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Comité d'évaluation des ressources transfrontalières | Transboundary Resources Assessment Committee

Comptes rendus 2014/01 | Proceedings 2014/01

Proceedings of the Transboundary Resources Assessment Committee for Georges Bank Yellowtail Flounder Diagnostic and Empirical Approach Benchmark

Report of Meeting held
14-18 April 2014

Stephen H. Clark Conference Room
Woods Hole Laboratory
Northeast Fisheries Science Center
Woods Hole, Massachusetts, USA

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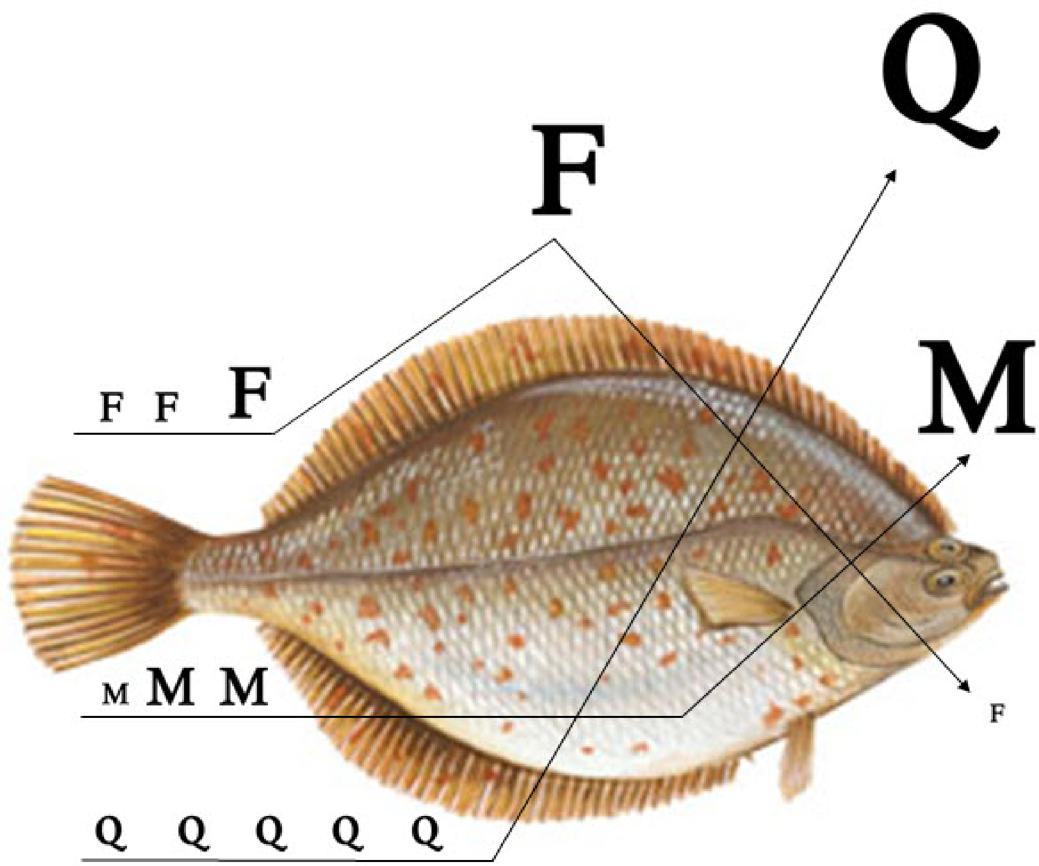

From : Fred Serchuk

FOREWARD

The purpose of these proceedings is to archive the activities and discussions of the meeting, including research recommendations, uncertainties, and to provide a place to formally archive official minority opinions. As such, interpretations and opinions presented in this report may be factually incorrect or misleading, but are included to record as faithfully as possible what transpired at the meeting. No statements are to be taken as reflecting the consensus of the meeting unless they are clearly identified as such. Moreover, additional information and further review may result in a change of decision where tentative agreement had been reached.

AVANT-PROPOS

Le présent compte rendu fait état des activités et des discussions qui ont eu lieu à la réunion, notamment en ce qui concerne les recommandations de recherche et les incertitudes; il sert aussi à consigner en bonne et due forme les opinions minoritaires officielles. Les interprétations et opinions qui y sont présentées peuvent être incorrectes sur le plan des faits ou trompeuses, mais elles sont intégrées au document pour que celui-ci reflète le plus fidèlement possible ce qui s’est dit à la réunion. Aucune déclaration ne doit être considérée comme une expression du consensus des participants, sauf s’il est clairement indiqué qu’elle l’est effectivement. En outre, des renseignements supplémentaires et un plus ample examen peuvent avoir pour effet de modifier une décision qui avait fait l'objet d'un accord préliminaire.

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ABSTRACT

The Transboundary Resources Assessment Committee (TRAC) met during 14-18 April 2014 in Woods Hole, Massachusetts, USA, to conduct a Diagnostic and Empirical Approach Benchmark review of Georges Bank Yellowtail Flounder (GB YTF). The consensus results of this benchmark will be applied in the June 2014 TRAC assessment for GB YTF. The results from the 2014 assessment will subsequently be used by the Transboundary Management Guidance Committee (TMGC) in developing management guidance for the 2015 fishing year for this transboundary resource.

RÉSUMÉ

Le Comité d’évaluation des ressources transfrontalières (CERT) s’est réuni du 23 au 26 juin 2014 à Woods Hole (Massachusetts), aux États-Unis, pour examiner les évaluations actualisées (jusqu’en 2011) concernant la morue de l’est du banc Georges, l’aiglefin de l’est du banc Georges et la limande à queue jaune du banc Georges, et pour étudier diverses questions scientifiques connexes. Les résultats de ces évaluations seront utilisés par le Comité l’orientation de la gestion des stocks transfrontaliers (COGST) pour formuler un avis sur l’orientation à donner à la gestion de ces ressources transfrontalières pour l’année de pêche 2015.

INTRODUCTION

The Transboundary Resources Assessment Committee (TRAC) co-chairs, L. O'Brien and K. Clark, welcomed participants (Appendix 1) to the April 2014 TRAC Diagnostic and Empirical Approach Benchmark review of Georges Bank Yellowtail Flounder (*Limanda ferruginea)*. The TRAC was established in 1998 to undertake joint US / Canada assessments of resources on Georges Bank (GB). Cod, Haddock and Yellowtail Flounder were the first species to be assessed by the TRAC, followed by Atlantic Herring (*Clupea harengus)*, Spiny Dogfish (*Squalus acanthias)* and Atlantic Mackerel (*Scomber scombrus)*. The April 2014 TRAC Yellowtail Flounder Benchmark terms of reference (ToR) received approval from the Canada / US Steering Committee, the Northeast Regional Coordinating Council (NRCC), the Gulf of Maine Advisory Committee (GOMAC), and the Transboundary Management Guidance Committee (TMGC).

Participants (Appendix 1) were reminded that the TRAC review process is two tiered, with assessment updates typically undertaken between more intensive benchmark reviews. A new benchmark for Eastern GB (EGB) cod was established in April 2013 and the benchmark for EGB Haddock was established in 1998. Prior to this meeting, the benchmark for GB Yellowtail Flounder (YTF) had been established in 2005. Assessments are conducted annually based on these benchmarks, and for GB YTF the results of this benchmark will be applied in the upcoming assessment.

The ToR and agenda for the meeting are provided in Appendix 2 and Appendix 3, respectively. During the meeting, each working paper was presented by one of the authors and then followed by a plenary discussion of that paper. Rapporteurs documented these presentations and discussions for the proceedings. Three reviewers were invited to participate in the benchmark review: Martha Krohn (DFO-Canada), David Miller (IMARES-The Netherlands), and Tom Wilderbuer (USA-NOAA).

Starting in January 2014, prior to the April benchmark meeting, several informal working group meetings were held every few weeks at the Northeast Fisheries Science Center (NEFSC) Woods Hole Laboratory, where anyone intending to submit a WP was invited to present their work in progress, or the final results. This provided a forum to suggest further refinements to the current analyses or another approach to explore. In some cases, those present agreed that further exploration on a specific hypothesis was not warranted given the results of the initial analyses.

All working papers (WPs) provided to the TRAC are listed in Appendix 4. With the large number of WPs (48) and the limited duration of the meeting (five days), the decision was made to limit presentations to those WPs that appeared to provide direct improvement to the assessment. Most analyses were conducted to ascertain if the data or method would improve the understanding of the current diagnostics of the assessment. The analyses were sound and thorough, and the results informative but not able to provide immediate improvements to the assessment and thus were considered as background documents. The designation of 'background' does not denigrate, in any way, the completed analyses. The authors of these WPs graciously agreed to not present, therefore, only 28 of the 48

WPs were presented to the TRAC in plenary, while all documents were digitally available to attendees.

GEORGES BANK YELLOWTAIL FLOUNDER BENCHMARK

Overview

Working Paper: Overview of Diagnostic Problems in the Current Benchmark Assessment Formulation for Georges Bank Yellowtail Flounder 2014/01

Presenter: C. Legault
Rapporteur: B. Linton

Presentation Highlights

This presentation addressed three questions: 1) How did we get here?, 2) What is a diagnostic benchmark?, and 3) What will we be doing this week? To address the first question, a brief review of the history of assessments for GB YTF was provided highlighting a number of issues such as the stock being declared collapsed in 1998, recovered in 2002, the development of a retrospective pattern, spatial heterogeneity, the 2004 Closed Area II special access program, the 2005 TRAC benchmark and recommendations for how to address it, the initial indications of a strong 2005 year class, the 2008 and 2009 deck tows of YTF in the DFO survey, the new US research survey vessel in 2009, the re-emergence of a retrospective pattern in 2011, some sensitivity runs in 2012 using different retrospective “fixes”, and the 2013 ICES World Conference on Stock Assessment Methods using this stock as an example. To address the second question, the current assessment was described and issues were described related to the retrospective pattern, scale, trend, concentration, age structure, and the decline in relative fishing mortality rate in 1995 despite survey total mortality rates remaining high. These problems were the same ones identified in the 2005 benchmark. To address the third question, summary statistics were provided regarding the collection of working papers for this meeting: 46 papers by 105 authors (56 unique) from ten organizations totaling 1,032 pages. Grouping the papers into the topics movement and distribution, life history, catchability, biomass, reference points, and synthesis was described. Also noted were the large number of background working papers that could not be presented due to time limitations, although these papers could be referred to during the week. Participants were requested to think about how the different pieces of information presented during the week fit together and to think about the big picture of how the stock was doing.
Discussion
There is no reason to split the NMFS bottom trawl survey indices in 1995, because there were no changes made to the surveys in that year. Actually, there was one change to

the survey in 1994, when a new winch system was put in place on the research vessel. The 1995 index values would be the first to be affected by this change. The new winch system by itself would not be enough to explain the observed retrospective pattern.

The 2014 DFO index value shows a decline in abundance relative to 2013. Actually, the 2014 DFO index value shows an increase in abundance relative to 2013, but is still low relative to the entire time series.

Since the retrospective pattern reappeared in the split series model, there is no fallback model for providing catch advice. It should be noted that there were legitimate reasons for why the other alternative models were rejected along the way.

The “aliasing of unknown mechanisms” (i.e., splitting the indices of abundance) was a temporary fix, and an effort should be made to avoid another temporary fix at this benchmark. That would be ideal, but catch advice must be provided for YTF in a couple of months. If another temporary fix is needed, then it should be made clear that it is only a temporary solution.

The catch advice from the different model formulations was similar, but the catch advice depends on the reference point. Were the effects of different reference points explored? Yes, even if you change the reference point, it doesn’t change the catch advice radically.

Changes to catch in the recent time period were explored, but anecdotal evidence from fishers suggests there was misreporting earlier in the time series (i.e., in the late 70s), due to misreporting of where landings were caught. Has the effect of changes to catches in the early time series been explored? This has not been looked at yet. It would likely take a large change in the early catches to reduce the retrospective pattern. A 3- to 5-fold change in recent catches was required to reduce the retrospective pattern, which was deemed to be an unrealistic level of catch.

Movement and Distribution

Working Paper:	Summary of Yellowtail Flounder Conventional Tagging Study TRAC Working Paper 2014/02
Presenter:	Larry Alade
Rapporteur:	B. Linton

Presentation Highlights

This working paper provides a general summary of the 2003-2006 YTF tagging study in the three stocks off the northeast coast of the U.S. Over 45,000 YTF were tagged with conventional disc tags and archival data tags in all three New England stocks with the objectives of estimating movement among stock areas and mortality, as well as providing growth observations. The pattern of release and recapture locations reveals frequent movements within stock areas and less frequent movement among stocks. Data storage tags show distinct periods of on-bottom and off-bottom movement behavior associated with movement to different habitats. Simulation of YTF life history, stock status, fishery dynamics, and the pattern of releases suggest that fishing mortality and movement estimates are confounded and cannot be independently estimated alone. Survival analyses for New England YTF as a whole supported the general magnitude of mortality from the age-based assessment. Comparison of scale samples collected during the release and recovery confirm the current interpretation of one annulus per year. Overall, this study furthered our understanding of YTF dynamics, particularly relative to movement behavior of the species that was considered previously ‘sedentary.’

Discussion

After the final report was completed in 2009, these tagging data were used in a tag-integrated statistical catch at age model. Including the tagging data and allowing for movement in the model did not change assessment results very much, and supports the current assumption of no movement between management areas. Inclusion of the tagging data in the model did help with the estimation of mortality.

Working Paper:	Spatial and temporal patterns of Georges Bank yellowtail flounder from the SMAST Bycatch Avoidance Program. TRAC Working Paper 2014/03.
Presenter:	C. O’Keefe
Rapporteur:	B. Linton

Presentation Highlights

Spatial and temporal overlap of scallops and YTF on GB has resulted in bycatch of YTF in the US sea scallop fishery. Bycatch of YTF has forced early closure of the scallop fishery on GB, resulting in substantial economic losses. To address this constraint and achieve optimal yield of scallops, we collaborated with the scallop fishing industry to implement a bycatch avoidance program. We designed a system to collect information on incidental catch that expands the use of existing Vessel Monitoring System technology and relies upon the active fishing fleet to provide data. Vessels supplied real-time communications about incidental bycatch rates during fishing activities. In turn, we compiled the information for the fleet and sent it back to active fishing vessels. While providing spatially and temporally-specific data on catch rates of non-target species, the fishing fleet gained valuable information about distribution of YTF in order to avoid bycatch “hotspots”. Fisheries dependent data collected by the program can be used to qualitatively track the distribution and relative magnitude of GB YTF bycatch in the scallop fishery during summer months in Closed Area II. Information from the Bycatch Avoidance Program indicates an increase in YTF bycatch in the scallop fishery in Closed Area II in late July through September compared to other months of the year. The observed increase in YTF bycatch suggests a possible seasonal migration of YTF to Closed Area II on GB.

