15	16253,46	20356,73	0,230678	0,272583	0,318629	4684,843	5438,283	6397,98	3108,116	3693,888	4649,413	112388,9
84	8	0	5414,545	12891,268	36022,52	18818,13	29284,51	45689,71	8903,462	17403,84	29879,87	0,151776	0,227535	0,317697	3652,882	6092,899	7592,639	2381,083	3976,741	6194,136	118069,6
85	0	0	12366,26	16730,373	31828,61	19969,98	24819,74	38247,24	10816,3	15212,13	23295,1	0,153775	0,203812	0,315713	3266,105	4479,589	6812,895	1960,065	3187,376	4795,294	107047,7
86	2	0	11844,94	26742,687	42131,88	23625,22	27676,85	35654,74	12037,63	16858,93	22973,95	0,213761	0,260263	0,316624	4684,316	6195,008	7070,378	2931,577	4310,086	5173,722	114243,6
87	2	0	5371,081	9824,681	38893,27	19170,19	35471,42	52970,54	12515,25	22826,44	45876,42	0,093116	0,126418	0,223458	2766,463	3497,974	5127,128	1853,182	2457,016	4435,464	92279,84
88	0	0	8695,752	23250,751	44724,33	24669,26	34671,35	42243,86	12804,39	21010,66	30054,44	0,214182	0,255989	0,297793	5212,788	6801,771	7285,547	3650,618	4483,262	5776,659	134836,7
89	1	0	11771,11	24291,331	40193,46	24752,35	27984,21	34775,27	14960,94	17753,75	23273,14	0,210871	0,224219	0,272861	4619,834	5598,439	6387,179	2931,577	3816,093	4731,175	112268,5
90	2	0	8082,587	28603,062	63372,93	28196,22	36373,51	44879,01	14589,24	21676,29	31728,15	0,194123	0,249857	0,330551	4638,247	6026,362	7622,8	2949,07	4353,34	5287,868	125715,9
91	4	0	7566,537	14660,881	47310,54	22082,67	31027,72	36672,02	11469,56	19062,4	27211,24	0,152875	0,227033	0,307063	3645,371	5128,046	6927,624	2358,278	3528,398	4684,608	116859,2
92	0	0	7464,143	16107,439	64682,73	26902,28	35266,41	50814,22	16327,54	20778,03	36584,97	0,161892	0,192844	0,237906	4635,284	6130,163	7278,582	2931,577	4520,471	5693,478	130897,9
93	2	0	12002,68	29361,018	45291,79	25101,29	27503,82	37819,41	15422,23	17012,52	19476,56	0,217215	0,303386	0,351784	4758,316	6025,57	7180,599	3367,556	3837,742	4714,859	120958
94	1	0	4873,961	19372,939	49709,69	18843,94	32985,66	49456,22	11633,91	18280,17	40825,49	0,104651	0,152875	0,211971	2715,186	4029,626	6128,558	1958,358	2931,577	4694,944	103223,9
95	2	1	6915,538	20304,831	49253,89	20950,15	32844,38	41127,1	12230,81	18673,48	29570,66	0,191703	0,228167	0,254093	3703,155	5907,544	7448,368	2418,655	3653,946	5683,441	119310,9
96	1	0	17715,83	23474,698	48193,52	23524,31	28579,83	34442,91	11523,3	16381,92	22201,74	0,22475	0,281125	0,308016	4404,351	5824,754	6718,077	2804,131	3509,754	5028,883	115344,2
97	2	0	10338,35	20458,096	37840,26	17744,41	28311,22	34567,38	10959,34	15781,26	26412,18	0,098665	0,211159	0,293689	2824,366	3839,73	5210,85	2234,351	2681,278	3733,229	82206,67
98	2	0	6293,243	16258,021	38165,31	23419,38	30969,42	45717,69	12762,1	20083,44	36054,24	0,068319	0,216447	0,276199	3180,062	4537,025	5489,686	2433,685	3346,664	4075,795	94367,32
99	1	0	11975,65	28681,21	40893,36	23556,13	34417,48	43237,96	13136,82	17733,33	32798,36	0,133204	0,199439	0,322712	3595,725	5463,38	7232,287	2857,896	3862,624	5562,958	118466,7
100	1	0	15639,54	25536,783	62782,43	27409,62	33796,08	38305,24	15091,07	21358,49	23518,7	0,201767	0,25398	0,288578	5005,576	6096,817	7083,322	3126,777	4183,387	5015,556	123173,5
Total	168	3	8922,051	19995,476	47267,89	24057,78	32045,73	40623,6	13072,14	19155,82	28474,45	0,152875	0,220267	0,288466	3497,974	5472,25	6960,956	2551,52	3667,84	4957,138	
Total landi	25 percentile	50 percentile	75 percentile																		
	98799,55258	114157,1782	121123																		

Table 2. Results of long- term stochastic simulations. Probabilities of SSB<Bpa, SSB<Blim and values of SSB, yield, landings, recruitment and fishing mortality. Settings: F target=0.4, 15 % the limit on year-to-year variation in catches, no addition restriction in variation of catches

				Recruits *1000			TSB			SSB			F		Catch (landing+discards),t				Landing,t		Landing,t
Iteration N	SSB<Bpa (N)	SSB<Blim (N)	25 Percent	50 Percentil	75 Percent	25 Percent	50 Percent	75 Percent	25 Percent	50 Percent	75 Percent	25 Percent	50 Percent	75 Percent	25 Percent	50 Percent	75 Percent	25 Percent	50 Percent	75 Percent	Total
1	1	0	10340,25	31845,41	54397,69	26263,18	32282,48	39610,75	12698,98	16701,44	28637,04	0,189584	0,242005	0,371022	4243,532	6247,388	7322,88	2931,577	3953,176	5103,151	118034,2
2	1	0	15853,99	31808,672	54294,31	25349,88	29422,57	33470,08	13773,59	16218,69	20975,94	0,238938	0,323626	0,402554	5603,403	7234,63	8008,014	3361,42	4531,909	5400,311	129408,6
3	3	0	10618,46	24813,382	40170,82	19203,83	36363,58	44222,04	12722,27	22083,48	31069,34	0,053536	0,152875	0,303573	1737,25	3494,23	7028,144	1365,402	2809,801	4938,779	93978,87
4	2	0	11794,62	25059,309	53212,66	21308,61	26916,5	31903,91	10945,21	15749,68	18797,17	0,227667	0,301365	0,365609	5141,744	6049,111	7116,601	3422,272	3879,196	5063,496	128237,6
5	2	0	5149,147	12596,228	38638,18	22299,02	33247,99	42643,11	12352,67	18759,92	33564,69	0,068332	0,152875	0,215338	2293,014	3473,256	4672,577	1890,037	2426,748	4021,555	82671,77
6	6	0	9103,115	15878,15	31399,7	16810,58	28908,39	34545,91	9159,621	13470,58	22244,13	0,172321	0,27063	0,390463	3691,131	5543,703	7262,412	2306,037	3761,258	5273,11	108310,9
7	1	0	5481,804	12047,688	43390,32	24027,8	34963,93	42339,63	10979,11	19430,71	30271,77	0,055063	0,194032	0,31907	2148,24	3761,293	7286,771	1724,1	3019,84	5253,822	95245,57
8	0	0	10328,68	34063,889	59744,15	23715,17	34093,12	46095,67	13208,03	16168,74	30926,22	0,194955	0,27314	0,371097	4706,798	7158,452	9459,666	2942,911	4605,883	6197,404	137545,7
9	3	0	7722,478	15687,861	37816,18	22488,02	35018,49	40784,93	11388,29	21455,5	30186,08	0,140269	0,2386	0,330662	3293,265	4717,824	8494,184	2624,376	3352,857	5524,164	117492,2
10	1	0	4938,701	15124,598	45745,58	25722,74	35874,48	59051,24	14622,67	20621,95	42247,5	0,065137	0,210027	0,31162	2879,678	5036,574	6854,591	2187,655	3571,988	4729,7	115726,5
11	1	0	5897,41	18446,455	45444,03	24978,85	37887,68	50973,66	12795,79	18999,59	36204,25	0,152875	0,2268	0,312085	4665,685	6463,275	8547,681	2931,577	4064,005	6750,841	138686,9
12	4	3	9630,993	19309,989	55132,22	21949,58	30591,94	44364,78	11654,42	16739,31	30159,67	0,186146	0,230168	0,267626	4488,932	5511,973	7289,585	2632,727	3650,763	4835,294	122213,9
13	1	0	7032,005	15242,722	52843,17	24187,01	36056,17	47255,39	12029,94	20763,09	29805,34	0,070322	0,246061	0,274638	2430,909	4612,406	6099,907	1987,206	3221,234	4267,788	94108,47
14	1	0	15965,35	37088,52	68261,94	27080,7	35513,79	40091,81	11542,43	17758,36	23726,51	0,287744	0,362919	0,40648	6621,484	7956,3	8959,46	3654,118	5091,446	6069,273	142509,7
15	2	0	9697,494	13649,664	44036,4	19006,04	26286,09	31192,17	11435,35	15133,46	23115,39	0,129471	0,193321	0,310112	3394,327	4712,575	5989,49	2312,84	3028,134	4701,922	102726,1
16	3	0	8192,869	14611,03	32386,2	20388,61	27378,4	38859,59	10509,79	15532,05	24101,34	0,084638	0,190965	0,35926	2448,294	4253,174	5663,052	1819,774	2931,577	4138,642	86737,13
17	4	0	14054,17	27349,228	43784,53	19656,53	25286,6	29732,17	10416,52	13749,14	16496,36	0,311513	0,370002	0,432018	4143,94	6728,652	7916,061	3007,235	4390,138	5090,613	119726,5
18	4	0	13864,32	21476,074	27384,34	19002,47	30390,13	40197,89	10158,36	15716,22	30119,91	0,108637	0,251656	0,361195	3215,204	4252,107	6466,923	2320,808	3468,488	4689,792	104796,3
19	0	0	9148,902	17143,353	41159,71	23356,13	30061,09	36027,36	13949,39	19944,38	26962,82	0,092124	0,156914	0,223336	2625,31	3515,568	5278,609	1883,37	2846,128	3867,645	82980,01
20	1	0	12509,59	26765,223	57913,94	25651,34	30839,67	35150,4	14145,17	16978,37	21700,16	0,262253	0,326101	0,380693	6280,877	6762,482	7430,833	3919,101	4487,219	5121,293	124021,5
21	2	0	12296,33	33579,743	67625,59	27387,74	30208,04	40628,22	14393,84	16787,72	22281,38	0,271634	0,337366	0,387232	6621,927	7647,362	8561,827	3984,939	4712,497	6391,567	144421,4
22	3	0	4729,149	11406,77	38401,69	18597,6	32713,55	45734,96	10833,8	20032,82	32568,99	0,068553	0,090625	0,130547	1284,19	2582,965	4563,638	872,1832	1911,43	2931,577	82022,77
23	1	0	17899,27	28001,068	54085,15	25265,75	29199,2	35328,74	14955,11	16866,65	20514,05	0,283094	0,308221	0,352259	5369,633	6860,214	7781,952	3470,586	4538,819	5439,321	128897
24	2	0	10864,84	16890,177	42380,34	18290,96	27363,66	35580,08	10845,12	17873,45	23459,3	0,176018	0,247187	0,318863	3497,974	4749,316	7055,087	2412,492	3156,055	5093,245	105531,5
25	4	1	11320,68	17851,14	61466,75	20795,07	33274,99	39023,9	10201,98	16101,3	25263,2	0,19325	0,286079	0,391377	3497,974	7236,345	8321,797	2567,837	5076,293	6028,938	126167,8
26	4	0	11003,02	18332,69	34820,62	22518,86	33824,71	42283,25	12444,4	21743,6	31964,74	0,073363	0,185736	0,331172	2188,956	4402,772	6490,449	1938,47	3058,369	4628,909	97027,38
27	0	0	9154,782	26713,735	57855,8	28334,9	34779,09	39569,11	15250,16	21284,87	27901,18	0,11648	0,261369	0,356089	3497,974	7150,543	8223,124	2931,577	4424,659	5668,936	126012
28	1	0	8252,697	14382,702	42639,71	25999,69	28318,49	34086,36	14014,09	16353,5	21451,58	0,064783	0,196524	0,304613	1814,368	3497,974	5927,283	1530,139	2931,577	4033,661	81958,79
29	5	0	8705,264	14016,757	47474,92	20932,36	36353,29	44206,59	10030,87	18211,82	33171,78	0,146802	0,189863	0,306239	3162,443	5155,923	7500,045	2246,145	3589,067	5486,784	117759,8
30	3	0	17276,64	31115,42	58036,42	25585,08	33093,31	39477,82	13179,43	16981,13	23405,66	0,266747	0,337655	0,441729	6292,353	7471,042	8650,408	3490,455	4679,183	5603,701	139119,3
31	1	0	5114,585	18915,659	43210,44	24850,02	32365,44	41875,12	11439,98	19957,82	32240,78	0,152875	0,21871	0,25306	3497,974	4858,059	6424,783	2334,511	3314,131	4805,183	109579,5
32	1	0	11172,68	36264,516	56032,07	25230,38	28762,67	33777,74	12875,88	14766	20312,91	0,315053	0,376784	0,43229	5651,296	6910,944	7845,664	3703,806	4126,253	5252,264	128229,4
33	3	0	9467,766	21365,113	44515,14	25691,93	33777,53	37582,33	13776,16	20990,99	28371,73	0,082955	0,164049	0,282959	1992,198	4007,022	7331,567	1493,06	2931,577	5206,677	103002,7
34	2	0	5879,608	13569,493	31730,32	22591,27	35915,54	45120,75	11734,18	20048,5	37150,79	0,074309	0,191441	0,276428	2435,684	3704,37	7210,702	1640,768	3031,869	4718,226	101715,4
35	5	0	10525,2	18253,178	32840,29	18023,28	22348,45	32083,05	10186,55	13832,63	21689,33	0,0674	0,215069	0,350392	1902,396	3121,461	5267,333	1409,645	2093,398	3375,699	78228,69
36	1	0	14752,86	29131,778	51503,85	25984,17	29420,76	39437,34	13393,2	17077,34	23887,44	0,182381	0,276213	0,345592	3881,138	6635,271	7704,052	2833,877	4148,96	5228,712	119469,8
37	8	0	4183,397	13157,545	32163,95	16858,44	32057,75	44397,8	9329,522	15635,81	33932,9	0,096707	0,152875	0,207698	2667,778	3952,679	5365,855	1595,423	2678,773	3931,635	89337,85
38	3	0	4233,314	14106,914	34228,58	23219,27	37262,49	46461,62	13224,79	24111,81	41722,49	0,058444	0,088042	0,152875	1898,735	2698,877	4104,654	1175,072	2250,867	3843,502	73919,54
39	2	0	13189,95	26067,72	57751,81	21283,16	24494,87	33953,67	11137,76	13631,81	18123,97	0,236558	0,312814	0,446233	3478,976	5397,633	7297,534	2471,699	3290,36	4309,077	102195,7
40	0	0	15749,6	28448,263	62754,5	24218,42	33322,88	38977,58	13157,37	17636,88	22598,88	0,209641	0,316357	0,352004	4554,208	6679,6	8219,75	2931,577	4714,733	5564,833	119101,2
41	6	2	11524,84	27813,449	53479,36	20868,88	29308,39	34616,79	10808,9	16546,36	21995,79	0,214018	0,277595	0,387513	3833,092	6449,457	8866,175	2723,995	3962,257	5986,701	121663,4
42	2	0	7839,939	24488,591	46223,04	23119,98	31252,08	39033,41	12541,98	19084,06	28920,77	0,088924	0,189095	0,265857	2491,121	4142,769	5647,435	1936,426	3128,205	3792,946	88606,72
43	3	1	5986,475	25836,298	72106,12	25739,53	38023,8	56827,89	14355,31	19980,81	34564,64	0,152875	0,205948	0,275934	4727,463	6022,21	7248,034	2752,123	3935,118	5355,045	125707,7
44	2	0	14525,82	26426,502	53240,41	22854,94	29905,04	39287,92	11752,87	16062,48	25735,44	0,16242	0,281099	0,392756	4259,755	6863,716	8074,96	2931,577	4338,106	5558,802	130082,4
45	1	0	17149,05	30115,626	56651,7	28417,17	32297,17	35202,18	12665,44	17006,23	24410,56	0,214632	0,325931	0,447936	4706,039	7723,573	9023,106	3112,664	4712,1	5678,354	133297,3
46	0	0	5310,412	19796,329	32614,61	23887,04	34388,57	41261,82	11979,92	21730,58	35317,53	0,074405	0,113165	0,219822	2299,918	3484,291	5008,425	1706,292	2749,616	3928,54	83734,91
47	2	0	7061,632	21893,985	40035,63	26362,83	36636,26	41861,87	14441,34	23565,94	31797,47	0,066983	0,152875	0,332865	1940,144	3902,322	7957,007	1521,78	3144,435	4912,517	103592,7
48	2	0	8020,737	14234,962	35048,08	26513,05	32839,28	40922,49	11527,36	18068,08	29314,32	0,073758	0,228388	0,36667	2298,313	4622,729	7335,704	1855,587	3735,575	4893,723	102121,5
49	1	0	9873,702	38652,473	70651,37	24080,6	31065,57	43319,61	12185,28	15752,74	26934,91	0,219374	0,291499	0,381731	5678,182	7412,775	8635,806	3248,393	4334,216	5931,92	135838,9
50	1	0	8992,597	26701,737	59952,91	23078,37	32357,85	35691,8	14431,86	18257,95	22856,75	0,259449	0,295563	0,344473	5114,632	7208,797	7627,613	3399,277	4788,665	5319,006	129311,6
51	3	0	7424,479	16355,316	61043,44	25251,71	34756,6	50215,16	10005,61	22944,5	14877,57	0,077539	0,152875	0,268635	1894,289	3572,757	6663,874	1304,741	2931,577	2931,577	112949,6
52	4	0	8818,443	19420,001	41681,98	25550,41	35553,87	46421,14	13627,24	21849,54	32949,68	0,064447	0,212558	0,270715	2357,095	4122,574	6269,919	2056,645	3324,278	4384,54	100198,2
53	3	0	12907,75	18195,141	50094,37	19422,72	31151,5	41506,73	10824,28	15077,11	26212,69	0,20155	0,295289	0,369098	3982,044	6417,58	8566,837	2526,087	3966,98	5830,818	127903,1
54	3	0	5571,76	19344,039	45805,48	23435,39	33144,46	37775,86	14241,18	22281,42	31353,59	0,068544	0,193613	0,231133	1674,88	3874,1	7161,173	1327,087	2919,849	4795,287	110763,5
55	3	0	16731,17	28932,039	50712,63	20907,15	26408,27	34111,53	10829,97	15970,9	21470,24	0,281683	0,330713	0,398221	5052,303	6519,993	8356,601	2931,577	4237,819	5165,591	127469,7
56	2	0	10132,63	12209,377	43347,32	22237,34	31664,43	36824,58	13676,23	20573	27223,78	0,07321	0,195899	0,266099	1969,006	3960,375	6678,629	1581,915	2942,774	4984,807	94866,13
57	4	0	4741,711	13897,379	34775,66	20101,47	30922,84	60106,38	11502,64	18741,1	47488,74	0,060503	0,082045	0,19237	1648,059	2794,933	4888,355	1185,01	2045,777	3685,259	73536,75
58	2	0	9604,121	20766,061	47365,62	21738	30354,5	37231,24	11382,55	16814,32	24116,7	0,152875	0,260481	0,325435	3208,349	5881,929	8328,469	2137,583	3692,324	5538,998	125149,8
59	3	0	11323,69	24505,984	67299,2	23185,4	29944,4	39949,03	13078,82	18388,68	22090,38	0,244382	0,294383	0,381306	4605,854	6928,298	10469,78	3188,946	4610,28	5721,985	144714,1
60	2	0	9886,499	21432,971	35598,86	28872,27	38549	45355,18	12835,24	22537,88	32043,63	0,066215	0,17375	0,276437	1862,478	3746,108	7534,761	1553,558	2931,577	4513,271	95415,97
61	1	0	9374,745	21759,581	52553,81	27571,79	36374,73	39686,34	12429,98	23482,09	32710,75	0,077735	0,225122	0,304826	3166,562	4487,925	6793,767	2693,435	3233,114	4795,428	105560,2
62	2	1	9793,037	24217,678	48332,61	24922,72	32046,08	43715,81	13798,07	19170,23	30116,37	0,152875	0,231033	0,27986	3497,974	5961,449	7386,431	2558,143	3808,541	5387,531	122573,6
63	3	0	9480,038	19967,206	38544,31	20737,16	28493,12	33192,09	11823	14326,39	20629,12	0,2415	0,295703	0,414264	4358,638	6419,291	7382,185	2719,093	4321,788	5223,638	118987,4
64	1	0	17270,06	28755,9	42312,34	23004,45	27256,16	36846,14	13227,31	17252,61	20322,88	0,202156	0,2467	0,301783	3811,367	5372,677	6666,105	2682,936	3460,229	4656,355	111017
65	6	0	10245,37	14379,107	50415,6	17823,57	25019,1	38536,38	9258,447	14095,19	23429,47	0,129573	0,246332	0,426681	2509,983	4050,114	7167,894	1838,995	2833,002	4675,817	101171,7
66	1	0	12434,95	25364,619	51534,73	26857,1	31726,99	34842,84	14433,63	21202,89	22439,22	0,124868	0,255453	0,307482	3417,581	5201,848	7439,05	2327,992	3621,614	5314,896	109591,5
67	3	0	4996,224	18033,599	62881,97	25592,97	37404,68	48866,87	12886,61	23249,84	34451,13	0,149808	0,217289	0,302788	3892,743	6225,093	7272,383	2667,187	3699,074	5800,08	122440,7
68	1	0	7904,893	19123,182	53788,48	27107,43	35144,16	39296,37	13341,57	19707,58	27186,47	0,072774	0,279623	0,33303	3122,622	5461,485	7012,176	2661,683	3739,635	4518,345	103650,1
69	3	0	11302,58	23332,079	43824,36	20726,69	26136,15	32795,34	12612,07	15834,4	20120,65	0,210196	0,27191	0,334654	3679,877	5296,192	6274,351	2622,978	3808,318	4603,994	104800,5
70	1	0	4969,665	18671,098	38127,25	23957,42	28491,1	36095,83	12793,98	16455,87	28868,35	0,112445	0,152875	0,271376	2706,424	4965,41	6525,53	1938,142	3136,006	4287,85	107910,7
71	2	0	16339,45	34516,411	56027,95	24443,25	30649,51	34897,72	12330,17	16760,47	21296,44	0,271935	0,329734	0,445265	5954,382	6984,361	8196,636	3467,149	4387,531	5507,201	133605,6
72	2	0	8430,988	25497,752	36903,2	23643,24	30750,42	40042,32	12364,24	17548,92	29309,89	0,072666	0,181235	0,288991	2316,338	4588,693	5944,802	1817,424	3142,031	4215,888	93276,76
73	3	0	8354,406	29139,921	51457,85	29847,75	36521,76	41665,86	13983,68	23181,45	29673,29	0,151088	0,261034	0,381644	3497,974	7970,986	10002,59	2931,577	4847,207	6602,83	141005,7
74	2	0	9340,441	25348,357	58675,11	27087,4	32847,85	45158,16	14881,99	21736,29	30393,34	0,152875	0,264299	0,306243	4863,673	6432,208	8013,457	3175,858	4195,857	6427,319	134003,4
75	2	0	10715,43	19849,201	46739,53	20664,31	28264,3	38638,58	12498,86	15969,24	24997,99	0,08585	0,277777	0,397588	2836,798	6230,344	7623,871	2183,347	3559,643	4717,015	103641,5
76	7	0	11421,96	19195,592	51367,54	16683	26970,07	43326,78	9376,753	12572,1	25957,46	0,153759	0,255579	0,329934	2181,148	6293,781	8700,88	1425,368	3310,918	6315,334	119948,3
77	2	0	9179,508	17872,741	77148,84	24846,58	30422,24	35432,13	12810,59	15921,23	22974,38	0,291334	0,335024	0,439679	5560,421	6954,433	8291,01	3303,596	4106,942	5517,085	132292,4
78	3	0	9853,665	14348,772	23454,12	17541,14	22096,69	28245,85	10649,1	13004,44	19341,69	0,152875	0,21023	0,250362	2743,206	3497,974	4736,213	1662,17	2545,41	3163,509	85942,54
79	2	0	8133,149	15509,604	46387,99	27183,44	32033,17	40811,6	14379,05	20505,04	27842,01	0,113304	0,262931	0,317986	3497,974	5489,219	6778,369	2760,974	4273,847	5109,375	111040,9
80	5	2	6306,863	14491,331	62660,54	26350,65	34863,13	56798,78	11248,42	18312,83	38885,3	0,082164	0,256248	0,351699	2220,231	6806,57	8519,416	1829,362	3865,877	5897,66	115082,7
81	1	0	18659,56	41849,016	63689,07	30060,3	33245,28	36192,25	14271,74	16966,82	22656,35	0,30057	0,354798	0,417248	6936,468	7902,883	8586,25	3841,422	5164,914	6099,583	145992,9
82	5	1	12004,26	23545,298	52244,26	22510,29	28077,97	38801,83	10078,46	14833,33	22663,08	0,246228	0,305623	0,416302	5974,527	6975,684	8221,073	3238,745	4100,564	6253,7	133976,1
83	1	0	8143,918	12973,671	42503,41	27024,69	30874,81	35419,21	14485,14	19460,86	25062,28	0,066694	0,260072	0,325811	2622,944	3989,17	6751,637	2059,096	3095,185	4417,392	94381,35
84	9	0	7369,373	15351,186	37444,26	18344,99	26732,17	40058,9	7769,907	15290,79	22913,75	0,174392	0,253867	0,416875	3340,636	7313,387	9037,004	2355,465	4423,203	6254,468	123589,9
85	5	1	13484,86	18068,658	32664,98	20347,17	26801,12	36441,41	10258,43	17287,26	22326,99	0,111989	0,152875	0,42225	2304,16	4563,1	7436,933	1848,515	2931,577	5095,727	101834
86	3	0	13497,36	28335,768	49407,09	20745,43	26961,33	34590,08	10977,08	13723,16	21090,36	0,268708	0,332179	0,421978	4086,092	6726,54	8278,852	2931,577	4244,09	5662,054	119440,5
87	2	0	4882,391	11033,434	39719,94	18343,88	30556,57	51716,43	10839,04	17393,44	38073,9	0,083432	0,202191	0,307246	2634,504	4164,763	6720,451	2109,124	3065,726	4752,949	109434,5
88	3	0	9235,495	26299,155	63591,19	22253,32	31171,62	44281,67	11744,24	16734,96	25152,32	0,264927	0,345404	0,367082	6323,027	7990,137	9347,571	3973,56	4910,579	6287,832	149208,4
89	1	0	10644,23	18808,221	42386,19	24699,18	33164,69	36860,34	13365,96	21140,98	25536,64	0,080906	0,261474	0,313584	3068,152	5366,217	6758,529	2689,719	3525,044	4728,48	103599,5
90	3	0	7926,153	26691,745	66769,54	27190,25	35940,15	47081,61	12115,46	19131,45	28990,23	0,211627	0,298275	0,392235	3658,168	7199,624	8470,146	2931,577	4509,482	6006,054	132417,9
91	3	0	6572,327	18735,883	44440,09	21186,28	30219,16	44750,21	11441,29	16885,77	32234,25	0,152875	0,264739	0,306776	2979,424	4347,416	6132,774	2177,397	2931,577	4249,371	106899,4
92	2	0	6171,017	18918	68835,45	24748,45	34773,2	49977,51	12338,17	19158,22	35602,11	0,192297	0,252166	0,309841	5107,339	7406,511	9276,285	2994,531	4990,349	7583,311	150833,3
93	3	0	12343,94	27890,32	49455,7	25367,06	28792,03	37504,89	12851,49	16127,53	25171,48	0,133679	0,316805	0,42503	3803,35	6206,796	7575,973	2874,139	4236,137	4873,404	112673,3
94	1	0	4717,099	20016,994	33791,46	18429,89	35911,35	50700,07	11858,42	20095,28	43511,94	0,082954	0,123872	0,197957	2466,617	3497,974	5257,279	1834,933	2825,809	4476,368	94427,18
95	4	0	9101,432	21404,91	51041,54	19290,9	30997,09	40720,47	10980,71	15823,28	26804,11	0,209504	0,256501	0,335953	4309,878	6024,871	7967,892	2875,652	3255,606	5772,078	123843,2
96	3	0	17895,84	26717,943	49242,57	21753,16	27465,43	31784,65	10464,47	15192,06	17324,18	0,260731	0,37348	0,409751	5213,704	6280,975	7634,752	3245,429	3591,087	5106,487	121660
97	8	0	11875,7	19886,599	43320,58	17234,91	21579,58	28176,19	8858,532	12926,51	16997,72	0,152875	0,307724	0,393871	2556,462	4326,977	5593,672	1810,806	2931,577	3846,239	84420,12
98	2	0	6862,387	16025,206	43307,6	22119,3	31121,48	45712,39	10973,37	18018,72	36050,56	0,068319	0,263036	0,323335	2765,271	4796,933	6233,879	2320,581	3346,494	4627,58	97517,73
99	1	0	8620,528	13530,542	35488,46	26113,23	36789,96	51333,19	14909,54	28243,46	41598,41	0,061426	0,112531	0,174998	2223,31	3648,631	5142,651	1608,56	2931,577	4080,388	86644,96
100	1	0	17043,57	26833,485	72830,99	26573,19	31441,26	37319,06	14159,4	18574,41	22442,27	0,229112	0,293843	0,383924	5040,123	7159,343	8095,031	3380,247	4477,469	5495,08	131845
Total	254	12	9361,589	20778,678	49561,9	22633,83	30913,41	40093,74	11655,8	17125,21	27273,06	0,147671	0,253814	0,351998	3378,424	5768,248	7845,346	2374,676	3669,858	5195,145	
Total landi	25 percentile	50 percentile	75 percentile																		
	100928,3347	112811,4724	127578,1																		

