CO-OPERATIVE INDUSTRY/GOVERNMENT PROJECT

2+3KLMNO GREENLAND HALIBUT – BRIDGING THE GAP

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THE GAP

A key objective originally set for this project was to investigate possibilities to reconcile or bridge the different perceptions of current stock status provided by the existing NAFO Scientific Council's XSA assessment of the resource and recent increasing catch rates experienced by industry (as well as recent increases in aggregated survey indices of abundance).

The gap remains after the recent NAFO SC meeting. Fig. 1 illustrates this difference and the difficulties it raises for managers in reaching a decision about an appropriate TAC, by showing projections of biomass for different constant catch levels as predicted under one of the more conservative Statistical Catch-at-Age assessments[1] (SCAA2, which reflects recent abundance increases similar to those in the surveys and CPUE), and as predicted under XSA (which manifests a recent declining trend in abundance).

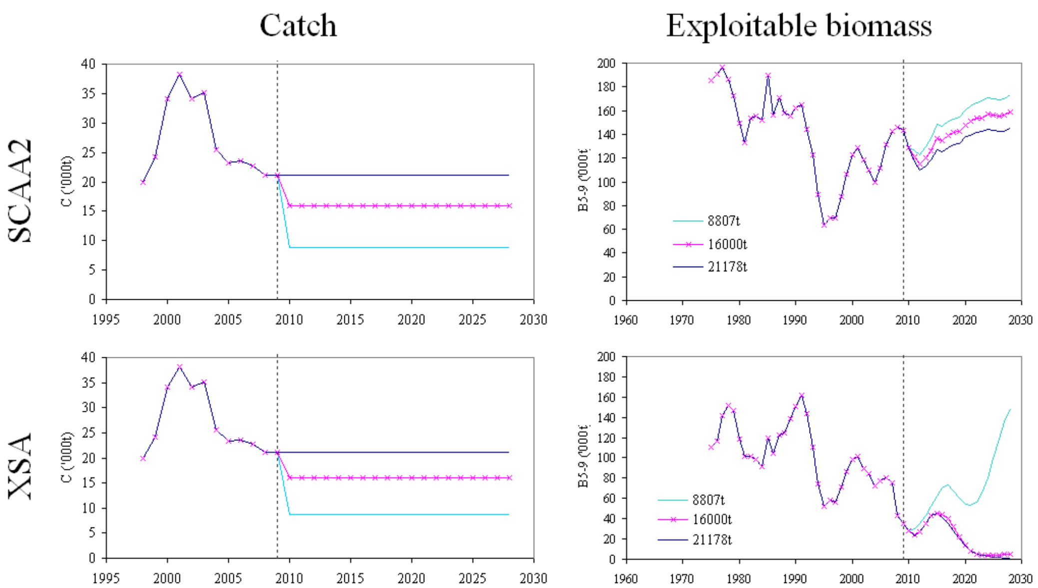


Fig. 1: Past values and projections of exploitable biomass for the SCAA2 and XSA assessments of the halibut resource under three levels of constant future annual catch: 21178 t (the NAFO SC's estimate of the present level of removals), 16000 t (the current TAC) and 8807 t (the TAC calculated for an F0.1 strategy under the XSA assessment).

[1] This has been chosen here from a number of alternative assessments to XSA, all of which reflect more positive recent trends in resource abundance.

The SCAA2 assessment indicates no problems – the exploitable biomass is projected to increase under all of the three catch levels considered. However projections under XSA show extinction of the resource in 15 years for the two higher levels of catch considered.

Should managers therefore rapidly reduce the TAC to a level that ensures biomass recovery if the XSA assessment is correct? That would mean almost halving of the current TAC. But if it is the SCAA2 assessment that is closer to the actual state of the resource, such an action would be unnecessarily squandering potentially good catches.

Is there a way managers can act in these circumstances of uncertainty that keeps the risk of severe stock reduction contained, while not decreasing catches unnecessarily? How can this gap between these two assessments and their different implications for management be bridged?