Discussion
Are there discard mortality rate estimates for the scallop dredge? Yes, the discard mortality rate for YTF in the scallop dredge is estimated to be approximately 85%. Are discarded YTF considered to be all dead by the managers? Yes.

In Canadian waters, peak bycatch tends to occur from April through June, which corresponds with the spawning season. Are there any full year estimates of bycatch for US waters? There are no full year estimates of bycatch from this program, due to regulations in the closed area. The Coonamessett Farm survey revealed similar trends in bycatch to those shown by the Bycatch Avoidance Program.

The scallop fishery receives an allocation of YTF in each area. If the scallop fishery lands significantly fewer YTF than their allocation, toward the end of the year, then that remaining allocation can be transferred to the groundfish fishery. This occurred for the first time in 2013, due to the seasonal closure and reduced scallop effort.

General Discussion: Movement and Distribution
The movement studies presented here suggest that movement is low between management areas. Can it be concluded that movement is not a major issue influencing the retrospective pattern? That appears to be a reasonable conclusion.

In the Royce et al. (1959) and Lux (1963a,1963b) tagging studies, tagging occurred on the fishing grounds. Was that issue addressed in the recent study? Tags were spread out spatially. The movement between Southern New England and GB suggests that the boundary between those areas is not well defined. A similar phenomenon was seen in the results in the southern range of the Royce and Lux studies. In particular, they saw YTF moving from the mid-Atlantic to Southern New England.

Did the recent genetic study show any differences between stocks? No, it did not show any differences between stocks.

Life History

Working Paper:	Estimates of natural mortality for flatfish in the Northwest Atlantic: A comparison of model predicted estimates. TRAC Working Paper 2014/05.
Presenter:	L. Brooks
Rapporteur:	B. Linton

Presentation Highlights
The main motivation of this paper is to compare empirical estimates of natural mortality (M) and compare it with the current estimate used for M (*M* of 0.2 yr^{-1}) for the GB YTF stock assessment. We examined a database of direct estimates of *M*, maximum age (t_{max}), von Bertalanffy growth parameters *K* and L_∞, as described by Then et al. (2014), for flatfishes (Order Pleuronectiformes). A total of six flatfish species (Family

Pleuronectidae) were available from Northwest Atlantic and Northeast Pacific ocean basins, with literature *M* estimates ranging from 0.18 to 0.39 yr^{-1}. We applied the original and updated equations of four empirical estimators based on t_{max} and on the von Bertalanffy growth parameters presented in Then et al. (2014) to the flatfish dataset to obtain empirical estimates of *M* and bootstrap-derived standard errors. With the exception of one species, the range of the empirical *M* estimates encompassed the literature *M* estimates. The t_{max}-based *M* estimates more closely matched the literature values than the growth-based *M* estimates. However, all the empirical estimates derived using bootstrap resampling suggested that *M* for the GB YTF is greater than 0.2 yr^{-1}. Empirical *M* estimates derived using both historical and recent growth estimates for the GB stock also provided evidence for $M > 0.2$. Based on a non-exhaustive literature survey, sexual dimorphism in growth and lifespan is prevalent in flatfish; for the stocks that exhibit such sex-specific differences, the females are typically the larger and longer-lived. Sex-specific empirical *M* estimates suggest that males experience higher M than females. The databases examined for the GB YTF stock suggest that females survive in greater numbers to older ages than males. Considering all of the data available for GB YTF, and patterns observed for other flatfish, it is not unreasonable to expect that M is greater for males than for females.

Discussion: see below WP 06

Working Paper:	Re-evaluation of GB Yellowtail Flounder natural mortality. TRAC Working Paper 2014/06.
Presenter:	L. Brooks
Rapporteur:	B. Linton

Presentation Highlights

We investigate several approaches based on life history to estimate M for GB YTF *Limanda ferruginea*. Currently, a value of M=0.2 is assumed for all ages in the stock assessment. A range of M estimates based on maximum age, growth, maturity, and weight were derived from both age dependent and age independent approaches applied to a variety of data sources. Further, an alternative approach to the traditional maximum age methods was explored based on the premise of estimating the average maximum age in the population. Results from our analyses indicated that M is higher than 0.2 and likely ranges from 0.3 to 0.5. While M appears higher than the current assumption in the stock assessment, we do not believe that the results of this study will change the perception of the stock nor will it resolve retrospective problems for GB YTF.

Discussion: WP 5 and WP 6
Does the observer program sex YTF when sampling? There is some ambiguity in the instructions given to observers. The instructions can be interpreted to say either sample 20 fish and record their sex, or sample 10 males and 10 females. The same problem with the sampling protocol exists for port samplers.

Is there a difference in growth coefficients between the old and new growth analyses? Yes, the old growth study estimated Linf = 50 cm and K= 0.335. The old analysis used a minimum age of 2 and a maximum age of 7, and depended on commercial ages. The new growth study uses a broader range of ages, and the ages come from the surveys. When survey data were subset into an early and late time periods, the estimated growth parameters for those two time periods were similar, which suggests the differences between the old and new estimates are due to the narrower age range used in the old study.

Jensen's (1996) approach estimates M to be 1.5 * K, but that does not appear to be the case for Alaskan stocks. How did Jensen's approach perform in this study? The M estimators using growth parameters (i.e., Jensen (1996) and Pauly (1980)) did not perform as well as maximum age-based estimators of M.

It is telling that in Table 2 of WP-6 only about 2% of the fish are age 6+, which lends further support to the idea that M is higher than the current assumption of 0.2.

Were any age-based methods for estimating M examined? WP-6 looked at Lorenzen's (1996) approach and Chen and Watanabe's (1989) approach to estimating an age-based M. Chen and Watanabe's approach did not produce realistic results, due to t0 being negative. Lorenzen's approach is basically just rescaling a maximum age-based estimate of M.

It needs to be remembered that a lot of these data were collected during a period when F was high. Also, the highest ages generally come from early in the time series (i.e., the 1970s). That's why the WP-6 analysis used predicted maximum age, as well as observed maximum age, to estimate M.

The GSI approach to estimating M was recently updated. Was the updated GSI approach used in this analysis? No, the Gunderson (1997) GSI approach was used to estimate M in this analysis.

Working Paper:	Natural mortality of GB YT derived from an instantaneous rates tagging model. TRAC Working Paper 2014/09.
Presenter:	T. Wood
Rapporteur:	T. Chute

Presentation Highlights

The primary objective of this working paper was to evaluate the mortality of YTF tag releases in the GB stock area. A total of 27,685 releases and 2,261 recaptures were used to estimate F and M from the instantaneous rates formulation of Brownie tag-recovery models. Models were examined with group (releases inside versus outside Closed Area II (CAII) and females versus males), and time-dependent parameters. The top model estimated M for CAII releases and outside releases. The top model also included group and time-dependent F estimates with non-mixing estimates in the release year. M for CAII releases was estimated to be 1.23, with a profile likelihood 95% confidence interval of 1.02 to 1.44. For outside releases, M was estimated to be significantly lower at 0.69, with confidence interval from 0.35 to 1.01. The results from this work are consistent with the perception that the GB YTF resource is experiencing an intense rate of mortality. While these mortality estimates corroborate stock assessment estimates, they could be inflated due to model assumption violation.

Discussion

M and F were estimated from tag return data. The tagged fish were all commercial sized and generally over 2 years of age. Reporting rate was assumed to be 59% (this value may be different in the working paper). Reporting rates and mortality estimates are entangled, and it should be considered that the reporting rate might be lower. The closed-area/open-area dynamics cause some problems with the models since the fishing rates are not the same inside and out. The F was higher for the closed area fish due to the way the fish were recovered, as they may have been caught on the outside of the closed area but still count as closed area fish since that is where they were tagged. There is quite a bit of fishing going on right at the closed area border. The estimates of M and F are high compared to those generated using other methods, and this may be because the reporting rate was fixed at the 59% value for all the models. There were also some model assumptions that may not have been realistic but the best option for now. The best estimates are probably the open area estimates.

Working Paper:	Beverton-Holt length-based mortality estimates for Yellowtail Flounder. TRAC Working Paper 2014/07
Presenter:	D. Hart
Rapporteur:	B. Linton

Presentation Highlights

Estimates of total mortality (Z) for GB YTF were obtained from trawl and scallop dredge survey data using the Beverton-Holt length-based mortality estimator. This estimator has the advantage of not requiring age or landings data, and can be used as a comparison to more complex stock assessment models. It also can be applied to on the substock level and in particular to areas closed to fishing. Although this estimator can be biased under non-equilibrium conditions, time-averaging the estimates over several years will usually give approximately unbiased results. Beverton-Holt length-based mortality estimates were similar to corresponding estimates from VPA results for the converged middle portion of the VPA (1985-2005), but were well above the VPA estimates during the most recent years. The Beverton-Holt estimates in the southern portion of Closed Area II, where YTF was observed to build up during the first decade after the area was closed, was relatively low during the first decade after closure, but has increased in the most recent years. An increase in M starting in about 2008 or 2009 is the most likely explanation of these results. Increase movement of YTF could potentially also explain at least some of these observations.

Discussion

Closed area II was not completely closed from 2010-2012, due to bycatch in the scallop fishery. Was this taken into account in this analysis? That fact along with movement between open and closed areas is why you can't treat the closed area BHZ estimate as an estimate of M. Even if that were a reliable estimate of M, that still wouldn't explain the increase in Z in the most recent years.

Since the stock was thought to have collapsed in the 1990s, are the good recruitments in the 1985-1994 period due to actually good recruitments or due to the loss of older fish? There is evidence of good recruitment early in that time period with the collapse occurring in the later part of time period. So, it is difficult to tease these two factors apart when looking at the relative length frequency averaged over entire 1985-1994 time period.

During the 1999-2003 time period, there was an active fishery operating on the margin of CAII, due to spill over from the closed area. This fact should be kept in mind when interpreting the BHZ estimates. That's why BHZ for that period can only be considered an upper bound on M.

There is an assumption that growth is constant for the entire time series. Is there any evidence that growth has changed over time? There is no trend in length at age over time in the fall survey. In the spring survey, there is some evidence of a change in length at age over time for ages 3 and 4 in recent years. All three surveys (i.e., NMFS fall and spring surveys and the DFO survey) show higher Zs in recent years, and that could be caused by a change in growth.

For 1999-2005, recruitment appears to be increasing which would mask changes in Z with the incoming recruits. If recruitment was trending then it would be an issue. Actually recruitment appears to be declining at the end of that time period, based on results from the last assessment.

Length frequencies of the catch were similar inside and outside of CLII during the Special Access Program (SAP), but these results from the scallop survey show larger fish in the closed area compared to outside of it. Currently, there is not an explanation for why that discrepancy exists. The SAP and scallop survey both occurred in the summertime, but the SAP lasted for a longer amount of time compared to the scallop survey.

Working Paper:	Relative abundance at age and size of Yellowtail Flounder off New England. TRAC Working Paper 2014/12.
Presenter:	S. Cadrin
Rapporteur:	T. Chute

Presentation Highlights

The retrospective pattern in the GB YTF assessment results from fewer survivors to old age than expected with such low recent fishery catch. US and Canadian assessments of

GB YTF have assumed a M=0.2 based on the probability of seven tagged YTF surviving to time of capture (Lux 1969), a 14-year old YTF in the Cape Cod stock (Lux & Nichy 1969) and a regression of total mortality on fishing effort (Brown & Hennemuth 1971), but the expectation of more older YTF may be a model artifact. Empirical evidence was explored to provide baseline information on unfished age distribution, including historical surveys and historical fisheries samples. Catch at age in the fall survey suggests more old fish in the 1970s and late 1990s-early 2000s, but the proportion of older YTF has been relatively constant. By contrast, there were proportionally more old fish in the 2013 spring survey and 2013 DFO survey than any previous decade. The fishery catch at age suggests more old fish in the 1970s and early 2000s, but the proportion of older YTF in the fully-recruited catch has been more constant. There was some fishery development before the early survey observations in the 1960s and peak catches before fishery age data in the 1970s, so earlier samples from the southern New England YTF fishery may be more appropriate for baseline information. Soon after the fishery began in 1935, Royce et al. (1959) monitored the fishery, sampling approximately 13,000 YTF over most months and vessels from 1942 to 1947 using a trip-based design that is similar to current US port sampling, collecting both scales and otoliths from almost 9,000 YTF. After eight years of fishing by a small fleet, there were few fish older than 7-years, and about the same proportion of older fish in the recent fishery on GB. The 2012 benchmark assessment of southern New England YTF revised the natural mortality assumption to M=0.3 based on maximum observed age and gonadosomatic index. Although catches of YTF are relatively low in the recent fishery and surveys on GB, the low frequency of older fish in early fishery samples suggests that the assumed M for GB YTF should be re-considered.

Discussion

There may be a selectivity issue causing the age frequencies to stay constant over time. If the same gear is being used to catch the fish they measure to construct length frequencies, larger fish may have been able to avoid the gear used. There has been some work done on the selectivity of YTF and found that there is no reason to believe selectivity has changed over time.

Very old fish rumored to be found on the Scotian Shelf may have been aged incorrectly. The GB YTF otoliths are very hard to read, and there have been changes in the way YTF have been aged over time with the discovery of more accurate methods.

The time series of ages is not without its bumps. We are looking for old fish based on our assumption that M is 0.2. If M is higher, we would not see the fish we were looking for and would not be surprised.

There has been some anecdotal evidence of very large fish in CAII. The closed areas may be having an effect on the age frequencies seen by various entities. Length frequencies may be different for studies operating at a much higher resolution, and in specific areas designed to yield catches of YTF, than those from the NOAA or DFO large-scale randomized surveys.