Table 3. Results of long- term stochastic simulations. Probabilities of SSB<Bpa, SSB<Blim and values of SSB, yield, landings, recruitment and fishing mortality. Settings: F target=0.5, 15 % the limit on year-to-year variation in catches, no addition restriction in variation of catches

			Recruits *1000			TSB			SSB			F			Catch (landing+discards),t			Landing,t			Landing,t
Iteration N	SSB<Bpa (N)	SSB<Blim (N)	25 Percent	50 Percentil	75 Percent	25 Percent	50 Percent	75 Percent	25 Percent	50 Percent	75 Percent	25 Percent	50 Percent	75 Percent	25 Percent	50 Percent	75 Percent	25 Percent	50 Percent	75 Percent	Total
1	2	0	10864,26	29131,22	61860,32	25119,3	32556,39	38640,71	12368,29	15782,85	27363,83	0,152875	0,284102	0,424492	3877,447	6311,252	7937,765	2948,783	3937,491	5258,391	117311,4
2	4	0	16932,76	32821,703	58673,2	23525,38	28628,8	32242,22	10869,95	14553,4	18447,92	0,244774	0,400552	0,519851	6141,85	7730,561	8887,92	3654,622	4716,927	5734,748	134595,8
3	7	0	13076,09	21976,561	60780,17	18678,67	31889,67	40069,09	9910,848	16295,83	24821,05	0,249935	0,379846	0,45716	3955,341	8163,771	9892,065	2871,727	4497,954	6302,435	140894,5
4	1	0	11424,83	25082,834	51336,12	22008,12	27906,72	34019,42	11975,27	15525,43	22516,34	0,163032	0,248321	0,343436	3462,726	5786,86	9002,349	2619,813	3658,93	5524,478	126442
5	2	0	5263,86	13327,348	41986,9	22862,12	33934,18	44712,54	13780,84	19345,91	36140,9	0,076695	0,09645	0,170295	2020,515	3072,951	4231,555	1403,732	2181,404	3403,533	78266,67
6	7	0	9204,824	16603,249	32784,81	16357,93	26433,37	34288,87	9002,04	11608,73	19708,62	0,149728	0,264258	0,453613	3368,082	5794,386	7750,144	1961,14	3606,956	5658,246	107645,8
7	0	0	5600,565	12157,655	44432,77	23216,42	36483,74	43267,99	10906,6	18220,95	28556,5	0,057816	0,152875	0,312165	1678,02	3497,974	8474,914	1287,105	2931,577	4753,488	96035,16
8	0	0	12584,44	36635,412	60325,83	23633,79	34957,54	43768,18	12387,65	15814,04	28498,1	0,157747	0,336558	0,449675	4370,758	8317,374	10070,31	2931,577	5188,491	6333,962	139813,8
9	3	0	9553,817	15323,807	43352,47	19605,55	35613,12	39538,47	11515,45	16921,24	28658,38	0,124028	0,276817	0,395018	3293,265	5134,195	9650,858	2409,969	4121,326	5786,524	122237,7
10	2	1	3552,628	12665,525	51404,3	25131,02	36951,94	59335,24	12845,08	26462,09	45217,56	0,03091	0,15787	0,377874	1480,707	3201,128	7421,856	1316,844	2742,066	4655,467	104828,4
11	2	0	7447,617	19579,808	49058,66	22216,2	36908,93	49343,36	12605,48	16752,51	34185,96	0,149693	0,261604	0,380379	3969,308	6722,133	9062,127	2931,577	4406,083	6890,488	137785,3
12	3	0	10894,17	16712,315	54654,6	25714,75	36748,53	44194,28	13873,91	24139,53	35496,07	0,068678	0,177258	0,249419	1819,326	3497,974	6701,255	1472,338	2830,456	4530,891	101216,7
13	0	0	6960,635	13628,002	48986,63	24424,65	34035,23	46264,08	12066,27	17757,32	31769,35	0,070322	0,192049	0,320156	2430,909	4666,316	6597,663	1987,206	3359,894	4445,558	95614,48
14	2	0	9624,114	25268,666	49372,44	29207,54	36915,97	43993,07	13224,12	20101,07	29322,32	0,074501	0,217265	0,364281	2611,879	4568,193	8812,537	2217,586	3668,906	5606,36	111352,1
15	2	1	7233,962	13016,456	31401,54	20342,7	25663,02	43196,65	11796,11	17424,74	28752,06	0,047146	0,131243	0,227074	1852,779	2836,297	4285,591	1453,416	2397,59	3489,97	72642,74
16	3	0	8161,451	14674,018	32984,73	19928,44	28134,12	37944,35	10872,9	16188,57	23966,55	0,084638	0,174948	0,378875	2225,315	3723,549	5663,052	1651,198	2931,577	4196,323	87761,68
17	6	0	14711,01	29462,648	48303,5	19809,21	24683,24	27687,98	10486,57	12174,69	13738,78	0,318427	0,460484	0,542647	4851,192	6991,114	8325,9	3350,166	4411,167	4908,395	119611,1
18	6	0	10424,02	16491,593	27326,03	18647,25	30203,04	41509,12	9551,246	18214,68	30463,29	0,070103	0,218545	0,368083	2685,972	3742,753	6546,098	1965,063	2931,577	4464,901	96997,72
19	1	0	8794,351	14908,111	40997,69	23543,95	29996,99	36786,52	14214,5	23835,47	28153,25	0,079824	0,111932	0,158605	2075,39	3156,409	4471,977	1473,615	2547,445	3562,078	73493,96
20	1	0	9726,88	19377,027	55700,22	27500,44	32587,48	36928,98	15039,69	21074,16	24572,31	0,108654	0,241571	0,36104	2896,885	5238,091	7651,319	2330,571	3798,21	5073,38	107350,4
21	3	0	14553,11	35508,381	73650,93	25735,45	30457,94	37987,45	11496,39	16511,19	21599,66	0,306155	0,377107	0,492193	6921,611	8440,242	9807,304	3928,973	5162,601	6239,722	147886,8
22	2	0	2551,373	10213,133	40907,47	20566,76	29336,31	55279,99	11783,5	23309,95	41661,83	0,045567	0,072443	0,111956	1437,501	2279,518	3466,862	992,1823	1865,471	2931,577	62575,53
23	2	0	19736,76	30082,351	62137,65	24938	28180,8	33060,15	13589,13	15943,65	17603,25	0,29469	0,368033	0,438322	6205,625	7439,239	8637,118	3395,388	4887,495	5799,43	134542,9
24	3	0	11281,37	16660,27	38720,57	18150,42	29349,04	36470,99	10342,18	20932,67	26761,72	0,105535	0,219027	0,309888	2552,013	3756,627	5942,756	2002,271	2745,706	4018,442	93859,17
25	3	0	11333,36	16627,422	65086,94	19616,33	31810,84	39354,37	10402,87	13411,28	24733,08	0,190664	0,270318	0,459138	3497,974	6698,653	8542,316	2187,788	4676,277	5618,156	122605,3
26	4	0	10724,26	20460,328	46626,85	22757,68	30450,6	42084,32	10871,9	17502,85	29475,25	0,073363	0,247317	0,36248	2443,521	4914,794	6958,049	2134,682	3283,691	4796,157	103048,2
27	1	0	10945,86	21602,113	48930,17	25103,04	36075,62	41611,85	13360,13	22744,16	28952,21	0,073408	0,200456	0,35175	2375,453	5376,637	8177,193	1799,843	4267,959	5756,619	113959,3
28	0	0	8514,124	14420,296	44102,9	25356,4	27435,3	34052,99	11726,76	15961,7	20642,19	0,064783	0,166407	0,367336	1866,766	3497,974	6707,991	1488,536	2991,234	4333,435	84318,88
29	6	2	8187,651	14692,561	40126,42	19970,85	35611,83	44603,08	9820,269	20570,67	33081,22	0,098465	0,153004	0,249504	2571,235	4188,847	6685,647	1652,932	2931,577	5181,168	108334,9
30	2	0	16715,89	34422,054	58418,42	26356,86	32895,14	38741,06	12107,36	15279,94	20069,63	0,284493	0,421619	0,53031	5297,517	8269,522	9759,064	3227,264	4841,148	5804,295	139020
31	0	0	5296,32	16810,397	27697,11	28633,53	34624,04	42959,18	14135,31	24018,15	30847,45	0,099243	0,1477	0,26617	2638,193	3790,441	5764,787	1960,856	2931,577	4668,78	98819,93
32	2	0	11753,56	40517,136	60306,21	23027,73	26711,91	32788,33	10857,29	12040,42	17112,74	0,364988	0,434885	0,542525	5890,965	7433,123	8488,424	3596,287	4239,278	5290,485	129791,6
33	2	0	10409,11	19914,888	47431,82	26010,83	33937,38	37764,07	12593,31	20934,18	26896,77	0,069356	0,168493	0,280506	2258,545	3497,974	6415,46	1857,411	2821,836	4863,211	99403,2
34	1	0	8867,586	21503,177	45011,6	23743,96	31159,18	43579,28	13186,76	16381,43	32896,52	0,101817	0,264679	0,350442	3497,974	5695,33	7454,715	2745,973	3913,751	4578,375	113140,7
35	2	0	9707,601	15996,627	30757,08	18638,28	25377,29	30578,03	11106,24	17598,25	22318,19	0,068721	0,152875	0,209575	1554,526	2536,59	4505,175	1144,679	1862,398	3610,701	72344,35
36	1	0	19161,03	29828,48	61508,92	24119,27	29020,27	33874,02	11884,21	14866,02	17848,16	0,294327	0,388226	0,454039	5640,914	7622,377	8633,632	3412,154	4713,417	5484,651	130995,6
37	6	0	4649,517	13082,694	33797,53	17598,03	33464,61	44753,65	11055,9	15713,79	34902,09	0,09156	0,166075	0,2145	2121,078	3497,974	5152,386	1446,861	2678,773	3823,054	84999,54
38	3	0	4008,574	13878,381	32274,38	24123,94	37987,78	47181	14088,41	24955,77	42610,71	0,05502	0,082812	0,12978	1686,16	2564,439	3900,192	1045,415	2139,114	3653,142	70110,56
39	3	0	12185,69	23562,022	62607,55	21834,34	26734,89	33663,86	12021,98	14285,86	20010,32	0,172959	0,283247	0,458584	3523,065	6161,863	7867,998	2504,335	3947,08	4920,947	109037,3
40	0	0	15747,36	30483,326	70012,41	23588,61	31374,17	37783,32	11914,8	15825,07	20647,58	0,266669	0,353503	0,458633	3523,621	7240,132	9051,111	2931,577	4397,995	5473,92	123831,6
41	7	0	11841,76	30254,527	57764,45	19927,8	27252,34	35322,93	9210,422	14269,33	18708,21	0,231795	0,323591	0,480845	3827,261	7241,332	9596,545	2723,995	4228,157	6059,663	128277,1
42	2	0	7056,624	24021,478	41093,44	23419,68	32736,43	39341,51	13006,49	21592,33	30552,59	0,066525	0,12804	0,236807	2274,182	3197,897	4391,081	1560,065	2283,713	3178,767	75121,53
43	3	0	5129,999	20073,838	78812,57	23873,59	36737,22	61080,29	15621,01	18663,84	38143,46	0,106098	0,207168	0,294152	3497,974	5854,286	7742,294	2686,876	3654,324	6006,716	118707,3
44	3	0	18612,17	28858,324	53818,56	22002,57	28848,68	38639,47	10871,2	13968,36	24463,85	0,15437	0,336687	0,457605	3574,323	7189,24	8333,741	2548,707	4437,824	5718,37	128934,8
45	3	0	15118,74	29710,562	65744,05	27226,41	31533,74	36270,29	11015,09	16320,94	27142,59	0,152875	0,346784	0,496202	3991,568	7085,85	9255,939	3018,877	4695,754	5489,471	130500,2
46	1	0	8544,911	17446,871	40918,39	21712,97	27363,3	38831,69	12315,86	15225,59	25738,68	0,086525	0,198257	0,324013	2573,22	4162,367	6141,92	2026,263	3023,476	4297,527	91115,95
47	0	0	6203,112	20090,211	45625,58	25625,47	35642,59	41426,29	13210,92	22889,52	31857,6	0,060842	0,107694	0,228682	1640,904	2956,409	5772,496	1087,164	2178,428	4089,801	84373,27
48	2	0	8155,599	14635,844	35211,56	24381,97	32962,51	40814,59	11272,86	17834,98	29244,54	0,073758	0,172962	0,388828	2238,218	4097,227	8545,224	1764,282	3254,999	5218,24	104415,3
49	3	1	9889,908	38398,864	63924,37	22579,14	29754,72	43275,84	10198,13	14944,75	25248,75	0,189741	0,331404	0,506301	5222,569	7021,462	9134,307	2887,321	4122,154	6488,675	136284,9
50	0	0	9720,925	23751,38	57751,79	23430,62	30844,41	36910,43	13758,61	16952,7	23294,18	0,206135	0,314079	0,355412	4187,62	6975,925	8422,799	2931,577	4413,185	5747,334	127959,5
51	5	2	11164,31	23195,757	58343,52	18565,99	27097,62	44127,56	9342,485	14053,3	14877,57	0,257613	0,311897	0,379315	3422,024	6803,755	10548,82	2410,482	3880,341	2931,577	139951,4
52	4	0	10375,24	25055,74	48051,89	23694,16	31483,26	40316,66	11950,88	15457,64	26841,3	0,211779	0,289682	0,434469	5309,751	7354,309	8576,072	2985,497	4686,584	6308,423	136276,5
53	3	0	8837,946	16685,937	48076,8	22981,41	31837,12	43048,68	11363,11	19870,77	31494,38	0,072347	0,177652	0,320835	2419,922	3801,403	7317,222	1638,904	2626,827	4133,084	97003,73
54	3	0	6523,691	19422,222	51736,29	23887,99	31866,44	37505,13	13884,05	22300,43	29524,17	0,068544	0,205474	0,255552	1763,471	4079,016	7472,97	1406,449	2931,577	4765,829	113008,4
55	0	0	6418,805	22016,019	42198,25	23697,53	30246,32	43537,97	13354,18	20025,36	27815,37	0,066657	0,178033	0,225407	2549,361	3762,874	5896,827	1851,998	2931,577	4478,484	92792,67
56	3	0	10138,75	13681,417	43225,32	20890,46	30650,45	36040,36	13612,39	18231,48	25523,31	0,070913	0,164216	0,326558	1969,006	3497,974	7611,303	1579,633	2937,177	5282,477	96207,12
57	4	0	4321,31	15924,338	29643,31	19414,27	36548,74	56885	12165,15	18937,66	43648,25	0,057821	0,077314	0,172661	1472,493	3405,965	5180,047	1014,494	2884,038	3835,475	78607,45
58	3	0	5177,777	14633,526	39397,33	19743,28	31440,02	52456,96	10821,64	18142,7	34183,71	0,067231	0,109296	0,315148	2071,966	4167,463	7046,535	1103,291	2931,577	5179,814	98757,4
59	2	1	12111,71	20844,506	44655,28	25803,73	31611,42	40133,24	12356,19	19077,83	30067,09	0,071627	0,19518	0,377013	2705,708	4777,685	7316,207	1832,016	3615,025	5007,365	108448,6
60	6	0	9503,36	22736,146	43423,42	18250,39	30899,77	38333,91	10249,36	13997,9	29076,61	0,076504	0,189596	0,437035	2781,308	4864,526	7465,936	1860,996	3667,435	5010,491	101923,4
61	1	0	9452,878	24266,209	53586,47	27470,76	36428,63	39043,43	12251,98	21775,21	31731,95	0,079684	0,262598	0,349216	3155,917	4864,126	6954,536	2387,4	3390,783	5054,965	106910,5
62	1	0	16385,35	39965,581	61098,8	23245,79	28971,83	35246,87	12157,35	15621,86	18663,94	0,324348	0,393277	0,48372	5848,78	7690,719	9848,244	3719,881	4969,763	6068,957	145115,5
63	5	0	8932,705	17331,021	35449,47	18836,7	28499,29	36722,49	10361,55	14821,2	24510,83	0,143942	0,269778	0,461907	3170,494	5545,213	7848,807	2413,238	4030,444	5408,635	113811,7
64	1	0	15971,19	29213,31	46911,83	23958,23	30237,46	37379,23	14481,96	20195,96	24219,89	0,144887	0,223714	0,27324	3369,577	4456,266	7023,981	2286,295	3313,035	4298,807	104971,3
65	8	0	10453,27	16129,947	51120,49	17363,49	24942,39	37352,49	8693,035	12738,77	22349,65	0,091233	0,318819	0,463948	1890,621	3497,974	8498,929	1192,239	2647,107	5390,098	100719,9
66	1	0	12316,59	27786,896	53915,61	27064,01	30401,4	34794,95	13780,84	18325,55	23909,64	0,085001	0,30815	0,378867	2656,233	5463,098	8308,689	2121,689	3739,298	5235,34	107840,6
67	3	0	5706,032	18402,464	47984,87	26201,01	34545,11	43918,66	15884,78	25129,84	30484,58	0,081027	0,222235	0,289571	2671,776	4960,224	7952,431	1978,759	3387,512	5285,377	113924,8
68	2	0	7982,465	17032,463	57380,19	27599,66	34216,87	39487,82	13348,92	20282,47	29458,7	0,07413	0,217973	0,377973	3154,175	4316,709	7549,95	2565,014	3394,47	4791,558	101172,2
69	4	0	11229,84	23332,079	43754,25	20079,54	27204,34	32020,89	12127,28	15640,91	20564,58	0,191191	0,244831	0,312948	3497,974	4503,54	7072,293	2581,622	3302,678	5162,052	105279,5
70	1	0	4701,836	19724,521	38507,5	23164,21	28450,88	39247,97	11307,16	16257,25	32655,57	0,095397	0,152875	0,315416	1691,637	5176,3	7472,567	1452,162	2931,577	4888,6	102938,6
71	3	0	14948,5	38302,447	54879,8	23656,5	29475,91	34690,02	12430,52	14927,21	19942,94	0,271935	0,354114	0,538585	3884,159	7679,146	9285,551	2931,577	4172,331	5702,119	121482
72	2	0	8180,367	25184,96	37538,7	24143,27	31193,42	40502,07	13138,23	18598,8	29630,93	0,070268	0,152875	0,289236	2316,338	4161,56	5944,526	1774,393	2931,577	4344,367	91993,65
73	2	0	7229,654	28044,111	56059,96	29033,26	36455,52	40726,94	13171,42	20401,18	31744,12	0,100263	0,294669	0,436253	2937,864	7920,37	10736,54	2429,243	4562,342	6583,748	137349,4
74	2	0	7184,553	17200,051	47947,31	26120,39	35172,83	44144,01	13452,47	20843,5	31693,85	0,089885	0,286722	0,331509	3338,468	6211,047	7726,555	2570,592	3953,986	5399,02	117712,2
75	2	0	7094,352	14787,879	41770,24	21549,2	33158,6	40968,48	12883,68	21044,78	31991,96	0,067943	0,099479	0,152875	1850,404	2984,107	4280,098	1294,736	2318,681	3748,119	73165,73
76	8	2	12771,15	21252,423	54346,7	15973,06	23859,78	40580,71	8463,771	11802,12	22757,32	0,204011	0,330104	0,43108	3483,853	6257,353	9302,527	2381,737	3555,087	6546,619	123987
77	2	0	9779,022	19209,309	77781,63	24162,98	28756,5	36040,44	12148,64	15459,66	20928,6	0,26746	0,347353	0,435476	4758,008	7030,074	9234,065	3121,754	4108,034	5801,669	133187,6
78	4	0	9764,498	14321,237	24271,77	17704,76	22610,66	29204,44	10738,83	13390,55	19881,32	0,103853	0,206367	0,299728	2081,107	3350,682	5813,175	1346,092	2594,85	3805,33	85112,3
79	1	0	8174,71	15105,9	47929,07	26915,39	31880,82	41829,49	12761,45	18485,15	28929,44	0,06744	0,259182	0,357794	2416,247	4859,936	7310,848	2027,027	3763,257	5057,957	103212,7
80	3	0	7022,757	17087,48	62660,54	23402,35	32929,62	54642,17	11267,05	17311,29	34860,57	0,082164	0,274074	0,427071	2269,273	6874,8	9091,923	1729,172	3487,004	5678,761	114744,9
81	2	0	20045,11	40333,289	68761,06	28528,89	31830,68	36780,96	13194,49	16249,91	20963,55	0,332507	0,407863	0,508183	7253,879	8449,905	9418,405	4139,299	5242,974	6149,376	150520,4
82	6	0	12036,19	23940,674	56488,63	21663,12	27222,78	39696,41	9679,772	13332,72	23282,81	0,207418	0,344237	0,486172	3531,652	8021,901	9437,531	2931,577	4495,988	6120,068	138002
83	5	0	11714,5	27410,343	47917,72	20531,54	24574,56	30464,94	10536,22	13128,51	15566,56	0,320515	0,397918	0,547748	4483,947	7190,096	8149,4	2975,599	3860,796	5248,941	118782
84	9	0	6476,834	9964,1025	38888,68	18124,08	29408,71	50676,91	8296,082	16588,54	35536,03	0,069656	0,208352	0,29134	1912,6	2908,825	7427,739	1078,239	2448,818	4149,363	89683,33
85	3	0	8959,808	15766,806	30763,71	20658,04	25256,17	42195,54	10770,31	16162,62	30914,26	0,080382	0,129422	0,205841	1932,878	2939,665	4682,903	1397,215	2246,964	3891,85	74403,75
86	1	0	6216,656	22527,994	49461,57	22670,63	28154,23	44069,67	11056,02	16810,91	31477,67	0,066189	0,268189	0,391467	2345,832	4718,306	7173,04	1928,202	3323,641	4404,516	100236,7
87	1	0	6765,283	13272,792	35543,25	18106,14	29722,67	51784,52	11543,52	15613,46	33408,97	0,074382	0,199903	0,329484	2233,873	3907,057	5942,146	1734,127	3165,75	4492,026	100893,4
88	1	0	11047,55	29654,659	76060,12	25015,46	29109,85	39488,7	11173,63	14829,08	20373,18	0,301301	0,399426	0,471944	6946,279	8779,615	10096,56	4146,815	5083,029	6290,299	149059,6
89	4	0	10372,49	19215,014	44626,4	24067,25	31564,69	35258,93	11788,68	19137,35	24840,23	0,080807	0,320695	0,394533	2705,656	5007,181	7798,367	2313,768	3618,994	5097,01	106445,7
90	5	1	9274,074	26163,851	79882,25	25376,4	33604,13	48418,92	11111,67	17958,5	26412,79	0,218394	0,336467	0,474565	3658,168	7719,876	9341,84	2931,577	4689,498	5980,518	135507,6
91	6	0	6841,907	16418,31	41544,96	18217,2	31304,9	38266,03	9323,694	20846,23	29088,93	0,073893	0,185206	0,358751	2112,945	3695,554	5832,992	1572,504	2956,83	3983,652	99333,58
92	3	0	8948,668	19777,641	87633,35	24312,98	35395,73	44124,55	11575,98	17804,18	29490,54	0,152875	0,272802	0,390318	4001,7	7415,284	10125,42	2520,728	4650,476	7297,058	144830,4
93	5	0	12704,47	27714,183	51219,58	24452,38	29723,04	37041,93	11112,59	15382,56	26858,11	0,118925	0,316805	0,512171	3193,383	5987,092	7917,929	2371,82	3939,555	5390,031	109436,7
94	1	0	7234,647	23400,117	58804,41	19974,26	32267,44	41515,61	12121,53	18977,16	28075,65	0,072644	0,152875	0,318271	1921,594	3497,974	6759,931	1362,162	2931,577	4619,124	102997,9
95	4	0	9165,48	20956,058	50995,51	19081,06	29835	40642,52	10838,67	16032,45	25299,58	0,196237	0,293575	0,369818	4302,187	6235,177	9133,741	2931,353	3831,258	5946,351	128488,4
96	2	0	16094,83	28037,68	55119,02	22761,73	27474,54	31524,08	11239,61	13666,24	20455,63	0,16942	0,400013	0,471523	3593,373	6366,545	8157,826	2612,155	4168,822	5269,965	116283,4
97	10	0	11444,18	19557,064	47085,67	17325,73	22826,62	29916,54	8464,32	12460,23	16901,86	0,241286	0,279798	0,373789	3497,974	5076,425	6308,311	2207,578	3246,093	4302,723	96601,44
98	5	0	7679,865	15588,011	43116,91	21306,02	30215,07	45707,23	10800,58	16352,08	36047,04	0,068319	0,263036	0,398049	2765,271	4836,477	6396,24	2319,79	3380,007	4652,8	98518,47
99	2	0	5003,356	13618,285	33968,44	27904,87	40404,29	51604,82	14072,42	33522,87	45877,26	0,046022	0,066866	0,152875	1700,374	2899,019	3933,068	1175,012	2398,928	3456,621	70551,45
100	2	0	19264,78	27829,998	76156,94	26290,85	30789,25	37789,77	12910,22	16253,71	23063,05	0,236096	0,31015	0,486995	4051,993	7696,551	8961,064	2760,781	4859,126	5622,14	129011
Total	290	11	9241,252	20751,278	50739,06	22275,41	30601,86	39958,02	11311,37	16508,25	27104,69	0,104651	0,248481	0,394115	2813,188	5267,562	8326,302	2007,52	3536,007	5190,851	
Total landi	25 percentile	50 percentile	75 percentile																	
	96898,6476	107743,1706	128038,9																	