THE BRIDGE

Careful consideration of the biomass projections under the XSA assessment in Fig. 1 provides a clue to the solution to this problem. In reality, were the TAC to be initially maintained at 16000 t say (or kept within the 16000-21178 t range), the risk to the resource is not nearly as great as these plots might lead one to think. Why? If the TAC was maintained at this level, the consequent reduction in biomass would be reflected in future declines in the survey indices of abundance. Future appraisals of these declining trends would then lead to the TAC being reduced to reverse these trends.

We thus recalculate the projections under such an approach. Specifically the rules used for the results shown are that each year the TAC is adjusted up or down by the same annual percentage change as shown by the surveys over the last five years (the trend is calculated for each survey and then averaged over the three), but in the interests of industrial stability, the annual TAC change (whether up or down) may not exceed 20%. Fig. 2 shows the results anticipated for future catches and exploitable biomass levels under this “Management Procedure” (MP) approach.

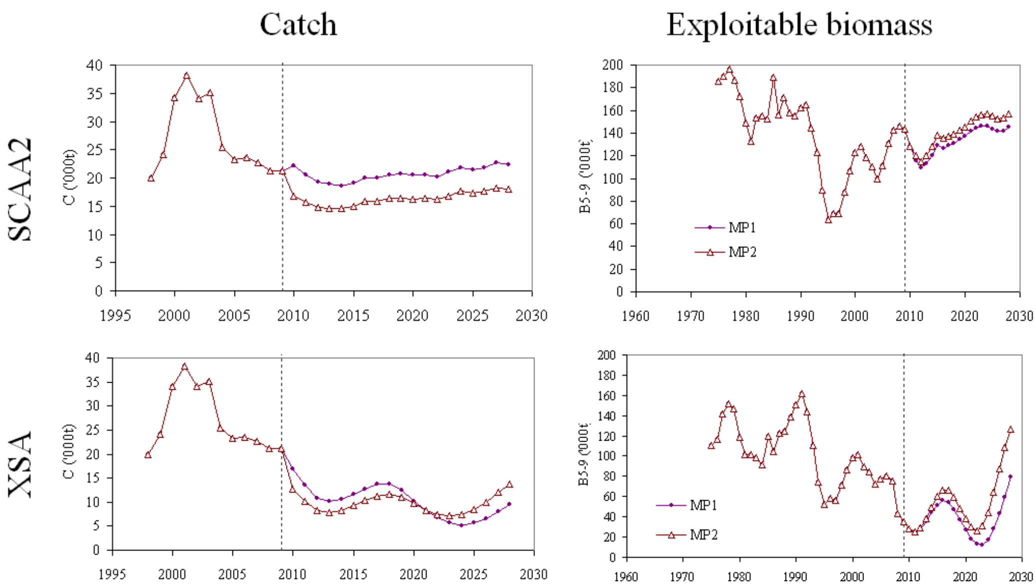


Fig. 2: Projections of exploitable biomass for the SCAA2 and XSA assessments of the halibut resource for two MPs. The MPs are identical in structure, except that MP1 commences at a TAC of 21178 t (the SC's estimate of the current annual catch), whereas MP2 commences at the current TAC of 16000 t.

If the SCAA2 assessment is correct, the exploitable biomass increases for both MPs after an initial small decline occasioned by a few poor incoming year-classes which have been identified in the assessments. The surveys reflect these changes, and consequently corresponding changes in the TAC. Thus the TAC projection under SCAA2 shown in Fig. 2 initially drops slightly, but later shows a slow increasing trend.

In contrast, if the XSA assessment is correct, the biomass will initially show a steep reduction matched by the survey indices, and under the TAC formula (MP) suggested, catches will be brought down quite rapidly. This initial TAC reduction is followed by stabilization, though with some variation as a consequence of fluctuating year class strengths. ***Most importantly though*** (and unlike the situation for the higher constant catches as shown in Fig. 1), the exploitable biomass projections for both MPs that are shown in Fig. 2 reflect eventual increases. Thus even though the TAC starts high, the formula used to take account of trends in survey indices adaptively reduces the TAC sufficiently to exclude any longer term risk to the sustainability of the fishery if the XSA assessment is correct.