Working Paper: Estimation of Georges Bank Yellowtail Flounder Total Mortality by Sex from NEFSC Bottom Trawl Surveys. TRAC Working Paper 2014/08.
Presenter: C. Legault
Rapporteur: T. Chute

Presentation Highlights

The NEFSC has conducted research bottom trawl surveys on GB since 1963 in the fall and since 1968 in the spring. Catches of YTF were assigned to age and sex bins based on standard sampling protocols. Estimation of total mortality rates by sex was conducted using both cohort and static (blocks of years combined) catch curves. Three general results emerged: 1) total mortality rates have remained high throughout the assessment period for both sexes, 2) male total mortality rates are higher than female total mortality rates, and 3) the difference in total mortality rates between the sexes is increasing in recent years, with female rates remaining the same while male rates increase. Only one of the three results has a simple explanation, the total mortality rate is higher for males than females because the M is higher for males than females. There may be other factors contributing to this difference by sex. There are no simple explanations for the other two results, with a number of possible explanations discussed but not supported.

Discussion

There is some evidence that catches of YTF are sometimes all male and sometimes all female; they don’t seem to be well-mixed in their natural habitats all the time. The fish may clump together by size, which would create groups that were more one sex than the other since males and females grow at different rates. Things like “missed catch”, which can never really be determined, are always thrown out as possible reasons for retrospective patterns. But work has been done on how possible it would be to have “hidden catch” to the extent that it would affect the analyses and create a retrospective pattern. The behavior of boats with and without an observer on board could make a real difference. There was a time period where some catches on a trip were not reported which was called “shack”, and these catches may have included YTF that went unrecognized.

You can calculate how much catch you need to “find” to fix the retrospective pattern. Misreporting could certainly have occurred but it is improbable that the amount of “missing catch” needed to balance the books would have gone unnoticed. It is difficult to weigh “missing catch” against “sudden four-fold increase in M” as a possible cause of the missing fish. Both seem improbable. The evidence for a change in Z is pretty overwhelming, even in the face of possible missing catch. There is probably a “missing catch” component AND an “increase in Z” component. It does not have to be an either/or situation.

The relative proportions of the two sexes that have differing mortality rates could cause some unique twists, especially for estimates of combined Z. Would the F part of Z be the same for males and females, and the difference lie in M only? That would be interesting but there does not seem to be any reason to believe they are, or are not, equally vulnerable to the fishery. Could the conversion factors between the Albatross IV and the Bigelow (which are length based) somehow be confounding the sex ratios? Probably not, YTF don't diverge in size by sex until age three, when the conversion factor is fixed. There is some indication that *Ichthyophonus* may be affecting the fish differently by sex, with males found to be infected at a higher rate than females.

Working Paper:	Are current incidence rates of *Ichthyophonus* consistent with high natural mortality. TRAC Working Paper 2014/11.
Presenter:	P. Rago
Rapporteur:	T. Chute

Presentation Highlights

A simple two stage model is used to describe the prevalence of *Ichthyophonus* in GB YTF. The dynamics of healthy and infected individuals are modeled as functions of two key parameters. The first is the rate of new infections, denoted as φ, and the lethality of the disease, denoted as M2. The lethality of *Ichthyophonus* is based on the median survival times for infected animals. Results suggest that the observed prevalence rate of 2.55% is consistent with a low rate of new infections and high lethality (M2>4). When F is low, say ~0.1, the high lethality of the disease could result in total mortality from natural causes exceeding F be a factor of 4. However, as F increases, the ability to attribute high losses due to M2 greatly diminishes, irrespective of the lethality of the disease or infection rate. Experimental data on the lethality of *Ichthyophonus* in YTF are needed. Empirical information on the infection rate for new fish is also needed. Finally, since the prevalence rates of *Ichthyophonus* may not be higher that earlier historical estimates, one has to explain why the current rates of prevalence would be so lethal.

Discussion

The data for prevalence comes from Coonamessett Farm research trips during which they looked for *Ichthyophonus* specifically in all the YTF they caught. The disease has been seen since 1968 in Canadian YTF, and on GB and in the GOM recently, but not in Southern New England. It was first noted in US YTF in 2010.

There are several strains of the disease which have different lethalities. There is also the poor condition factor (determined by weight at length) found in YTF, to be considered. Does poor condition contribute to contracting the disease, or does the disease cause the poor condition? There is also some evidence that fish populations in a highly reduced state are more vulnerable to diseases. A whole set of possible effects of the disease could be estimated using a variety of values of F and M. There is a retrospective issue which could possibly be fixed with a sudden introduction of another cause of mortality to YTF. Could this disease be it? Fish have been collected and analyzed only since 2012.

General Discussion: Life History (mortality)

In the recent period the Z would probably be around 1.0 maybe higher for males. M of 0.2 is probably unreasonable, and there have been various estimates presented today.

There is no reason to believe the M has not ever been lower. Perhaps it was about 0.3 at some point but then got progressively higher over time, as in the progression of a disease.

Then you have to add other dimensions: changes over the life of the fish, and possibly by sex, and possibly by season, ad infinitum.

It was suggested that there is no good reason to use a different M for each age when you can find an average and get pretty much the same results (lesson learned from the herring assessment).

An argument for the age-based M is it would be useful for making projections, calculating reference points and “subsets” of an assessment to get a more accurate result.

Tony Wood’s tagging return model could offer another M estimate if run without taking the closed area into account.

Exploring two time stanzas and different mortality values for different stanzas does not seem to solve the retrospective problem.

Three stanzas seem to be indicated. Time periods of 1973-1994,1995-2003, ~2004-2013 have been suggested. There might be a reason to use splits in time that correspond to closing and opening of closed areas for some types of analysis. Is there another reason to place the split in 1995, or is it just because of the creation of the closed areas?

Would the declines in condition correspond to any of those dates? Does the start of decline in condition correspond in time to the decline in the catch of males in the survey (and thus an assumed increase in the Z for males)? Yes, it was at about the same time.

Based on one of the tagging data models, the F seems to be having a larger impact on the male Z than the female Z. So M is the same for both males and females and F is higher for males. How to test this?

Need to make sure we are not assigning break points just to fix the retrospective; if we see that “something happened” and made a break point, did something notable happen, or something more indirect?

Lots of species have seen a decline in condition, but YTF has been the worst. Have there been causes found for changes in M (breakpoints) in other species?

Is there any reason to truncate the time series? It might be more straightforward to make estimates from a more recent time period where fewer conversion factors etc. would have to be made along the way.

There was a suggestion to increase M from 0.2 to 0.4 all over, with no break points, for both sexes combined. Does not solve everything, but does solve some things. This is based on the range of M values that have been estimated for this meeting using various techniques. This would start the discussion, and then if we wanted to tweak around with break points that would be the next step.

The VPA estimate would be more in line with other approaches if an M of 0.4 was used.

From the consumption data (stomach contents of all surveyed fish species), it does not seem that YTF would have as high an M as 0.4 since they do not seem to be heavily preyed upon. For instance, herring have an M=0.5 and virtually everything eats them. There are very few examples of YTF consumption in the food habits database. But, they do mature very fast and do not live very long…so they may have a life-history driven rather than predation-driven high mortality rate.

So if the starting point of M was to be 0.4, then would it be raised from there during the different stanzas? The group needs to consider different scenarios. One is continuous with no breaks. Another might be two stanzas, 1973-2003 and 2004-2013, since a mid 1990's break seems unconvincing. Or, since management changes occurred in 1994, it might be reasonable to use only the 1994-2013 time series. The port data collection methods, etc. changed over in 1994 and has been widely considered more reliable since then. There have also been many changes in management, closed areas, the environment, Canadian fishing rules etc. that make the time series lack stationarity which argues toward truncating the time series. The changes over time seen in the catch curves could also serve as time breaks for increasing the Z in the model. An increase in M from the suggested baseline of 0.4 to 0.8-1.0 in a second stanza (2004-2013) was put forward. If there were to be a third stanza of 73-94, the suggested baseline M would be 0.4 for that stanza as well.

There should be a discussion about recruitment levels and possible changes in predation on young-of-the-year fish. There was a drop in the larval index that corresponded in time with the drop in condition. DFO also has seen fewer recruits recently.

If we looked at the original development of the M=0.2, there may be some biological information we can use to determine if that particular measure has changed. That may be a more concrete reason for the changing of M over time. i.e., having M linked to something we can measure, like the condition index, which unfortunately only begins in 1992.

A good follow-up would be to look at the correlation between the condition factor and the decrease in males over time in the survey data and see if we can tie M to condition. We couldn't estimate an M from the correlation with condition numerically, but we can see where the changes occurred and their magnitude.

Catchability

Working Paper:	Biomass estimates for YTF based on Bigelow surveys and prior information. TRAC Working Paper 2014/13.
Presenter:	L. Jacobson
Rapporteur:	B. Linton

Presentation Highlights
We developed and evaluated a prior distribution for capture efficiency of YTF on Georges Bank during NEFSC bottom trawl surveys by the NOAA ship *Henry B. Bigelow* and estimated swept-area biomass for the stock during 2009-2013. Capture efficiency was defined as the probability of capture for YTF located between the doors of the bottom trawl. Door spread is more useful than wing spread in defining capture efficiency because the effective width of bottom trawls is wider than the wing spread for flatfish and capture efficiency based on door spread has an upper bound of one based on published studies. *Bigelow* survey data were used because sensor data describing net geometry are available for every tow and because it had the highest capture efficiency based on catch per area swept. Currently there are no direct estimates of capture efficiency for YTF by the *Bigelow* so two studies reported in the scientific literature were used to define a prior distribution for flatfish in bottom trawl gear. The first study was conducted with four flatfish (arrowtooth flounder, flathead, rex and Dover sole) in the Gulf of Alaska using a Polynor'eastern trawl (Sommerton et al. 2007). The second study was conducted with English plaice in the North Sea using a Granton otter trawl (Harden Jones et al., 2007). The prior distribution for efficiency estimates based on estimates for these five flatfish averaged 0.37 with 95% of the prior probability distribution between 0.18 and 0.56. The prior appears plausible in comparison to six upper bound estimates for YTF from other data and upper bound estimates for other species. Uncertainty in the area swept by a tow and the area covered by the survey were also examined and found to be minor relative to the uncertainty in the catch per tow and capture efficiency. Results suggest that YTF biomass estimates for Georges Bank can be improved using prior information for capture efficiency, particularly if experimental work for YTF in *Bigelow* bottom trawl surveys is carried out. Such prior information could be used to estimate swept-area biomass directly or potentially in stock assessment modeling.

Discussion
Why was 30 cm chosen as the length cutoff for estimating biomass in this analysis? This study aimed to produce an estimate of biomass that was meaningful in stock assessment terms. Looking at length frequency distribution, 30 cm appeared to be a reasonable cutoff for the exploitable biomass. Can the assessment model produce an estimate of exploitable biomass for comparison to this analysis? The assessment model is age

based, so the age corresponding to 30 cm would need to be determined to obtain a comparable estimate of exploitable biomass.

In the twin trawls, were the rollers the only difference between the two gears? Yes, that was the only difference. Would towing two nets at the same time change the herding behavior compared to towing one net? That is quite possible. The gears were set up to be as close as possible to the Bigelow gear, but just adding the second net introduces differences.

When comparing the beta distribution of whole net capture efficiencies from the literature to the capture efficiencies bounds, one must remember that this is not a comparison of apples to apples. The capture efficiency bounds are upper bounds rather than actual estimates of capture efficiency. The bounds should be greater than the literature derived distribution, and they are in most cases, except for the ground gear paired trawl.

The trawlable portion of GB in US waters is estimated to be 93%, and is assumed to be the same in Canadian waters. The Canadian survey has trouble in several areas (e.g., Cultivator Shoals) of GB, so this 93% estimate may be high. The only area excluded from the US trawlable habitat estimate was German Bank. The presence of lobster pots also makes areas untrawlable, which would lower this estimate of 93%. So this lower bound estimate of trawlable habitat of 93% likely is too high.

Working papers 13 and 14 use different values for the area of GB, 37,286 km^2 and 37,773 km^2, respectively. A single value for the area should be agreed upon and used for all of these analyses.

What was the catchability value used to produce the biomass estimates? A range of catchability values was used, rather than a single value. Is there a table listing the range of catchabilities used? No, but such a table can be created.

Do the recent declines in predicted biomass from this study correspond to the changes in M discussed yesterday? These biomass trends are based on the survey indices, so if those changes in M are consistent with the indices, then they would be consistent with the estimated biomass trends. It probably is too early in the meeting to determine whether or not the changes in biomass and M are consistent.

Using the capture efficiency distribution from the literature makes an assumption that the capture efficiency of the Bigelow is similar to the capture efficiency of the gears used in those literature studies. Actually, the assumption is that the Bigelow catch efficiency is contained within that literature derived distribution. Someone with better understanding of the gear may be able to say whether that is a reasonable assumption, but the catch efficiency estimates from the literature seem fairly similar across gears and species.

Working Paper: Minimum bounds on GB YTF spawning stock biomass with a meta-analysis of catchability across northeast stock assessments. TRAC Working Paper 2014/14.
Presenter: D. Richardson
Rapporteur: B. Linton

Presentation Highlights
The objective of this working paper is to evaluate the minimum spawning stock biomass (SSB) of GB YTF based on an analysis of different factors contributing the catchability of the NEFSC trawl survey. This catchability analysis is then applied to a suite of other stocks that are assessed using NEFSC trawl survey data. The catchability of GB YTF was found to be highest during the night using the Bigelow survey gear. When the survey indices were standardized to nighttime Bigelow tows, the estimate of 2010-2012 SSB ranged from 11,000-23,000 mt using wing spread swept areas and 4,200-9,000 mt using door spread swept areas as the effective trawl area. Estimates of the nighttime catchability of the Bigelow net for seven other flatfish stocks from the NEFSC assessments ranged from 0.6-1.8 in the fall and 0.3-1.7 in the spring (a q of 1.0 corresponds to wing spread swept area and 2.55 to door spread swept area). The GB YTF stock exhibited a strong increase in implied catchability (survey SSB/assessment SSB) as was highlighted in the 2013 assessment. A similar pattern of increasing implied catchability in the mid-1990s was also evident in the other flatfish stocks on average, though the magnitude of change was much lower.