Table 4. Results of long- term stochastic simulations. Probabilities of SSB<Bpa, SSB<Blim and values of SSB, yield, landings, recruitment and fishing mortality. Settings: F target=0.3, the limit on year-to-year variation in catches by equation TACy = TACf + 0.2 * (TACy-1 – TACf), no addition restriction in variation of catches

			Recruits *1000			TSB			SSB			F			Catch (landing+discards),t			Landing,t			Landing,t
Iteration N	SSB<Bpa (N)	SSB<Blim (N)	25 Percent	50 Percentil	75 Percent	25 Percent	50 Percent	75 Percent	25 Percent	50 Percent	75 Percent	25 Percent	50 Percent	75 Percent	25 Percent	50 Percent	75 Percent	25 Percent	50 Percent	75 Percent	Total
1	1	0	11154,65	27887,411	62369,17	24928,96	31785,88	37896,11	15144,82	17791,44	23127,48	0,238051	0,292261	0,33356	5152,291	6474,53	7240,694	3214,08	4184,244	5012,544	123792,3
2	1	0	14832,61	29669,201	53120,08	26336,76	29846,56	34951,26	16366,85	18231,91	22561,92	0,233171	0,276081	0,325103	5036,738	6293,811	7113,793	3665,024	4281,998	5110,263	124956,8
3	4	0	12089,07	21903,925	52812,56	21499,74	34102,18	38889,41	10886,43	20449,83	26164,63	0,247603	0,26306	0,323368	3976,269	6742,627	8215,441	2851,395	4567,783	5717,8	129225,1
4	2	0	11671,85	24770,411	56968,64	23380,64	28825,84	35701,65	14440,75	18824,51	22237,23	0,22531	0,244819	0,292918	4503,618	5592,64	6446,631	2931,577	3976,538	4788,825	122142,2
5	0	0	10068,88	20847,339	41453,47	21824,26	26685,03	34206,32	12850,64	15758,88	21552,01	0,241516	0,295162	0,334771	5142,925	5987,714	7332,636	3449,96	3926,369	5089,638	119213,7
6	4	0	9949,994	15806,166	31047,21	18131,32	28186,1	34998,73	10224,81	14797,87	22731,47	0,217918	0,300003	0,354553	3718,544	5327,272	7798,825	2471,037	3782,196	5580,241	116307
7	2	0	8396,834	16522,314	50417,75	23819,37	31143,2	36149,26	11568,72	16689,85	24108,06	0,226873	0,261755	0,314377	4992,799	6058,91	6781,793	3066,034	4065,78	5313,552	117746
8	0	0	8013,724	36320,385	67389,71	23557,68	36177,55	46935,64	13825,46	18283,63	29907,38	0,225052	0,274149	0,306307	4410,855	6583,069	9298,941	3294,931	4443,597	6529,457	135507,8
9	3	0	8313,168	19579,083	51457,62	21949,27	33159,76	37820,48	12964,42	20084,45	25738,52	0,224959	0,265119	0,323407	4642,088	5538,06	8158,469	2751,598	3860,897	5964,837	125656,5
10	0	0	9585,659	32368,078	64220,64	27472,5	31918,8	43966,52	16033,95	18926,68	27400,96	0,219486	0,274399	0,321385	5303,688	6486,557	8599,531	3375,26	4522,161	6994,445	147231,9
11	0	0	6270,983	18768,46	56264,77	23800,9	36303,15	48857,47	11755,55	22907,24	33437,96	0,210657	0,255305	0,318234	5443,592	7464,674	8870,041	3122,702	5057,457	7230,816	147979,1
12	0	0	10380,52	24047,399	58429,08	22883,13	32824,97	40508,26	14085,41	17812,55	26756,06	0,20578	0,286377	0,327697	3497,974	6549,802	9502,677	2839,966	4630,958	6553,016	132759
13	0	0	11213,33	19372,995	54458,43	23562,93	29425,85	38439,84	12033,76	18285,77	21567,45	0,209822	0,284534	0,312692	4743,727	6247,146	7240,664	3017,261	4078,774	5210,74	117397,5
14	0	0	14751,98	32475,717	63580,57	28686,62	35276,95	41806,15	13845,15	19240,89	25708,84	0,283981	0,314192	0,332236	5365,019	6995,456	8446,587	3607,516	4700,544	5751,407	138528,9
15	1	0	9197,422	13566,087	50322,97	20387,36	26787,75	34741,45	10953,82	15119,4	20992,65	0,236958	0,278555	0,330304	3911,019	5558,494	6772,896	2522,906	4342,588	5037,449	118265,8
16	1	0	8979,22	23683,135	47925,94	23611,85	29834,98	35175,75	12644,93	16445,32	22143,79	0,235669	0,279915	0,335951	4292,202	5967,574	7058,684	3067,741	4332,893	4863,961	114958
17	2	0	12644,48	23187,523	41270	21858,62	27283,31	31657,81	12148,34	17235,16	20016,66	0,278639	0,304259	0,321784	4607,85	5903,499	6931,572	2938,458	3999,908	4818,715	118499,4
18	1	0	14005,46	23819,259	41611,01	20198,41	30422,26	35166,16	11610,92	19438,75	22405,67	0,22186	0,271618	0,325206	3905,683	5635,788	7087,584	2623,104	3953,222	4870,223	119691,3
19	0	0	10962,57	17117,096	51772,5	23080,29	27048,69	29880,08	13715,73	15508,87	20341,73	0,222088	0,264994	0,32174	4389,635	5147,641	6259,789	2931,577	3464,663	4537,248	106829,8
20	0	0	12606,71	25497,606	58953,47	26992,99	31102,38	35691,14	15852,83	18454,25	22203,28	0,218777	0,273488	0,319301	4996,13	6007,467	6894,944	3268,124	4130,102	4701,628	120436,4
21	1	0	11855,04	31868,287	59118,2	28554,93	31414,26	40391,65	16576,25	19120,64	24463,92	0,24156	0,261026	0,325052	5295,74	6745,851	7665,298	3543,725	4349,868	6056,302	135327,8
22	2	0	11487,05	16367,812	54646,15	19227,14	22238,15	28612,17	10683,13	13217,22	16442,35	0,234245	0,295088	0,324564	3497,974	4609,151	6733,43	2561,684	3238,2	4332,88	112867,3
23	1	0	16284,78	27727,631	51128,84	25934,19	30802,53	36382,77	15928,76	19385,91	22173,77	0,2346	0,269724	0,333815	5322,474	5974,347	6875,886	3207,904	4317,463	4888,218	122232,3
24	2	0	11154,11	16833,375	40795,32	18326,93	27026,65	37522,87	11106,43	14838,99	24438,41	0,241141	0,275895	0,32066	4009,546	5455,874	6985,043	2733,603	3503,121	4951,235	112674,5
25	2	0	10713,16	19895,464	59417,87	23003,78	33702,58	38142,11	10769,93	18065	25489,91	0,21172	0,286484	0,328361	4389,789	6379,465	7400,546	2931,577	4353,972	5258,195	121652,8
26	1	0	11820,02	21157,58	60242,29	23643,83	29712,53	35405,5	14609,28	17188,49	24443,09	0,206976	0,309253	0,333324	5234,013	6272,58	7575,725	3243,394	4321,299	5653,278	127682,1
27	0	0	8969,487	29041,674	56507,44	27843,38	33743,15	39292,44	16695,12	20555,6	26197,56	0,225594	0,260896	0,321543	5952,775	6525,705	7525,556	3850,558	4735,03	5690,09	133594,7
28	2	0	12426,84	29134,462	47458,16	21681,58	28234,92	31413,02	12162,93	16551,76	18674,66	0,216861	0,266014	0,328253	3923,889	5339,518	6269,614	2658,699	3667,535	4288,042	102836,5
29	4	0	8507,633	16092,269	49245,95	21292,21	35127,6	40107,47	12218,05	18472,61	26970,97	0,205377	0,263642	0,313145	3888,896	6618,932	8165,659	2931,577	4158,923	6203,931	130643,8
30	2	0	17365,79	25656,31	52733,88	28889,88	33792,49	40083,79	16065,25	20309,33	24867,29	0,247706	0,268342	0,328902	5313,687	6715,278	7858,248	3499,426	4246,525	5507,944	138607,8
31	1	0	8779,541	21965,311	41927,1	20630,16	28676,54	37178,72	11720,86	16651,7	25464,22	0,218787	0,240275	0,267668	4425,77	5109,14	6541,902	2680,797	3573,341	4846,249	113474
32	0	0	10625,1	34184,613	51459,52	26242,02	29493,98	35093,5	13636,54	17862,35	22557,85	0,261829	0,307342	0,324873	5057,077	6305,882	7011,106	3447,523	4176,913	5120,757	125002,1
33	1	0	12270,13	27576,409	48431,03	23661,17	28125,28	36166,11	12523,28	16838,79	21616,48	0,237575	0,290851	0,327701	4339,702	5763,786	7961,78	2931,577	3922,896	5405,692	120874,1
34	1	0	9036,861	17675,805	49779,74	23065,18	31962,67	38598,24	14516,87	17914,51	25271,85	0,215022	0,254071	0,296322	4713,606	5723,147	6993,23	2931,577	4007,644	4778,483	121235,4
35	4	0	10747,76	18926,103	42660,86	18023,28	21729,37	25781,27	10806,36	13218,48	16330,55	0,212909	0,267686	0,305598	3637,876	4175,52	4901,176	2539,119	2931,577	3329,887	90569,9
36	1	0	15455,33	29166,731	54268,62	25682,35	31834,17	35293,99	15608,92	18624,89	22442,81	0,225926	0,256736	0,296773	4808,46	6058,918	6909,476	3126,802	3928,016	5002,922	119750
37	6	0	8927,822	16850,884	43360,16	17121,26	22609,21	37596,88	9743,419	14118,11	23624,89	0,213979	0,270185	0,315669	3242,852	4212,5	8382,68	2280,849	2931,577	4613,47	111107,4
38	0	0	10842,75	20258,771	51003,51	22826,8	30776	35883,93	13096,44	18106,89	22216,37	0,243613	0,270145	0,338096	5181,466	6038,568	7069,795	3029,42	4260,851	5212,39	121771,5
39	1	0	11745,96	25725,149	52823,29	23002,46	26382,05	34130,95	12992,71	16016,38	19712,01	0,254969	0,281983	0,344694	4551,248	5161,629	6542,349	3273,318	3583,362	4125,237	111544,3
40	0	0	15472,49	26707,965	57986,65	26094,6	33496,58	39611,63	15001,36	18376,28	25277,77	0,228934	0,256238	0,294385	4557,944	6583,667	7455,901	3275,926	4307,923	5238,809	120025,1
41	4	0	11679,73	31383,488	46099,98	23135,71	29217,07	37575,66	12911,49	16303,87	24902,76	0,25836	0,277851	0,349302	4421,655	5921,396	7617,546	3087,417	3935,137	5413,081	122189,5
42	1	0	9306,454	24260,937	68192,73	23279,16	26214,89	35821,58	11526,73	15395,74	21880,08	0,224748	0,288373	0,345345	4141,577	5618,598	7270,102	2931,577	3561,011	4649,093	114449
43	2	0	11505,44	28079,808	72112,22	26962,78	36706,48	44014,85	15399,08	20344,67	27906,3	0,20534	0,294152	0,323507	4615,05	6096,58	9574,32	3424,186	3748,756	6445,526	142472,1
44	2	0	15929,1	31878,872	54476,42	26096,82	29796,18	34295,32	14990,49	17824,86	20845,76	0,247427	0,2831	0,317689	4938,935	6320,526	7465,499	3584,666	4201,421	5127,235	130107,9
45	1	0	14120,17	26844,375	59121,88	28320,37	32594,99	35812,96	14255,73	19042,7	22834,83	0,25365	0,307152	0,334954	5139,553	7007,877	7726,814	3697,45	4843,113	5347,909	130545,6
46	1	0	9275,054	20855,664	40589,34	21867,21	28507,81	32120,98	12395,67	17071,04	20163,87	0,233892	0,264034	0,336766	4142,121	5109,976	7157,571	2931,577	3736,413	4920,196	111251,8
47	0	0	8243,776	21931,986	76032,58	25138,23	33490,67	40506,05	13719,69	19563,8	25454,04	0,262579	0,291449	0,333519	5062,356	6666,105	7813,555	3363,488	4335,459	5501,594	136642,7
48	0	0	8617,344	15703,398	70757,34	25532,72	32133,12	37230,23	13206,51	20412,05	25093,44	0,224897	0,264114	0,282102	4649,999	6587,543	7484,271	3189,064	4249,863	5547,318	122363,6
49	1	0	11613,16	35907,054	70516,04	26403,73	31962,44	42540,22	14625,42	16837,92	24400,17	0,247446	0,291681	0,342472	4954,246	6796,303	8317,762	3715,862	4489,342	5710,507	132493,9
50	0	0	8489,756	23740,048	59060,79	24556,21	31604,46	37231,88	14826,44	21170,18	23683,93	0,222219	0,261761	0,305995	4979,768	6128,039	7069,076	3626,058	4068,001	4900,701	124175,4
51	3	0	9758,529	23250,442	63787,16	23484,85	29007	44412,47	11536,94	17281,24	14597,45	0,222588	0,301426	0,341188	4142,469	5746,512	8442,759	2931,577	3984,222	2931,577	136772,5
52	1	0	12658,09	25132,724	72936,28	24260,17	33839,25	41797,78	13580,89	19031,3	25724,23	0,231203	0,277405	0,327186	4146,734	6517,026	8599,393	2965,131	4148,356	5791,664	129988,6
53	3	0	11786,43	23403,628	50082,71	20177,64	31562,37	40801,45	11953,28	17096,21	26135,81	0,239712	0,292885	0,322834	4443,146	5707,425	8295,214	2931,577	4097,247	4963,462	124704,1
54	2	0	11440,87	19753,899	52706,58	20195,85	24644,18	40084,26	11685,64	16302,07	21329,72	0,23025	0,283005	0,308841	4242,108	5017,05	8580,242	2834,854	3532,182	5609,441	126762,5
55	0	0	16072,98	27725,969	46130,12	22828,62	28046,05	34924,54	12375,56	16662,27	23187,85	0,247201	0,286977	0,314885	4758,654	5814,909	6999,112	3122,559	4091,928	5409,216	126449,3
56	2	0	10490,96	18211,976	48332,51	21928,5	27005,3	34019,9	13784,64	16786,11	20992,15	0,234922	0,261721	0,309552	4332,379	5157,668	7126,6	2931,577	3712,442	4866,045	110750,5
57	5	0	9927,638	20276,367	53162,28	20796,58	28836,37	42054,95	10723,29	16984,48	26043,66	0,22174	0,27177	0,316756	4430,34	5196,765	8651,872	2919,045	3531,941	5989,961	123564
58	2	0	8599,815	21387,715	56774,36	21702,73	30901,16	36903,72	12243,2	18129,72	23744,66	0,246519	0,276239	0,317544	4403,498	6468,157	7697,879	3039,209	4286,966	6012,437	131956,5
59	1	0	11260,05	23668,939	58069,26	24094,08	31275,74	41440,62	14012,84	20013,97	23958,09	0,219424	0,257608	0,310933	4306,37	6480,67	9379,799	3003,31	4537,854	6219,009	135962
60	1	0	14916,42	22915,197	44477,46	20437,98	34228,6	41432,65	12981,33	17418,38	27237,39	0,221209	0,275496	0,321519	4209,902	6316,415	8121,647	2912,634	4445,132	5714,568	122049,5
61	1	0	11239,69	34193,184	60183,35	26377,1	32813,42	38223,96	13394,44	17629,34	23686,19	0,243169	0,30566	0,353557	4958,045	6726,934	8770,459	3112,008	4312,375	5901,567	136616,7
62	0	0	13842,76	31121,013	51046,32	27051,78	29940,78	37424,81	14953,95	19034,36	23456,57	0,233471	0,280719	0,34936	4974,123	6517,573	7492,141	3450,461	4204,46	5322,375	134582,3
63	2	0	8906,268	19305,368	34775,22	22093,65	29490,56	33513,91	13015,76	16872,28	21808,24	0,232848	0,271763	0,314724	4312,54	5917,771	6890,889	2931,577	4133,081	5060,832	115270,7
64	1	0	17216,08	30263,295	45334,55	22994,27	27404,85	36387,38	13115,84	17183,22	21332,54	0,233589	0,247099	0,309956	4194,145	4744,705	6807,292	2875,261	3529,09	4922,616	114971,2
65	3	0	9692,744	20119,526	50052,52	17886,04	26084,28	36587,1	10821,34	13407,07	19896,35	0,20534	0,268494	0,348742	3497,974	4773,345	6834,448	2355,16	3179,459	4451,519	108302,4
66	1	0	15547,82	30909,425	51006,93	24016,07	30668,52	33993,65	14618,8	16686,57	21649,7	0,221635	0,27052	0,320255	4109,65	5799,051	7256,825	2931,577	3843,022	4878,796	115824,9
67	1	0	7074,946	18488,135	63327,56	24651,18	32648,95	42844,16	13857,27	18467,75	29542,64	0,250609	0,272385	0,326136	5182,272	7477,913	8728,344	3935,459	4856,623	6298,448	138348,7
68	1	0	9759,205	23646,5	50746,59	25922,46	32135,07	37462,2	13928,07	18331,37	25090,63	0,233274	0,275496	0,321703	4600,317	6247,327	7399,729	3265,137	4210,034	5195,925	120343,5
69	1	0	11473,4	24120,645	43784,47	20833,63	25201,42	32129,87	12870,05	15607,94	19715,22	0,238043	0,296446	0,313024	4244,855	5173,236	5954,63	2931,577	3665,166	4135,622	103843,4
70	1	0	8437,167	17666,602	41984,76	19304,42	26926,71	30484,31	12655,96	16205,25	20690,21	0,199058	0,251966	0,293378	3497,974	5112,852	6720,601	2303,871	3460,722	4765,042	116810,1
71	1	0	14835,66	30906,167	48776,59	27225,49	31280,54	35404,25	16041	19100,2	22629,49	0,218976	0,271935	0,32097	5336,802	6137,293	6977,793	3691,746	4279,922	5075,219	126157,4
72	1	0	10748,71	21592,275	59648,11	23478,23	29827,06	40348,34	12184,47	16587,56	25125,2	0,258313	0,297361	0,351036	4503,58	6035,483	7843,07	3290,191	4004,786	5526,483	135408,6
73	2	0	10568,55	30624,514	50484,03	27457,68	31930,9	42975,26	14300,03	19314,93	27156,63	0,240603	0,298817	0,325854	5376,199	6854,216	8718,574	3535,737	4536,201	6390,619	139660,8
74	2	0	11191,54	21067,42	66801,6	27259,91	34047,74	45949,49	16087,84	21892,47	28803,5	0,233064	0,280355	0,310179	4958,444	6516,474	9049,017	3296,931	4781,595	6754,28	147042,5
75	0	0	10095,25	19447,228	51898,39	21948,14	29541,95	33501,39	13085,55	16307,46	21110,23	0,246244	0,291647	0,334859	4821,631	5680,261	6810,835	3064,961	3881,35	4731,066	117036,7
76	5	0	10661,61	18273,206	50755,47	17652,03	26577,48	42417,02	9544,897	13449,2	27084,49	0,21597	0,28308	0,329413	3497,974	5246,555	7443,738	2489,845	3639,808	5984,949	120974,3
77	1	0	8945,813	19158,57	66562,23	26650,05	31837,49	34420,17	15083,22	19004,11	23133,27	0,244314	0,267978	0,330882	5343,421	6022,81	7375,245	3688,04	4342,25	4974,35	126454,2
78	4	0	10269,66	19042,3	24736,8	16814,32	22128,35	25450,42	10439,82	12923,98	17622,6	0,202542	0,294089	0,334753	3497,974	4111,881	6067,331	2372,648	2910,573	4181,314	92967
79	1	0	9401,989	20210,195	59757,13	29777,12	32894,52	37019,91	16545,6	21616,3	25424,96	0,215064	0,254566	0,292862	5316,814	6215,317	7146,691	3691,574	4511,195	5020,468	124324,7
80	2	0	10211,93	16663,624	65331,88	26289,52	32122,64	45750,76	12132,39	18286,63	29123,08	0,213473	0,280588	0,357964	5614,033	6718,401	8546,29	2931,577	4703,179	6968,539	141856,4
81	0	0	17144,11	35986,432	62323,51	30583,74	34409,16	39032,77	16294,89	20673,11	24621,73	0,237962	0,281083	0,329103	5920,506	6452,015	8372,803	3696,938	4623,664	5921,473	137867,4
82	3	0	13626,49	23213,843	60841,7	26877,82	29908,47	39057,4	12962,24	18617,17	21865,58	0,246347	0,304028	0,333829	4888,898	6408,71	8294,864	3138,482	4223,831	5801,965	131580,8
83	1	0	9501,175	24940,973	40151,82	23067,69	28066,95	32846,94	14109,84	16413,68	20623,75	0,24785	0,284247	0,335975	4630,181	5531,668	6987,249	2939,999	3645,905	5091,648	113760,9
84	9	0	8710,529	14869,178	35985,97	17467,41	26587,1	38013,24	7673,639	16831,83	22252,4	0,228942	0,300465	0,335745	3497,974	6244,573	7687,171	2046,975	4075,827	5769,908	119258
85	0	0	13833,35	17875,947	43377,66	18353,86	23048,9	37898,88	10496,55	12662,59	21757,12	0,205841	0,301471	0,358174	3497,974	5135,025	7369,082	2565,827	3682,669	5167,532	114204,7
86	2	0	12905,42	27376,189	43968,45	23489,87	27485,7	36218,93	12079,99	16446,2	21260,15	0,245718	0,29616	0,32782	4383,969	6192,271	6823,576	2931,577	4187,759	5110,215	116947,5
87	1	0	11571,27	17907,003	44738,43	18468,08	26350,76	41017,56	11154,36	15074,01	24361,74	0,233313	0,266846	0,31871	3405,944	6260,838	7374,931	2474,125	3719,473	5993,405	123352,3
88	0	0	9825,506	21748,552	55641,06	24864,11	32378,86	42654,87	13805,52	20331,85	25035,27	0,227374	0,2797	0,326793	5255,632	6764,441	7775,397	3676,512	4646,488	5790,079	138366,5
89	1	0	11355,91	25985,264	41903,71	24655,73	27806,98	34389,98	14520,84	17879,71	22134,69	0,21167	0,238362	0,304751	4601,799	5565,703	6842,547	2931,577	3911,851	4831,091	114680,5
90	2	0	11874,6	31141,567	61307,85	29106,87	35793,94	40612,69	16284,94	20421,08	27058,97	0,250424	0,285501	0,342877	5855,174	7011,846	8807,177	4163,279	4901,526	6078,26	142902,2
91	3	0	9712,254	18180,345	48826,07	19853,99	29863	33940,62	11406,7	16860,81	23259,36	0,23715	0,285753	0,344274	4085,535	5300,374	7706,763	2900,209	3529,607	5010,589	125472,5
92	2	0	6117,961	19827,663	70561,96	28312,99	33435,19	47262,3	14523,44	20543,86	33270,3	0,226913	0,247553	0,326413	5551,64	6932,154	10159,37	3204,49	5295,102	6358,989	149189
93	1	0	12955,61	29459,696	46566,32	25521,89	27991,89	37080	14474,15	17076,11	21034,05	0,25485	0,319066	0,351734	4997,136	6331,064	7142,173	3518,649	4083,072	4768,625	125554,3
94	1	0	8997,697	23536,782	57670,83	20338,78	26719,55	44224,15	12018,97	14008,63	27362,44	0,214307	0,283603	0,315189	3814,289	5174,238	7491,637	2596,514	3245,894	5408,713	118797
95	2	0	8320,912	20743,864	50245,94	19416,81	32026,21	39730,62	12042,46	16730,11	28181,97	0,223183	0,236768	0,278842	3594,522	6071,625	8333,905	2456,915	4138,067	5745,794	121976,8
96	0	0	17809,3	26008,961	45798,55	23267,8	29813,02	31693,38	12075,58	16893,44	19966,07	0,26228	0,298137	0,357132	4670,492	5866,441	7237,718	3004,394	3710,715	4985,345	118423,9
97	5	0	11528,38	21557,415	43080,29	18042,55	22563,59	30234,18	10006,74	13006,13	17080,57	0,2495	0,30165	0,337904	3839,73	4732,764	5646,149	2604,882	3107,774	3913,6	96802,97
98	1	0	13736,4	23756,659	45707,98	22019,78	27813,1	38198,97	13553,45	15662,82	22664,41	0,263036	0,293418	0,311332	4484,029	5235,65	7881,017	3080,109	3812,883	5641,638	126984,5
99	1	0	13163,54	25979,795	44955,65	21475,18	33058,06	40847,87	12731,09	17495,42	26752,86	0,243785	0,268679	0,331059	3914,489	6864,352	9293,968	2990,733	4661,403	6541,126	140640,2
100	1	0	15628,26	29910,594	66482,75	27555,97	33469,07	37487,44	15184,33	19998,64	23989,48	0,251845	0,287287	0,307477	5174,218	6461,567	7082,516	3704,117	4367,561	5140,643	130464,1
Total	153	0	10550,76	22748,042	53503,37	22967,07	29941,82	37685,75	12756,49	17253,41	23951,04	0,229984	0,278921	0,326423	4483,147	6122,563	7758,527	2932,659	4050,14	5336,438	
Total landi	25 percentile	50 percentile	75 percentile																		
	117014,3888	122857,9907	132090,9																		

