

**REPORT ON AN INVESTIGATION OF REASONS FOR DIFFERENCES
BETWEEN OUTPUTS FROM ASPM AND ADAPT-VPA ASSESSMENTS
OF THE GULF OF MAINE COD STOCK**

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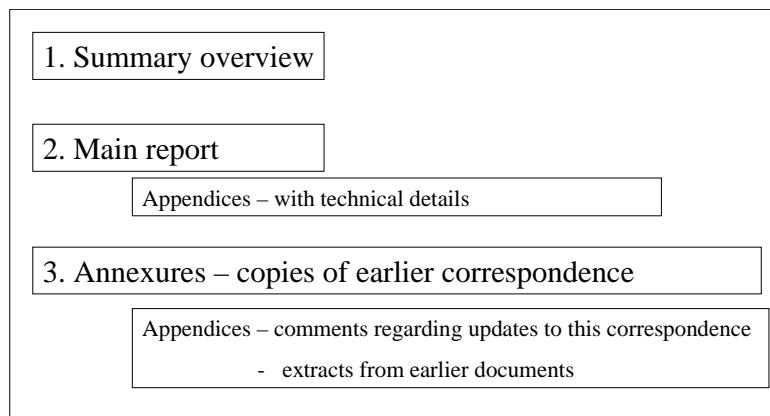
February 2005

SUMMARY

The application of ADAPT-VPA and ASPM assessment methods to the same data set for the Gulf of Maine cod stock allows two primary reasons for earlier differences in assessment results from these two approaches to be identified:

- the longer period of data which the ASPM method is able to take into account; and
- decreasing selectivity at larger ages estimated by the ASPM approach, in contrast to the flat selectivity assumed by the ADAPT-VPA application of Mayo *et al.* (2002).

Arguments are presented that the ASPM approach (with specific details of an application still to be discussed) should be preferred over ADAPT-VPA as the basis for management recommendations for this resource. Since the ASPM assessments consistently indicate the resource status to be appreciably better relative to the *MSY* biomass, this has important implications for what might constitute appropriate management measures at present.



Schematic summarising structure of documents presented.

BACKGROUND

During the Groundfish Science Peer Review Meeting held in Durham, New Hampshire over 3-8 February 2003, assessments of the Gulf of Maine and Georges Bank cod stocks based upon an Age-Structured-Production-Model (ASPM) approach were presented. These assessments yielded results that differed appreciably from those conducted by NEFSC scientists using ADAPT-VPA, with consequent importantly different implications for management measures.

The report of this meeting by the chair of the panel of independent reviewers (Dr A I L Payne) states in paragraph 11 of their response regarding biological reference points that: "At present there are no obvious reasons to choose one method over the other, to deviate from the current approach, or indeed to select a completely different model/method from the two presented." The Executive Summary and Recommendations of the report, at paragraph 10, goes on to state that: "Reasons for differences in the outputs of the different models need to be sought."

This report endeavours to address this last recommendation. It focuses on the Gulf of Maine cod stock, for which the original differences found were greater.

This overview of the work first lists the accompanying components of the report and explains the background to their inclusion. It ends with a summary of the findings.

REPORT COMPONENTS

The core component of this report is a paper by the authors entitled: "A comparison between ADAPT-VPA and ASPM-based assessments of the Gulf of Maine cod stock". The paper presents results for both approaches which are based on identical data to facilitate comparison and identification of (methodological) reasons for differences in results. It also provides an examination of the sensitivity of both assessment approaches to alternative inputs or assumptions.

This paper is the fourth in a series of papers/sets of results and comments addressing this issue that have been forwarded to the NEFMC and/or the NEFSC since the February 2003 meeting in Durham. Efforts have been made to keep this paper, together with its Appendices (which provide technical specifications for the methods used), self-standing so that readers need not refer also to the previous papers and commentaries in the series. Nevertheless, there is further information in those earlier reports that is pertinent to the issues under consideration here, but not readily included in the latest paper attached.

To address this, further components have been added to this report in the form of three Annexures drawn from this earlier correspondence. These comprise:

- Annexure A: A response to comments re the ASPM methodology by Review Panelist McAllister, which was attached to a letter to the NEFMC chair, Thomas Hill, dated 31 March 2003.
- Annexure B: A list of issues raised at the time of the February 2003 review meeting by NEFSC scientists concerning the ASPM methodology, and advice on progress made in addressing these, which was attached to a letter to the NEFMC chair, Thomas Hill, dated 17 July 2003.
- Annexure C: A letter dated 10 October 2003 to the then Acting Science and Research Director of the NEFSC, Dr John Boreman, containing responses to comments made by NEFSC scientists concerning the ASPM assessments that had been conveyed in a letter from Dr Boreman dated 12 September 2003.

Since, however, some of the material in these Annexures is dated by subsequent analyses or events, an Appendix has been added to each to advise on such, and particularly on any changed views that arise from the results of the paper attached here. Furthermore, occasionally these Annexures refer to material contained in the three papers submitted earlier (Butterworth *et al.* 2003a, b, c – see References section of paper attached). To avoid any consequent need for the reader to cross-refer, such material has been appended to these Annexure Appendices.

SUMMARY OF FINDINGS

Two reasons are identified for past differences in results of applications of the two assessment methods to the Gulf of Maine cod stocks:

- the longer period of data which the ASPM method is able to take into account; and
- decreasing selectivity at larger ages estimated by the ASPM approach, in contrast to the flat selectivity assumed by the ADAPT-VPA application of Mayo *et al.* (2002).

Points in favour of the ADAPT-VPA approach as applied together with its results are that:

- the flat selectivity assumption is favoured in terms of the fitting criterion used for this method;

while points against are that:

- there are internal inconsistencies in the mathematics;
- the fitting criterion used ignores information for the plus group; and
- comparative attempts to force the flat selectivity onto the ASPM application evidence model misspecification, particularly for the plus group.

Points in favour of the ASPM approach and its results are that:

- it can take more data into account; and
- it does not require the unrealistic assumption of error-free catch-at-age data;

while reservations concerning the specific implementations investigated are:

- the appreciable decline in selectivity indicated for older ages; and
- the need to consider dome-shaped stock-recruitment functions.

Overall these considerations would seem to indicate that implementation of the ASPM approach (though with the specific details of the application still to be discussed) is to be preferred over the current ADAPT-VPA approach as a basis for management recommendations.

The ASPM assessments considered consistently indicate current stock status relative to the *MSY* biomass to be appreciably better than suggested by the current ADAPT-VPA assessments. Clearly this has implications for the management measures appropriately applied to the stock.