Discussion
Could a table of the implied catchabilities and associated SSBestimates be provided? Yes, and SSB can be recalculated with a length cutoff of 30 cm for better comparison to WP-13.

As noted previously, the measure of the area of GB used in WP-14 differed from the value used in WP-13 by less than 2%, and both measures differ from the area measurement used in SAGA.

Which strata were used in this analysis? Strata 13-21 are considered the proper strata for GB YTF. Stratum 22 (i.e., the northern edge of GB) is not included for YTF.

Were all spawners assumed to be fully selected to the gear? Yes. The length frequencies suggest that fish are not fully selected until around 31 or 32 cm, which would bias the biomass estimates low. That is correct, which is why these estimates of SSB are considered conservative.

YTF have three different stocks with different day-night effects. Is there an explanation for what is driving these differences? Length-specific day-night catch ratios are weighted by abundance at length, maturity at length, and weight at length to produce an overall day-night catch ratio, and those weightings differ between the stocks. A closer look at the data would need to be taken to determine the relative contribution of the different factors to the differences in the ratios. In addition, the angle of the sun and the amount of illumination also differ between the areas.

What is the minimum estimate of maximum catchability? The minimum estimate of maximum catchability is around 0.7, which is in the range of the experimentally derived catchability estimates.

Which assessment produced the SSB estimates used to calculate the implied catchabilities? SSB estimates from the most recent assessment were used in this analysis. It would be helpful to include the reference to the assessment in the WP.

Were retrospective adjusted estimates of SSB used in this analysis? No, but it may not be necessary to account for retrospective bias, if you are just interested in looking at trends in biomass. It might be all right to ignore the retrospective bias for the comparative analysis, but it probably is not right to ignore the retrospective bias with the assessment SSB.

Is the assessment model fitting to a biomass index? Not quite, the model is fitting to age-specific indices of abundance.

Working Paper:	Abundance and spatial distribution of Yellowtail Flounder in Closed Area II South, 2010 vs. 2012, from an image-based survey. TRAC Working Paper 2014/15.
Presenter:	B.Shank
Rapporteur:	B. Linton

Presentation Highlights

We compare the abundance and spatial distribution of YTF from two high-resolution, image-based surveys of Closed Area II South from 2010 and 2012. Estimated YTF abundance in the survey area was 76% lower in 2012 than in 2010, with estimates of 1.36 million and 5.81 million individuals respectively. The spatial distribution of YTF also constricted in 2012 compared to 2010. Bottom water temperatures were notably warmer in 2012 than 2010 and the shifts in the spatial distribution correlate well with the shifts in water temperatures. Based on the abundances from the image surveys, we calculate an average efficiency for the NEFSC survey dredge of 0.62 and apply this to the dredge survey data throughout the stock area to get estimates of absolute abundance for the survey time series. The expanded dredge time series abundances are lower than the stock assessment model but the dynamics generally agree for recent years although lower than the assessment model in the years before 1994.

Discussion

How was the prorated abundance estimate obtained? A portion of the 44 unidentified flatfish were assigned to YTF based on the proportions of YTF observed in the survey.

The length frequencies between the dredge and HabCam surveys are quite different. This might be due to that fact that complete lengths could not be measured for YTF on the edges of the frame, which would account for the higher numbers of small fish in HabCam. The HabCam images could be reexamined to weed out partial lengths. It might be sufficient to restrict the analysis to lengths greater than 30 cm.

Was the swept area abundance estimate expanded to cover all of GB or to just the Closed Area II South? Abundance was scaled to cover all of GB.

The VPA abundance estimates include Canadian waters. Did the dredge/HabCam survey data used in this analysis include Canadian waters? Someone will need to check on this.

The Coonamessett Farm survey sees similar differences in YTF numbers between August and July as the dredge/HabCam surveys did.

Why has catchability estimate for the dredge survey changed from last year's assessment? It was noticed that the confidence interval from the inverse variance mean approach did not include the most believable mean estimate of 0.818. So, this analysis used the mean efficiency for lack of a better alternative.

A time series of bottom temperatures might help to inform M, since YTF aren't thought to live in temperatures greater than 12 C. The NMFS flatfish survey has seen YTF in greater than 14 C waters, so 12 C may not be a hard and fast threshold.

Working Paper:	Gear avoidance behavior of Yellowtail Flounder associated with the HabCam towed imaging vehicle. TRAC Working Paper 2014/16.
Presenter:	B. Shank
Rapporteur:	B. Linton

Presentation Highlights

Estimating the efficiency of survey gear is difficult in the absence of having known densities of target organisms. Image based surveys have the advantage of both providing an abundance estimate and recording the behavior of the organism and its reaction to the gear at the time it was sampled (Uzmann 1977). We explored how this recorded behavior may be informative for understanding the catchability of the imaging gear itself, using an image library from the HabCam towed underwater vehicle. YTF exhibited clear diel behavioral patterns. While most individuals were recorded resting on the substrate, 30% of individuals observed at night were partially buried in the sediment and 30% of the individuals observed during the daytime were swimming near the bottom, most of which were confirmed to be fleeing the vehicle. There were no strong patterns in the directional orientation of flounder resting on the bottom but most of the flounder reacting to the vehicle were swimming towards the vehicle rather than away from it. Most swimming fish were observed in the same image where they had been resting or in the adjacent image but some fish covered longer distances, suggesting that a fish that swam perpendicular to the image track could escape being photographed. We conclude that burying behavior or gear avoidance could marginally decrease the catchability of YTF in HabCam imagery. The observed diel patterns in burying behavior and gear avoidance may also provide insight into diel variations in efficiency observed for other mobile gear types.

Discussion

Is the flight direction of YTF truly random? It may not be not be, but there is no evidence to suggest an alternative flight pattern. As a modification of the current analysis, YTF could be scattered randomly on and off of the survey track. This would also allow for fish starting off the track and fleeing on to it.

Working Paper:	Evaluating age and length composition data for inference about selectivity shape. TRAC Working Paper 2014/17.
Presenter:	L. Brooks
Rapporteur:	T. Chute

Presentation Highlights

Age and length composition data from three fishery-independent surveys and from the commercial catch at age were examined to determine whether there was sufficient information to infer selectivity shape outside of the VPA model application. Age and length composition supported the same conclusions about relative selectivity between the NMFS spring, NMFS fall, and DFO surveys. Specifically, the DFO survey appears to have dome-shaped selectivity, the NMFS spring survey has higher selectivity than the DFO survey at the oldest ages, and the NMFS fall survey has the greatest selectivity (over all three surveys) at the youngest ages. The NMFS fall survey does not always observe the oldest age (6), so the relative selectivity patterns were not as informative about this age class for the fall survey. The DFO survey had relative selectivity patterns that were most similar to the fishery. This would suggest that there might be some doming expected for the fishery selectivity. Two alternative VPA configurations were explored to determine if allowing for doming in the fishery could help resolve the severe retrospective pattern; the dome models reduced the retrospective slightly, but the magnitude was still very large. Literature on gear related research was reviewed, with some studies indicating that the length of the bridal can affect capture efficiency for flatfish, with longer bridals being less efficient; additionally, some but not all studies found selectivity effects based on fish length, with longer bridals having lower selectivity for larger fish. These efficiency and selectivity results could help interpret the observed patterns for GB YTF. Research recommendations describing studies that could help test the performance of groundfish gear in the Northeast were provided.

Discussion

For the landings data, calendar quarters one and two were used for comparison to the survey catches, both in age composition and length composition. The different gear used by the DFO survey, the NMFS survey and on commercial vessels may be the cause of the difference in selectivity seen.

Combining the Albatross IV and Bigelow survey results by using a calibration factor may not be ideal. It may be best if the time series are kept separate, especially for modeling, as the two gears are so different. Also, for historical data, there is no way to convert it or relate it to either the Albatross IV or the Bigelow. So, Albatross IV catches are being bumped up, or Bigelow catches are being bumped down, but some older data is not calibrated. There just might be a better way to look at the data without trying to force one into the units of the other, especially when the conversion factors are often so large.

Are there plans to have the Bigelow be a time series all on its own now? Yes, that will be one of the runs done every time. There is a way we can develop weights for both the ships too, instead of always converting one to the other.

Do we want to calculate swept area a new way using the gear configurations, such as wing spread and door spread and bridle length? The survey ships have sensors on both the doors and the wings to help analyze their performance. Door spread might be a way to calculate swept area, but some nets are designed to minimize herding and in those cases the wings might be a better measure. If you use door spread as a measure of area swept it would be difficult to get a q of one, so in that sense you would have some warning that something was wrong if you ended up with a high value, but there are plenty of examples of selectivity over one with all sorts of measures so that is certainly not foolproof. We need to find what the best measure is and use that unit consistently.

It has been suggested that flatfish do not herd at night between the net doors. So there might be some reason to look into this and compare night and day catches.

Catchability for the HABCAM needs to be assessed by looking at the length frequency over 30 cm for a direct comparison.

The timing of the surveys should also be taken into account since abundance and distribution change over the year.

General Discussion: Catchability

There was agreement that door spread would be used for estimation of q rather than wing spread.

Information was available indicating that fish do not herd at night, so using wingspread would not be an issue.

An estimated q greater than 1.0 when using door spread is of concern, but this is not as clear for wing spread. Regardless, there is no effect on estimates and model results.

Regardless of what gear is used, there is an effect of distance between bridle and net, etc. Doors and wings have sensors, so measurements can be recorded.

Biomass

Working Paper: Implications of retrospective patterns for bias in discard rates and unobserved landings. TRAC Working Paper 2014/18.
Presenter: P. Rago
Rapporteur: T. Chute

Presentation Highlights

Previous analyses of retrospective patterns for GB YTF have demonstrated that total catch would have to increase fivefold in order to compensate for the retrospective pattern. The increase in catch would require increases in unreported landings, or significant increases in discarding rates on unobserved trips. The implications of a fivefold increase in total catch were examined for three US fleets that constitute the majority of US catch of GB YTF during 1989 to 2011. Bias factors required to achieve a fivefold increase in total catch as a function of bias in landings on unobserved trips and bias factors for bias in discard rates on unobserved trips were computed. Results suggest that bias factors greater than five are required to increase the total catch by a factor of five. We conclude that neither increased discarding rates on unobserved vessels nor illegal landings on unobserved vessels seem plausible given the extreme magnitude of change implied by our analyses. Trends in US fishing effort by otter trawls has declined in recent years, indicating that non-observed fishing mortality effects, such as due to injury from passing through meshes, is not a likely cause of the missing catch needed to explain the retrospective pattern.

Discussion
It would introduce a very different perception of the catch and discard data if the observed data was considered unbiased and the unobserved trips were considered biased very low. This could be translated into an “observer effect” of quite impressive proportions when there is no evidence of the effect being that great (it has been studied). The unobserved trip bias may be of any size, but there was a fivefold increase in catch needed to cure the retrospective problem when only catch was altered and not other factors.

Are more YT being lost through incidental mortality recently? Could this be the sink? Effort on the Canadian side has probably declined in the last few years, and more vessels are using mesh designed to let more fish escape unharmed, so from the Canadian side that speculation doesn’t make sense. On either side, there does not seem to be any reason to believe there is suddenly an increase in incidental mortality; management changes, large increase in effort etc.

Trying to change q and M to resolve diagnostic problems seems to be more in favor than attempting to change catch. There is always the potential for people to misreport, and the catch reports have the human factor, whereas nobody can ‘cheat’ on q and M.

The real solution is likely some combination of changes in M, q, and missing catch.

Working Paper:	A larval index for GB YT with comparisons of relative larval production between the YT stock areas. TRAC Working Paper 2014/19.
Presenter:	D. Richardson
Rapporteur:	J. Deroba

Presentation Highlights

The distribution and abundance of larval YTF on GB and in Southern New England are presented for the years 1996-2012. Southern New England YTF larval production was much lower than GB YTF larval production early in the time series. However, in 2006 GB YTF larval production dropped substantially, whereas Southern New England production started to rise near the end of the time series. The result was higher larval production in southern New England versus on GB in recent years.

Discussion

A question was raised about whether the larval index was sensitive to the assumed rate of larval mortality. The index, however, is driven by newly hatched larvae and so the index is robust to the assumed mortality rate because cumulative mortality of newly hatched larvae is relatively small. In other words, the newly hatched larvae have not been alive long enough for the assumed mortality rate to matter much.

The larval index shows an abrupt shift and a discussion centered around whether temperature or some other environmental variable may have changed availability. There have been warm years (2012), but years from 2006 onwards were not all warm. There were large changes in the zooplankton community in the 2000 period, but not necessarily during 2005-2006. No environmental variable, including temperature, has demonstrated an abrupt shift that would explain the pattern in the larval index. Consequently, addressing hypotheses about the shift in the larval index will require additional research and data that is not readily available.

Measures of precision (e.g., confidence intervals) were not available for the larval index, but could be generated. The main feature of the index, however, is an abrupt shift and including measures of precision is not likely to change our perception of the shift or affect conclusions.

Some wondered whether larger larvae may have the ability to avoid the net and that this may explain some of the patterns in the index if sampling time relative to hatching time changed systematically. The term that was being referenced as “relative mortality” in the index calculation, however, also accounts for avoidance behavior; avoidance is indistinguishable from mortality. Consequently, the index calculation already accounts for avoidance and this hypothesis is not a likely explanation.

The ultimate question about this data source is whether to consider its' use in a stock assessment model. Participants came to the general agreement that larval production is likely decoupled in possibly non-intuitive ways from SSB and recruitment. Consequently, spending time trying to incorporate the index into a stock assessment should not be a priority and possibly not worth attempting. The data, however, are likely a robust index of larval abundance and still useful for identifying changes in the system/stock.