Table 5. Results of long- term stochastic simulations. Probabilities of SSB<Bpa, SSB<Blim and values of SSB, yield, landings, recruitment and fishing mortality. Settings: F target=0.4, the limit on year-to-year variation in catches by equation TACy = TACf + 0.2 * (TACy-1 – TACf), no addition restriction in variation of catches

			Recruits *1000			TSB			SSB			F			Catch (landing+discards),t			Landing,t			Landing,t
Iteration N	SSB<Bpa (N)	SSB<Blim (N)	25 Percent	50 Percentil	75 Percent	25 Percent	50 Percent	75 Percent	25 Percent	50 Percent	75 Percent	25 Percent	50 Percent	75 Percent	25 Percent	50 Percent	75 Percent	25 Percent	50 Percent	75 Percent	Total
1	2	0	13376,95	29147,224	65755,31	22416,64	30876,12	36675,7	12899,89	15302,52	19640,91	0,296555	0,364244	0,42031	5840,344	7437,125	8161,566	3496,559	4638,146	5462,428	130497
2	1	0	14886,61	31808,672	58450,95	24789,63	29179,71	33911,83	14273,9	16355,09	20120,12	0,293051	0,376198	0,431108	5761,999	7213,748	8487,595	3979,335	4496,071	5583,951	134583,1
3	6	0	13201,2	26794,805	64800,96	19194,32	32111,51	38075,92	10060,42	17667,74	21802,37	0,326476	0,35521	0,393413	4623,226	7568,48	9043,992	2931,577	5099,513	5892,288	138663,6
4	2	0	12468,26	26092,394	61865,83	21257,18	27430,64	34457,59	12560,51	16117,77	22053,37	0,269884	0,315068	0,365609	5238,118	6323,318	8224,146	3218,634	4419,444	5279,66	134188,8
5	2	0	10536,41	23692,845	49159,84	20228,25	24306,16	32443,44	11025,59	13570,94	19465,68	0,286273	0,388798	0,446098	4787,772	6706,898	7999,151	3055,489	4366,954	5483,05	123703
6	4	0	10232,97	15931,213	35430,32	18102,23	25442,65	34195,23	9514,836	11291,66	18217,29	0,19819	0,37471	0,459061	3497,974	5806,223	9045,214	2086,034	3850,368	6036,096	120782
7	3	0	9623,713	17574,894	54544,91	19196,44	27987,28	36033,5	10314,23	13506,06	20529,69	0,227542	0,34104	0,431141	3849,986	6485,162	7743,899	2931,577	4204,344	5405,169	120279,3
8	0	0	11102,1	36663,727	70472,73	22457,86	35080,92	45564,42	11697,8	17330,16	25276,61	0,289549	0,344565	0,408786	4447,342	7843,583	10968,19	2942,911	4763,571	6982,65	144453,1
9	3	0	9147,659	21332,339	54622,61	19141,27	31226,67	36492,51	10900,14	16079,44	20973,2	0,27098	0,354799	0,429491	5116,757	6456,82	8683,389	3244,128	4329,746	5997,379	133287,1
10	2	1	9415,5	37229,615	81471,14	24895,41	31838,79	40574,73	12839,49	17327,09	26489,03	0,289852	0,368594	0,431297	6250,411	7136,074	9703,049	4036,256	4638,043	6895,952	156610,7
11	3	0	8829,369	25343,219	59372,85	21081,84	35092,26	44341,95	10244,27	17203,41	28293,07	0,275994	0,334621	0,430839	6377,792	7947,993	10046,88	3382,536	5466,893	6821,53	152744,3
12	0	0	12136,9	27243,114	62426,94	22875,9	30613,05	40283,29	12915,36	16796,94	22099,97	0,226739	0,374984	0,43875	3957,766	7383,362	11060,51	2595,419	5217,787	7179,466	142091,3
13	2	0	12258,95	21503,759	58697,86	21744,26	27827,99	35002,05	10657,15	15728,24	18033,44	0,271736	0,364759	0,411383	4173,958	6897,3	8255,824	2931,577	4263,173	5289,6	123037,4
14	0	0	18623,72	36690,954	80279	27197,84	33524,95	40128,91	11309,4	16944,8	21871,21	0,340661	0,417036	0,448916	6275,385	7994,522	9736,015	3648,242	4944,664	6273,226	146028
15	4	0	10291,59	16561,812	53252,17	18414,62	22774,88	32201,17	10466,22	12672,3	17523,19	0,258019	0,372411	0,448843	4165,691	6339,448	7663,796	2931,577	4103,597	5344,412	122042,5
16	2	0	9789,746	28047,859	54087,15	21080,38	27979,44	34149,65	10812,13	13998,66	18802,72	0,256103	0,347348	0,451564	4403,357	7015,273	8533,206	2931,577	4523,701	5481,467	121241,6
17	4	0	14017	27023,551	44324,41	20256,96	25454,17	29318,98	10509,6	14272,79	16465,45	0,320166	0,38922	0,424466	5037,74	6498,251	7706,882	3267,807	4387,942	4996,936	121153,5
18	5	0	15615,96	25436,334	49762,01	18762,56	29325,96	34037,04	10185,64	16723,52	19569,47	0,279319	0,352206	0,432044	4314,285	6594,657	8231,474	2900,024	4368,106	5078,056	127210,7
19	1	0	11234,08	19122,972	56810,1	21843,74	25011,54	29391,92	11020,47	13766,5	17972,31	0,263735	0,350008	0,41353	4992,311	5695,657	6981,029	3093,376	3883,225	4699,828	113489,9
20	1	0	13215,7	27903,022	62561,84	25574,81	30399,37	33540,01	13445,8	16424,83	19398,51	0,289229	0,367322	0,420425	6015,774	6756,195	7909,794	3890,975	4409,834	5052,219	129462
21	1	0	13982,55	34836,434	66942,7	27218,69	30783,41	37589,07	13575,03	17004,41	21382,06	0,30475	0,337255	0,425913	6041,236	7736,753	8897,675	3985,974	4961,909	5936,194	144746,2
22	5	0	11342,14	18131,247	56784,93	17418,97	22152,26	27546,54	9657,26	11960,93	15885,78	0,308524	0,388311	0,41362	4095,436	5531,677	7118,758	2931,577	3629,767	4390,515	116939
23	1	0	17869,23	29152,683	59011,87	23595,32	29024,65	35012,83	12606,2	16766,31	18836,3	0,288975	0,329973	0,450868	6004,867	6884,537	8402,888	3150,491	4495,634	5203,029	131932,2
24	4	0	11185,09	18685,295	56783,5	17770,43	26486,87	35096,54	10133,84	12794,16	20313,3	0,283085	0,34625	0,410821	4080,276	6254,259	7967,071	2931,577	4208,958	5284,899	118553
25	3	1	10429,94	23728,5	58584,37	19577,25	30947,8	37509,6	10258,96	15309,75	20937,44	0,253284	0,364938	0,438088	4524,497	7071,243	8069,402	3280,257	4643,001	5686,888	129499
26	2	0	13533,83	25836,92	70559,41	23203,46	26751,65	34005,97	11302,81	15691,09	20935,8	0,264953	0,402768	0,439623	5625,803	6740,994	8722,778	3099,748	4791,825	5844,326	133116,5
27	0	0	11185,86	30562,494	65557,31	25736,55	32048,47	38560,37	14214,77	17474,05	23219,25	0,29626	0,339642	0,422933	6917,036	7722,047	8405,864	4379,828	4883,804	6265,097	144414,3
28	1	0	12448,01	32829,012	52312,83	21554,64	26890,16	29632,65	11113,93	13732,77	15880,8	0,2657	0,349427	0,442488	4068,527	6176,732	7174,527	2725,988	3956,969	4635,772	108051,6
29	5	0	10727,67	18995,913	54720,05	18944,37	32378,8	38632,22	10942,45	15810,26	23176,77	0,218425	0,321601	0,419205	3497,974	7515,315	9337,689	2534,452	4450,479	6400,682	136549
30	2	0	18352,73	32267,445	57504,01	27259,63	33616,59	38654,33	13288,52	16962,21	22136,38	0,311432	0,358808	0,434269	6181,446	7648,953	9459,854	3940,137	4770,813	6307,568	151051,1
31	1	0	10852,09	23053,385	46757,53	19398,16	26134,46	36544,81	10831,87	14769,73	21943	0,270362	0,302478	0,338172	3504,8	5841,957	7710,547	2724,889	3994,869	4916,057	119424,3
32	0	0	11182,7	35974,828	57136,98	23743,89	27241,76	34076,39	10931,44	14299,98	19530,43	0,346589	0,391072	0,433537	5600,103	7070,019	7957,999	3653,144	4367,528	5305,843	131893,6
33	3	0	12408,06	34002,769	58368,11	22250,14	25530	33662,39	10851,31	13998,36	18527,85	0,282959	0,394242	0,439694	4781,786	6413,889	8455,485	3275,218	4047,167	5940,342	126644,8
34	1	0	11317,62	19955,824	59075,64	21758,37	29719,74	37564,82	12679,23	15634,72	20846,94	0,2157	0,311979	0,390842	3606,78	6902,302	7891,33	2931,577	4625,027	5033,079	126007,6
35	5	0	11072,78	20860,536	43515,48	17883,33	20848,97	23353,1	9754,896	10909,98	14051,34	0,243445	0,309538	0,407547	3121,461	4908,891	6007,901	2093,398	3215,039	3634,42	93749,72
36	1	0	18084,62	32695,069	61843,46	25085,43	30618,73	33466,87	13398,59	16502,77	19094,32	0,285444	0,332408	0,391885	5074,528	6766,202	8180,599	3370,541	4191,166	5343,571	129230,3
37	7	0	9716,966	18184,179	44963,36	16858,44	20650,53	33712,95	9545,582	12636,39	20693,62	0,236428	0,338592	0,404089	3281,353	4729,367	9250,094	1953,343	3215,048	5250,7	115242,7
38	1	0	12007,34	21545,626	59624,74	22606,92	27995,86	33323,74	11771,52	14787,9	18439,12	0,31968	0,340711	0,447598	4980,607	6760,721	8162,739	3286,709	4378,519	5234,227	127316,5
39	2	0	12637,62	26221,606	59463,7	21285,43	24693,07	32753,56	10785,55	13655,56	17624,88	0,317429	0,367523	0,466073	5088,092	6176,641	7347,178	3392,144	3954,336	4502,538	117814,9
40	0	0	15750,86	28444,672	68207,24	24633,06	31651,56	38039,08	12682,14	15319,77	21896,06	0,275436	0,332752	0,377747	4811,763	7687,691	8618,049	3518,746	4867,459	5586,153	131073,5
41	5	0	12453,52	34686,261	55488,57	22812,65	28056,04	35296,28	10971,2	14295,97	20860,75	0,272522	0,368798	0,472773	4209,364	6750,5	8215,471	2931,577	4190,4	5764,197	127609,1
42	4	0	9620,717	23544,185	72853,15	20470,44	25392,9	36043,65	10558,76	13898,94	19871,45	0,265857	0,376264	0,44766	3645,353	6547,318	8610,064	2457,862	4167,732	5106,959	120051,3
43	2	0	12434,78	31871,308	81660,47	22828,81	34159,32	44225	13266,08	16336,81	28152,14	0,258281	0,346592	0,422585	4762,319	7310,941	11507,6	3305,068	4259,857	7720,363	151883,9
44	2	0	19144,54	38872,642	56413,46	24165,6	27919,79	31820,2	12928,55	14758,4	17327,34	0,324643	0,379659	0,430686	5664,319	7102,302	8303,249	3635,63	4530,354	5523,911	137581,4
45	1	0	16501,45	29638,014	68163,97	26146,34	31405,66	34192,22	12697,68	15911,02	19478,86	0,331119	0,405785	0,450523	5621,187	8048,56	8756,29	3883,315	5014,774	5695,628	140341
46	2	0	9441,651	22123,717	43928,88	20987,57	26786,35	32045,42	11759,98	14240,65	18586,79	0,287362	0,327517	0,446431	3836,661	5886,692	7961,608	2853,729	3989,383	5131,811	116765,2
47	3	0	9115,071	25195,682	79027,78	24988,34	30190,7	39940,65	11399,38	16282,41	22941,17	0,324274	0,389706	0,448421	5954,729	7702,706	9216,961	3649,305	4799,356	6140,682	145881,5
48	3	0	9507,038	16716,622	71966,65	23556,33	31107,31	36378,8	11216,91	16625,27	22022,81	0,27452	0,327959	0,372441	5057,721	7519,049	8381,912	3214,018	4789,845	5935,378	129863
49	2	0	12758,14	38652,473	76808,13	23358,02	31045,95	40008,35	12259,09	15789,08	21163,51	0,302951	0,388901	0,45061	5206,279	7635,927	9879,114	3647,217	4815,036	5731,82	140814,9
50	0	0	9352,949	27195,717	62650,05	24233,23	30803,06	35815,91	13302,97	17538,07	21814,6	0,279929	0,334947	0,414687	5334,352	7180,535	8283,897	3284,098	4524,465	5404,295	132734,8
51	4	0	12825,63	23928,792	70202,78	19018,85	28026,98	42801,28	9447,942	15094,81	14877,57	0,291477	0,375534	0,430213	3572,757	6971,342	9873,16	2931,577	4203,337	2931,577	142669,1
52	3	0	11800,57	30133,352	72612,35	22765,15	31419,56	42875,86	11102,29	15515,32	23364,04	0,259906	0,365406	0,443796	4504,611	7355,523	10459,24	2931,577	4391,368	5940,196	138184,3
53	2	0	14988,25	29849,139	50274,22	19585,37	29005,54	36658,89	10907,43	15032,49	20936,72	0,293203	0,374456	0,440209	4058,956	6520,112	8951,897	2931,577	3965,805	6125,808	129018,8
54	3	0	12498,36	22002,19	54992,61	18181,94	23539,77	38457,78	10761,63	13558,41	17765,57	0,263501	0,370519	0,415047	4695,487	5624,61	9816,607	3118,182	3776,084	6377,82	132773,3
55	2	0	17432,65	28762,17	52179,69	21646,99	25828,43	33098,95	10879,06	14070,86	19715,97	0,316005	0,370237	0,419473	5358,818	6525,294	8380,884	3489,014	4344,558	5062,654	132234,6
56	2	0	11527,82	19866,709	53024,97	19066,24	24965,67	30543,7	11050,54	14096,29	19312,23	0,266099	0,3296	0,409079	3758,883	6192,337	8245,288	2931,577	4169,069	5376,242	116422,6
57	7	0	10019,77	23240,457	61311,08	18595,12	25697,41	38379,67	9405,283	13227,84	22469,97	0,296322	0,341967	0,439084	5123,797	5965,574	9184,458	2955,951	3913,603	6196,987	128826,5
58	2	0	9117,546	28806,392	62629,42	21189,73	30214,96	35691,01	11061,35	16888,26	21553,65	0,299023	0,359036	0,406433	4770,007	7757,017	8749,475	3066,81	4889,421	5877,131	141866,9
59	2	0	12346,96	24397,367	72738,61	23867,47	29711,5	38846,72	11448,95	17116,11	21592,94	0,264215	0,334776	0,429445	5281,245	6967,678	10608,51	3271,909	4446,761	6543,739	144142,8
60	5	0	19913,1	24897,861	62074,32	19463,26	30510,21	37349,66	10918,7	15567,74	22561,11	0,303032	0,360577	0,438561	4519,458	6871,177	9598,217	3124,489	4563,223	6188,92	129389,6
61	1	0	13371,39	38442,971	63492,44	23955,55	31037,06	38047,52	11402,74	15249,49	21848,69	0,28391	0,379768	0,481451	5137,064	7492,081	9856,76	3086,368	4938,983	6303,944	143093,3
62	1	0	14632,7	37633,957	62923,73	24227,25	28885,29	35685,43	13338,48	16407,32	20733,29	0,284874	0,367604	0,464174	5786,646	7560,343	8295,578	3779,862	4616,079	5823,826	144310,1
63	4	0	10187,47	20539,609	37129,21	20650,64	28537,43	31440,83	10471,38	14666,04	18305,02	0,269778	0,352377	0,416463	5534,903	6774,758	7759,913	2931,577	4432,788	5166,748	120652,5
64	1	0	20274,49	31163,697	47814,72	21396,65	25615,16	34209,39	11931,67	14668,04	17765,46	0,284952	0,31346	0,417286	4874,052	5465,664	7777,511	2931,577	3493,047	5222,995	122702,8
65	6	0	10093,99	19408,289	50416,78	17771,72	25159,7	35708,64	9269,864	12541,2	17542,47	0,229887	0,324398	0,440544	3350,355	5796,295	8208,795	2519,243	3326,709	5298,964	114789,1
66	1	0	16478,63	33358,083	53509,43	22385,5	28366,01	31823,59	11519,7	15156,55	18326,78	0,283116	0,358181	0,433087	4715,853	6439,802	8148,579	3003,943	4171,689	5253,839	122452,1
67	2	0	10075,46	21166,552	71065,92	22421,83	29713,21	40246,02	11613,23	16410,36	24235,9	0,27882	0,367695	0,428351	5498,966	8173,02	9842,486	3054,581	5416,803	6301,454	143543,4
68	1	0	11425,85	29370,519	54214,05	25176,74	30092,43	35481,45	12853,3	16552,45	21640,79	0,297095	0,327792	0,434499	5809,712	6893,415	8308,45	3502,511	4818,87	5495,641	128196,9
69	2	0	12141,68	25769,47	46555,2	20298,41	23146,95	30805,85	10867,96	13310,82	16532,39	0,299804	0,35473	0,420477	4458,715	5833,139	6798,422	2937,752	3866,86	4460,469	109033,8
70	1	0	9534,634	19661	45082,79	18136,38	26024,1	28907,77	11676,05	13410,21	18248,9	0,194386	0,323444	0,391417	3497,974	5488,935	7511,653	2380,507	3796,033	4719,105	119036
71	1	0	16156,94	36250,704	53349,29	25670,52	30566,36	33803,86	13723,17	16745,93	21308,25	0,281913	0,346552	0,434342	6135,375	7287,214	8527,708	3886,003	4831	5388,852	134869,6
72	4	0	11975,05	26296,488	59590,18	21238,53	25996,56	40879,91	11513,12	15074,81	22657,79	0,304648	0,37767	0,449393	4813,867	6599,024	10211,12	3445,834	4415,585	6275,635	144012,6
73	3	0	12317,64	34525,343	71241,11	24767,09	31636,83	42230,51	10857,96	16631,85	23188,96	0,312799	0,381644	0,437123	5942,013	8009,659	9735,178	3879,832	4572,375	6900,506	149747,2
74	2	0	13523,62	28582,661	84876,3	26769,5	33432,69	42875,67	13250,13	19585,04	24894	0,291271	0,3434	0,403482	5814,288	7604,414	10507,44	3642,831	4608,932	7136,817	156130
75	2	0	11769,21	19934,072	53383,13	20730,11	27610,56	31094,66	11243,1	13987,75	17162,68	0,306634	0,373461	0,440875	4964,697	6497,851	7623,871	3329,371	4222,523	4992,504	122924,4
76	6	0	14191,83	23614,673	51341	17304,48	24444,46	40744,84	9433,477	12484,58	21233,31	0,268892	0,331265	0,387329	3403,293	6379,344	8779,515	2330,557	3436,471	5921,165	124577,7
77	1	0	9479,687	18717,354	76604,91	24795,2	29176,82	34046,31	12642,21	16049,54	20634,57	0,306737	0,347208	0,43029	5449,867	7233,044	8918,501	3707,187	4438,686	5451,232	135466
78	6	0	10298,36	20476,557	32142,54	16475,75	19965,18	23032,1	9682,172	11310,9	14863,35	0,229853	0,352127	0,433197	3497,974	4525,061	6465,961	2245,252	2981,624	4468,883	95594,45
79	2	0	9853,435	25480,25	71541,39	28257,02	31415,75	34594,89	14459,63	18046,9	21539,68	0,283022	0,339605	0,388849	6099,338	7096,66	8398,072	4143,224	4903,591	5420,962	134349,3
80	3	0	11099,03	19280,051	65367,45	22081,02	31357,03	42134,21	10553,13	16240,53	23250,08	0,280509	0,367691	0,463932	6357,797	7746,81	9457,312	3440,704	4953,638	6998,855	148820,4
81	0	0	19646,37	40666,986	65845,07	30060,3	33292,01	38185,76	14211,17	16995,69	21733,43	0,302862	0,37771	0,435899	6806,057	7619,041	9269,663	4097,877	5110,008	6200,826	149865,7
82	3	0	15948,74	26819,175	74388,59	23892,54	28058,53	37001,98	11008,81	15232,91	18766,81	0,327543	0,383777	0,47719	5985,396	7164,195	9228,756	3747,187	4429,901	6013,389	141233,5
83	3	0	10343,97	26287,231	46055,32	20369,35	25498,45	31230,27	10802,46	13765,24	17274,69	0,312428	0,379767	0,446136	5074,562	6117,503	7661,734	3335,031	3777,073	5253,849	119568
84	10	0	9621,079	15259,611	37420,07	14219,74	24290,46	35440,53	7712,518	12443,04	19103,07	0,250169	0,331584	0,449969	2868,853	6713,8	9201,312	2129,773	4774,351	5495,296	123397,5
85	4	0	15016,01	20703,546	41690,09	17446,66	20840,63	35688,46	9729,432	11734,38	16341,65	0,18576	0,402281	0,484194	3450,359	5387,241	9355,443	1960,065	3758,971	5169,993	114278,1
86	4	0	13741,92	27808,725	48611,87	20887,77	26096,95	32805,99	10908,64	12865,94	18851,34	0,286373	0,344417	0,436128	4224,378	6961,779	8355,027	2931,577	4130,651	5757,063	122659,1
87	2	0	13593,64	23161,993	45902,56	18234,83	23631,82	36687,04	10414,28	12814,83	20316,81	0,293606	0,336436	0,420538	3836,004	6612,635	7895,936	2559,676	4088,4	6096,783	128159,9
88	2	0	10719,31	30037,344	65953,57	23522,27	30873,4	40775,52	11574,77	16891,53	21509,71	0,291038	0,366221	0,435117	5736,165	7670,994	8927,344	4008,997	5217,774	5808,579	146788,4
89	1	0	12279,83	30647,06	44176,73	22926,32	27441,07	32932,74	12883,71	16149,81	19592,74	0,258978	0,312594	0,401656	4785,001	6360,65	7586,716	3099,896	4337,72	5263,107	121647,7
90	2	0	13021,83	39709,252	71710,37	26724,74	34097,87	39107,53	14118,09	17315,7	22658,58	0,332466	0,38171	0,470029	6607,298	8101,893	10173,59	4604,576	5361,707	6436,699	155490,1
91	6	0	10878,28	19687,055	48810,37	18262,03	26609,69	33612,23	10486,02	14443,63	20727,13	0,284755	0,330521	0,468463	4497,048	5837,206	8693,628	2963,372	3720,956	5758,244	128773
92	3	0	7515,33	22900,269	90777,27	23435,29	33103,48	47158,15	11797,39	17051,76	25537,37	0,287251	0,328711	0,42346	5950,688	7688,521	11439,7	3441,412	5572,724	6360,954	156847
93	3	0	14742,84	29967,335	50436,48	24121,82	27117,35	35413,88	11585,18	14888,75	18942,88	0,306166	0,389868	0,453233	5572,845	7275,662	8354,453	3157,76	4576,254	5241,511	132636
94	2	0	10976,57	27208,423	66162,1	18256,65	22738,43	41435,81	10101,14	13010,6	20771,86	0,293426	0,369817	0,420431	4404,873	6339,005	8460,658	2994,818	3799,949	5720,886	123377,2
95	5	0	9131,007	21090,618	50397,58	18323,73	30653,04	36814,36	11123,77	13941,88	23294,59	0,284793	0,306505	0,375159	4130,166	6675,155	9116,596	2931,577	4600,927	6252,187	128302,6
96	2	0	18084,96	28077,927	48336,67	21384,62	28078,27	30342,7	10531,24	13457	16921,53	0,322535	0,384377	0,48404	5120,624	6727,677	7899,44	3170,297	3832,108	5293,906	123298,2
97	8	0	12778,37	22009,085	46663,76	17366,13	20093,05	27094,92	8980,536	10770,08	14543,26	0,279628	0,393871	0,429371	3762,588	5066,698	5983,956	2677,096	3383,158	4080,55	98799,89
98	1	0	14522,31	29669,568	50650,6	21797,32	26813,24	36472,53	10772,19	14010,11	18724,45	0,283575	0,36903	0,421873	4812,493	6690,34	9242,747	2947,758	3958,912	6100,655	132074,4
99	3	0	14027,86	32144,212	47710,28	18913,44	31716,46	39152,73	10673,72	15491,72	23277,2	0,316114	0,350106	0,453571	4399,627	8072,338	10018,44	3037,123	4655,605	7192,337	149585
100	1	0	17442,58	32185,774	72780,55	26482	31441,26	36347,28	13164,71	16635,07	20356,21	0,304219	0,372977	0,411527	6272,806	7771,278	8726,798	4324,911	4766,54	5330,461	141283,4
Total	263	2	11743,79	25994,622	59354,19	21180,41	28117,87	36123,76	10943,78	15151,46	20693,33	0,281221	0,358193	0,431659	4876,421	6925,374	8966,793	3044,898	4373,596	5733,744	
Total landi	25 percentile	50 percentile	75 percentile																		
	122349,671	129680,9578	141429,3																		