Naturally it may be that neither the XSA nor the SCAA2 assessments is correct. For example, the real situation of the resource could be intermediate between the two, or even perhaps better than indicated by SCAA2. Correspondingly then, future catches and biomasses would be respectively intermediate between or above the future trends indicated in Fig. 2.

FOR HOW LONG?

For how long need the formula suggested be applied? Probably 3-4 years would be appropriate for what is an ***interim*** approach. While current information is unable to indicate which of the various current assessments of the resource (such as XSA or SCAA2) is the most likely to be correct, results from future surveys should provide a basis to discriminate amongst them.

To illustrate this, Fig. 3 below shows past and projected results for one of the three surveys under MP1 and MP2 (note that as future catches are different for these two MPs, the future abundances of the resource will differ under these scenarios).

SURVEY ABUNDANCE

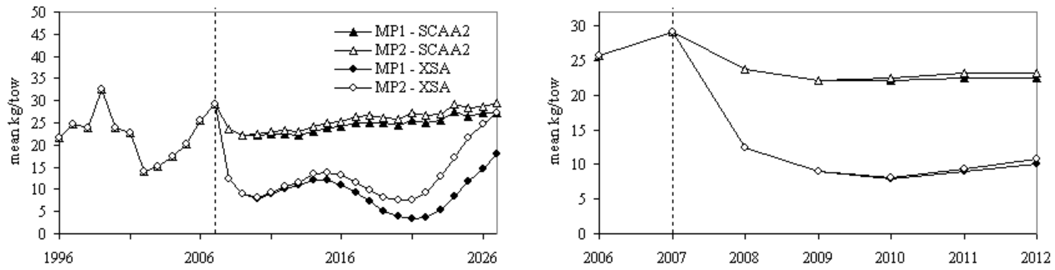


Fig. 3: Past values and future projections for the results from the Canadian Fall survey for the MP1 and MP2 approaches depending on whether the SCAA2 or the XSA assessment is that which reflects the underlying situation.

Note that if the XSA assessment is correct, a large (about 50%) drop in the survey index of biomass is predicted to have occurred in the Fall 2008 survey; whereas a modest drop (about 15%) is projected under SCAA2. (Results for the other two surveys – the EU and Canadian spring surveys – are qualitatively very similar.) If another 1-2 years of survey results do not reflect the steep decline as projected under XSA, then it would be reasonable to conclude that the SCAA2 or perhaps even some more optimistic view of stock status is closer to reality. Thus the suggested interim approach also provides the basis to subsequently determine which is the more reliable assessment.

UNCERTAINTIES

Future projections are not as "certain" as the impression that the plots in Figs 1-3 might convey. There is uncertainty about the strength of future recruitments, and survey indices do not match abundances exactly. Results need to take account of these uncertainties, which leads to the need to show projections as probability distributions. What were shown in Figs 1-3 above were only the central trends (the medians) of these distributions. In Fig. 4 below we add the 90% probability envelopes for projections under MP2.

