Retrospective analyses, improvement of assessment and prediction methods for haddock stocks.

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Contents

- Introduction
- Objectives of the work
- Statement of the problem
- Methods and results
- Conclusions

Introduction

- NEA haddock annually asessed by AFWG using a catch at age model (VPA) that uses measurement of the number of fish caught in each age group

- In common with computing machinery evolution the software for stock assessment and projection was changed but calculations were made on the same principle as previously

Introduction

The standard software and methods used for stock assessment and projection of NEA haddock at AFWG*

<table>
<tr><th>Year</th><th>Assessment methods</th><th>Short-term projection catch and biomass</th><th>Recruitment projection</th></tr>
<tr><td>1978 -1985</td><td rowspan="2">IFAP module (VPA)</td><td rowspan="5">IFAP module (management options table)</td><td>(Survey indices ratio)</td></tr>
<tr><td>1986-1991</td><td>RCRTINX2 (regressions of yearclasses)</td></tr>
<tr><td>1992-1993</td><td>VPA version 3.1(SVPA/XSA), ADAPT</td><td rowspan="5">RCT3 (regressions of yearclasses)</td></tr>
<tr><td>1994-1998</td><td>VPA version 3.11 (SVPA/XSA)</td></tr>
<tr><td>1999-2002</td><td rowspan="2">VPA version 3.2 - VPA95 (SVPA/XSA)</td></tr>
<tr><td>2003-2005</td><td>MFDP(management options table)</td></tr>
</table>

* - in brackets - methods

Objectives of the work

- Current work will aim at investigating a part of the uncertainty, i.e. observation errors given a particular model specification using ADAPT algorithm.
- Overall objective is to investigate if current assessment and projection procedures can be improved.
- It is expected that such improvements may provide for scientific advice. This will help solve main tasks of AFWG.
- Materials for investigation were input data for stock assessment and projection which used in AFWG 2005

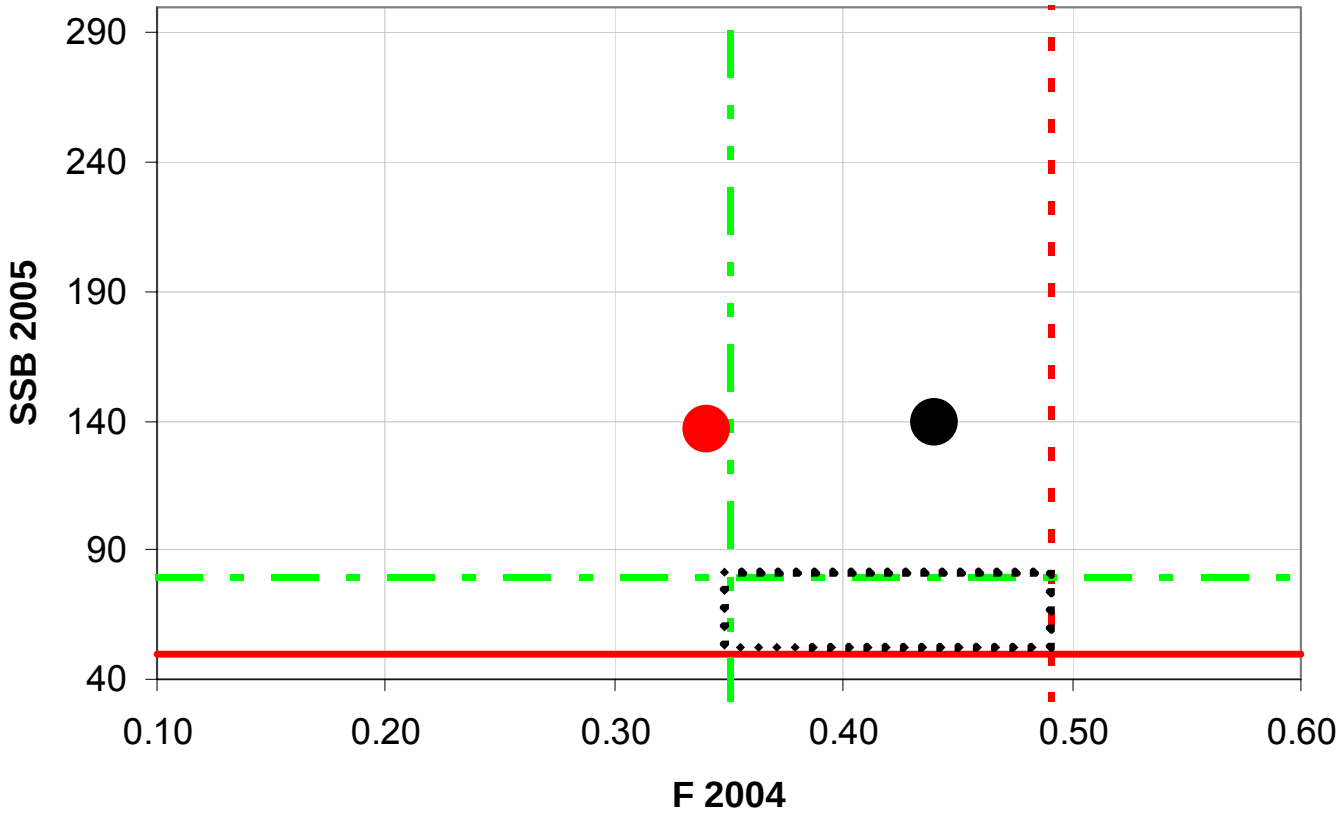
Statement of the problem (Unsertainty)