Table 6. Results of long- term stochastic simulations. Probabilities of SSB<Bpa, SSB<Blim and values of SSB, yield, landings, recruitment and fishing mortality. Settings: F target=0.3, the limit on year-to-year variation in catches by equation TACy = TACf + 0.2 * (TACy-1 – TACf), addition restriction: adjusting of TAC not used if SSBy+1<Bpa

Percentile 25				Recruits *1000		TSB			SSB			F			Catch (landing+discards),t				Landing,t		Landing,t
Iteration N	SSB<Bpa (N)	SSB<Blim (N)	25 Percent	50 Percentil	75 Percent	25 Percent	50 Percent	75 Percent	25 Percent	50 Percent	75 Percent	25 Percent	50 Percent	75 Percent	25 Percent	50 Percent	75 Percent	25 Percent	50 Percent	75 Percent	Total
1	1	0	11154,65	27887,411	62369,17	24928,96	31785,88	37896,11	15144,82	17791,44	23127,48	0,238051	0,292261	0,33356	5152,291	6474,53	7240,694	3214,08	4184,244	5012,544	123792,3
2	1	0	14832,61	29669,201	53120,08	26336,76	29846,56	34951,26	16366,85	18231,91	22561,92	0,233171	0,276081	0,325103	5036,738	6293,811	7113,793	3665,024	4281,998	5110,263	124956,8
3	4	0	12089,07	21903,925	52812,56	21499,74	34102,18	38889,41	10886,43	20449,83	26164,63	0,247603	0,26306	0,323368	3976,269	6742,627	8215,441	2851,395	4567,783	5717,8	129225,1
4	2	0	11671,85	24770,411	56968,64	23380,64	28825,84	35701,65	14440,75	18824,51	22237,23	0,22531	0,244819	0,292918	4503,618	5592,64	6446,631	2931,577	3976,538	4788,825	122142,2
5	0	0	10068,88	20847,339	41453,47	21824,26	26685,03	34206,32	12850,64	15758,88	21552,01	0,241516	0,295162	0,334771	5142,925	5987,714	7332,636	3449,96	3926,369	5089,638	119213,7
6	3	0	9903,5	15611,057	31047,21	18891,09	28072,61	35085,89	10549,55	14740,15	22731,47	0,218615	0,295141	0,350191	3877,159	5320,656	7798,825	2916,798	3437,991	5538,864	115972,9
7	2	0	8396,834	16522,018	50417,77	23799,97	31127,81	36149,26	11576,78	16689,85	24100,9	0,227542	0,259319	0,314415	4992,822	6058,91	6774,176	3078,29	4065,78	5317,152	117606,3
8	0	0	8013,724	36320,385	67389,71	23557,68	36177,55	46935,64	13825,46	18283,63	29907,38	0,225052	0,274149	0,306307	4410,855	6583,069	9298,941	3294,931	4443,597	6529,457	135507,8
9	3	0	8313,168	19579,083	51457,62	21949,27	33159,76	37820,48	12964,42	20084,45	25738,52	0,224959	0,265119	0,323407	4642,088	5538,06	8158,469	2751,598	3860,897	5964,837	125656,5
10	0	0	9585,659	32368,078	64220,64	27472,5	31918,8	43966,52	16033,95	18926,68	27400,96	0,219486	0,274399	0,321385	5303,688	6486,557	8599,531	3375,26	4522,161	6994,445	147231,9
11	0	0	6270,983	18768,46	56264,77	23800,9	36303,15	48857,47	11755,55	22907,24	33437,96	0,210657	0,255305	0,318234	5443,592	7464,674	8870,041	3122,702	5057,457	7230,816	147979,1
12	0	0	10380,52	24047,399	58429,08	22883,13	32824,97	40508,26	14085,41	17812,55	26756,06	0,20578	0,286377	0,327697	3497,974	6549,802	9502,677	2839,966	4630,958	6553,016	132759
13	0	0	11213,33	19372,995	54458,43	23562,93	29425,85	38439,84	12033,76	18285,77	21567,45	0,209822	0,284534	0,312692	4743,727	6247,146	7240,664	3017,261	4078,774	5210,74	117397,5
14	0	0	14744,51	32523,462	63268,7	28678,86	35410,98	41811,2	13807,92	19224,25	25786,85	0,283981	0,314415	0,332236	5360,735	6995,456	8446,587	3595,307	4700,544	5757,694	138492,9
15	1	0	9197,422	13566,087	50322,97	20387,36	26787,75	34741,45	10953,82	15119,4	20992,65	0,236958	0,278555	0,330304	3911,019	5558,494	6772,896	2522,906	4342,588	5037,449	118265,8
16	1	0	8979,22	23683,135	47925,94	23611,85	29834,98	35175,75	12644,93	16445,32	22143,79	0,235669	0,279915	0,335951	4292,202	5967,574	7058,684	3067,741	4332,893	4863,961	114958
17	2	0	12644,48	23186,864	41263,43	21856,5	27283,31	31658,75	12470,89	17234,44	20020,24	0,278639	0,304263	0,321395	4603,392	5903,145	6950,809	2972,385	4000,398	4830,265	118098,7
18	1	0	14005,46	23819,259	41611,01	20198,41	30422,26	35166,16	11610,92	19438,75	22405,67	0,22186	0,271618	0,325206	3905,683	5635,788	7087,584	2623,104	3953,222	4870,223	119691,3
19	0	0	10962,57	17117,096	51772,5	23080,29	27048,69	29880,08	13715,73	15508,87	20341,73	0,222088	0,264994	0,32174	4389,635	5147,641	6259,789	2931,577	3464,663	4537,248	106829,8
20	0	0	12606,71	25497,606	58953,47	26992,99	31102,38	35691,14	15852,83	18454,25	22203,28	0,218777	0,273488	0,319301	4996,13	6007,467	6894,944	3268,124	4130,102	4701,628	120436,4
21	1	0	11855,04	31868,287	59118,2	28554,93	31414,26	40391,65	16576,25	19120,64	24463,92	0,24156	0,261026	0,325052	5295,74	6745,851	7665,298	3543,725	4349,868	6056,302	135327,8
22	2	0	11487,05	16367,812	54646,15	19227,14	22238,15	28612,17	10683,13	12927,22	16442,35	0,234245	0,295088	0,334564	3497,974	4609,151	6733,43	2561,684	3238,2	4332,88	112867,3
23	1	0	16284,78	27727,631	51128,84	25934,19	30802,53	36382,77	15928,76	19385,91	22173,77	0,2346	0,269724	0,333815	5322,474	5974,347	6875,886	3207,904	4317,463	4888,218	122232,3
24	2	0	11154,11	16833,375	40795,32	18326,93	27026,65	37522,87	11106,43	14838,99	24438,41	0,241141	0,275895	0,32066	4009,546	5455,874	6985,043	2733,603	3503,121	4951,235	112674,5
25	2	0	10713,16	19895,464	59417,87	23003,78	33702,58	38142,11	10769,93	18065	25489,91	0,21172	0,286484	0,328361	4389,789	6379,465	7400,546	2931,577	4353,972	5258,195	121652,8
26	1	0	11820,02	21157,58	60242,29	23643,83	29712,53	35405,5	14609,28	17188,49	24443,09	0,206976	0,309253	0,333324	5234,013	6272,58	7575,725	3243,394	4321,299	5653,278	127682,1
27	0	0	8969,487	29041,674	56507,44	27843,38	33743,15	39292,44	16695,12	20555,6	26197,56	0,225594	0,260896	0,321543	5952,775	6525,705	7525,556	3850,558	4735,03	5690,09	133594,7
28	2	0	12426,84	29134,462	47458,16	21681,58	28234,92	31413,02	12162,93	16551,76	18674,66	0,216861	0,266014	0,328253	3923,889	5339,518	6269,614	2658,699	3667,535	4288,042	102836,5
29	4	0	8507,633	16092,269	49245,95	21292,21	35127,6	40107,47	12218,05	18472,61	26970,97	0,205377	0,263642	0,313145	3888,896	6618,932	8165,659	2931,577	4158,923	6203,931	130643,8
30	2	0	17365,79	27556,31	52733,88	28889,88	33792,49	40083,79	16065,25	20309,33	24867,29	0,247706	0,268342	0,328902	5313,687	6715,278	7858,248	3499,426	4246,525	5507,944	138607,8
31	1	0	8779,541	21965,311	41927,1	20630,16	28676,54	37178,72	11720,86	16651,7	25464,22	0,218787	0,240275	0,267668	4425,77	5109,14	6541,902	2680,797	3573,341	4846,249	113474
32	0	0	10625,1	34184,613	51459,52	26242,02	29493,98	36093,5	13636,54	17862,35	22557,85	0,261829	0,307342	0,324873	5057,077	6305,882	7011,106	3447,523	4176,913	5120,757	126002,1
33	1	0	12270,13	27576,409	48431,03	23661,17	28125,28	36166,11	12523,28	16838,79	21616,48	0,237575	0,290851	0,327701	4339,702	5763,786	7961,78	2931,577	3922,896	5405,692	120874,1
34	1	0	9079,316	17669,098	49768,55	23451,2	31858,44	38582,58	14558,73	17894,71	25278,33	0,205998	0,253656	0,296322	4683,754	5723,341	6997,312	2931,577	3966,781	4778,483	120943,7
35	4	0	10747,76	18926,103	42660,86	18023,28	21729,37	25781,27	10806,36	13218,48	16330,55	0,212909	0,267686	0,305598	3637,876	4175,52	4901,176	2539,119	2931,577	3329,887	90569,9
36	1	0	15455,33	29166,731	54268,62	25682,35	31834,17	35293,99	15608,92	18624,89	22442,81	0,225926	0,256736	0,296773	4808,46	6058,918	6909,476	3126,802	3928,016	5002,922	119750
37	6	0	8838,25	16852,612	43347,97	17168,93	22619,91	37605,08	9816,494	14129,07	23630,9	0,212816	0,270214	0,315669	3229,121	4215,911	8381,761	2183,461	2931,577	4612,633	110641
38	0	0	10842,75	20258,771	51003,51	22826,8	30776	35883,93	13096,44	18106,89	22216,37	0,243613	0,270145	0,338096	5181,466	6038,568	7069,795	3029,42	4260,851	5212,39	121771,5
39	1	0	11745,96	25725,149	52823,29	23002,46	26382,05	34130,95	12992,71	16016,38	19712,01	0,254969	0,281983	0,344694	4551,248	5161,629	6542,349	3273,318	3583,362	4125,237	111544,3
40	0	0	15472,49	26707,965	57986,65	26094,6	33496,58	39611,63	15001,36	18376,28	25277,77	0,228934	0,256238	0,294385	4557,944	6583,667	7455,901	3275,926	4307,923	5238,809	120025,1
41	4	0	11679,73	31383,488	46099,98	23135,71	29217,07	37575,66	12911,49	16303,87	24902,76	0,25836	0,277851	0,349302	4421,655	5921,396	7617,546	3087,417	3935,137	5413,081	122189,5
42	1	0	9306,454	24260,937	68192,73	23279,16	26214,89	35821,58	11526,73	15395,74	21880,08	0,224748	0,288373	0,345345	4141,577	5618,598	7270,102	2931,577	3561,011	4649,093	114449
43	2	0	11505,44	28079,808	72112,22	26962,78	36706,48	44014,85	15399,08	20344,67	27906,3	0,20534	0,294152	0,323507	4615,05	6096,58	9574,32	3424,186	3748,756	6445,526	142472,1
44	2	0	15929,1	31878,872	54476,42	26096,82	29796,18	34295,32	14990,49	17824,86	20845,76	0,247427	0,2831	0,317689	4938,935	6320,526	7465,499	3584,666	4201,421	5127,235	130107,9
45	1	0	14120,17	26844,375	59121,88	28320,37	32594,99	35812,96	14255,73	19042,7	22834,83	0,25365	0,307152	0,334954	5139,553	7007,877	7726,814	3697,45	4843,113	5347,909	130545,6
46	1	0	9047,486	20504,893	40600,56	21881,97	28457,93	32770,33	12660,93	17042,15	20310,53	0,23379	0,264034	0,333524	3554,624	5140,618	7136,863	2931,577	3736,413	4919,678	111106,3
47	0	0	8244,068	21931,986	75523,29	25498,42	33421,9	40506,05	13726,77	19573,49	25472,08	0,257572	0,291751	0,333519	5069,761	6666,105	7813,555	3363,307	4336,488	5492	136497,5
48	0	0	8617,344	15703,398	70757,34	25532,72	32133,12	37230,23	13206,51	20412,05	25093,44	0,224897	0,264114	0,282102	4649,999	6587,543	7484,271	3189,064	4249,863	5547,318	122363,6
49	1	0	11613,16	35907,054	70516,04	26403,73	31962,44	42540,22	14625,42	16837,92	24400,17	0,247446	0,291681	0,342472	4954,246	6796,303	8317,762	3715,862	4489,342	5710,507	132493,9
50	0	0	8489,756	23740,048	59060,79	24556,21	31604,46	37231,88	14826,44	21170,18	23683,93	0,222219	0,261761	0,305995	4979,768	6128,039	7069,076	3626,058	4068,001	4900,701	124175,4
51	3	0	9758,529	23250,442	63787,16	23484,85	29007	44412,47	11536,94	17281,24	14597,45	0,222588	0,301426	0,341188	4142,469	5746,512	8442,759	2931,577	3984,222	2931,577	136772,5
52	1	0	12658,09	25132,724	70117	24260,17	33839,25	41893,31	13580,89	19552,32	25724,23	0,209058	0,277405	0,327186	4146,734	6517,026	8599,393	2965,131	4012,817	5791,664	129337,3
53	3	0	11786,43	23403,628	50082,71	20177,64	31562,37	40801,45	11953,28	17096,21	26135,81	0,239712	0,292885	0,322834	4443,146	5707,425	8295,214	2931,577	4097,247	4963,462	124704,1
54	2	0	11440,87	19753,899	52706,58	20195,85	24644,18	40084,26	11685,64	16302,07	21329,72	0,23025	0,283005	0,308841	4242,108	5017,05	8580,242	2834,854	3532,182	5609,441	126762,5
55	0	0	16072,98	27725,969	46130,12	22828,62	28046,05	34924,54	12375,56	16662,27	23187,85	0,247201	0,286977	0,314885	4758,654	5814,909	6999,112	3122,559	4091,928	5409,216	126449,3
56	2	0	10490,96	18211,976	48332,51	21928,5	27005,3	34019,9	13784,64	16786,11	20992,15	0,234922	0,261721	0,309552	4332,379	5157,668	7126,6	2931,577	3712,442	4866,045	110750,5
57	5	0	9830,397	20276,367	53181,16	20914,65	28826,34	42053,62	10779,61	16984,59	26011,57	0,221743	0,270893	0,316754	4431,321	5302,688	8650,796	2743,998	3624,826	5989,147	123466,5
58	2	0	8599,815	21387,715	56774,36	21702,73	30901,16	36903,72	12243,2	18129,72	23744,66	0,246519	0,276239	0,317544	4403,498	6468,157	7697,879	3039,209	4286,966	6012,437	131956,5
59	1	0	11260,05	23668,939	58069,26	24094,08	31275,74	41440,62	14012,84	20013,97	23958,09	0,219424	0,257608	0,310933	4306,37	6480,67	9379,799	3003,31	4537,854	6219,009	135962
60	1	0	14916,42	22915,197	44477,46	20437,98	34228,6	41432,65	12981,33	17418,38	27237,39	0,221209	0,275496	0,321519	4209,902	6316,415	8121,647	2912,634	4445,132	5714,568	122049,5
61	1	0	11239,69	34193,184	60183,35	26377,1	32813,42	38223,96	13394,44	17629,34	23686,19	0,243169	0,30566	0,353557	4958,045	6726,934	8770,459	3112,008	4312,375	5901,567	136616,7
62	0	0	13842,76	31121,013	51046,32	27051,78	29940,78	37424,81	14953,95	19034,36	23456,57	0,233471	0,280719	0,34936	4974,123	6517,573	7492,141	3450,461	4204,46	5322,375	134582,3
63	2	0	8906,268	19305,368	34775,22	22093,65	29490,56	33513,91	13015,76	16872,28	21808,24	0,232848	0,271763	0,314724	4312,54	5917,771	6890,889	2931,577	4133,081	5060,832	115270,7
64	1	0	17216,08	30263,295	45334,55	22994,27	27404,85	36387,38	13115,84	17183,22	21332,54	0,233589	0,247099	0,309956	4194,145	4744,705	6807,292	2875,261	3529,09	4922,616	114971,2
65	3	0	9692,744	20119,526	50050,1	18220,36	26066,93	36619,14	10830,76	13712,81	19857,07	0,20534	0,278656	0,337946	3564,055	4849,78	6822,633	2369,243	2931,577	4451,519	108249,1
66	1	0	15547,82	30909,425	51006,93	24016,07	30668,52	33993,65	14618,8	16686,57	21649,7	0,221635	0,27052	0,320255	4109,65	5799,051	7256,825	2931,577	3843,022	4878,796	115824,9
67	1	0	7074,946	18488,135	63327,56	24651,18	32648,95	42844,16	13857,27	18467,75	29542,64	0,250609	0,272385	0,326136	5182,272	7477,913	8728,344	3935,459	4856,623	6298,448	138348,7
68	1	0	9791,089	23646,5	50746,59	25998,33	32099,4	37327,13	14027,61	18331,37	25090,63	0,233145	0,269971	0,321703	4525,263	6247,327	7399,729	3130,876	4237,765	5195,925	120168,8
69	1	0	11445,88	24120,645	43784,47	20884,69	25315,23	32131,43	12870,05	15607,94	19715,22	0,233501	0,295346	0,313024	4050,478	5177,683	5954,63	2885,532	3665,166	4135,622	103802,8
70	1	0	8437,167	17666,602	41984,76	19304,42	26926,71	30484,31	12655,96	16205,25	20690,21	0,199058	0,251966	0,293378	3497,974	5112,852	6720,601	2303,871	3460,722	4765,042	116810,1
71	1	0	14835,66	30906,167	48776,59	27225,49	31280,54	35404,25	16041	19100,2	22629,49	0,218976	0,271935	0,32097	5336,802	6137,293	6977,793	3691,746	4279,922	5075,219	126157,4
72	1	0	10748,71	21592,275	59648,11	23478,23	29827,06	40348,34	12184,47	16587,56	25125,2	0,258313	0,297361	0,351036	4503,58	6035,483	7843,07	3290,191	4004,786	5526,483	135408,6
73	2	0	10568,55	30624,514	50484,03	27457,68	31930,9	42975,26	14300,03	19314,93	27156,63	0,240603	0,298817	0,325854	5376,199	6854,216	8718,574	3535,737	4536,201	6390,619	139660,8
74	2	0	11191,54	21067,42	66801,6	27259,91	34047,74	45949,49	16087,84	21892,47	28803,5	0,233064	0,280355	0,310179	4958,444	6516,474	9049,017	3296,931	4781,595	6754,28	147042,5
75	0	0	10095,25	19447,228	51898,39	21948,14	29541,95	33501,39	13085,55	16307,46	21110,23	0,246244	0,291647	0,334859	4821,631	5680,261	6810,835	3064,961	3881,35	4731,066	117036,7
76	5	0	10764,84	18285,01	50808,1	17643,5	26528,2	42490,95	9968,743	13440,21	27060,17	0,236308	0,28308	0,319231	3497,974	5262,334	7443,738	2503,76	3138,35	5984,949	120843,7
77	1	0	8945,813	19158,57	66562,23	26650,05	31837,49	34420,17	15083,22	19004,11	23133,27	0,244314	0,267978	0,330882	5343,421	6022,81	7375,245	3688,04	4342,25	4974,35	126454,2
78	4	0	10269,66	19042,3	24736,8	16814,32	22128,35	25450,42	10439,82	12923,98	17622,6	0,202542	0,294089	0,334753	3497,974	4111,881	6067,331	2372,648	2910,573	4181,314	92967
79	1	0	9391,487	20525,014	59445,76	29756,39	32856,58	37046,79	16546,82	21688,83	25400,32	0,212875	0,254417	0,292862	5361,754	6215,317	7202,211	3691,574	4503,433	4980,487	124139
80	2	0	10211,93	16663,624	65331,88	26289,52	32122,64	45750,76	12132,39	18286,63	29123,08	0,213473	0,280588	0,357964	5614,033	6718,401	8546,29	2931,577	4703,179	6968,539	141856,4
81	0	0	17144,11	35986,432	62323,51	30583,74	34409,16	39032,77	16294,89	20673,11	24621,73	0,237962	0,281083	0,329103	5920,506	6452,015	8372,803	3696,938	4623,664	5921,473	137867,4
82	3	0	13626,49	23213,843	60841,7	26877,82	29908,47	39057,4	12962,24	18617,17	21865,58	0,246347	0,304028	0,333829	4888,898	6408,71	8294,864	3138,482	4223,831	5801,965	131580,8
83	1	0	9501,175	24940,973	40151,82	23067,69	28066,95	32846,94	14109,84	16413,68	20623,75	0,24785	0,284247	0,335975	4630,181	5531,668	6987,249	2939,999	3645,905	5091,648	113760,9
84	9	0	8710,646	14909,088	35984,53	17467,68	26589,62	38011,23	8117,138	16832,66	22256,25	0,228952	0,304778	0,335754	3497,974	6245,116	7686,932	2227,854	4077,563	5769,908	119208,8
85	0	0	13833,35	17848,493	43377,66	18353,86	23048,9	37898,88	10740,03	12662,59	21757,12	0,205841	0,301471	0,358174	3387,213	5135,025	7369,082	2440,321	3682,669	5167,532	114151,5
86	2	0	12900,97	27354,548	43951,92	23489,87	27485,7	36218,93	12147,37	16446,2	21260,15	0,245718	0,29616	0,32782	4086,092	6192,271	6823,576	2931,577	4187,759	5110,215	116891,1
87	1	0	11571,27	17907,003	44738,43	18468,08	26350,76	41017,56	11154,36	15074,01	24361,74	0,233313	0,266846	0,31871	3405,944	6260,838	7374,931	2474,125	3719,473	5993,405	123352,3
88	0	0	9825,506	21748,552	55641,06	24864,11	32378,86	42654,87	13805,52	20331,85	25035,27	0,227374	0,2797	0,324031	5255,632	6764,441	7775,397	3676,512	4646,488	5790,079	138018,8
89	1	0	11355,91	25985,264	41903,71	24655,73	27806,98	34389,98	14520,84	17879,71	22134,69	0,21167	0,238362	0,304751	4601,799	5565,703	6842,547	2931,577	3911,851	4831,091	114680,5
90	2	0	11874,6	31141,567	61307,85	29106,87	35793,94	40612,69	16284,94	20421,08	27058,97	0,250424	0,285501	0,342877	5855,174	7011,846	8807,177	4163,279	4901,526	6078,26	142902,2
91	3	0	9712,254	18180,345	48826,07	19853,99	29863	33940,62	11406,7	16860,81	23259,36	0,23715	0,285753	0,344274	4285,535	5300,374	7706,763	2900,209	3529,607	5010,589	125472,5
92	2	0	6117,961	19827,663	70561,96	28312,99	33435,19	47262,3	14523,44	20543,86	33270,3	0,226913	0,247553	0,326413	5551,64	6932,154	10159,37	3204,49	5295,102	6358,989	149189
93	1	0	12955,61	29459,696	46566,32	25521,89	27991,89	37080	14474,15	17076,11	21034,05	0,25485	0,319066	0,351734	4997,136	6331,064	7142,173	3518,649	4083,072	4768,625	125554,3
94	1	0	8997,726	23546,005	57661,07	20339,58	26718,09	44223,87	12019,91	14008,58	27370,43	0,214308	0,283603	0,313318	3795,201	5173,504	7491,543	2600,599	3245,867	5408,723	118793,7
95	2	0	8320,912	20743,864	50245,94	19416,81	32026,21	39730,62	12042,46	16730,11	28181,97	0,223183	0,236768	0,278842	3594,522	6071,625	8333,905	2456,915	4138,067	5745,794	121976,8
96	0	0	17809,3	26008,961	45798,55	23267,8	29813,02	31693,38	12075,58	16893,44	19966,07	0,26228	0,298137	0,357132	4670,492	5866,441	7237,718	3004,394	3710,715	4985,345	118423,9
97	5	0	11528,38	21557,415	43080,29	18210,85	22563,59	30234,18	10242,51	13006,13	17080,57	0,2495	0,30165	0,337904	3711,429	4732,764	5646,149	2604,882	2931,577	3913,6	96676,73
98	1	0	13681,24	23749,096	45686,97	22693,02	28137,69	38199,38	14275,41	15636,53	22554,65	0,251044	0,284691	0,311332	4387,875	5254,526	7885,751	3066,403	3776,203	5641,638	126611,8
99	1	0	13163,54	25979,795	44955,65	21475,18	33058,06	40847,87	12731,09	17495,42	26752,86	0,243785	0,268679	0,331059	3914,489	6864,352	9293,968	2990,733	4661,403	6541,126	140640,2
100	1	0	15628,26	29910,594	66482,75	27555,97	33469,07	37471,56	15184,33	19889,69	23989,48	0,251845	0,287287	0,306818	5235,377	6461,567	7082,516	3626,539	4367,561	5140,643	130329,9
Total	152	0	10552,81	22740,669	53503,37	22980,49	29937,89	37670,61	12759,95	17257,08	23951,04	0,229555	0,278698	0,326159	4446,319	6118,794	7758,416	2931,577	4042,8	5337,4	
Total landi	25 percentile	50 percentile	75 percentile																		

Table 7. Results of long- term stochastic simulations. Probabilities of SSB<Bpa, SSB<Blim and values of SSB, yield, landings, recruitment and fishing mortality. Settings: F target=0.4, the limit on year-to-year variation in catches by equation TACy = TACf + 0.2 * (TACy-1 – TACf), addition restriction: adjusting of TAC not used if SSBy+1<Bpa