Working Paper:	The August 2013 flatfish survey on Georges Bank. TRAC Working Paper 2014/23.
Presenter:	C. Legault
Rapporteur:	T. Chute

Presentation Highlights

A pilot flatfish survey was conducted on the US portion of GB during August 2013 with a goal of providing a population estimate for YTF in this region. This survey was designed and conducted with the fishing industry using two commercial vessels and a net designed to catch YTF. Fishermen classified the region into two strata: one expected to have high densities of YTF and the other expected to have low densities of YTF. Stations were randomly assigned within these strata, with the high density stratum allocated more stations. The high efficiency trawl could not be fished everywhere on GB, so some stations were moved during the survey. Results showed much higher catch rates in the high density stratum than in the low density stratum, with some heterogeneity within each stratum. Catch rates within the high density stratum generally increased from south to north and from west to east and were generally higher at night than during the day. Size and age distributions were similar in the two strata and similar to the NEFSC 2013 fall survey, despite the latter catching many fewer YTF. Estimation of the YTF population for the entire GB region requires estimating the proportion of the population on the Canadian side of the bank and the catchability of the net. The authors suggest a reasonable range of possible values is 4,000 mt to 10,000 mt, with higher likelihood of being closer to the lower end of the range than the upper end of the range.

Discussion

The most useful parts of this survey were the ability to calculate a lower bound on the biomass estimate with reasonable certainty, and the validation of the bottom trawl survey age and size frequencies.

Will the survey happen again? That is unknown. Getting permission for a US commercial fishing boat to survey on the Canadian side will be very difficult, so if this survey is repeated it would probably be just on the US side again. The NMFS fall survey covers the bank well and gives similar results and with the NMFS spring and DFO survey, is there any utility in a fourth survey? Experimental work to measure capture efficiency would likely be more useful to the assessment.

The un-trawlable places, which are removed from the area of the survey, are hard to quantify. There are probably YTF there, but not too many, so the fact that they are not part of the survey does not mean there is huge biomass out there that is unaccounted for. Starting in August, the YTF seem to concentrate in CAII, according to participants involved in year-round sampling. This pattern, seen on this special survey, is not always in evidence.

The fact that the age composition was the same everywhere could be an indicator of spatial heterogeneity in the fishery.

Working Paper:	Kriged estimates of YT biomass in the Closed Area II access area based on the Georges Bank pilot flatfish survey. TRAC Working Paper 2014/21.
Presenter:	C. Adams
Rapporteur:	T. Chute

Presentation Highlights

Kriged estimates of YTF biomass in the Closed Area II Access Area were calculated using data from the GB pilot flatfish survey. Differences in spatial structure were identified, so estimates of biomass were derived separately for each vessel, as well as a combined estimate for both vessels. Kriged estimates of YTF biomass were 1,652 mt, 1,767 mt and 1,683 mt for the Mary K, Yankee Pride and combined data, respectively. These estimates were more precise than those obtained by simple swept area expansion of the arithmetic mean kg/tow.

Discussion

The assumed catchability used for this analysis was 1.0. Was there a way to deal with any differences in fishing power between the two vessels? There should not be too much difference in the fishing power of the boats if they are going the same speed, have similar gear and have the same wing spread. The other variables should only make minor differences.

Why does it look like the areas of highest density are in different places with the three maps (kriged Yankee Pride, kriged Mary K and kriged combined)? The placement of the stations sampled by the two boats does make a difference. One is sampling more heavily in one quadrant. Looks like there is some directional data that is dominating, making the regions of highest density appear to be elongated, there may be a way to dampen this effect when this technique is used again.

Based on the CV, the kriged combined would give the best estimate, but given the drift and problems with the survey design, the kriged Mary K estimate of 1,652 mt would be the preferred estimate.

Working Paper: Yellowtail Flounder estimates from the VIMS scallop dredge survey in Closed Area II. TRAC Working Paper 2014/22.
Presenter: C. Legault
Rapporteur: J. Deroba

Presentation Highlights

The Virginia Institute of Marine Science (VIMS) has conducted surveys for scallops since 1999 simultaneously towing both commercial and NMFS scallop survey dredges. Surveys in the scallop access area of Closed Area II (southern portion) occurred in August 2005, May 2007, July 2008, and May 2011. In addition to scallop information, catch and size distributions of YTF were recorded. Estimates of abundance in the study area are derived from mean catch rates and expanded to the study area. These surveys provide a snapshot of YTF abundance and size structure at discrete times. The different gears used in the survey allow for insight into the selective nature of the commercial gear, but also allows for estimates of juvenile YTF that are retained in the lined NMFS scallop dredge. Seasonality in YTF abundance in CAII may be a consideration in assessing trend over time.

Discussion

This survey used a commercial dredge in some cases and participants wondered whether observer data could be used as a basis of comparison for checking the similarity in bycatch rates. Very little observer data was available that overlapped sufficiently in time and space to make such a comparison worth pursuing.

A survey dredge and commercial dredge were both used in this study. Applying a maturity ogive to the catches at size/age from each gear type would produce generally similar estimates of SSB. This result was contrasted with the observation that the survey gear generally catches smaller fish than the commercial gear and so the indices of abundance differ, but these differences are minimal after applying a maturity ogive where little fish no longer contribute significantly.

Observations from this and other surveys suggest that weight at length has declined through time, but a static equation is currently used for most calculations leading into an assessment. This should likely be reconsidered. No significant shifts have been observed in maturity at length/age.

Working Paper: A new groundfish survey technique examining Georges Bank Yellowtail Flounder. TRAC Working Paper 2014/45.
Presenter: K. Stokesbury
Rapporteur: T. Chute

Presentation Highlights

The objective of this research is to improve estimates of the abundance, spatial distribution, size structure, and length-weight relationship of the GB YTF stock using a combination of fishermen's knowledge, advanced video observations designed for nets and state-of-the art benthic imagery. Here we report on our first two research cruises to GB, describing the sampling techniques. Ten tows with an open codend, covering approximately 175 km and 8 closed codend tows were conducted and filmed. The fishing vessel was able to continually tow the net with an open codend over most of the 70 m and 80 m depth contours. The estimate of YTF biomass following the assumption of the survey design was 1432.0 mt (95% CL 555.7 and 2308.3 mt) representing 6.5 % of the stock area. These results suggest that the NMFS stock assessment of 826 mt may be an underestimate. We are continuing to develop this sampling protocol as it seems highly promising and has already served to increase the dialogue and examination of the data supporting the YTF stock assessments.

Discussion

A net was towed for long transects without a codend, and the fish passing through were caught on video for later enumeration and identification. Short closed-codend tows were made approximately three times a day. Isobaths were followed with the open-net camera tows since it was thought the less the depth changed the more stable the biotic community would be, over the length of the tow.

Sometimes the number of fish counted passing by the camera and the fish in the net (for the closed-codend tows) don't match. This can happen for two main reasons: billowing sediment can obscure the passing fish from the camera positioned in the middle of the net, and the camera sees the fish that are not retained in the net. They were able to place cameras on several parts of the net. The videos of the front of the net show that flatfish can escape capture (whether they escape injury is unclear) under the net even with small cookies.

The Go-Pro cameras used for this project are small, rugged and fairly inexpensive. You can attach several of them to the net without affecting its performance. They are paired with a diving light for illumination purposes.

Working Paper:	Estimates of yellowtail flounder biomass on Georges Bank derived from a seasonal dredge survey. TRAC Working Paper 2014/20.
Presenter:	G. DeCelles
Rapporteur:	J. Deroba

Presentation Highlights

A seasonal dredge survey was completed in Closed Area I (CLI), Closed Area II (CLII), and on the southwest portion of GB in 2013. Eight survey trips were made over the course of the year, and 75 to 91 survey tows were completed during each trip. A total of 696 standardized survey tows were completed during the scallop dredge survey in 2013.

Approximately 2/3 of the surveys tows made during each trip were made in CLII, and on the southwest part of GB (corresponding to NMFS survey offshore strata 13 and 16), which are areas where YTF are seasonally abundant on GB. Each YTF caught during the survey was measured to the nearest centimeter, and the total weight of YTF observed during each survey tow was calculated. Estimates of YTF density and area swept biomass were calculated for each trip. Each of the eight survey trips produced an area swept biomass estimate of adult-sized YTF (range = 872 mt to 3462 mt) that was greater than the estimate of adult biomass (826 mt) derived from the most recent stock assessment (Legault et al., 2013). The results of the survey suggest that the stock assessment for YTF on GB is underestimating the biomass of the resource.

The scallop dredge survey offers high resolution information on the distribution and abundance of YTF on GB. In addition, the survey is conducted throughout the year, which improves the temporal resolution of survey observations that are available to assess the YTF resource on GB. Given the importance of the GB YTF resource to both the groundfish and scallop fisheries, and the magnitude of diagnostic issues associated with the stock assessment model, additional sources of information should be considered in the assessment of this resource. The spatial and seasonal resolution of the scallop dredge survey is superior to the three surveys that are currently used in the assessment. Therefore, we recommend that future TRAC assessments incorporate additional survey information directly into the assessment, or use survey based area-swept biomass estimates to ground truth the output from candidate assessment models

Discussion

This survey demonstrated a seasonal shift in the concentration of YTF, with a generally wider distribution during spring spawning and a more concentrated distribution during summer feeding. While seasonal changes in concentration driven by spawning and feeding activity are a likely explanation, changes in susceptibility to the gear could also not be ruled out. Thus, strong conclusions about why seasonal shifts in concentration were observed, or even if the changes were real, cannot be drawn. The seasonal patterns were observed in multiple years though, 2011-2013.

While comparing the trends and biomass estimates from this survey to others and the VPA assessments, the recommendation was made to standardize the age/size range over which the calculations were being conducted. Rather than standardization, the decision was made that an excel template should be completed for each data source and an explanation of the relevant age/size range, q assumption, survey timing, etc. should be recorded. Thus, each data source can be properly interpreted alongside others. The recommendation was also made to take care in noting the spatial extent of each data source. For example, CAI is not in the assessment, but is included in some surveys.

Working Paper: Abundance of Yellowtail Flounder in the access area of Closed Area II on Georges Bank in June 2008 from a large-scale Petersen tagging study. TRAC Working Paper 2014/24.
Presenter: S. Cadrin

Rapporteur: J. Deroba

Presentation Highlights

Abundance of YTF in the access area of Closed Area II on GB was estimated using a large-scale Petersen tagging experiment. In June 2008, a ten-day mark-recapture experiment was conducted in which nearly 73,000 YTF were tagged, with nearly 44,000 YTF collected in the second sample, including 177 recaptured with tags. Abundance in the study area was estimated to be approximately 18 million for ages 2+ using a variety of conventional and modified models. The Petersen estimates of abundance are significantly greater than contemporary estimates of age-2+ abundance of YTF in the entire GB stock area from the 2013 stock assessment. Sensitivity analyses indicate that the discrepancy in abundance estimates from the tagging study and the stock assessment are robust to a wide range of assumptions. Therefore, the tagging estimates suggest that the stock assessment is substantially underestimating abundance. A mark-recapture experiment using conventional external tags has never been attempted at this large a scale. The ability of this cooperative study to estimate abundance in an area closed to fishing demonstrates the capability of the method for evaluating marine protected areas and complementing conventional stock assessments.

Discussion

Someone questioned whether the recapture effort was random in space. Yes it was.

The question was raised about whether all batch marked fish also got t-bar tags. If not, an attempt could be made to estimate tagging mortality from the relative recapture rates of batch mark and t-bar recaps. Only “viable” fish were t-bar tagged, but most fish not given a t-bar tag were sacrificed for maturity sampling. So, something might be possible, but not very likely.

Several attendees felt the number of recaptures were too low, given the number of tagged fish. The number of recaptures would only be low, however, if you also question the subsequent Petersen estimate of abundance.

Most tagged fish were likely from the 2005 year class, but our perception of the 2005 year class has changed through time as new information has been collected. So, can you discount the more recent VPA estimates that include this new information with a single Petersen estimate? Participants agreed that the validity of the comparison would depend on the treatment of the retrospective pattern and a broader interpretation of uncertainty. Several participants noted that the group had agreed to increase M and so we should not get side tracked on making comparisons to VPA output until M and other inputs have been updated. Conclusions of the Petersen estimate are robust to tag loss/mortality based on the information available.

Someone questioned whether the time series of “ramp” conditions affected recaptures. An examination of this issue concluded that tow duration was not important, but time on deck was, and this aspect was minimized in the study.

Swept area biomass estimates were not generated in this study because gear and tow duration were not sufficiently standardized.

T-bar tags can sometimes shear off, especially when using a tag gun, and this would reduce tag retention. These types of "misfires" were recorded, however, and successful tags included a tug to test the quality of the anchor.

Recapture rate was not affected by sampling intensity and exploitation rate was not estimated in the study. Exploitation could be estimated on an annual basis and this might be considered in the future.

Based on seasonal surveys, the population in the experimental area doubles or triples from June-September, but some wondered whether this was reasonable and if this tagging could inform the debate. In short, the tagging was aimed to occur during spring spawning and cannot directly inform the plausibility of the seasonal population shifts.

Participants noted that the movement rates of tagged fish seemed relatively high and wondered if tagging induced greater activity? Researchers acknowledged that time spent off bottom and increased movements could be caused by tagging and that this may have contributed to low recaptures. Fish were also tagged and released at the surface such that settling may have occurred outside the study area and also affected the number of recaptures.

Would the spatial distribution of recaptures inform the concerns that tagged fish emigrated at a higher rate than untagged fish? No sampling was conducted outside the study area, so the spatial distribution of recaptures would not likely be informative.

Tagging was conducted around the clock.

As an alternative to subtracting an estimate of immigration from the Petersen estimate of abundance, an adjustment to the number of recaptures (C) could be made and this would change the scale of the estimate slightly. Similarly, a Chapman estimator could be considered in the future.

Working Paper:	Application of index methods to Georges Bank Yellowtail Flounder. TRAC Working Paper 2014/25.
Presenter:	P. Rago
Rapporteur:	J. Deroba

Presentation Highlights

Simple graphical and empirical methods are used to examine the relationships between relative abundance and estimated catch of GB YTF for three different synoptic surveys over the period 1963 to 2013. All three surveys reveal similar trends in abundance and relative F. Kalman filtered estimates appear to be a useful way of summarizing trends and have strong similarities to model based estimates. Measures of relative F increased steadily up through 1994, fell sharply in 1995, and have declined since then. Relative biomass increased rapidly for about 8 to 10 years after the decline in F, but has since declined, despite continued reductions in relative F. The simple model results suggest a change in underlying relationship between abundance and exploitation. While aggregated data used in this analysis are insufficient to identify the underlying cause, the large changes suggest that any model will have diagnostic problems unless an underlying mechanism for the change is incorporated into the model.

