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NEFMC SSC Panel Peer Review of the Fishery Data for Stock Assessment Working Group Report

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Introduction

A panel of three representatives (Sullivan, Uchida, and Wiedenmann) from the Scientific and Statistical Committee of the New England Fisheries Management Council were asked to provide a peer review of the *Fishery Data for Stock Assessment Working Group Report* coauthored by Cadrin (Chair), Frede, Keiley, Linton, Maguire, Rago, Bell, Giacalone, Demarest, Brown and Gibson with contributions by O'Keefe, DeCelles, Wright, Hansell, McGuire and Hennen.

The panel found the Working Group Report to be clear and thorough in its coverage of the strengths and weaknesses of information collected from fishery dependent sources such as might be derived from commercial and recreational landing statistics, logbooks, vessel trip reports, onshore monitoring and observer programs. Particular attention was given to the usefulness and biases associated with Catch Per Unit Effort (CPUE) and Landings Per Unit Effort (LPUE) data as might be employed to assess relative changes in stock abundance to supplement federal or state survey CPUE indices. The quality and usefulness of discard data collected from the fishery, although an important category of fishery dependent data, are not addressed in this review, as these data sources were not included for consideration in the Terms of Reference for the Working Group Report and will be considered elsewhere[1].

The Working Group Report, through its executive summary, the main body of the report, and adjoining appendices, provides a clear and concise summary of the complex topic of how fishery data is gathered and utilized for the purposes of informing science and management actions. In contrast, federal and state scientific surveys collect information through a proscribed unbiased statistical design to obtain relative abundance indices (e.g. survey CPUE) that are intended to be representative of the population over its entire domain, while gathering other pertinent biological information in an unbiased manner such as age, size and sex composition, growth, maturity and fecundity. Data gathered from fishery dependent sources, while abundant and rich in information, may not be, more specifically, globally representative of the total stock dynamics because of economic incentives for fishermen to maximize harvest and consequently be more likely to "sample" areas that are higher in abundance. Nevertheless, fishery dependent data is

[1] The Peer Review acknowledges the Council is considering potential improvements to monitoring and collection of discard data in the development of Amendment 23.

an abundant, rich and often underutilized source of information worth careful examination.

Responses to the Terms of Reference

This peer review report will step through each Term of Reference and comment on the completeness of the report and how well it addresses the strengths and weakness of the fishery dependent data.

> ***TOR1:*** *Explain how fishery dependent and fishery independent data are used in stock assessments, including how different data elements are used and interact in an age-based analytic assessment.*
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> The report clearly explains how fishery dependent and fishery independent data are used in fishery stock assessments. Both data sources are used in a variety of ways including the estimation of population relative abundance indices that are used to characterize trends in age-based and other analytic assessment methods. In New England, stock assessments often rely on standardized statistically designed surveys using abundant survey information. Other regions, that do not have regular standardized surveys often rely solely on fishery dependent data sources, while still other regions, such as in the North Pacific, often incorporate both. The reasons for this are partly historical, partly philosophical and partly practical. However, the advances now being made in how data are collected and analyzed suggests that further consideration be given to using fishery dependent data not only to supplement existing survey-based relative abundance indices, but also to provide more localized abundance data to inform spatial management, for example, and to usefully characterize how the fleet sees changes in population abundance relative to survey estimates.
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> A classic example of how fishery dependent data can be susceptible to bias associated with targeting behavior is the CPUE used for assessment that came from the herring purse seine fishery in the North Atlantic. Here, because the fish school, the perceived CPUE did not change as the stock decreased, because the fleet continued to be able to find schools to set on until no more schools were left. The abundances within a school remained the same while the number of schools decreased. Managers were unintentionally misled about stock status and the stock collapsed. This example is not uncommon in occurrence and is often used to justify scientific survey sampling as the gold standard. However, fishery dependent data serves to inform as well.
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> While fishery dependent data, such as CPUE, can, under the right circumstances, be folded into the more comprehensive designed scientific surveys, as discussed in more detail later, it is useful to consider other information that may come from fishery dependent data sources. For example, greater focus is being given to understanding the social and economic consequences of risk and decision making relative to fishing behavior and responses to management actions. This is because fishermen are guided by

economic incentives. For commercial fisheries this would be primarily the (expected) profit; for recreational fisheries this would be more vaguely captured as “utility” – number of fish kept or caught (kept + release), spending time on water, hanging out with friends, etc. Understanding these incentives and developing the behavioral models could reduce the biases of fishery dependent data and hence enhance the usefulness of CPUE data. However, this requires the collection of socioeconomic information on fisheries, which is typically available through fishery dependent data sources. Note that this type of information not only can be used to help correct for targeting biases, but can be used directly to reduce risk to the fishery and optimize management actions.