			Recruits *1000			TSB			SSB			F			Catch (landing+discards),t			Landing,t			Landing,t
Iteration N	SSB<Bpa (N)	SSB<Blim (N)	25 Percent	50 Percentil	75 Percent	25 Percent	50 Percent	75 Percent	25 Percent	50 Percent	75 Percent	25 Percent	50 Percent	75 Percent	25 Percent	50 Percent	75 Percent	25 Percent	50 Percent	75 Percent	Total
1	2	0	13376,95	29147,224	65755,31	22416,64	30876,12	36675,7	12899,89	15302,52	19640,91	0,296555	0,364244	0,42031	5840,344	7437,125	8161,566	3496,559	4638,146	5462,428	130497
2	1	0	14886,61	31808,672	58450,95	24789,63	29179,71	33911,83	14273,9	16355,09	20120,12	0,293051	0,376198	0,431108	5761,999	7213,748	8487,595	3979,335	4496,071	5583,951	134583,1
3	6	0	13201,2	26794,805	64800,96	19194,32	32111,51	38075,92	10060,42	17667,74	21802,37	0,326476	0,35521	0,393413	4623,226	7568,48	9043,992	2931,577	5099,513	5892,288	138663,6
4	2	0	12468,26	26092,394	61865,83	21257,18	27430,64	34457,59	12560,51	16117,77	22053,37	0,269884	0,315068	0,365609	5238,118	6323,318	8224,146	3218,634	4419,444	5279,66	134188,8
5	2	0	10536,41	23692,845	49159,84	20228,25	24306,16	32443,44	11025,59	13570,94	19465,68	0,286273	0,388798	0,446098	4787,772	6706,898	7999,151	3055,489	4366,954	5483,05	123703
6	4	0	10232,97	15931,213	35430,32	18102,23	25442,65	34195,23	9514,836	11291,66	18217,29	0,19819	0,37471	0,459061	3497,974	5806,223	9045,214	2086,034	3850,368	6036,096	120782
7	3	0	9623,713	17574,894	54544,91	19196,44	27987,28	36033,5	10314,23	13506,06	20529,69	0,227542	0,34104	0,431141	3849,986	6485,162	7743,899	2931,577	4204,344	5405,169	120279,3
8	0	0	11102,1	36663,727	70472,73	22457,86	35080,92	45564,42	11697,8	17330,16	25276,61	0,289549	0,344565	0,408786	4447,342	7843,583	10968,19	2942,911	4763,571	6982,65	144453,1
9	3	0	9147,659	21332,339	54783,44	19173,96	31226,67	36476,73	11059,76	16082,07	20973,2	0,27098	0,341446	0,429491	4272,203	6456,82	8683,389	3097,195	4329,746	5997,379	133052,9
10	2	0	9408,862	37229,615	81580,59	24805,54	31774,93	40475,26	13009,62	17641,98	26572,52	0,290303	0,368644	0,431297	6005,548	7136,074	9829,073	4036,256	4522,43	6937,147	156757,2
11	3	0	8829,369	25343,219	59372,85	21081,84	35092,26	44341,95	10244,27	17203,41	28293,07	0,275994	0,334621	0,430839	6377,792	7947,993	10046,88	3382,536	5466,893	6821,53	152744,3
12	0	0	12136,9	27243,114	62426,94	22875,9	30613,05	40283,29	12915,36	16796,94	22099,97	0,226739	0,374984	0,43875	3957,766	7383,362	11060,51	2595,419	5217,787	7179,466	142091,3
13	2	0	12258,95	21503,759	58697,86	21744,26	27827,99	35002,05	10657,15	15728,24	18033,44	0,271736	0,364759	0,411383	4173,958	6897,3	8255,824	2931,577	4263,173	5289,6	123037,4
14	0	0	18623,72	36690,954	80279	27197,84	33524,95	40128,91	11309,4	16944,8	21871,21	0,340661	0,417036	0,448916	6275,385	7994,522	9736,015	3648,242	4944,664	6273,226	146028
15	4	0	10291,66	16561,812	53216,2	18465,62	22810,35	32250,85	10762,05	12672,3	17523,19	0,257777	0,372411	0,448939	4184,609	6333,75	7663,796	2931,577	4104,046	5356,135	121938,9
16	2	0	9789,746	28047,859	54087,15	21080,38	27979,44	34149,65	10812,13	13998,66	18802,72	0,256103	0,347348	0,451564	4403,357	7015,273	8533,206	2931,577	4523,701	5481,467	121241,6
17	4	0	14017	27023,551	44324,41	20256,96	25454,17	29318,98	10509,6	14272,79	16465,45	0,320166	0,38922	0,424466	5037,74	6498,251	7706,882	3267,807	4387,942	4996,936	121153,5
18	5	0	15373,95	25436,35	49762,01	18946,41	29326,27	34037,04	10183,98	16723,52	19569,47	0,279194	0,352208	0,431384	4314,28	6594,657	8231,474	2900,024	4389,237	5078,056	127253,8
19	1	0	11234,08	19122,972	56810,1	21843,74	25011,54	29391,92	11020,47	13766,5	17972,31	0,263735	0,350008	0,41353	4992,311	5695,657	6981,029	3093,376	3883,225	4699,828	113489,9
20	1	0	13236,26	28003,638	62366,81	25737,05	30344,88	33541,25	13647,36	16645,31	19381,27	0,288851	0,364628	0,423525	6015,774	6738,024	7909,794	3536,411	4404,159	5063,035	129346,6
21	1	0	13982,55	34836,434	66942,7	27218,69	30783,41	37589,07	13575,03	17004,41	21382,06	0,30475	0,337255	0,425913	6041,236	7736,753	8897,675	3985,974	4961,909	5936,194	144746,2
22	4	0	11342,37	18149,157	56744,56	17468,3	22241,67	27552,18	9651,989	12054,75	15886,24	0,308524	0,388311	0,412844	4095,436	5531,677	7124,051	2931,577	3630,257	4390,515	116933
23	1	0	17926,19	29152,683	58964,58	23740,38	28984,8	34983,21	12781,81	16748,09	18815,69	0,288457	0,329973	0,450871	6002,702	6970,007	8404,77	3172,456	4489,814	5200,835	131883,7
24	4	0	11185,09	18685,295	56783,5	17770,43	26486,87	35096,54	10133,84	12794,16	20313,3	0,283085	0,34625	0,410821	4080,276	6254,259	7967,071	2931,577	4208,958	5284,899	118553
25	3	0	10470,43	23728,5	58603,36	19577,25	30947,8	37509,6	10275,79	15309,75	20937,44	0,253284	0,364938	0,438088	4559,193	7071,243	8069,402	3309,39	4643,001	5686,888	129478,6
26	2	0	13533,83	25836,92	70559,41	23203,46	26751,65	34005,97	11302,81	15691,09	20935,8	0,264953	0,402768	0,439623	5625,803	6740,994	8722,778	3099,748	4791,825	5844,326	133116,5
27	0	0	11207,04	30302,818	65557,31	25711,52	32050,24	38503,61	14214,77	17474,05	23189,16	0,29626	0,338651	0,422933	6917,036	7722,047	8395,917	4379,828	4889,408	6265,097	144319,8
28	1	0	12448,01	32829,012	52312,83	21554,64	26890,16	29632,65	11113,93	13732,77	15880,8	0,2657	0,349427	0,442488	4068,527	6176,732	7174,527	2725,988	3956,969	4635,772	108051,6
29	5	0	10727,67	18995,913	54720,05	18944,37	32378,8	38632,22	10942,45	15810,26	23176,77	0,218425	0,321601	0,419205	3497,974	7515,315	9337,689	2534,452	4450,479	6400,682	136549
30	2	0	18352,73	32267,445	57504,01	27259,63	33616,59	38654,33	13288,52	16962,21	22136,38	0,311432	0,358808	0,434269	6181,446	7648,953	9459,854	3940,137	4770,813	6307,568	151051,1
31	1	0	10852,09	23053,385	46757,53	19398,16	26134,46	36544,81	10831,87	14769,73	21943	0,270362	0,302478	0,338172	3504,8	5841,957	7710,547	2724,889	3994,869	4916,057	119424,3
32	0	0	11182,7	35974,828	57136,98	23743,89	27241,76	34076,39	10931,44	14299,98	19530,43	0,346589	0,391072	0,433537	5600,103	7070,019	7957,999	3653,144	4367,528	5305,843	131893,6
33	3	0	12408,06	34002,769	58368,11	22250,14	25530	33662,39	10851,31	13998,36	18527,85	0,282959	0,394242	0,439694	4781,786	6413,889	8455,485	3275,218	4047,167	5940,342	126644,8
34	1	0	11218,77	19960,353	58337,82	21758,37	29536,33	37562,72	13424,24	15409,57	20844,48	0,2157	0,311839	0,388659	3606,78	6662,209	7829,064	2931,577	4612,462	4959,473	125771,7
35	5	0	11072,78	20860,536	43515,48	17883,33	20848,97	23353,1	9754,896	10909,98	14051,34	0,243445	0,309538	0,407547	3121,461	4908,891	6007,901	2093,398	3215,039	3634,42	93749,72
36	1	0	18055,66	32642,804	61846,11	25088,38	30644,59	33469,07	13143,1	16591,44	19094,7	0,281293	0,3324	0,393453	5074,528	6777,587	8055,337	3375,231	4191,166	5503,62	128960,2
37	7	0	9716,966	18184,179	44963,36	16858,44	20650,53	33712,95	9545,582	12636,39	20693,62	0,236428	0,338592	0,404089	3281,353	4729,367	9250,094	1953,343	3215,048	5250,7	115242,7
38	1	0	12007,34	21545,626	59624,74	22606,92	27995,86	33323,74	11771,52	14787,9	18439,12	0,31968	0,340711	0,447598	4980,607	6760,721	8162,739	3286,709	4378,519	5234,227	127316,5
39	2	0	12637,62	26221,606	59463,7	21285,43	24693,07	32753,56	10785,55	13655,56	17624,88	0,317429	0,367523	0,466073	5088,092	6176,641	7347,178	3392,144	3954,336	4502,538	117814,9
40	0	0	15750,86	28444,672	68207,24	24633,06	31651,56	38039,08	12682,14	15319,77	21896,06	0,275436	0,332752	0,377747	4811,763	7687,691	8618,049	3518,746	4867,459	5586,153	131073,5
41	5	0	12453,52	34686,261	55488,57	22812,65	28056,04	35296,28	10971,2	14295,97	20860,75	0,272522	0,368798	0,472773	4209,364	6750,5	8215,471	2931,577	4190,4	5764,197	127609,1
42	4	0	9620,717	23544,185	72853,15	20470,44	25392,9	36043,65	10558,76	13898,94	19871,45	0,265857	0,376264	0,44766	3645,353	6547,318	8610,064	2457,862	4167,732	5106,959	120051,3
43	2	0	12434,78	31871,308	81660,47	22828,81	34159,32	44225	13266,08	16336,81	28152,14	0,258281	0,346592	0,422585	4762,319	7310,941	11507,6	3305,068	4259,857	7720,363	151883,9
44	2	0	19185,06	38408,975	56413,46	24448,64	27961,22	32304,19	12926,12	14878,62	17327,34	0,324643	0,378388	0,430686	5557,594	7158,713	8337,866	3593,029	4592,047	5523,911	137499,6
45	1	0	16501,45	29638,014	68163,97	26146,34	31405,66	34192,22	12697,68	15911,02	19478,86	0,331119	0,405785	0,450523	5621,187	8048,56	8756,29	3883,315	5014,774	5695,628	140341
46	2	0	9433,341	22276,226	42927,07	20988,83	27194,74	32045,42	11763,11	14656,66	18515,24	0,263248	0,322715	0,447898	3674,1	5915,697	7961,608	2720,354	3951,36	5308,098	116555,5
47	1	0	9166,814	25204,939	79027,78	24988,34	30207,77	39940,65	11399,38	16282,41	22903,74	0,324274	0,389706	0,414248	5889,306	7702,706	9216,961	3649,305	4624,576	6142,155	145913,7
48	3	0	9507,038	16716,622	71967,33	23556,33	31107,31	36224,47	11263,51	16748,12	22007,9	0,25826	0,334867	0,372441	4936,842	7518,245	8381,912	3418,228	4789,845	5926,061	129667,2
49	2	0	12758,14	38652,473	76808,13	23358,02	31045,95	40008,35	12259,09	15789,08	21163,51	0,302951	0,388901	0,45061	5206,279	7635,927	9879,114	3647,217	4815,036	5731,82	140814,9
50	0	0	9352,949	27195,717	62650,05	24233,23	30803,06	35815,91	13302,97	17538,07	21814,6	0,279929	0,334947	0,414687	5334,352	7180,535	8283,897	3284,098	4524,465	5404,295	132734,8
51	4	0	12825,63	23928,792	70202,78	19018,85	28026,98	42801,28	9447,942	15094,81	14877,57	0,291477	0,375534	0,430213	3572,757	6971,342	9873,16	2931,577	4203,337	2931,577	142669,1
52	3	0	11797	30125,589	72616,12	23138,16	31373,08	42864,7	11099,89	15477,35	23380,77	0,259791	0,365984	0,444449	4615,025	7352,388	10452,16	2931,577	4460,005	5939,435	138233,7
53	2	0	14988,25	29849,139	50274,22	19585,37	29005,54	36658,89	10907,43	15032,49	20936,72	0,293203	0,374456	0,440209	4058,956	6520,112	8951,897	2931,577	3965,805	6125,808	129018,8
54	3	0	12498,36	22002,19	54992,61	18181,94	23539,77	38457,78	10761,63	13558,41	17765,57	0,263501	0,370519	0,415047	4695,487	5624,61	9816,607	3118,182	3776,084	6377,82	132773,3