Discussion

Participants questioned why catch could exceed the Kalman filter swept areas, and the reason was that the swept areas were premised on a given q. Therefore, results should be interpreted more in a relative sense.

A combination of catch and survey data may inform bounds on q if you treat catch as a minimum abundance. This method is analogous to the “envelope” analysis often used in the region and could be done. The ratio of survey area swept biomass/catch is a bound for q to constrain the set of estimates over time.

Graphs of relative F and survey abundance clearly show a shift in 1994-1995, but recent years also were trending away from an isocline suggesting some other recent “oddity”.

This analysis supports the previously discussed time block/breakpoints, although this data is not independent of all previous analysis.

Participants questioned whether closed areas could be restricting the spatial range of catch and confound the ratios used in relative F. This concern is likely valid but the effect is unknown.

Comparisons of the Kalman filtered estimates to VPA estimates should not be over-interpreted given VPA model diagnostic issues and impending changes to the VPA. The Kalman filtered estimates, however, do show divergence in recent years, but general consistency in years before breakpoints. This convergence/divergence is informative.

General Discussion: Biomass

Several working papers suggest that if VPA model estimates are lower than some other estimate of abundance or biomass, then the VPA is invalid. But, can you use scale from a given study to devalue some other assessment run? Answering this question will be important as will how to interpret these comparisons in the context of uncertainty.

In addition to scale, the group should also have a discussion on relative stock status. In other words, where is the stock now relative to some previous time. This discussion would directly address a TOR.

Considering various working papers and data sources in light of hypotheses about causes of the modeling issues might be helpful. If given hypotheses cannot be dismissed, then certain estimates of biomass also cannot be dismissed, or vise versa.

Future comparisons of scale should include a retrospective adjusted terminal value from VPA runs.

Reference Points

Working Paper: The effect of a higher natural mortality on overfishing reference points for Georges Bank Yellowtail Flounder. TRAC Working Paper 2014/26.
Presenter: S. Cadrin
Rapporteur: A. Miller

Presentation Highlights
Recent exploratory analyses of the GB YTF stock assessment considered increased values of assumed M. However, the effect of assumed M on the overfishing reference point (F_{ref}) was not considered in the explorations. As a demonstration, conventional reference points from yield-per-recruit ($F_{0.1}$, F_{max}), spawning biomass-per-recruit ($F_{40\%}$) and age-based production models (MSY, F_{MSY}, and B_{MSY}) were derived using the alternative assumptions of M=0.2 (as currently assumed) and M=0.45 (the value suggested from model likelihood by the 2012 TRAC). All F reference points increased as a function of M using conventional methods. Results suggest that all candidate overfishing reference points increase as the assumed value of M increases, and the assumed value of M in the stock assessment should also be applied to overfishing reference points for appropriate stock status determination.

Discussion
A reviewer posed the question: at high M, how does SSB at MSY compare to historic high biomass? Answer: above and below.

SRfit was used to determine FMSY. It was suggested to present a replacement line but the replacement line changes over the time series. When M was changed from 0.2 to 0.3, this did not change the stock recruit relationship but did show some change in recruitment processes. It is assumed that changes in vital rates are independent. When looking at the equilibrium, the shape of the yield curve appears to become more flat topped when M is ~0.45. This would result in similar long term yield if fishing at a lower F, but different rebuilding targets.

Discussion about the distinction between a constant M and a time varying M ensues. FMSY may not be consistent if there is not a per recruit estimate. A constant M assumed for ages 1+ does not reflect the number of recruits that survive. There are recruitment dynamics of eggs and larvae that are different than adults and this is an implicit assumption in this approach.

There is also the assumption that recruitment is the same for a quantity of SSB, but if repeat YTF spawners have a higher viability of their output than first time spawners, it would affect reference points and likely give more weight to ages 3-5.

In the SNE YTF stock there has been a change in recruitment which could also be a concern on GB and how productivity is modeled. This may be more of an issue for the last 5 years than the last 20 years. Data during the 2000s shows good recruitment and a change would have to have happened in the mid-2000s.

Working Paper: What direction should the fishing mortality target change when natural mortality increases within an assessment? TRAC Working Paper 2014/27.
Presenter: C. Legault
Rapporteur: A. Miller

Presentation Highlights
Traditionally, M in a stock assessment has been assumed to be constant over years and ages. When M increases within an assessment, as has occurred in a number of Canadian cod stocks, the US Gulf of Maine cod stock, and the US Atlantic herring stock, the question arises how to change the fishing mortality rate target (Ftarget). Yield per recruit considerations lead to an increase in the Ftarget, while maximum sustainable yield considerations often lead to a decrease in the Ftarget. Neither approach is theoretically superior. Using results from the recent Gulf of Maine cod assessment and an example from the GB YTF assessment, both approaches are examined. Problems are found with both the yield per recruit and maximum sustainable yield approaches, leading us to recommend either not allowing M to change within an assessment model or if M does change to base the Ftarget on the natural mortality rate considered most appropriate based on the life history traits of the species of interest.

Discussion
Initial discussion centered around these questions: How does the model perform versus real life scenarios? Does it assume a stock can adjust for diseases when present? Does using condition factor as a rate of change in total mortality imply a changing M?

There was one particular question about using the 48 combinations. The 48 combinations resulted from fitting six different stock-recruitment curves and applying eight different natural mortality values in the reference point calculations to each. The six stock-recruitment curves had similar fitting properties. The eight natural mortality rates covered the range of values that were used in the assessment which generated the stock and recruitment estimates (0.2 to 0.9).

A recommendation was made to keep M constant suggesting that it's possible a change of M is likely the cause in the retrospective pattern. Chris agrees, but wanted to make sure there is a reason why changes to M over time are being made because there are costs associated with this decision. Concern was raised about how to handle Fref calculations with a changing M because it is more complex than just fitting a stock recruit curve. It may also be important to check that reasonable reference points result.

Proxy reference points may be useful. FMSY may actually increase and then decrease with an increasing M over time. Remember Fref is an upper bound target F. Under transboundary management, F is reduced below Fref when stock sizes are poor. It is important to take into account scientific uncertainty (external information that suggests the stock is not as robust or doesn't have good productivity). In practice, this is not what's been done in the TRAC.

Synthesis

Working Paper:	Synthesis of information presented for Georges Bank Yellowtail Flounder diagnostic benchmark: putting the pieces together. TRAC Working Paper 2014/46.
Presenter:	C. Legault
Rapporteur:	A. Miller

Presentation Highlights

This diagnostic benchmark is being conducted to address concerns expressed about the performance of the current stock assessment model for GB YTF. It is not a standard benchmark that examines different stock assessment model formulations. Rather, it examines all the information currently available about this stock outside of a stock assessment model framework. A large amount of work has been conducted leading up to this meeting (thanks everyone!). This paper summarizes findings from the working papers grouped into the topics of movement and distribution, life history, missing catch, catchability and biomass, and reference points. I provide a number of TRAC Decision Points that I hope will act as a guide through this large amount of information. Finally, I provide six hypotheses regarding the cause of the poor diagnostic performance of the current stock assessment model along with possible processes for generating catch advice. These hypotheses are put forward to help frame the discussion only, there are many other possible ways to put the pieces together.

Discussion

Reference to Larry Jacobson's catchability presentation was made – shellfish assessments using absolutes with priors on catchabilities. It was questioned whether this is possible - to use all three surveys with a range of whole net catchabilities. This would be somewhere between what is currently being done and using bounds. It was recognized that it is not possible in a VPA, but priors could be set up using SCAA. This would require a benchmark procedure and is beyond this meeting, but may be a consideration for the future. It was noted, however, that moving towards a SCAA will not likely remove the retrospective pattern.

There was a suggestion for a management strategy evaluation because it could review all operating model processes. This was well received but there was a realization that this would not be a short term solution.

A proposition to remove any of the hypotheses off the table was made. Increasing M and dimorphic growth were discussed this week. Dimorphic growth is not a strong hypothesis and has not worked with other species such as fluke. A suggestion by a reviewer was made to remove the “missing catch” hypothesis.

Some discussion on clarification of the TORs took place. TOR 3 was not clear on whether or not F reference points could be decided at this meeting. Some concern was raised regarding TOR 2 and moving forward with a changing base M with respect to its’ effect on reference points. If M continues to increase this could be a problem and it may be best to be risk averse in the management. Some suggest that it may be best to not throw out any of the hypotheses just yet. There was more support for a higher M because it addresses life history, biomass, and catchability issues. Another suggestion was to look to the standard in the Canadian Maritimes where harvest control rules have been broadly adapted by management and precautionary approaches have been used when concrete scientific advice is not possible. A point was raised that because a reasonable amount of fish are in the closed area, this also provides a safety net similar to harvest control rules, however, closed areas may soon be reopened.

From a US perspective, Fref must be retained, however, without precise biomass estimates (not just an index) this is not possible and not something that has been successful in the past. One suggested way around this is to use a traditional YPR Fref as is done with skates.

Working Paper:	A mass balance approach for evaluating alternative estimates of biomass and mortality for Georges Bank Yellowtail Flounder. TRAC Working Paper 2014/49.
Presenter:	P. Rago
Rapporteur:	A. Miller

Presentation Highlights

The basic dynamics of any exploited population can be described in terms of the underlying processes of growth, recruitment, and mortality. Mortality can be further partitioned into losses from catch C_t and natural sources. The empirical approach will provide a variety of estimates of biomass, and some estimate of total Z. Using all this data, the biomass at time t+1 can be estimated to evaluate alternative estimates of biomass and mortality of GB YTF.

Discussion

Some initial discussion on this approach included dialogue on how to combine all data sources, realizing that doing so would require a model (i.e., state space) and thus defeat the purpose of this more simplistic approach. A suggestion was made to get a common estimate of the population trend and relate this to the catch.

Positive feedback about this approach was received from reviewers. Because there are so many issues with the models, this may be a good way of guiding further discussion. Everything in this analysis is independent of the stock assessment model. Estimates of growth rate based on weights at age in the catch of the landings vary over time quite a bit. Instantaneous growth rates do decline as expected.

Some concern was raised about how a truncated approach (only recent years) may lose long term perspective of stock dynamics, particularly since estimates of growth based on weights at age from landings vary over time. As part of the sharing agreement, there is some precedent to blending all three surveys. The suggestion was made to use the same algorithm on absolute quantities so that all three surveys can be put on the same time scale.

Another concern is the resulting estimates of catchability. If the Albatross IV has a q=0.4 this would imply a Bigelow q~0.8 – does this seem realistic? These values are generally higher compared to other studies. There was discussion on how to search for more accurate q values, but ultimately there was general consensus that we believe the survey trends and that a lot of focus has been on ensuring that we have accurate q estimates. However, if survey catchabilities are believed accurate, this leans towards more support to the missing catch theory.

There was a question regarding the impact of this on fisheries selectivity since it is believed to be changing over time and how it would affect the combined values of F and M. This approach cannot deal with this. It would have to be done empirically, but would still require a model based estimate of selectivity.

There was another concern regarding the loss of good information on age structure from the surveys if this method is used. It may be useful as a metric to show the nature of the trend of age structure, but cohort Zs are specific to each age frequency within each survey and cannot be incorporated without more modeling.

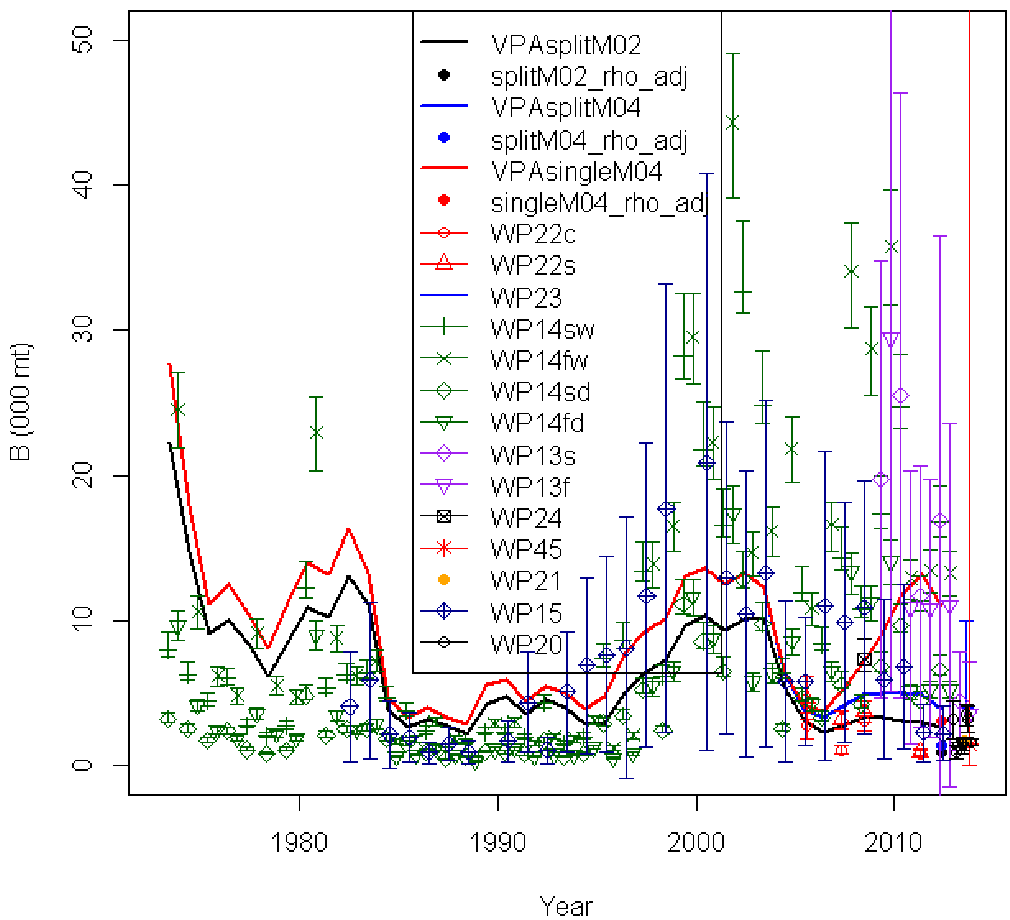
The group consensus is that this approach is worth pursuing. It is clear that a single q across the time series is not going to work. Using a shorter time series may be an appropriate way to address this.

