

Section 1

1.1 Introduction

The Groundfish Assessment Review Meeting (GARM) is a regional peer review process developed this year to provide assessment updates for the 20 stocks managed under the Northeast Multispecies Fishery Management Plan (Multispecies FMP). The meeting occurred during October 8-11, 2002, in Woods Hole, Massachusetts.

The GARM is distinct from the Northeast Stock Assessment Review Committee (SARC) process, which produces “benchmark” stock assessments and related management advice. The purpose of the GARM was to provide assessment updates, using existing model formulations and data sources.

The goals of the GARM were to provide peer review of assessment updates, summarize stock status for individual components and the resource as a whole, and provide estimates of adjustments in fishing mortality rates, as necessary, to achieve biological reference points. The GARM also reviewed the results of data exploration studies for evidence of changes in trawl survey efficiency associated with trawl warps that were misaligned on the NOAA R/V *Albatross IV* on trawl surveys occurring from winter 2000 to spring 2002. Last, the GARM provided numerous comments and recommendations regarding specific stock assessments and generic data collection and analysis procedures.

Background and History

In the Northeast region, stock assessments are peer reviewed through the Northeast Regional Stock Assessment Workshop (SAW) process. The SAW provides for a thorough review of new or revised assessment methodology over a cycle, for any one stock, that is two to five years long. In addition, the transboundary Georges Bank stocks of cod, haddock and yellowtail flounder are jointly assessed by Canadian and US scientists at regular meetings of the Transboundary Resource Assessment Committee or TRAC. Since the SAW and TRAC cannot reassess every stock every year, the assessment peer review process also includes more frequent stock assessment updates to ensure that management actions are based on the most recent status information available.

There are 12 species of groundfish, comprising 20 distinct stocks, managed under the New England Fishery Management Council’s Northeast Multispecies Fishery Management Plan (Groundfish FMP). The status of all the stocks in the complex was updated in 1999 and again in 2000 to provide current status information relevant to annual management adjustments. (Northern and Southern Demersal SAW Working Groups, 1999, Assessment of 19 Northeast Groundfish Stocks through 1999; Northern and Southern Demersal SAW Working Groups, 2000, Assessment of 19 Northeast Groundfish Stocks through 2000).

In March of this year, partly in response to a Federal court request for re-evaluation of current stock reference points, a special panel was convened to update reference points for all the stocks in the complex and to determine the fishing mortality rate that would provide for stock recovery (to the biomass target) by 2009 ($F_{REBUILD}$; NEFSC 2002a). The most recent data available to the Working Group, however, was through 2000 (augmented by some 2001 survey indices), now a year old. Since the New England Council is finalizing actions on a major amendment to the Groundfish FMP (Amendment 13) which would readjust management measures so as to attain biomass targets by 2009, it was necessary to update the groundfish assessments through 2001.

In September of this year the NEFSC found that the marks on the wire ropes attaching scientific survey gear to the vessel were not at true 50 m length intervals they are intended to indicate. The marks are used by the vessel crew to determine how much towing wire is deployed. The warps were most recently replaced in February 2000, and used in eight bottom trawl surveys, beginning with Winter 2000 and ending with Spring 2002.

Since the mis-measured warps may have affected survey catchability, two additional sets of analyses are included in the GARM report: analysis of the sensitivity of assessment results to hypothesized increases of 10%, 20% and 100% in abundance indices; and, as an independent study, 10 separate analyses of trawl survey data to determine whether or not the mis-marking could be detected via comparative analysis of existing survey data.

1.2 Terms of Reference

Terms of reference for the meeting were:

- (a) provide updated catch information (landings and discards, where appropriate) for the stocks to be assessed. Catch-at-age data (based on port sampling) will be estimated, where applicable,
- (b) provide updated research vessel survey indices (through spring 2002) for all appropriate survey series, including NMFS spring and autumn series, Canadian series, and state surveys,
- (c) estimate 2001 fishing mortality rates (or appropriate proxies) for all 20 stocks, and provide estimates of 2001 stock sizes and measures of uncertainty (see Section 2),
- (d) evaluate stock status relative to applicable biological reference points (F_{MSY} and B_{MSY} ; Section 2),
- (e) provide updated estimates of F-Rebuild (the fishing mortality rate required to rebuild biomasses to B_{MSY} by 2009) for all applicable stocks (Section 2),

(f) evaluate and comment on the potential sensitivity of assessment results to trawl warp marking discrepancies that occurred in bottom trawl surveys conducted between winter 2000 and spring 2002 (Sections 3-5).