55	2	0	17432,65	28762,17	52179,69	21646,99	25828,43	33098,95	10879,06	14070,86	19715,97	0,316005	0,370237	0,419473	5535,168	6525,294	8380,884	3489,014	4344,558	5062,654	132234,6
56	2	0	11531,04	19866,709	52978,27	19503,26	25110,24	30556,1	11210,12	14258,5	19301,7	0,266099	0,327332	0,409079	4203,593	6056,054	8241,305	2931,577	4164,614	5396,775	116428,1
57	7	0	10008,79	23240,457	62370,17	18595,12	26036,14	38333,4	9405,283	13231,54	22776,66	0,296621	0,341967	0,439084	5123,797	5898,01	9184,458	2991,566	3983,005	6196,987	128753,1
58	2	0	9117,546	28806,392	62629,42	21189,73	30214,96	35691,01	11061,35	16888,26	21553,65	0,299023	0,359036	0,406433	4770,007	7757,017	8749,475	3066,81	4889,421	5877,131	141866,9
59	2	0	12349,57	24385,735	72731,85	24533,16	30133,24	38890,74	12086,47	17108,39	21888,38	0,263779	0,334787	0,409606	5054,131	6650,964	10617,95	3271,909	4357,455	6543,739	143201,1
60	5	0	19913,1	24897,861	62074,32	19463,26	30510,21	37349,66	10918,7	15567,74	22561,11	0,303032	0,360577	0,438561	4519,458	6871,177	9598,217	3124,489	4563,223	6188,92	129389,6
61	1	0	13371,39	38442,971	63492,44	23955,55	31037,06	38047,52	11402,74	15249,49	21848,69	0,28391	0,379768	0,481451	5137,064	7492,081	9856,76	3086,368	4938,983	6303,944	143093,3
62	0	0	14672,45	37484,203	63140,8	24754,27	29050,78	35782,07	13177,25	16588,18	20676,65	0,27986	0,374859	0,464174	5760,658	7246,232	8295,578	3905,448	4545,893	5615,168	143888,1
63	4	0	10187,47	20539,609	37129,21	21114,41	28537,43	31440,83	10471,38	14666,04	18305,02	0,269778	0,352377	0,412701	4998,46	6774,758	7759,913	2931,577	4432,788	5166,748	120276,5
64	1	0	20274,49	31163,697	47814,72	21396,65	25615,16	34209,39	11931,67	14668,04	17765,46	0,284952	0,31346	0,417286	4874,052	5465,664	7777,511	2931,577	3493,047	5222,995	122702,8
65	6	0	10093,99	19408,289	50416,78	17771,72	25159,7	35708,64	9269,864	12541,2	17542,47	0,229887	0,324398	0,440544	3350,355	5796,295	8208,795	2519,243	3326,709	5298,964	114789,1
66	1	0	16478,63	33354,488	53509,43	22385,5	28429,97	32015,81	11519,7	15317,29	18363,91	0,283116	0,358181	0,433087	4715,853	6502,301	8269,037	3003,943	4226,334	5292,408	122469,9
67	2	0	10075,46	21166,552	71065,92	22421,83	29713,21	40246,02	11613,23	16410,36	24235,9	0,27882	0,367695	0,428351	5498,966	8173,02	9842,486	3054,581	5416,803	6301,454	143543,4
68	1	0	11361,44	29388,478	54179,32	25179,41	30092,43	35478,99	12835,02	16554,53	21676,63	0,29721	0,328121	0,429109	5809,712	6893,415	8308,45	3594,116	4818,87	5495,641	128198,1
69	1	0	12141,69	25783,85	46555,2	20298,41	23126,57	30806,67	10867,71	13316,84	16532,39	0,301547	0,35472	0,42048	4458,715	5832,452	6799,05	2937,752	3845,902	4460,979	108945,7
70	1	0	9534,634	19661	45082,79	18136,38	26024,1	28907,77	11676,05	13410,21	18248,9	0,194386	0,323444	0,391417	3497,974	5488,935	7511,653	2380,507	3796,033	4719,105	119036
71	1	0	16156,94	36250,704	53349,29	25670,52	30566,36	33803,86	13723,17	16745,93	21308,25	0,281913	0,346552	0,434342	6135,375	7287,214	8527,708	3886,003	4831	5388,852	134869,6
72	4	0	11975,05	26296,488	59590,18	21238,53	25996,56	40879,91	11513,12	15074,81	22657,79	0,304648	0,37767	0,449393	4813,867	6599,024	10211,12	3445,834	4415,585	6275,635	144012,6
73	3	0	12317,64	34525,343	71241,11	24767,09	31636,83	42230,51	10857,96	16631,85	23188,96	0,312799	0,381644	0,437123	5942,013	8009,659	9735,178	3879,832	4572,375	6900,506	149747,2
74	2	0	13523,62	28582,661	84876,3	26759,09	33432,69	42875,67	13250,13	19585,04	24926,48	0,291381	0,3434	0,403482	5831,907	7619,08	10507,44	3599,842	4608,932	7136,817	156125,5
75	2	0	11917,94	19934,072	53382,47	20729,52	27693,97	31211,61	11254,06	14187,58	17162,68	0,306634	0,373461	0,441196	4941,73	6497,851	7658,762	3329,371	4131,405	5090,156	122723,5
76	6	0	14191,83	23614,673	51341	17304,48	24444,46	40744,84	9433,477	12484,58	21233,31	0,268892	0,331265	0,387329	3403,293	6379,344	8779,515	2330,557	3436,471	5921,165	124577,7
77	1	0	9479,687	18717,354	76604,91	24795,2	29176,82	34046,31	12642,21	16049,54	20634,57	0,306737	0,347208	0,43029	5449,867	7233,044	8918,501	3707,187	4438,686	5451,232	135466
78	6	0	10298,36	20476,557	32142,54	16475,75	19965,18	23032,1	9682,172	11310,9	14863,35	0,229853	0,352127	0,433197	3497,974	4525,061	6465,961	2245,252	2981,624	4468,883	95594,45
79	2	0	9853,435	25480,25	71541,39	28257,02	31415,75	34594,89	14459,63	18046,9	21539,68	0,283022	0,339605	0,388849	6099,338	7096,66	8398,072	4143,224	4903,591	5420,962	134349,3
80	3	0	11098,87	19261,798	65385,86	22116,96	31357,03	42091,82	10572,71	16235,91	23211,32	0,280509	0,353663	0,463656	5688,183	8065,728	9415,747	3440,352	4995,702	6979,675	148581
81	0	0	19672,84	40620,127	65845,07	30060,3	33250,89	38039,61	14415,74	16978,65	21694,44	0,285107	0,377992	0,433326	6727,832	7619,041	9295,487	4097,877	5110,008	6186,691	149820,4
82	3	0	15743,81	26819,175	74393,03	24100,3	28059,35	37001,98	11009,23	15231,85	19439,53	0,296471	0,383777	0,463446	5989,218	7164,479	9273,602	3848,28	4247,129	6042,097	141318,1
83	2	0	10341,83	26287,231	45989,53	20668,93	25481,13	31234,27	10940,72	13988,88	17272,83	0,314062	0,362723	0,446558	5189,24	6219,726	7661,734	3129,257	3849,046	5241,295	119335,7
84	10	0	9621,079	15259,611	37420,07	14219,74	24290,46	35440,53	7712,518	12443,04	19103,07	0,250169	0,331584	0,449969	2868,853	6713,8	9201,312	2129,773	4774,351	5495,296	123397,5
85	4	0	14962,05	20671,51	42169,71	17781,3	21265,66	35688,46	9877,208	11753,16	16341,65	0,193148	0,39502	0,484712	3450,359	5570,982	9355,443	1960,065	3762,071	5116,451	114389,8
86	4	0	13741,92	27808,725	48611,87	20887,77	26096,95	32805,99	10908,64	12865,94	18851,34	0,286373	0,344417	0,436128	4224,378	6961,779	8355,027	2931,577	4130,651	5757,063	122659,1
87	2	0	13593,64	23161,993	45902,56	18234,83	23631,82	36687,04	10414,28	12814,83	20316,81	0,293606	0,336436	0,420538	3836,004	6612,635	7895,936	2559,676	4088,4	6096,783	128159,9
88	1	0	10719,31	30037,344	65953,57	23562,66	30873,4	40775,52	11749,63	16891,53	21509,71	0,291038	0,366221	0,419228	5736,165	7670,994	8927,344	3570,04	5217,774	5808,579	146765,7
89	1	0	12279,83	30647,06	44176,73	22926,32	27441,07	32932,74	12883,71	16149,81	19592,74	0,258978	0,312594	0,401656	4785,001	6360,65	7586,716	3099,896	4337,72	5263,107	121647,7
90	2	0	13021,83	39709,252	71710,37	26724,74	34097,87	39107,53	14118,09	17315,7	22658,58	0,332466	0,38171	0,470029	6607,298	8101,893	10173,59	4604,576	5361,707	6436,699	155490,1
91	3	0	10867,41	19794,65	48412,02	18778,12	26603,11	33613,76	10766,43	14440,25	20741,87	0,285886	0,33042	0,435873	4497,048	5659,854	8694,252	2981,89	3718,82	5758,433	128844
92	2	0	7515,33	22603,231	90777,27	23748,88	33070,78	47158,15	11794,69	17105,02	25583,97	0,287251	0,328991	0,420393	5353,428	7730,343	11629,44	3441,412	4830,247	6360,954	157062,8
93	3	0	14742,84	29967,335	50436,48	24121,82	27117,35	35413,88	11585,18	14888,75	18942,88	0,306166	0,389868	0,453233	5572,845	7275,662	8354,453	3157,76	4576,254	5241,511	132636
94	2	0	10976,57	27208,423	66162,1	18256,65	22738,43	41435,81	10101,14	13010,6	20771,86	0,293426	0,369817	0,420431	4404,873	6339,005	8460,658	2994,818	3799,949	5720,886	123377,2
95	5	0	9131,007	21090,618	50397,58	18323,73	30653,04	36814,36	11123,77	13941,88	23294,59	0,284793	0,306505	0,375159	4130,166	6675,155	9116,596	2931,577	4600,927	6252,187	128302,6
96	2	0	18084,96	28077,927	48336,67	21384,62	28078,27	30342,7	10531,24	13457	16921,53	0,322535	0,384377	0,48404	5120,624	6727,677	7899,44	3170,297	3832,108	5293,906	123298,2
97	8	0	12782,21	22009,085	46682,14	17608,02	20449,31	27094,92	8971,474	10770,08	14543,26	0,279628	0,393871	0,429371	3762,588	5055,49	5983,956	2677,096	3383,158	4074,092	98773,07
98	1	0	14522,31	29669,568	50650,6	21797,32	26813,24	36472,53	10772,19	14010,11	18724,45	0,283575	0,36903	0,421873	4812,493	6690,34	9242,747	2947,758	3958,912	6100,655	132074,4
99	3	0	14027,86	32144,212	47710,28	18913,44	31716,46	39152,73	10673,72	15491,72	23277,2	0,316114	0,350106	0,453571	4399,627	8072,338	10018,44	3037,123	4655,605	7192,337	149585
100	1	0	17442,58	32185,774	72780,55	26482	31441,26	36347,28	13164,71	16635,07	20356,21	0,304219	0,372977	0,411527	6272,806	7771,278	8726,798	4324,911	4766,54	5330,461	141283,4
Total	252	0	11740,26	25969,965	59328,59	21219,77	28149,01	36095,31	10969,72	15161,34	20698,89	0,279896	0,357549	0,430766	4844,444	6920,376	8964,131	3044,898	4368,474	5720,659	
Total landi	25 percentile	50 percentile	75 percentile																		
	122337,148	129572,933	141455,3																		

Annex 7 – Additional Information provided during the RG/ADGHADDOK

Additional notes following Needle and Mosqueira (2011)

The following results come from a run carried out on 23/08/2011, taking 1 hour 47 minutes. A target F of 0.4 was assumed. The results in Figures 1-3 are based on ALL 500 iteration runs (i.e. including those for which true F reached to FLR-imposed maximum of 2.0), while Figures 4-6 give the results when the 56 runs for which F reached 2.0 have been removed (as I would still argue that these need to be dealt with in *some* way!).

Note that these plots will not be identical to those in Needle and Mosqueira, as a different set of randomised recruitment values has been used.

The conclusion from Figure 2 is that, on average, B will be less than Bpa for 2 years out of the 20 years included in the simulation. Figure 3 shows that the probability of B being less than Bpa increases steadily as the simulations progress forward in time. Stripping the F = 2.0 runs from the analysis reduces these probabilities by about 50%, so the removal of these runs is very influential (more than I would have thought).

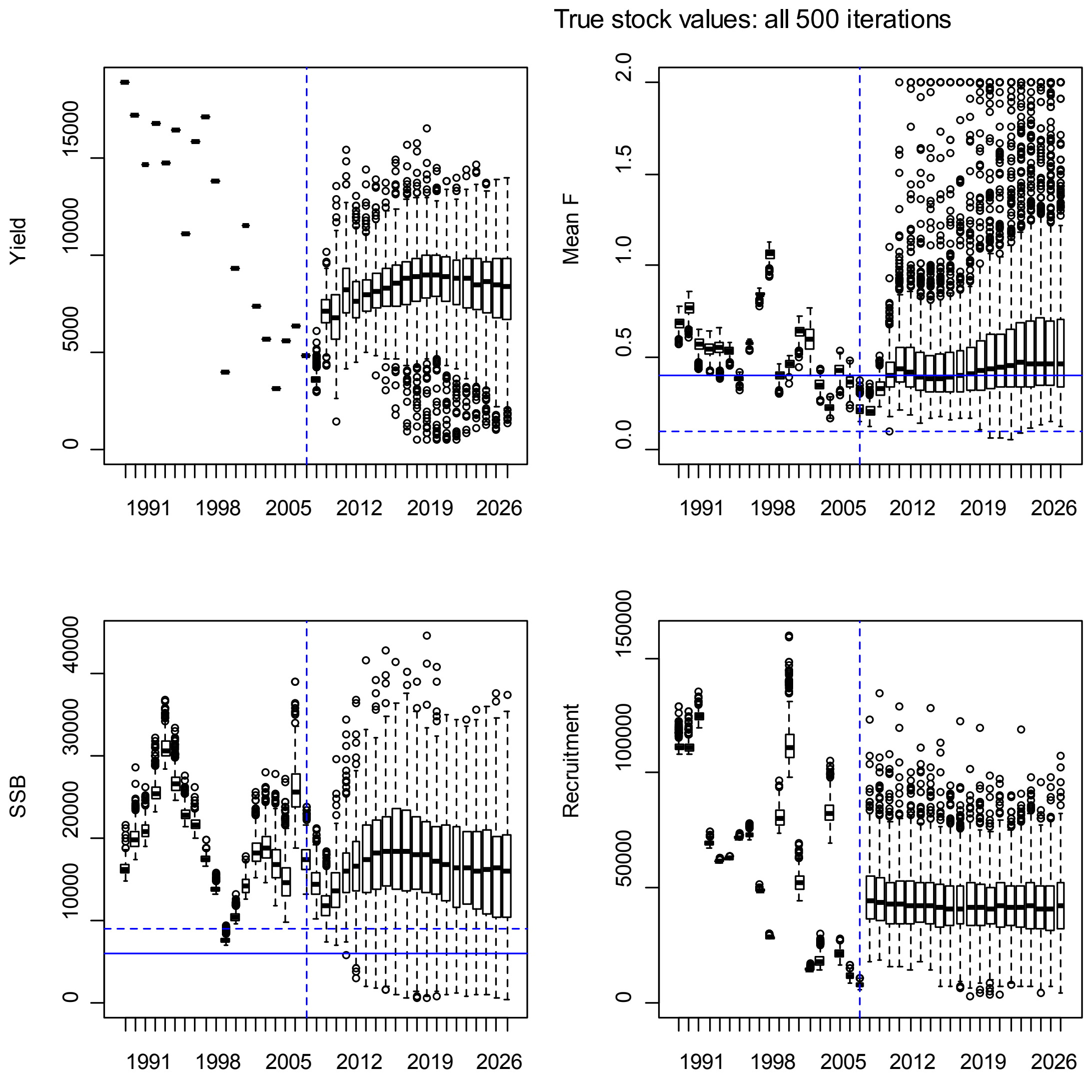
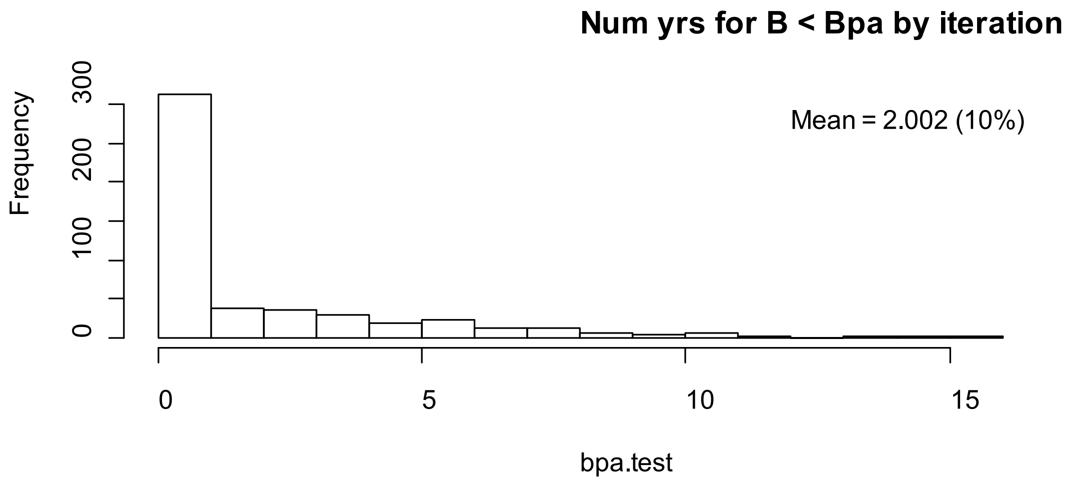


Figure 1 (cf. Figure 10 in Needle and Mosqueira) – target F = 0.4, all 500 iterations included:



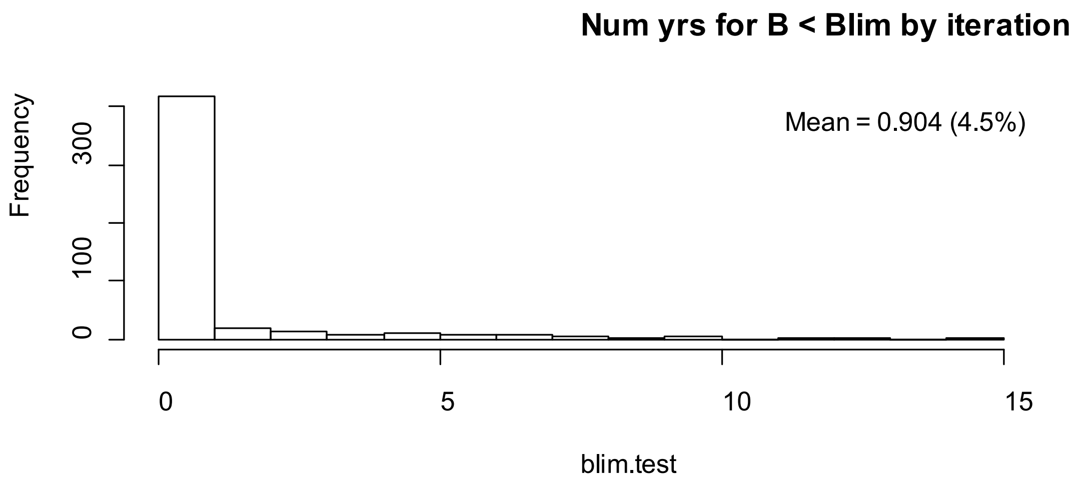


Figure 2 (cf. Figure 12 in Needle and Mosqueira) – target F = 0.4, all 500 iterations included:

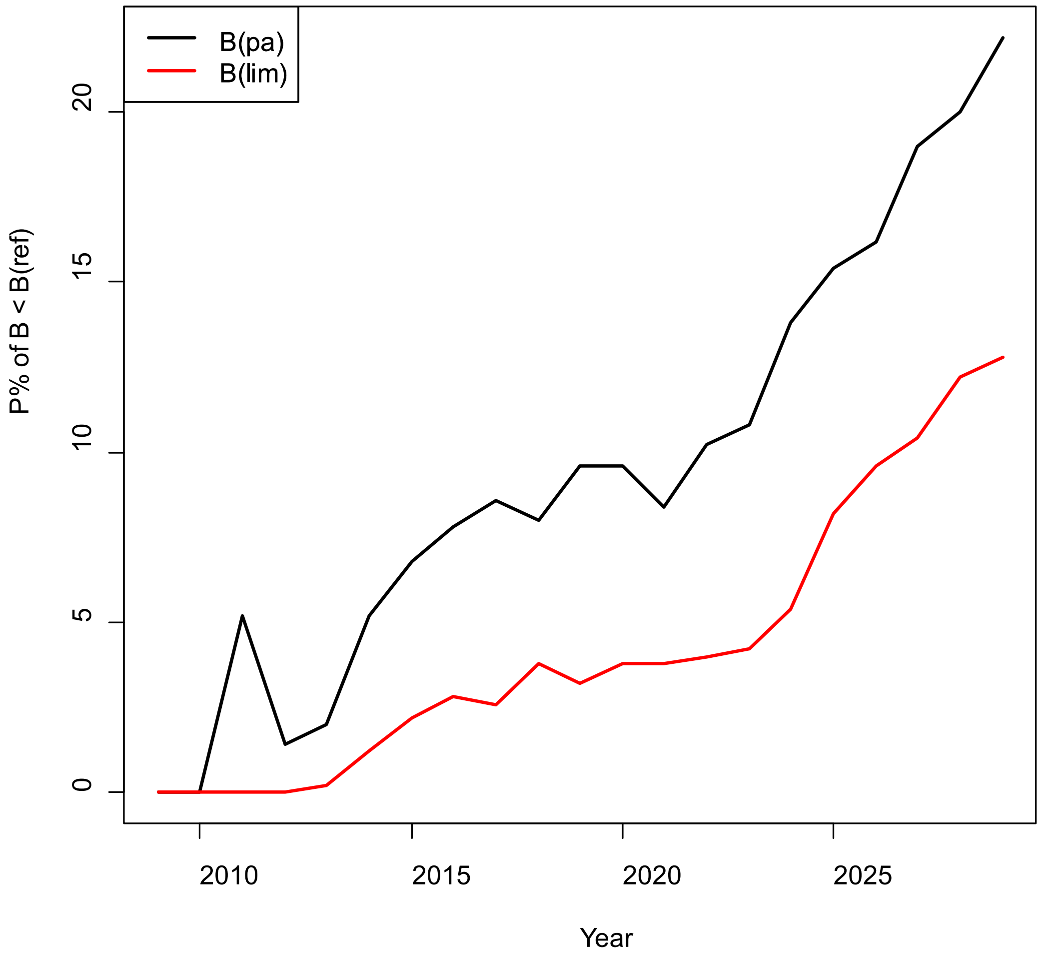


Figure 3: probability (over all 500 iterations) of B < B(pa) or B < B(lim), assuming target F = 0.4.