In regards to missing catch, there was a suggestion to look into what changes in catch reporting have changed over time (i.e., time of day, ports, etc.). This data has been scoured, but would require a great effort to address some of these questions. Work by Chad Demarest revealed some statistically significant effects within the reporting, but no real resulting impact. Phase shifts shown by this analysis agree with the shifts seen in reporting. Cues exist, but there is no evidence for misreporting and nothing to validate dealer data pre-1994.

If there was an event occurring (oil spill, new disease, etc.) it should be expected that a model would not be successful in assessing what is really happening. This was somewhat addressed with the parasitic *Ichthyophonus*. It is possible that YTF have a preferred prey species that may be the source of the disease. If massive amounts of YTF were dying would we expect to see an increase in scavengers in this area? We have a good incidence rate of this disease, but not a good lethality rate.

There were multiple motions to move forward with just post-1994 data, though it is important to recognize that there is qualitative information in prior years that would be lost. By using the mass balance approach, issues prior to 1994 would not need to be reconciled.

Chris Legault presented the following plot of all studies vs. VPA estimates of biomass.


B (000 mt)
0
10
20
30
40
50
1980
1990
2000
2010
Year
VPAsplitM02
splitM02_rho_adj
VPAsplitM04
splitM04_rho_adj
VPAsingleM04
singleM04_rho_adj
WP22c
WP22s
WP23
WP14sw
WP14fw
WP14sd
WP14fd
WP13s
WP13f
WP24
WP45
WP21
WP15
WP20

One way of incorporating data from all of the various studies would be to look at those that represent a fraction of GB and possibly expanding them to the total area of the bank which could serve as a lower bound. Another suggestion was made to simply look at consistency in trends among all of the studies. This would provide some scale and give a better idea of how well the assessment estimates stand up to the other studies. If one of the sub-stock areas gives estimates above the model estimate, this is a real indication of a problem, but this does not seem to be the case. One issue with this is the assumption that no YTF are outside of the study area. All of the studies seem to be giving the same signal – one of concern. Questions were raised about the uncertainty of all of these estimates, what the average trend line looks like for each study, and whether or not any of the points are completely unbelievable. All of these are flawed to some extent (movement, seasonality, subset of total area, etc.), however, all of these flaws would end up pushing current estimates up (with the exception of the tagging study). Dave Richardson's door values should be absolute.

An attempt was made at a group consensus statement: the stock biomass should stay at the VPA based biomass estimate or above, but not be decreased . Nothing to the contrary was heard.

The mass balance approach is going to suggest an increasing M because it includes other removals that are not catch. The most recent M (essentially M=Z because the catch is so low) implies YTF are taking on a more short lived life history. This also means the stock is very dependent upon recruitment. A consensus was reached to increase M to 0.4 earlier in the meeting.

There was a question of what F to apply since the overfishing/overfished status needs to be addressed. Can a special consideration be applied about the stock's current health and productivity since the NMFS survey data suggests such steep declines? It will be difficult to predict two years forward.

Discussions continued regarding the consensus that the stock is collapsed (answers TOR 2). Fishermen haven't caught close to quota so F should definitely come down. A contradiction to this is pointed out - the mass balance approach does not show major declines in F in the last few years. 2013 was the second lowest DFO catch of YTF of all time (the lowest being in 1989). Other indications of poor condition include poor recruitment, decrease in condition factor, disease prevalence, declining estimates of instantaneous growth rates. Density dependence and Fulton's K values indicate a stock in trouble.

Despite this, there is concern raised about being over-precautionary. Lowering catch limits will lead to problems because other fisheries will have a hard time avoiding them. Some industry members have indicated it is impossible in small mesh fisheries to avoid catching YTF.

Some concern was raised about the mass balance approach moving forward because it is not entirely empirical and because it did not perform well in early years. Swept area biomass would be another approach to consider moving forward. In comparing these two approaches there is a need to determine what F is used. A reminder was made that we are providing scientific advice and not management suggestions. Some concern was raised again about the loss of age structure data from the surveys; using swept area biomass alone would not incorporate all available information directly, although the information could still be examined.

As a way forward it was suggested by the chair that both mass balance and the combined swept area biomass approaches be considered. There is agreement that going forward with both methods may help with catch advice. A question was raised about how the mass balance approach would translate into an Fref or an annual exploitation rate – was concern about the exploitation rate increasing. There is some disparity because some do not believe an M as high as 0.9, but are willing to accept the mass balance approach, which could estimate M as being even higher.

Some discussion took place on how to set exploitation rates from both the mass balance and swept area of biomass approaches. F40% is a reasonable place to start. It was noted that the TORs do not require a decision upon reference points, but this was countered by a response that TOR 3 compels the process to consider them. A reminder was made that the SSC will be tasked to provide catch advice on F40% and 75% of F40%. A suggestion was made to provide a Zref instead. The chair suggested the mass balance run YPR with M = 0.4 and for swept area use the last 3 years of each survey. By going forward with these empirical approaches, what is the average biomass we would be applying it to? Some suggestions were made for a two or three year average. Another suggestion was to use the terminal data point if a trend in biomass exists. The Kalman filter as applied in the mass balance approach is a valid approach.

Final points were made about estimating exploitation rates. It was suggested TRAC use the surveys as a complete package for both biomass and exploitation rates since we are moving forward with an empirical approach. Two candidates were suggested: 35% (F 0.55) and 28% (F 0.4) with an M of 0.4. Some concern was raised regarding how exploitation rates will be calculated in the future. Some options were to use the table Chris Legault provided, looking back at the time series of the surveys, or the YPR calculation. TRAC agreed to use Chris's table as the preferred method (see below)

.

Exploitation Rate

F

		0.05	0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75	0.8	0.85	0.9
	0.2	0.044	0.086	0.127	0.165	0.201	0.236	0.269	0.301	0.331	0.360	0.387	0.413	0.438	0.462	0.484	0.506	0.526	0.546
	0.3	0.042	0.082	0.121	0.157	0.192	0.226	0.257	0.288	0.317	0.344	0.370	0.396	0.420	0.442	0.464	0.485	0.505	0.524
	0.4	0.040	0.079	0.115	0.150	0.184	0.216	0.246	0.275	0.303	0.330	0.355	0.379	0.402	0.425	0.446	0.466	0.485	0.504
	0.5	0.038	0.075	0.110	0.144	0.176	0.207	0.236	0.264	0.290	0.316	0.341	0.364	0.386	0.408	0.428	0.448	0.466	0.484
	0.6	0.037	0.072	0.106	0.138	0.168	0.198	0.226	0.253	0.279	0.303	0.327	0.349	0.371	0.392	0.412	0.431	0.449	0.466
	0.7	0.035	0.069	0.101	0.132	0.161	0.190	0.217	0.243	0.267	0.291	0.314	0.336	0.357	0.377	0.396	0.414	0.432	0.449
M	0.8	0.034	0.066	0.097	0.126	0.155	0.182	0.208	0.233	0.257	0.280	0.302	0.323	0.343	0.363	0.381	0.399	0.416	0.433
	0.9	0.032	0.063	0.093	0.121	0.149	0.175	0.200	0.224	0.247	0.269	0.290	0.311	0.330	0.349	0.367	0.385	0.401	0.417
	1.0	0.031	0.061	0.089	0.116	0.143	0.168	0.192	0.215	0.238	0.259	0.280	0.299	0.318	0.337	0.354	0.371	0.387	0.403
	1.1	0.030	0.058	0.086	0.112	0.137	0.161	0.185	0.207	0.229	0.249	0.269	0.288	0.307	0.325	0.342	0.358	0.374	0.389
	1.2	0.029	0.056	0.082	0.108	0.132	0.155	0.178	0.200	0.220	0.240	0.260	0.278	0.296	0.313	0.330	0.346	0.361	0.376
	1.3	0.027	0.054	0.079	0.104	0.127	0.150	0.171	0.192	0.212	0.232	0.251	0.269	0.286	0.303	0.319	0.334	0.349	0.364
	1.4	0.026	0.052	0.076	0.100	0.122	0.144	0.165	0.185	0.205	0.224	0.242	0.259	0.276	0.293	0.308	0.323	0.338	0.352
	1.5	0.025	0.050	0.073	0.096	0.118	0.139	0.159	0.179	0.198	0.216	0.234	0.251	0.267	0.283	0.298	0.313	0.327	0.341

CONSENSUS

The following summarizes decisions made by the TRAC during the Benchmark.

- **Movement and Distribution** Movement of Georges Bank Yellowtail Flounder outside of stock boundaries is not a likely source for the poor diagnostics in the current VPA formulation.

- **Missing Catch** Examination of the magnitude of change required in the estimated discards or reported landings to explain the amount of missing catch needed to fix the retrospective pattern demonstrated these are unlikely the primary sources of the retrospective pattern.

- There has been consisten**t aging** of yellowtail that has been verified historically and also recently based on the number of growth marks from tagged and recaptured yellowtail. Issues with age determination do not appear to be a major source of uncertainty in the stock assessment.

- **Natural Mortality** Based on the expected equilibrium age compositions and the range of M values estimated from life history attributes, the TRAC agreed that M =0.2 is likely an underestimate and that an M=0.4 is more consistent with these attributes. *TRAC recommends that the M=0.4 be applied as a sensitivity VPA for the June 2014 assessment.*

- **Productivity** Several indicators suggest major change in productivity in recent years**.** The most recent survey biomass estimates are among the lowest in the time series and recent recruitment has generally been below average. The Georges Bank Yellowtail Flounder larval index dropped sharply since 2006. Condition factor has been variable but declining since 1998 and fecundity declines with poor condition factor. *TRAC concluded that the stock biomass is low and productivity is poor.*

- **Catchability** Absolute biomass estimates for NEFSC and DFO survey trawl time series will be based on the door spread footprint rather than by the wing spread as done previously. Estimation of biomass based on wing spread is confounded by the herding effect. Empirical estimates of survey efficiency, e.g. whole net efficiency for trawl surveys, should be considered to inform the scale of area swept biomass estimates. Such estimates impose realistic constraints on estimated catchability from the model outputs. *TRAC recommends that door spread swept area biomass estimates be applied in a sensitivity VPA for the June 2014. TRAC also recommends further research to refine estimates of survey gear efficiency.*

- **Absolute Biomass** estimates from surveys or other approaches can be used to inform the plausibility of model estimates, even in cases when the information applies to only part of the stock area. Model results well below the absolute estimates can be used to reject model results, but only when uncertainty in both estimates indicates a real difference. *TRAC agreed that the empirical estimates of biomass should be used to inform and evaluate consistency of VPA biomass estimates*

- There is **gear avoidance** in all surveys. Catchability should always be assumed to be less than one for whole gear. Preliminary analyses indicate there is gear avoidance by Yellowtail Flounder even during HABCAM surveys, in which catchability has previously been assumed to be 1.0.

- **Biomass Estimation and Exploitation** TRAC agreed to use time series from 1995 forward for interpretation of biomass estimated in the empirical approach. Current biomass will be estimated as the average of the estimated absolute biomass from the NMFS spring and DFO bottom trawl surveys from year *i* and the NMFS autumn bottom trawl survey from year *i-1*. Although these are multi-species surveys, these are the only surveys that sample the entire stock area. A Mass Balance Approach was developed that reconciles time series of survey biomass, catch, survey based total mortality, and individual growth. This approach estimates that M has ranged between 0.8 and 2.0 since 2009. This M represents all losses other than those due to estimated catch. The exploitation rate is calculated as catch/the average of the survey biomasses.

This method was used to guide the selection of an appropriate harvest rate based on yield per recruit analyses. The target exploitation rate, based on the ratio of yield per recruit / total biomass per recruit over a range of M > = 0.4 at F0.1 and F40%, is estimated to be ~ 0.23

- **Catch advice** will be based on the current average biomass described above, the target exploitation rate and qualitative criteria (e.g. is there convincing evidence that the stock is increasing or decreasing; is recent recruitment above or below average, etc.). The catch is being set for the next fishing year without making projections for the interim year.

Reasons to decrease TAC	Reasons to maintain or increase TAC
Lack of convincing evidence that the stock is increasing (or any convincing evidence at all)	Lack of convincing evidence that the stock is declining (or any convincing evidence at all)
recent recruitment has generally been below average. **Larvae index collapse, low age 1/2 in indices, low proportion of age 1/2 in catch**	No clear decline in Kalman filter biomass in indices (Spring & Fall) High relative to late 80s early 90s, and stock recovered then with higher catch
Condition factors poor	Current relative F low, M (potentially) increasing Relative F is not driving the stock right now
Survey biomass indices declining	MSY approach: do not forgo potential catch
Precautionary approach (first do no harm)	Closed area ‘safety net’ (for now) + bycatch avoidance programs
Danger of reducing age structure and spawning opportunities if M stays high	

CONCLUSIONS

The chairs of the meeting thanked participants for attending the benchmark for Georges Bank YTF. The consensus results will be applied in the upcoming June TRAC assessment review. Proceedings of the meeting will be published in French and English on the TRAC website: http://www.bio.gc.ca/info/intercol/trac-cert/index-eng.php. Those choosing to do so, can submit working paper, modified by any recommendations of this meeting, to be published as TRAC Reference Documents in the coming months.

REFERENCES

Brown, B.E. and R.C. Hennemuth. 1971. Assessment of the yellowtail flounder fishery in subarea 5. ICNAF Res. Doc. 71/14.

Chen, S., and S. Watanabe. 1989. Age Dependence of Natural Mortality Coefficient in Fish Population Dynamics. Nippon Suisan Gakkaishi 55:205-208.

Gunderson, D.R., 1997. Trade-off between reproductive effort and adult survival in oviparous and viviparous fishes. Can. J. Aquat. Sci. 54, 990–998.

Harden Jones, F. R., Margetts, A. R., Walker, M. G., and Arnold, G. P. 1977. The efficiency of the Granton otter trawl determined by sector-scanning sonar and acoustic transponder tags. Rapp. P.-v. Reun. Cons. int. Explor. Mer. 170: 45-51.

Jensen, A. L. 1996. Beverton and Holt life history invariants result from optimal trade-off of reproduction and survival. Canadian Journal of Fisheries and Aquatic Sciences 53:820-822.