1.3 Participants

The following individuals participated in some or all of the GARM (October 8-11, 2002):

External -

Steven Correia -Massachusetts Division of Marine Fisheries
Chris Darby - Center for Independent Experts (United Kingdom, England)
Joe Hunt - Department of Fisheries and Oceans (Canada)
Jon Helge Volstad - Center for Independent Experts (Maryland)

Chris Kellogg – New England Fishery Management Council
Chad Demerest – New England Fishery Management Council

NEFSC -

Frank Almeida
Jon Brodziak
Steve Cadrin
Laurel Col
Dvora Hart
Lisa Hendrickson
Larry Jacobson
Chris Legault
Ralph Mayo (Chair, Northern Demersal WG)
Steve Murawski (Meeting Chair)
Paul Nitschke
Loretta O'Brien
Paul Rago (Chair, Assessment Methods WG)
Anne Richards
Fred Serchuk
Gary Shepherd
Kathy Sosebee
Mark Terceiro (Chair, Southern Demersal WG)
Michele Thompson
Susan Wigley
Jim Weinberg

Additionally, the following individuals participated in the ASMFC Winter Flounder Technical Committee Meeting (September 24-25) which supplied Southern New England and Gulf of Maine winter flounder assessments for consideration at the GARM:

Jay Burnett NEFSC
Steve Cadrin NEFSC
Steve Correia MADMF, Chair
Laura Lee ASMFC, RIDMF
Chris Legault NEFSC
Anne Mooney NYDEC
Lydia Munger ASMFC
Paul Nitschke NEFSC
Sally Sherman MEDNR
David Simpson CTDEP
Kathy Sosebee NEFSC
Mark Terceiro NEFSC
Susan Wigley NEFSC

1.4 Assessed Stocks

The GARM reviewed the status of 20 fishery stocks included as the large mesh species complex in the Northeast Multispecies Fishery Management Plan (FMP). Earlier assessment reviews for this species complex (e.g., NEFSC 2001) had included 19 stocks, since the status of Gulf of Maine winter flounder had never before been assessed. Stocks considered at this meeting (and letter designations of order in the report) are:

- A. Georges Bank Cod
- B. Georges Bank Haddock
- C. Georges Bank Yellowtail Flounder
- D. Southern New England Yellowtail Flounder
- E. Cape Cod Yellowtail Flounder
- F. Gulf of Maine Cod
- G. Witch Flounder
- H. American Plaice
- I. Georges Bank Winter Flounder
- J. Southern New England/Mid Atlantic Winter Flounder
- K. White Hake
- L. Pollock
- M. Acadian Redfish
- N. Ocean Pout
- O. Gulf of Maine/Georges Bank Windowpane
- P. Southern New England/Mid-Atlantic Windowpane
- Q. Mid-Atlantic Yellowtail Flounder
- R. Gulf of Maine Haddock
- S. Atlantic Halibut
- T. Gulf of Maine Winter Flounder

1.5 Overview

Initial stock assessments were developed by the Northern and Southern Demersal Working Groups of the SAW (Stock Assessment Workshop), and the ASMFC Winter Flounder Technical Committee. These working groups and the Technical Committee met at various times before the GARM meeting to develop draft assessment documents. Additionally, work related to the trawl warp offset issue was coordinated through the Assessment Methods Working Group.

Most stock assessments reviewed at the GARM were routine updates of assessments previously reviewed in the SAW or elsewhere. However, the Gulf of Maine winter flounder assessment was newly developed (by the ASMFC Technical Committee), and is scheduled to be peer reviewed at SAW 36 (December 2002). Accordingly, the details of the analytical stock assessment modeling are not incorporated herein, pending that “benchmark” review. The results are, however summarized, and input data are presented and evaluated.

The GARM meeting incorporated peer reviews by both regional stock assessment scientists (both NMFS and non-NMFS people) and external experts. The Center for Independent Experts (CIE, University of Miami) provided two individuals for the meeting. The roles of the CIE experts were to comment on analyses presented at the GARM, and to provide written critiques, which are attached as appendices to this report.