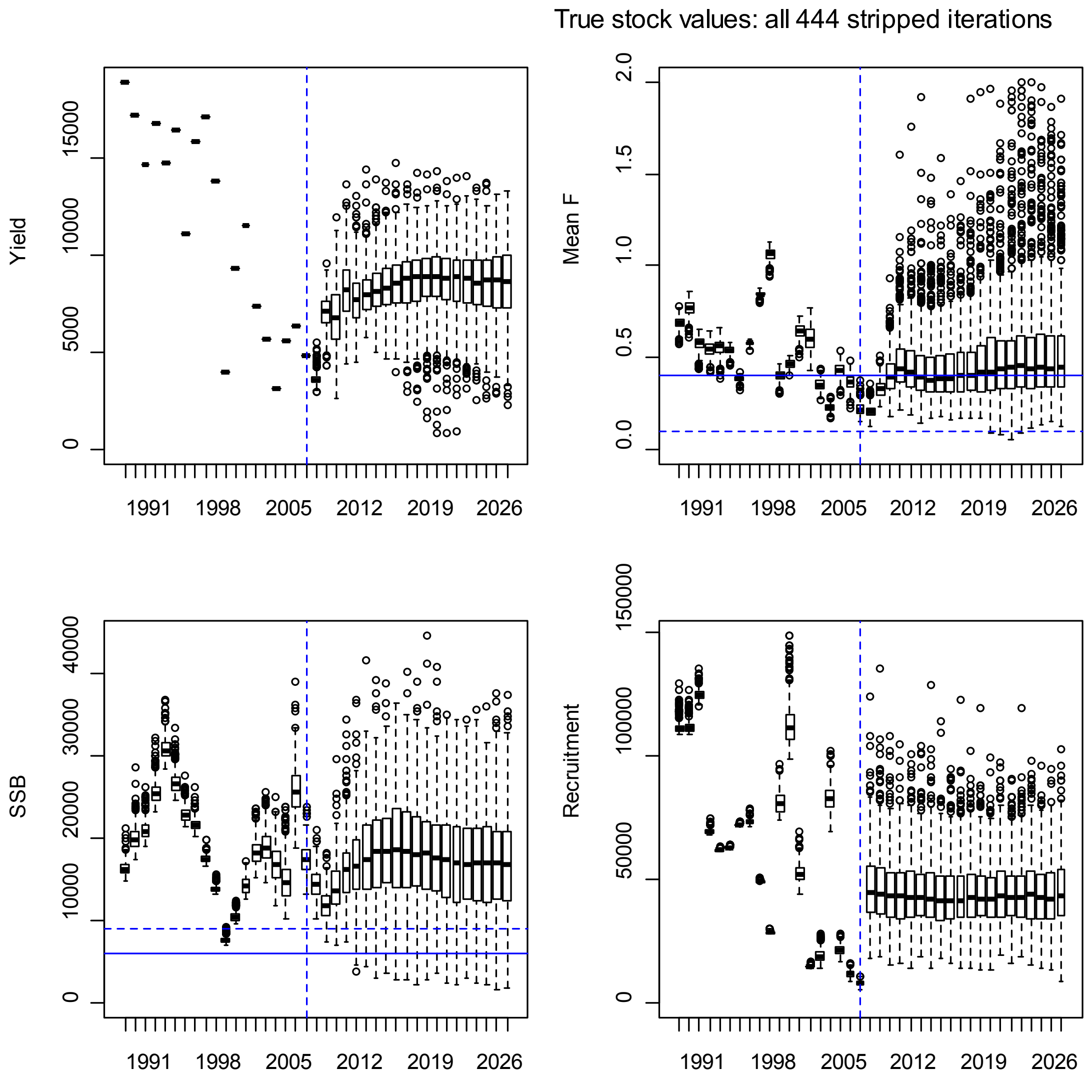


Figure 4: as Figure 1 but for 444 stripped iterations

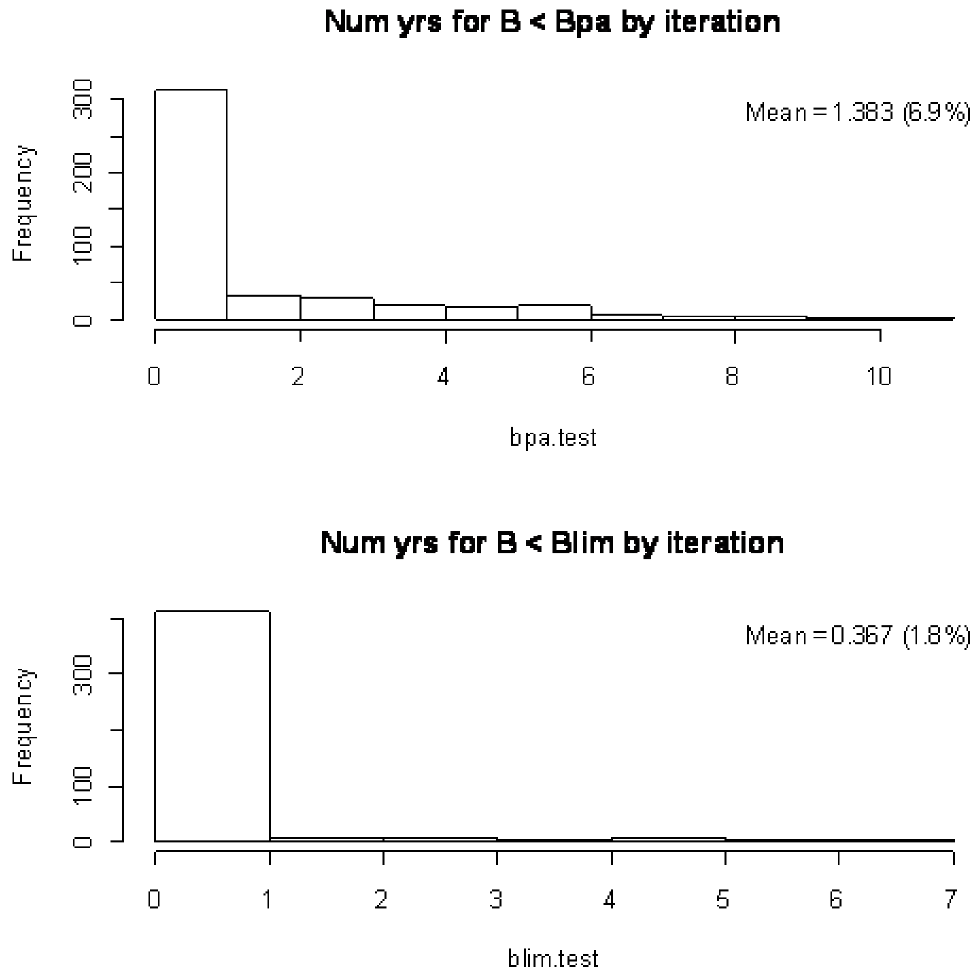


Figure 5: as Figure 2 but for 444 stripped iterations

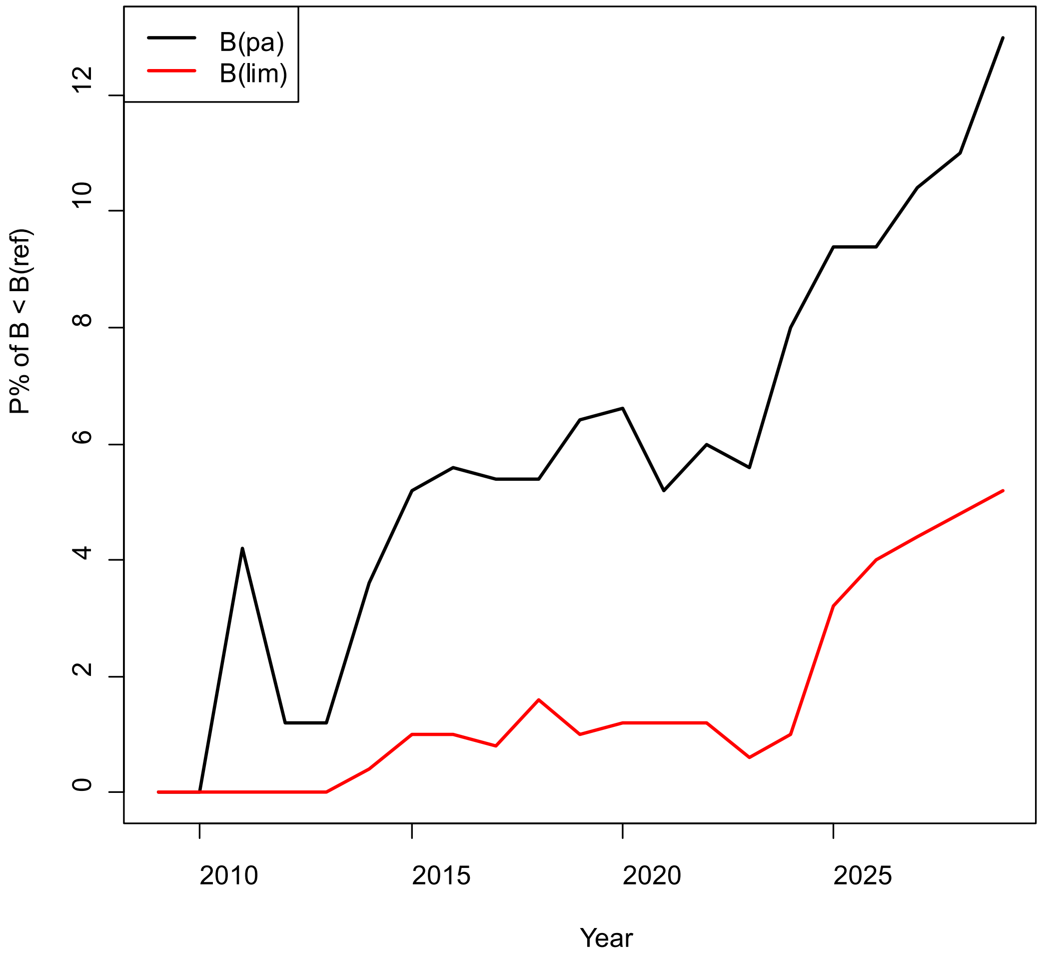


Figure 6: as Figure 3 but for 444 stripped iterations

Annex 8 – Technical Minutes of peer review

Review /Advice Drafting Group

NEAFC request on Rockall Haddock Management Plan Evaluation

Review group Technical Minutes

23-24 August 2011

Participants: Ghislain Chouinard (Chair)

Alain Biseau

Carmen Fernandez

Jean-Jacques Maguire

Norman Graham

Coby Needle

Vladimir Khlivnoy

Cristina Morgado (ICES Secretariat)

General

The RG/ADG considered analyses regarding a request from NEAFC for an evaluation of a proposal for the harvest control rule (HCR) component of a long-term management plan for Rockall Haddock (see Annex 1 –Request). The RG/ADG worked by correspondence and three WEBEX meetings. The RG/ADG received two separate analyses (Needle and Mosqueira WD2011 and Khlivnoy WD2011) to consider since the timing of the analyses did not allow for a unified analysis to be received from WGCSE. The material for the review was received by the RG/ADG on August 15 about 5 working days prior to the start of the RG/ADG meeting. As can be the case in these reviews, clarification had to be sought from the principals involved in the analyses. While documentation of the analyses was provided, the level of details of the documentation required for these types of analyses to conduct a proper review is high and was incomplete on some aspects of the methodology. This required a number of exchanges to obtain clarifications. The RG/ADG received good collaboration from the analysts who conducted the analyses. Without the help of those involved in the analyses, the review could not have been completed. However, there were issues in understanding the analyses due to terminology differences, translation and WEBEX sound quality such that full understanding of the analyses was not possible. The RG/ADG notes that availability of the analysts during the review is essential for these to be efficient.

Technical comments

a) Main conclusions

While the analyses performed were evaluated to have been well conducted, the RG estimates that no definite conclusion could be made on the precautionary aspects of the plan. This was because a larger range of analyses would be required in order to be able to conclude as to whether the plan was precautionary or not. Specifically:

- The assumed stock-recruitment relationship makes the simulations very unlikely to reproduce a period of low recruitments under moderately high SSB, as experienced in recent years (even with the random variability assumed around the stock-recruitment relationship).
- The evaluation follows the example of the ICES stock assessment in not allowing explicitly for the presence of two fleets (EU and RF) with very different characteristics, especially in terms of fishing pattern. The relative catches of these 2 fleets have been highly variable in the past. Using a constant selection in the simulations is unlikely to reflect future conditions
- The analyses assumed perfect implementation, i.e. the set TAC is not exceeded but this condition is unlikely to be met.

b) Secondary issues

i - Comments relative to the draft HCR

Although the assumed objective of Paragraph 3 of the proposed HCR is TAC stability, the proposed HCR is different from rules in other management plans to promote TAC stability. The rule implied by paragraph 3 allows for stability when the TAC in the previous year is close to the value calculated in Paragraph 2.

Paragraph 4 only provides continuity in terms of the F value to be applied in the TAC year with respect to paragraph 2 when the target F in paragraph 2 is 0.3. The way the proposed HCR is stated currently produces a discontinuity in the F to be applied in the TAC year when Ftarget=0.4 depending on whether the SSB computed in paragraph 2 is just above or just below Bpa. This issue should be examined if further requests for evaluation are prepared.

ii - Specific comments on the working documents

The main difference in terms of methodology between the two WDs was that one used forecasts with uncertainties (including accounting for errors in the assessment) while the other combined forecast and re-assessment with uncertainties in both. The RG/ADG noted that the second approach is the one more frequently adopted for such analyses.

As noted above, the relationship between stock and recruitment (S-R) is very weak but it was further noted that the parameters of the S-R of the Needle-Mosqueira and the Khlivnoy analyses were different. A possible cause could be the slightly different time series used in the two analyses to estimate the relationships, but it could not be clarified whether there might be other reasons too.

The authors noted that the work represents evaluations of the likely performance of a management plan. In reality, what is being evaluated is a harvest control rule that may form a part of a management plan. Other management plans (e.g. cod) contain a wide range of other attributes such as effort constraints, technical measures, etc.

a) Needle-Mosqueira working document

Overall, the text was relatively clear. Details that were not provided in the text were, for the most part, clarified with the analyst. An additional analysis was also performed during the RG/ADG.

On page 2, the comment '…*the resulting code on which this paper is based cannot be guaranteed to be error-free*' was of concern to the RG/ADG group in terms of confidence in the analyses. Upon further discussion with the analyst, it was accepted that much the code had been reasonably tested (particularly the FLR bits) and would be used as the basis for advice. However, the RG considers that thorough checking of all aspects of the code is required for future analyses based on the code presently developed.

In the equation at the bottom of page 2, the "epsilon" factor in this formula needs to be exponentiated.

The selection pattern at age for the simulations was not adequately described in the WD.

On page 5, the sentence '*The median values from these plots are the result of smoothing across different realisations of recruitments, and are therefore only useful as an indication of likely future events.*' suggested that some type of smoothing was applied. This was not the case and the sentence should be clarified. It was explained that the word smoothing is probably inappropriate, the meaning being that the trajectory of the median is unlikely to correspond to any individual trajectory (among the 500 iterations).

In the simulation package used by Needle-Mosqueira, the maximum value of F is set at 2.0. It was noted that the potential impacts of the constraint of F on the results of the analyses should be investigated. Furthermore, the simulations that reached the constraint were excluded from the results as they were difficult to explain. The RG concluded that excluding these simulations would result in an underestimation of the probabilities of falling below biomass reference points. Other techniques of restricting F increases between years in simulations should also be explored.

On the third line of second paragraph page 6, there was reference to 9 evaluations runs but there are only 2.

In Table 1 (page 6), the value 1.69 should be replaced by 0.169.

It would be useful for analyses of this type to provide data on the number of years for which F is above the target as well as indicating the probability of being above the target in specific years (for example, 2015 and 2030).

There was reference to true F and assessed F in the document. A clear explanation of the terms "true" and "assessed" would be useful. It was explained that the true F is what the stock is actually subjected to (using $F = \ln(Na/N(a+1)) - M$), while the assessed F is what the FLXSA assessment says the F is (on the basis of catch and survey data).

In Figure 7, for the years just before 2020, the XSA assessments (red lines) seemed to overestimate F and also overestimate SSB and recruitment (truth is black lines), yet the catch values were fit exactly (top left panel of Figure 7). This could not be fully explained. In a discussion with the analyst, the latter mentioned that the catch data used for the XSA assessment during the management strategy evaluation phase is not the "true" catch but has a 10% error. This should be explained in the working document (which did not mention it), as well as how the error in the catch is exactly incorporated (e.g. whether it differs for different ages or is the same for all ages, whether it is incorporated in catch in weight or in numbers, etc). It was thought unlikely that this was the cause of the overestimation of F and SSB in the years before 2020 in Figure 7, although it was noted that the catch displayed in the top left panel of Figure 7 is the "true" catch and not the catch data that goes into the XSA assessment.

There was some confusion about the interpretation of the box plots whiskers in Figures 9 and 10. It appears that the description in the caption did not match the representation. This produced an apparent discrepancy between the results of Figs 9 and 10 as well as the results shown in different figures (Figs 9-10 and 11-12). It has been explained that these whiskers are not the 5% and 95% percentiles as indicated in the captions of Figures 9 and 10. Instead, the R help tool indicates that the whiskers correspond to the more usual definition of boxplots and are based on 1.5 times the inter-quartile range.

An additional run was conducted with a target F =0.4 with the objective of calculating the actual probabilities of SSB < Bpa or Blim in each of the next 20 years (in addition to calculating the number of these years in which SSB may be expected to below Bpa or Blim). These results suggested that on average SSB will be less than Bpa in 2 out of the 20 years and slightly less than 1 year in 20 for B < Blim when including all iterations (i.e. including those reaching the constraint of F= 2.0). The probabilities that SSB < Bpa or Blim showed an increasing trend over the 20 year period, being above 20% and 10%, respectively, in some years at the end of the period. This suggested that analyses including low recruitment scenarios, other assumptions for the selection pattern and implementation error, which would lead to higher probabilities of SSB < Bpa or Blim, may indicate that the HCR's for this target F may not be precautionary. It was noted that whether or not the simulations when F reaches the constraint of 2.0 are included in the result has a large influence on the conclusions. Excluding these simulations reduces the abovementioned probabilities by about 50%.

b) Khlivnoy working document

Generally, the description of the analyses was more difficult to understand. Responses provided by the analyst helped in the understanding but differences as to the meaning of terms and translation and WEBEX connection difficulties left some issues unclear.

The document examined more scenarios than the Needle-Mosqueira document and examined other HCR's than those suggested in the request, including an HCR that would remove discontinuities in F referred to above. The RG/ADG considered that even though these options are not in the draft of the proposed HCRs, they are particularly relevant.

The paper notes that there is only accurate data on landings, in fact this isn't the case either as there is considerable area misreporting between VIb, VIa and IVa. Where information is available, this is now reported by WGCSE.

It was understood that the inputs used as the basis for the analysis were those used in the most recent assessment of the stock conducted in 2011 (unlike the Needle-Mosqueira analysis, which started from the stock assessment conducted in 2010).

The document referred to a method of random numbers a few times to introduce variability (recruitment estimates and assessment errors) but it was unclear how the method was used. Further clarifications would be required to explain how this was conducted.

It was not entirely clear how the "assessment error" feature was incorporated in the management strategy evaluation. Also the RG suspects that the "assessment errors" were based on SSB and not TSB (total stock biomass) as indicated in the document, but this needs to be checked and clarified by the author.

In Table 1 (page 8), it was unclear what 'YES' and 'NO' meant for the analyses. It was concluded that when one column contained a NO the TAC constraint was not removed, whereas when it contained a YES the TAC constraint was removed.

Suggestions for changes in the HCR with regards to setting the TAC on landings versus on total catches were provided by the author of the paper but the RG/ADG concluded that setting the TAC on total catches could be feasible if adequate monitoring mechanisms for these were in place.

As for the Needle-Mosqueira work, the RG considers that thorough checking of all aspects of the code used for this analysis is required for future analyses based on the code presently developed.

Conclusion

The analyses reviewed by the RG on the proposed harvest control rules (HCR's) of a long-term management plan for Rockall haddock were considered preliminary and incomplete. The RG/ADG could thus not confidently conclude whether the HCR's are consistent with the precautionary approach or not.

While the simulations appear to be not that different to approaches used elsewhere, additional documentation would have been useful. It would be beneficial that some of the points outlined above are examined in more detail and other management options are also evaluated e.g. improvements in the selection profile of the fishery. Additionally, thorough checking of all aspects of the code is required.

References

Khlivnoy, V. 2011. The analysis of EU-Russia proposal for harvest control component of a long-term management plan for haddock at Rockall. ICES ACOM working document. 18 p.

Needle, C. and I. Mosqueira 2011. An evaluation of a proposed management plan for haddock in Division VIb (Rockall) . ICES ACOM working document. 20 p.

Needle, C. and I. Mosqueira 2011. Additional notes following Needle and Mosqueira (2011). (additional analysis conducted during RG/ADG)