- There are several categories of uncertainty in fish science:
  - natural variation
  - observation errors in input data
  - model misspecification
  - uncertainty in transaction scientific advices into management
  - imperfect implementation of management strategies
  - others

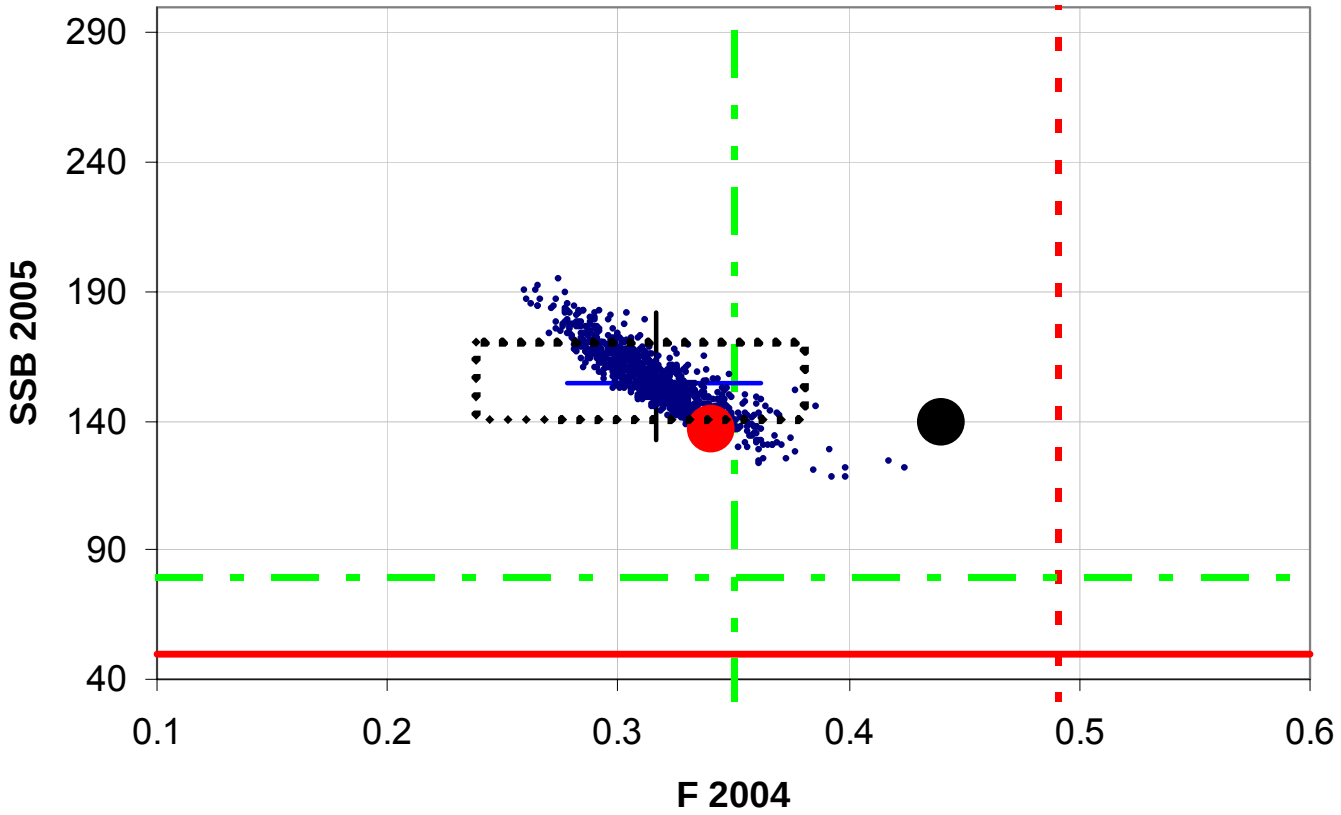
- Precautionary approach in fishery management which imply care fish stocks on a safe biological limits should (can) been based on total unsertainty estimates in stock assessment.