Stock Assessment Results

Results of the stock assessment updates are provided as fishing mortality rates and biomasses in 2001, relative to management reference points (section 2). The biological reference points (F-MSY and B-MSY) are, in most cases, those proposed by the Working Group on Re-Evaluation of Biological Reference Points for New England Groundfish (NEFSC 2002a). In one case (white hake) the GARM rejected the analytical stock assessment results (based on an ASPIC surplus production model) and substituted an index-based assessment evaluation. Appropriate index-based reference points based on the replacement ratio method (NEFSC 2002a) are thus proposed for white hake (section 2-K). Additionally, no reference points have yet been proposed for the Gulf of Maine winter flounder stock, although the ASMFC Technical Committee’s Report analyzes F40% maximum spawning potential as a candidate for F-MSY, and considers B-MSY based on mean recruitment multiplied by spawning biomass-per-recruit at F-MSY (section 2-T).

Of the 19 stocks for which 2001 fishing mortality (or its proxy) can be estimated, 10 were fished below F-MSY in 2001, and 9 above. Additionally, the biomass of eight of the stocks was at or above $\frac{1}{2}$ B-MSY, while 12 stocks were below the threshold. Stock biomasses have improved in 19 of the 20 stocks since 1995 (the exception being Mid-Atlantic yellowtail), with a median percent increase in biomass for all stocks of 177% (range: -33 to 2430 percent). Landings of the complex of 20 groundfish stocks have

increased by 40% since 1995, primarily driven by increases from four Georges Bank stocks (haddock, yellowtail, cod and winter flounder). Fishing mortality (F) rates declined for 15 of 19 stocks between 1994 and 2001, with the median percent decline in F of 70% (range +48 to 95 percent). The four stocks showing increases in F since 1994 were Cape Cod and Mid-Atlantic yellowtail, white hake and Southern New England/Mid-Atlantic winter flounder.

Two stocks continue to have extremely high fishing mortality rates (Mid-Atlantic yellowtail flounder and Cape Cod yellowtail flounder). In the former case, SAW Working Groups will present analyses to SARC 36 recommending that the Mid-Atlantic and Southern New England yellowtail flounder resources be combined. The case of Cape Cod yellowtail flounder remains enigmatic, in that the apparent mortality rates on the stock remain exceptionally high despite the reductions in F seen in co-occurring stocks (e.g., Gulf of Maine cod, and winter flounder). The GARM recommended additional biological studies, including tagging, to better understand the relationships between Cape Cod yellowtail and adjacent stocks of the same species.

The percent reductions in F necessary to achieve B-MSY by the target dates varied by stock and were primarily dictated by the strength of incoming recruitment. Short-term projections of target TACs for the 2003-2004 fishing year and medium-term projections for calculating F-Rebuilds assumed that F in 2002 (calendar year) would be 85% of that in 2001, based on assumptions provided by the Multispecies Plan Development Team (PDT).

Evidence for Interventions in Trawl Survey Data Due to Warp Offsets

The GARM reviewed the results of a series of 10 different studies to evaluate evidence for an intervention in the NMFS trawl survey data associated with the use of miscalibrated trawl warps (sections 3 and 4). There were eight affected surveys (winter 2000, 2001 and 2002; spring 2000, 2001 and 2002; and fall 2000 and 2001). Information collected from dockside warp measurements indicated that the warp miscalibration was related to the initial biased marking of the 50 meter intervals on one warp and was not due to progressive wire stretch. Therefore, the degree of intervention was thought to be approximately equal in all surveys since winter 2000.

Information on the potential effects of the warp offset on trawl survey performance evaluated by the GARM included studies of rates of gear damage over time, calculations of trawl geometry as a function of the warp offsets, by depth, patterns in mean/variance relationships in trawl survey catch data by stock, and depth-at-capture information from pre- and post-warp misaligned cruises. The results of trawl warp offset experiments, including video and sensor data, presented at the Trawl Warp Workshop (NEFSC 2002b), were also considered. Additionally, the GARM evaluated trends (directional changes from year-to-year) in abundance measures before and after the warp mis-marking. The results from side-by-side trawling experiments conducted by the *Albatross* and *Delaware* vessels to estimate their relative fishing power, conducted before and after the warp mis-marking on the *Albatross* were also considered. Standardized catch-rates from surveys

conducted with mismatched warps were compared to survey CPUEs from surveys with comparable spatial and temporal coverage, and unaffected by the problem (e.g., Canadian trawl surveys and USA sea scallop surveys). The GARM also examined evidence for differences in length distributions from survey catches pre- and post warp offset by evaluating the relative size composition from various sources.

Based on evidence reviewed from each of these 10 studies there was no indication of a systematic reduction in trawl survey catch efficiency due to the trawl warp offsets.