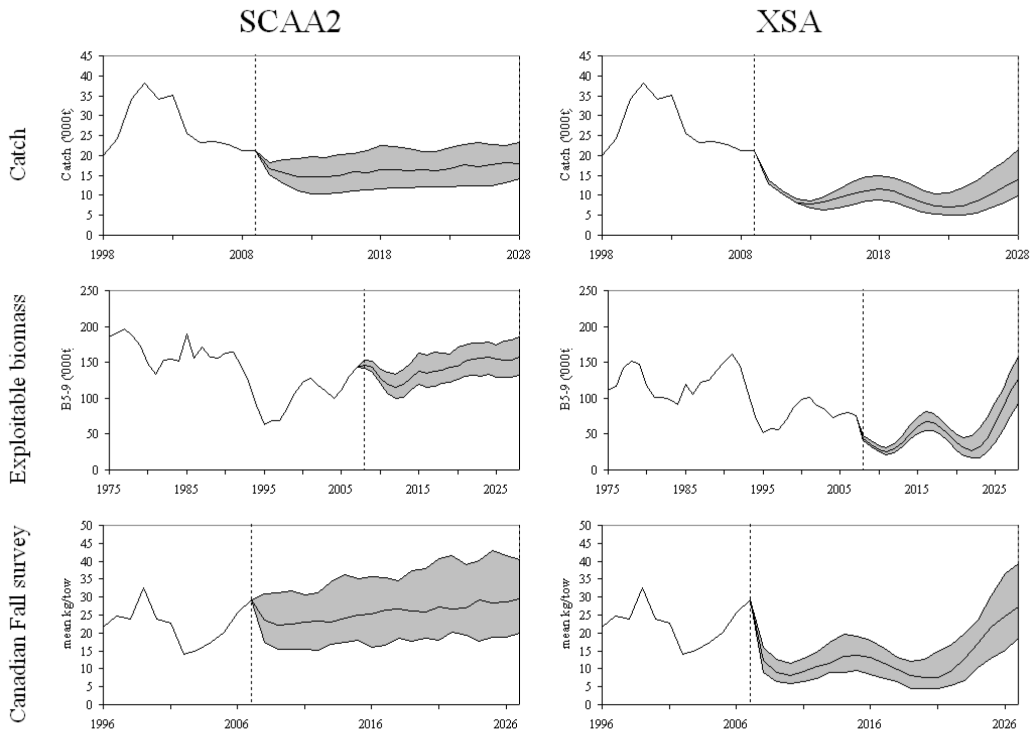


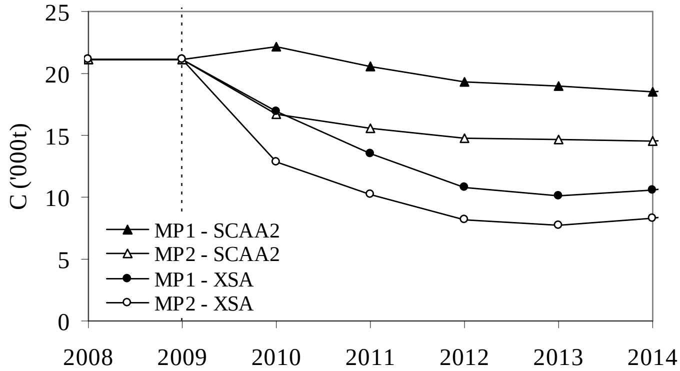
Fig. 4: Past values and projections under MP2 for catches, exploitable biomass and results from the Canadian Fall survey. The projections show not only medians but also 90% probability envelopes.

Importantly, even given these uncertainties about the future, the application of the MP safeguards the future abundance of the resource. This is because even given these uncertainties, there is more than a 95% chance of an eventual increase in biomass even under the more pessimistic XSA assessment.

WHERE NEXT?

Application of a formula (MP) along the lines suggested above is put forward as a basis to set TACs for this halibut resource for (probably) the next three years. Note that the resource is protected against undue depletion, but appropriate levels of catch continue to be suggested, whichever assessment better reflects the underlying reality. Thus the vexing problem of choosing the "best" amongst the different assessments is avoided – rather the values of future data are what implicitly make the choice.

Fig. 5 shows the most likely TACs under the four combinations of two MPs and two assessments, though note that these plots and the future TAC values quoted do not incorporate the uncertainties reflected in the Fig. 4 plot.



	SCAA2		XSA	
	MP1	MP2	MP1	MP2
2008	21.2	21.2	21.2	21.2
2009	21.2	21.2	21.2	21.2
2010	22.1	16.7	16.9	12.8
2011	20.6	15.6	13.6	10.2
2012	19.3	14.7	10.8	8.2

Fig. 5: The most likely (strictly the median) future TACs projected under the four combinations of two assessments and two MPs. Note that the 2008 and 2009 catches are as assumed by the NAFO SC.

Notes:

a) In the late 1990's, a similar problem that arose in the Namibian hake fishery – different assessment yielding appreciably different results – was solved using essentially this same approach. Future survey and CPUE data showed that the more pessimistic assessment was incorrect, with subsequent TACs being increased slightly rather than severely reduced.

b) A technical scientific document detailing the basis for the calculations reported above is in preparation.