- The AFWG 2004 states that the uncertainty may be underestimated and that difference between Blim and Bpa may be too small therefore it should be investigated

The current uncertainty is reflected in distance between lim and pa points which are adopted by ACFM for this stock as Blim=50 thou. t and Bpa =80 thou. t.



Methods and results



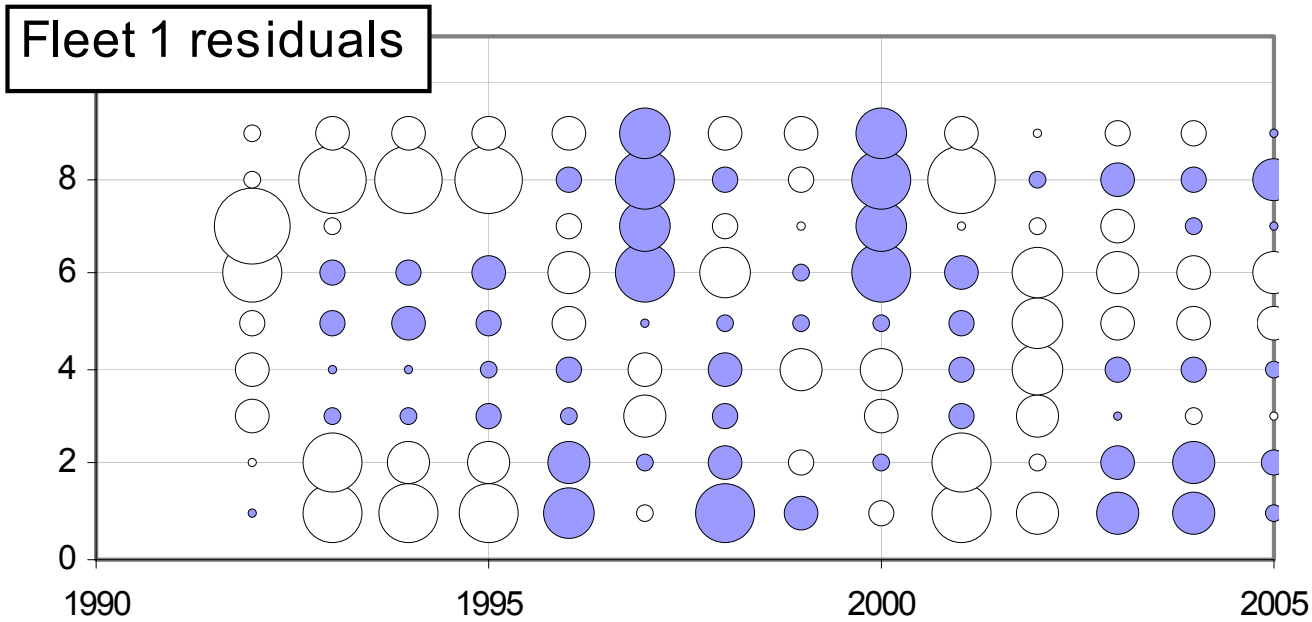
Methods and results

- Algorithm of adaptive framework ADAPT was created in Excel and calculations done with input data from AFWG 2005.

- The purpose was estimate **part** of the assesment uncertainty, i.e. **observation errors** given a particular model specification, was characterized by using bootstrap methods.

- Bootstrap method based on principle random resampling of the residuals from the observed-predicted ”tuning” indices.