Sensitivity of Stock Assessment Calculations to Potential Warp Offsets

Given the absence of measurable intervention effects associated with the warp offsets, the GARM endorsed the nominal assessment calculations as the basis for management decision-making. However, in order to examine the robustness of the management advice to potential variations in the survey catches, the GARM also carried out a series of sensitivity analyses examining survey catchability (Section 5).

Sensitivity runs conducted for the various assessments included arbitrary increases in trawl survey catches for affected surveys of 10%, 25% and 100%. The results of these analyses are presented in each stock assessment section of this report (Section 2). Specifically, each assessment contains a “cross” plot, of the mean and 80% confidence intervals of the estimated 2001 F and biomass. The status determination levels (F-MSY and 1/2 B-MSY) are given in each cross plot as frames of reference. Four such crosses are computed for each stock, giving the nominal, +10%, +25+ and +100% results (e.g., see Figure F6 for Gulf of Maine cod). The confidence intervals from the +10% and +25% sensitivity runs overlapped the nominal assessment results for all stocks, thus changes of this magnitude have no statistically significant impact on estimates of F and SSB. The stock assessment models integrate unaffected catch information from commercial and recreational fisheries and the full time series from the research vessel surveys, reducing the influence of variations in recent survey indices.

In only three of 20 stocks did the status determination for overfished (i.e., $B_{2001} < 1/2 B_{MSY}$) change from overfished to not overfished (Table 2). In two cases (American plaice, and Gulf of Maine haddock), the stocks were near $1/2 B_{MSY}$ based on nominal assessment results. In these cases the hypothetical 10% increases in survey catches were sufficient to change biomass status determination. Of the 18 other cases, arbitrary increases in recent survey catches of 100% (i.e., doubling the catch) changed only the biomass status for white hake.

In only one case (Southern New England yellowtail flounder) did the status determination regarding the overfishing criterion (fishing mortality rate) change with arbitrary increases in survey catches up to 100%. The overall management advice is thus robust to variations in recent survey catch rates.

Recommendations

The GARM participants considered a number of generic recommendations for improving stock assessments and associated management advice:

- Based on considerations outlined in section 6.1, a retrospective evaluation of the performance of stock projections used in support of management is recommended. Such an analysis could shed light on the utility of various recruitment assumptions and other sources of uncertainty in stock and landings projection approaches.
- Index methods for biomass and fishing mortality status determination are used for a number of the groundfish stocks for which age- or length-based catch and abundance information are lacking. The performance of these indices should be evaluated and uncertainty measures routinely incorporated in the determination of stock status.
- Port sampling for estimating landings-at-age is an important component of stock assessment. The overall levels of port sampling have increased since 1998, as landings have increased. Maintenance, and in some cases, improvement in the rates of sampling are required to ensure adequate levels of sampling for estimating the catch-at-age. Further, a simulation (re-sampling) study is recommended to evaluate the reliability of catch-at-age estimates in relation to the rates of sampling.
- Estimation of fishery discards remains problematic for these stocks, as the overall level of sea sampling prior to 2002 was low and variable by fishery type. Increased rates of sea sampling coverage (occurring in 2002) should allow a statistical evaluation of the reliability of discard estimates, and the development of target sampling rates in order to reliably estimate discard mortalities at age for inclusion in assessments.
- Some stocks might have sufficient age and length-based information to upgrade the assessment type from an index basis to an age structured assessment (e.g., Gulf of Maine haddock). Age-structured modeling, even with partial information, may improve the basis for status determination for these stocks, and these improvements should be investigated.
- The GARM considered a variety of studies, including comparative fishing experiments developed to evaluate ship effects, to understand better the potential for effects on survey indices owing to the warp offset issue. The GARM notes that in order to evaluate the warp offset issue more directly, appropriately designed experimentation with warp offset and warp aligned tows is considered the most direct method for testing.

Numerous recommendations and comments pertaining to individual assessments are provided in the stock-specific chapters of the report.

1.6 Acknowledgements

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1.7 References

NEFSC 2001. Assessment of 19 Northeast Groundfish Stocks through 2000: a report to the New England Fishery Management Council's Multi-Species Monitoring Committee. Northeast Fisheries Science Center Reference Document 01-20. 217 p.

NEFSC 2002a. Final report of the Working Group on re-evaluation of biological reference points for New England groundfish. Northeast Fisheries Science Center Reference Document 02-04. 123 p.

NEFSC 2002b. Report of the Workshop on Trawl Warp Effects on Fishing Gear Performance, 2-3 October, 2002, Woods Hole, MA. Northeast Fisheries Science Center Reference Document 00-15. 80 pp.