

APPENDIX B. Consequence Analysis: Risks Associated with 2015 Projected Catch

The risks associated with potential management actions taken during 2015 are examined with a consequence analysis by undertaking stock projections under the competing assumptions of the 'state of nature'. The two states of nature are the VPA "M 0.8" model and the ASAP M 0.2 model, both presented at the 2013 cod benchmark model meeting (Claytor and O'Brien 2013) and updated through 2014 for this 2014 assessment. At the benchmark model meeting, the TRAC agreed to apply the VPA "M 0.8" model for providing catch advice, however, given that $F_{ref}=0.18$ is no longer consistent with that model, the TRAC also agreed to provide a consequence analysis of projected catch at two different fishing mortality rates from both models.

The analysis presents the consequences of management actions taken by setting projected catch according to the VPA "M 0.8" model if the true state of nature is such that M has remained unchanged at 0.2 and stock productivity is best reflected by the ASAP M 0.2 model, and conversely, if management actions were taken by setting projected catch according to the ASAP M 0.2 model (Appendix A) while the true state of nature is such that M has increased to 0.8 on older ages since 1994 and stock productivity is best reflected by the VPA "M 0.8" model.

Data input to each model projection is as previously described for the VPA "M 0.8" and for ASAP M 0.2 (Appendix A). These are short term projections, for one year to 2016, and do not account for any longer-term consequences.

The column headers in the text table below represent the 'true' states of nature:

- VPA M 0.8 $M=0.2$ except $M=0.8$ for ages 6+ from 1994 onward
- ASAP 0.2 $M=0.2$ for all ages and all years

The row headers indicate the basis of the management action during the projected period (2015) for four different catches. The notation in parentheses indicates where that catch was derived, e.g., the row with a 1,150 mt catch was projected from the VPA "M 0.8" model at $F=0.11$. The cells of the table indicate the projected 2015 fully recruited F and 2016 January 1 ages 3+ biomass, and the projected percent increase in biomass from 2015 to 2016.

If the VPA "M 0.8" model assumptions are the 'true state of nature', fishing at projected catch of 1,850 mt at $F_{ref}=0.18$ or at catch of 1,150 would not allow for a biomass increase in 2016, and fishing at the projected catch of 489 mt or 308 mt from the ASAP model would not allow for biomass increase in 2016 either.

If the ASAP $M=0.2$ model assumptions are the 'true state of nature', implementing the VPA 0.8 projected catch of 1,850 results in high F in 2015 and loss of biomass in 2016 as would the projected catch of 1,235 mt. At projected catches of 489 mt or 308 mt, biomass would increase more than 10%.

In summary, considering both model projections, 2015 catches at or below 489 mt would allow for low exploitation of the stock but not necessarily a minimum 10% increase in the 2016 biomass. Even with no fishing, the 3+ biomass in 2016 would decrease from 2015 based on the

VPA M 0.8 model, while a catch of 489 mt would result in at least a minimum 10% increase in the 2016 biomass based on the ASAP 0.2 model.

The consequence analysis reflects the uncertainties in the assessment model assumptions. Despite these uncertainties, all assessment results indicate that low catches are needed to promote rebuilding.

Appendix B. Table 1. Projection of 2015 fishing mortality (F), 2016 January 1 stock biomass (ages 3+), and percent increase in biomass from 2015 to 2016 of Eastern Georges Bank Atlantic cod at $F_{ref}=0.18$ and alternative $F=0.11$ for each of two ‘true state of nature’ management models: VPA $M=0.8$ and ASAP $M=0.2$ and the consequence analysis of the projections of the alternative management action.

CONSEQUENCE ANALYSIS			
		VPA 0.8	ASAP
Catch 2013		463 mt	463 mt
quota 2014		7,600 mt	7,600 mt
2013 biomass (3+)		10,410 mt	2,285 mt
2014 biomass (3+)		11,719 mt	NA
Projected 2015 Catch (mt)			
1,850	2015 F	0.18	0.89
(VPA F=0.18)	2016 Biomass	10,802	2,169
	% inc B from 2015	-15%	-28%
1,150	2015 F	0.11	0.48
(VPA F=0.11)	2016 Biomass	11,484	2,843
	% inc B from 2015	-10%	-5%
489	2015 F	0.04	0.18
(ASAP F=0.18)	2016 Biomass	12,129	3,481
	% inc B from 2015	-5%	16%
308	2015 F	0.03	0.11
(ASAP F=0.11)	2016 Biomass	12,307	3,660
	% inc B from 2015	-4%	22%
	F<=Fref & 10% biomass increase in 2015		
	F< =Fref & biomass increase < 10% in 2015		
	F>Fref and biomass increase < 10% in 2015		
	not feasible projection		