Methods and results

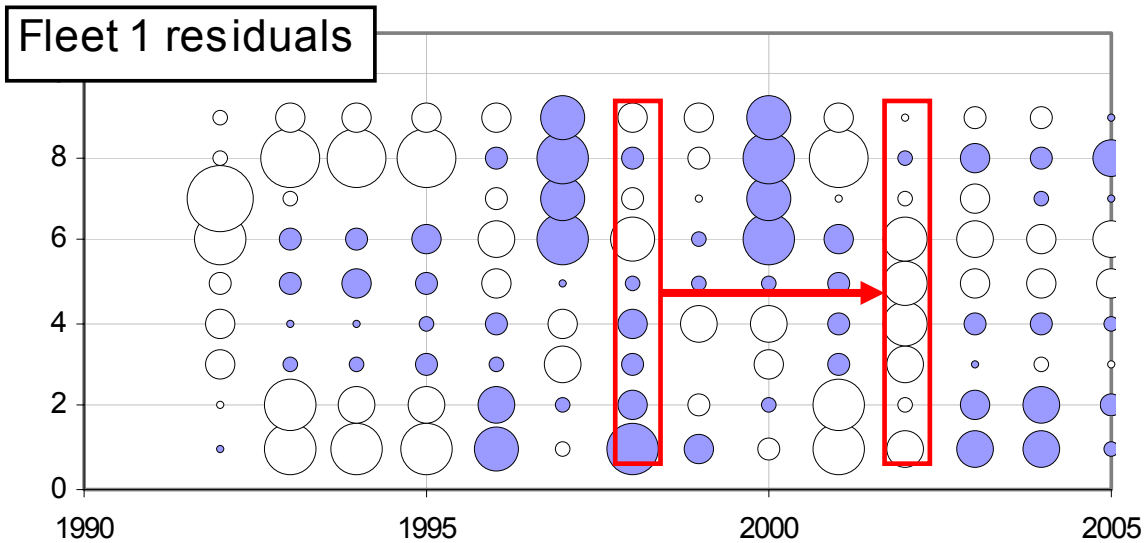


Model calculated population parameters and recalculated a and b which correspond regressions, what provide smallest differences between observed" and "modeled" population abundance using used nonlinear least-squares minimization procedure

choused the "best" fit to the tuning indices.