Legault, C.M., L. Alade, W.E. Gross, and H.H. Stone. 2013. Stock Assessment of Georges Bank Yellowtail Flounder for 2013. Transboundary Resources Assessment Committee Reference Document 2013/01. 132 p.

Lorenzen, K. 1996. The relationship between body weight and natural mortality in juvenile and adult fish: a comparison of natural ecosystems and aquaculture. Journal of Fish Biology 49:627-647.

Lux, F.E. 1963a. Identification of New England yellowtail flounder groups. Fish. Bull. 63: 1-10.

Lux, F.E. 1963b. Yellowtail tagged south of Cape Ann. Bureau of Commercial Fisheries memorandum, Woods Hole, Massachusetts.

Lux, F.E. 1969. Landings per unit of effort, age composition, and total mortality of yellowtail flounder, *Limanda ferruginea* (Storer), off New England. ICNAF Research Bulletin 6: 47-52.

Lux, F.E. and F.E. Nichy. 1969. Growth of yellowtail flounder, *Limanda ferruginea* (Storer), on three New England fishing grounds. ICNAF Research Bulletin 6: 5-25.

Pauly, D. 1980. On the interrelationships between natural mortality, growth parameters, and mean environmental temperature in 175 fish stocks. J. Cons. Int. Explor. Mer. 39(2): 175-192.

Royce, W.F., R.J. Buller and E.D. Premetz. 1959. Decline of the yellowtail flounder (Limanda ferruginea) off New England. Fish. Bull. 59: 169-267.

Somerton, D.A., P. T. Munro, and K. L. Weinberg. 2007. Whole-gear efficiency of a benthic survey trawl for flatfish. Fish Bull. 105:278:291.

Then, A.Y., J.M. Hoenig, N.G. Hall, D. Hewitt. (*Accepted with minor revision*). Evaluating the predictive performance of empirical estimators of natural mortality rate using information on 201 fish species. ICES J. Mar. Sci.

Uzmann J, Cooper R, Theroux R, Wigley R. (1977) Synoptic comparison of three sampling techniques for estimating abundance and distribution of selected megafauna: submersible vs. camera sled vs. otter trawl. Mar. Fish. Rev. 39.12-19.

APPENDICES

Appendix 1. List of Participants April 2014

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Appendix 2. Terms of Reference

TRAC Georges Bank Yellowtail Flounder Diagnostic Benchmark, 2014

In the 2013 TRAC Status Report (TSR) the following Special Comments were provided:

The TRAC acknowledges that the assumptions made about population dynamics in the model do not fully capture the trends in the data. However, the model's conclusion that stock conditions are poor is valid.

There is a continued need to conduct research to limit the possible causes for the retrospective bias exhibited in this assessment.

In response to these comments, the 2014 benchmark meeting is designed to explore all the data available for Georges Bank yellowtail flounder, including data that cannot easily or feasibly be incorporated in a stock assessment model. The purpose of this exploration is to evaluate possible sources of the poor diagnostics exhibited by the current Virtual Population Analysis (VPA). The work to be reviewed during this 2014 benchmark extends the 2005 benchmark assessment which recommended consideration of "trends in relative abundance and relative mortality rates derived from survey and fishery data" (Gavaris et al. 2005). The 2014 diagnostic benchmark will not examine alternative stock assessment models. Such an examination was conducted during the ICES World Conference on Stock Assessment Methods (July 2013, Boston, MA) where no model was found that performed well relative to all the data. As such, the following terms of reference are strictly limited to exploration of the data.

Terms of Reference

Summarize all available data for Georges Bank yellowtail flounder which can be used to explore possible causes of the poor diagnostics in the current VPA for this stock.

Determine which pieces of information are consistent with alternative hypotheses regarding current stock status (e.g., current population is near carrying capacity, current population is near a desired amount, and current population is well below a desired amount).

If possible, describe how catch advice could be provided based only on the data (e.g. without relying on a stock assessment model). If feasible, identify and estimate appropriate fishing mortality reference points.

Date of the benchmark meeting: April 14-18, 2014.

All individuals interested in presenting a working paper for this meeting must contact the US and Canada Co-Chairs no later than February 18, 2014 to indicate their intention to present and to identify their intended topic. Working papers will be due 2 weeks prior to the meeting, so the deadline to submit working papers will be March 28, 2014. Authors must be present at the meeting or via webex to present their working papers. Failure to adhere to these TRAC protocols will result in the working paper being excluded from the meeting agenda. These protocols are designed to allow sufficient time for meeting participants to review the material and to ask questions of the authors during the meeting.

Gavaris, S., R. O'Boyle, and W. Overholtz. 2005. Proceedings of the Transboundary Resources Assessment Committee (TRAC) Benchmark Review of Stock Assessment Models for the Georges Bank Yellowtail Flounder Stock. TRAC Proceedings 2005/01, 36 p.

Appendix 3. Meeting Agenda

Transboundary Resources Assessment Committee
Georges Bank Yellowtail Flounder Empirical Approach Benchmark
Stephen H. Clark Conference Room
NEFSC Woods Hole Laboratory

14-18 April 2014

AGENDA (subject to drift on timing)

<u>14 April – Monday</u>

9:00 – 9:15	Welcome and Introduction (Co-Chairs)
9:15 – 10:15	WP1: Overview of diagnostic problems in current benchmark for GBYT (Legault)
10:15 – 11:00	Movement and Distribution WP2-Alade, WP3-O'Keefe, WP4-Alade
11:00 – 11:15	Break
11:15 – 12:30	Life History: WP5&6-Brooks, WP9-Wood, WP7-Hart, WP12-Cadrin, WP8-Legault,Wp11-Rago
12:30 – 1:30	Lunch
1:30 – 3:30	Life History: Continued
3:30 – 3:45	Break
3:45 – 5:30	Life History: Discussion and Synthesis

<u>15 April – Tuesday</u>

9:00 – 9:15	Summary of Monday Discussion
9:15-11:00	Catchability: WP13-Jacobson, WP14-Richardson, WP-16&15-Shank, WP17-Brooks
11:00 – 11:15	Break
11:15 – 12:30	Catchability continued: Discussion
12:30 – 1:30	Lunch
1:30 – 3:30	Biomass: WP18-Rago, WP19-Richardson, WP23-Legault, WP21-Adams, WP22-Rudders, WP45-Stokesbury,WP20-DeCelles, WP24-Cadrin,WP25-Rago

3:30 – 3:45 Break

3:45 – 5:30 Biomass: Continued

16 April – Wednesday

9:00 – 11:00 Summary of Tuesday Discussion
Biomass continued: WP18-Rago, WP19-Richardson, WP23-Legault, WP21-Adams,WP22-Rudders, WP45-Stokesbury,WP20-DeCelles, WP24-Cadrin, WP25-Rago

11:00 – 11:15 Break

11:15 – 12:30 Biomass: Discussion and Synthesis

12:30 – 1:30 Lunch

1:30 – 2:30 Reference Points: WP26-Cadrin, WP27- Legault

2:30 – 3:30 Discussion/Re-visits

3:30 - 3:45 Break

3:45 – 5:30 Re-visits; Discussion and Synthesis

17 April – Thursday

9:00 – 11:00 Summary of Wednesday Discussion

Discussion and Synthesis; WP 46-Legault

11:00 – 11:15 Break

11:15 – 12:30 Discussion and Synthesis; Report writing

12:30 – 1:30 Lunch

1:30 – 3:30 Discussion and Synthesis; Report writing

3:30 – 3:45 Break

3:45 – 5:30 Report writing

18 April – Friday

9:00 – 4:00 Report Writing and Final Consensus

Appendix 4. List of Working Papers

Working Papers presented are starred (*)

OVERVIEW

*1 Legault , Chris. Overview of diagnostic problems in the current benchmark assessment formulation for Georges Bank yellowtail flounder.

MOVEMENT, DISTRIBUTION

*2 Alade, Larry - Summary of Yellowtail Flounder Conventional Tagging Study

*3 O'Keefe,Catherine E., Gregory R.DeCelles and Steven X. Cadrin. Spatial and temporal patterns of Georges Bank yellowtail flounder from the SMAST Bycatch Avoidance Program

4 Alade, Larry - Spatial Pattern of GB Yellowtail flounder from Commercial and Observer data

LIFE-HISTORY

*5 Then, Amy Y.and Elizabeth N. Brooks. Estimates of natural mortality for flatfish in the Northwest Atlantic: A comparison of model predicted estimates.

*6 Alade, Larry - Re-evaluation of GB yellowtail flounder Natural Mortality

*7 Hart, Dvora. Beverton-Holt length-based mortality estimates for Yellowtail Flounder.

*8 Legault, Chris. Estimation of Georges Bank yellowtail flounder total mortality by sex from NEFSC bottom trawl surveys.

*9 Wood, Tony. Natural mortality of GB YT derived from an instantaneous rates tagging model.

10 # not assigned

*11 Rago, Paul and C. Huntsberger. Are current incidence rates of *Ichthyophonus* consistent with high natural mortality.

*12 Cadrin, Steve and Catherine E. O'Keefe. Relative Abundance at age and size of Yellowtail Flounder off New England.

CATCHABILITY

*13 Jacobson, Larry, Chris Legault, Michael Martin, and Phil Politis. Biomass estimates for
YTF based on Bigelow surveys and prior information.

*14 Richardson, David, Rich Bell, John Manderson, and Jon Hare. Minimum bounds on GBYT Spawning Stock Biomass with a meta-analysis of catchability across northeaststock assessments.

*15 Shank, Burton, Dvora Hart, Scott Gallager, Amber York, and Kevin Stokesbury. Abundance and spatial distribuiton of Yellowtail Flounder in Closed Area II South, 2010 vs. 2012, from an image-based survey.

*16 Shank, Burton and Jon Duquette. Gear avoidance behavior of yellowtail flounder associated with the HabCam towed imaging vehicle.

*17 Brooks, Elizabeth N. and Philip J. Politis. Evaluating age and length composition data for inference about selectivity shape.

BIOMASS

*18 Rago,Paul, Susan Wigley and Chris Legault. Implications of retrospective patterns for bias in discard rates and unobserved landings.

*19 Richardson, David E., Katey Marancik, and Harvey Walsh. A larval index for GB YT with comparisons of relative larval production between the YT stock areas.

*20 DeCelles,Greg, Katherine Thompson, and Steve Cadrin. Estimates of yellowtail flounder biomass on Georges Bank derived from a seasonal dredge survey.

*21 Adams, Chuck. Kriged estimates of YT biomass in the closed area II access area Based on the George Bank pilot flatfish survey.

*22 Rudders, Dave and Chris Legault. Yellowtail Flounder Estimates from the VIMS Scallop Dredge Survey in Closed Area II.

*23 Martin, Michael and Christopher M. Legault. The August 2013 Flatfish Survey on Georges Bank.

*24 Cadrin, Steven, Jessica Melgey, and Kevin D.E.Stokesbury. Abundance of Yellowtail Flounder in the Access Area of Closed Area II on Georges Bank in June 2008 from a Large-Scale Petersen Tagging Study.

*25 Rago, Paul and Chris Legault. Application of index methods to Georges Bank Yellowtail Flounder.

*45 Stokesbury, Kevin. A new groundfish survey technique examining Georges Bank Yellowtail Flounder

REFERENCE POINTS

*26 Cadrin, Steven X. The effect of a higher natural mortality on overfishing reference points for Georges Bank Yellowtail Flounder.

*27 Legault, Chris and Michael Palmer. What direction should the fishing mortality target change when natural mortality increases within an assessment?

SYNTHESIS

*46 Legault, Chris. Synthesis of information presented for Georges Bank yellowtail flounder diagnostic benchmark: putting the pieces together.

*49 Rago, Paul. A Mass Balance Approach for Evaluating Alternative Estimates of Biomass and Mortality for Georges Bank Yellowtail Flounder.

BACKGROUND ANALYSES

Literature Review

28 Legault, Christopher M. and Steven X. Cadrin. A guided tour through the yellowtail flounder literature for the 2014 Georges Bank yellowtail flounder diagnostic benchmark.

Movement

29 Winton, Megan, Katherine Thompson, Carl Huntsberger and Ronald Smolowitz. Seasonal distribution of yellowtail flounder in Georges Bank scallop access areas as inferred from the seasonal bycatch survey.

Life History

30 O'Brien, Loretta. Estimation of the Intrinsic Rate of Increase for Georges Bank Yellowtail Flounder.

31 Huntsberger,Carl and Roxanna Smolowitz. Prevalence of *Ichthyophonus* sp. in yellowtail flounder sampled during the seasonal bycatch survey on Georges Bank.

32 McBride, Richard S., Sandra J. Sutherland, Sarah Merry, and Larry Jacobson. Agreement of historical Yellowtail Flounder age estimates: 1963-2007.

33 McElroy, W.D., E.T. Towle, M.J. Wuenschel, and R.S. McBride. Spatial and annual variation in fecundity of yellowtail flounder in U.S. waters.

34 Traver, Michele. Comparison of distribution and prey of four flounders on Georges Bank.

47 Rago, Paul. Bias of maximum age estimators of natural mortality.

Catchability

35 Jacobson, Larry. Ghost Surveys in the Sky! (Empirical check on problems with Q in TRAC 2013 VPA).

36 Linton, Brian C. Relative catch efficiencies of Georges Bank Yellowtail Flounder and Fourspot Flounder in Scientific surveys.

37 Hennen, Daniel R. Catchability estimates using Habcam images as an estimate of absolute abundance.

Catch

38 Palmer, Michael. A summary of commercial catch investigations conducted in support of an empirical approach to the Georges Bank yellowtail flounder stock assessment.

39 Palmer, Michael and Susan E. Wigley. Using positional data from vessel monitoring systems (VMS) to validate the logbook-reported area fished and the stock allocation of commercial fisheries landings, 2004-2011.

40 Palmer, Michael. Estimating the magnitude of unreported dealer landings for the northeast large mesh groundfish species from 1996 to 2007.

Biomass

41 Clark, Don, and Loretta O'Brien. Summary of Yellowtail Flounder Catches in the DFO summer Scotian Shelf Survey - 4X and 4VW.

42 O’Brien, Loretta. Annual surplus production of Georges Bank Yellowtail Flounder estimated from 2013 VPA model results.

43 Sosebee, K. A. and M. Traver. An examination of the relationship between

Management