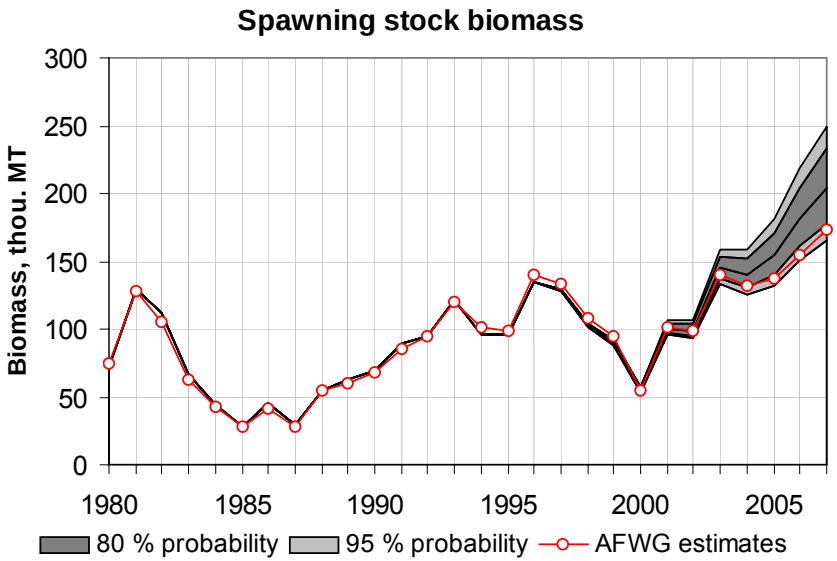
Methods and results

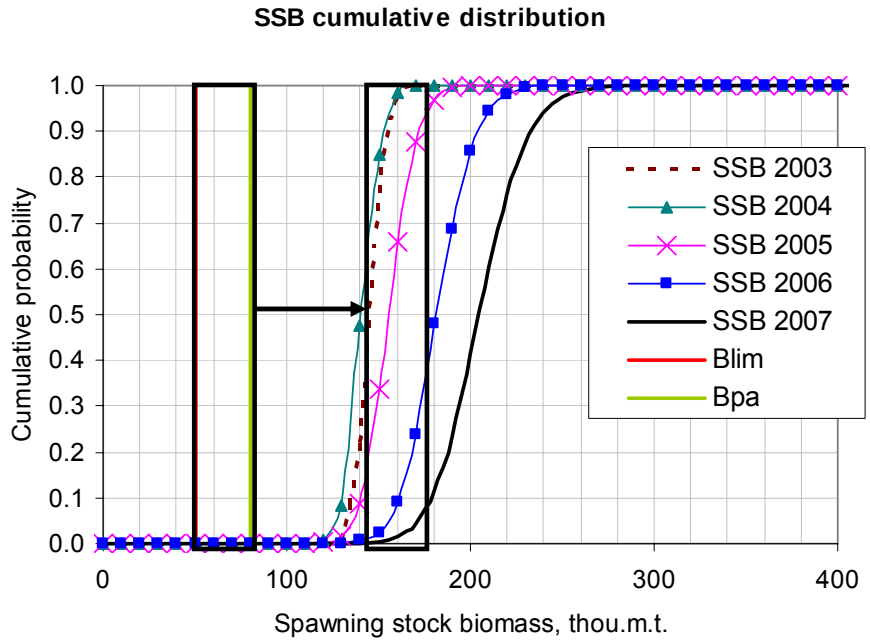
- The residuals of that fit were bootstrapped



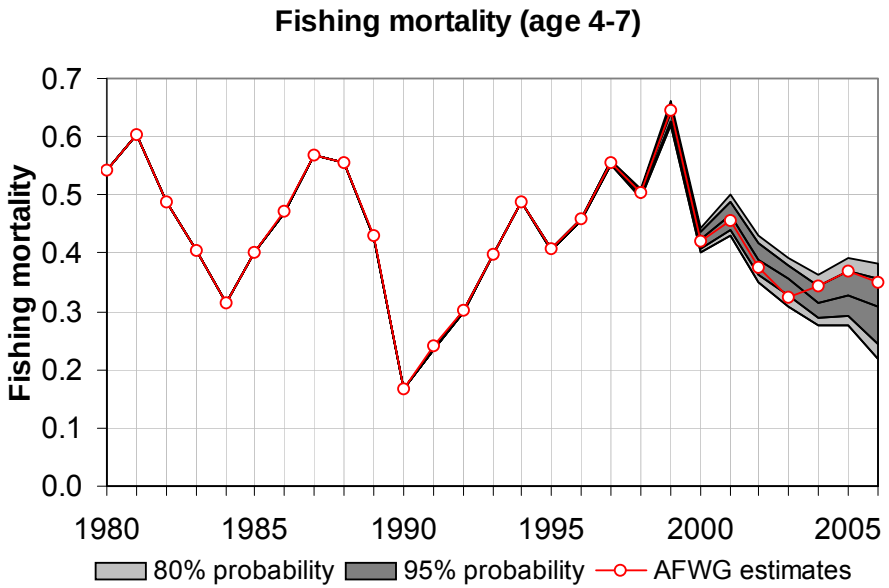
- 1000 times and new values of N produced. The distribution of the associated Fs and SSB provided an indication of variation and the bias (deviations).

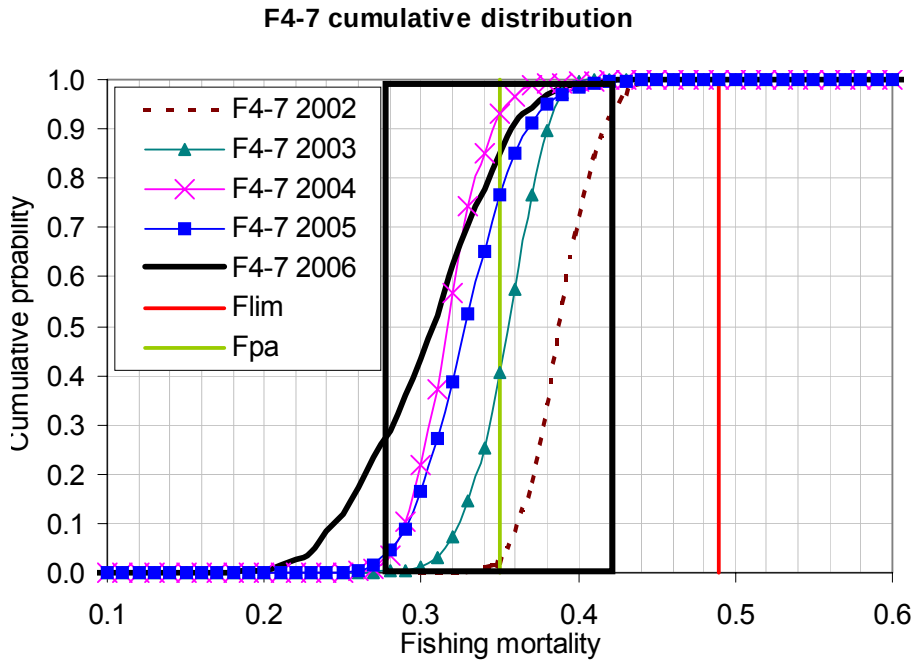
Methods and results



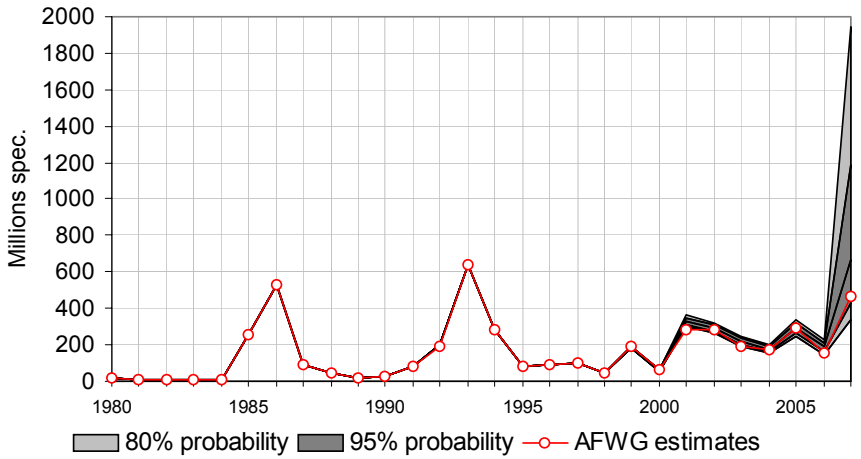


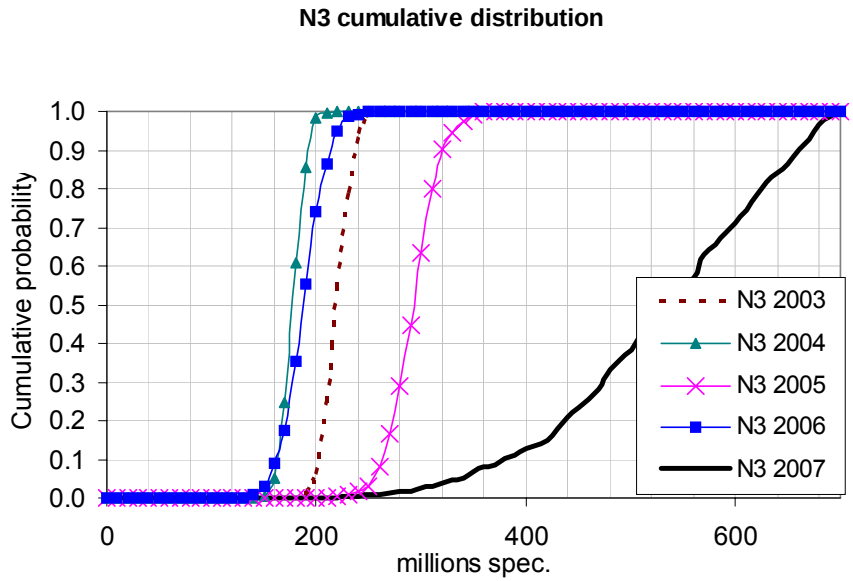
Methods and results





Methods and results





Conclusions

- Suggested algorithm based on ADAPT framework allow to investigate part of uncertainty in stock assessment and projection procedure and its prototype - program ADAPT can been applied as alternate approach for estimation of population dynamics of NEA haddock

- This uncertainty analysis is only the first step in the construction of full analysis of uncertainty in stock assessment.

- Additional work to more fully characterizes all important sources of uncertainty in the assessment process can been done by working group members in relation to estimation more conservative biological reference points and evaluation of the harvest control rules.

Conclusions

- Main weakness of current methods for stock assessment and projection is in using several partly different, partly similar models
- Models takes to account more or less the same input data but receives different estimation of population numbers and fishing mortality, therefore level of uncertainty increasing with each step.
- The framework should allow for a procedure stock assessment and short-term projection more simple, objective and robust to criticism.

Acknowledgments

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Спасибо за внимание!

Thanks for attention!