Should fishery dependent data be considered for expanded use in New England, data handling and quality assurance procedures already in use in areas outside the northeast might be considered (e.g. SEDAR, STAR) as was noted in the Working Group Report.

Again, to echo observations made in the Working Group Report, technological advances in terms of computational and data gathering hardware and software can greatly improve the acquisition and use of fishery dependent data.

TOR 2: *Summarize the theoretical utility and limitations of using catch per unit effort (CPUE) and landings per unit effort (LPUE) as indexes of abundance for Northeast multispecies (groundfish) stocks, including recent efforts to create a CPUE for any of these stocks and the results of those efforts.*

The Working Group Report provides a thorough consideration of the pros and cons of using fishery independent and fishery dependent catch rates. The summaries provided of examples of where and when CPUE from both sources was used was seen to be valuable.

Consideration of the use of CPUE from any source requires recognition of the potential utility of CPUE and fishery and survey data more generally beyond its specific use as a relative abundance index for tuning assessment models. For example, it is important to recognize that catch by itself is necessary and effort by itself is informative relative to spatial and temporal fishing pressure, and that CPUE can be used to examine local catch rates and reasons why fishers make the choices they make. Furthermore, the quality of information that comes out of CPUE measurements from fishery dependent data includes providing information that can be shared with the assessment community about what the fishermen are seeing in their landings relative to what the scientists might see from their data sources.

In any quest for new or additional information some effort should be spent on examining the costs relative to the benefits of collecting that information. Special attention should be given to examining elements of the fishery that may act as a

greater source of information, for example, sub-fleets representing fishing vessels and captains that have been consistently operating over time.

In thinking beyond relative abundance indices, consideration should be given to whether fishery dependent CPUE might be used to better assess discard species, for example in the groundfish fishery, the non-target bycatches of windowpane flounder and ocean pout, or constraining stocks such as Georges Bank yellowtail flounder.

Fishery dependent CPUE can be used in some instances when fishery independent data is not available, such as for assessing inshore measures of relative abundance. Cooperative surveys are also helpful in this regard.

Model-based statistical estimation methods (e.g. GLM, GLMM, GAM, GAMM) have advanced greatly in recent years and can be used to augment and even merge fishery dependent data with fishery independent data.

TOR 3: *Identify the fishery factors and fishery dependent data needed to create a CPUE that would be a reliable index of abundance for Northeast multispecies stocks – without regard to existing fishing practices, regulations, or monitoring systems.*

As mentioned in the report, ideally one would like to have the fleet be homogenous (uniform) in fishing power, gear used, timing, and location. In many cases, not all of these criteria can be met or even standardized for all fisheries, but in some cases they can.

There is an expected change in efficiency with catch shares that could be taken advantage of, but may also add an extra level of complexity; for example, what impact do catch-share programs and other incentives have on the technical efficiency of the fleet (e.g. sharing captains, or reduced number of vessels fishing)?

While it may be impossible to manage the fleet in such a way as to make it fully homogenous in behavior, other approaches to this problem exist to standardize these indices, including modern methods for statistical modeling, incentives for reporting, and the use of study fleet, for example.

The usefulness of conducting cost/benefit analyses, as mentioned under TOR 1, is applicable here as well. For example, conducting a standardization using GLMM might take time away from conducting an assessment or managing a database, but then again it might be worth it!

Directed research on factors influencing CPUE for both fishery dependent and fishery independent CPUE measures is needed and should be prioritized.

Fine scale spatial and temporal resolution of catch, effort, and behavior information can now be gathered and interwoven with other biophysical

phenomena through, remote sensing and oceanographic modeling, for example. This should be done for data from both fishery independent as well as fishery dependent sources. Often, a greater quantity of data is available from the fishery dependent sources, albeit targeted data, than can be collected from (expensive) surveys. Just this order of magnitude difference in quantity makes considering the utility of using such data sources worthwhile to consider.

We fully endorse the use of action plans as outlined and exemplified in the Working Group Report in the recommendations section to implement efficient mechanisms for gathering data from all sources.

TOR 4: *Compare the desired factors identified with existing conditions and data for the fishery through a gap analysis of factors and data needed, as well as the analytical approaches necessary, to create a CPUE that would be a reliable index of abundance for Northeast multispecies stocks.*

One should recognize that differences in implementation of these recommendations exist when applying these methods to data gathered from the commercial fleet when compared to that available from the recreational fleet, and even within sub components of these fleets there are differences in reporting. Some balance is needed in the quantity and quality of information gathered, especially for those stocks that have significant landings by both fleets (in other words, not to put all your eggs/otoliths/tows in one basket). Other potential sources of uncertainty outside the scope of this review still need to be considered, including monitoring of landings, discards, compliance, enforcement, and environmental conditions.

If monitoring is to be considered for gathering any additional information, percent coverage of the fleet is an important consideration. In the North Pacific, debates continue to exist on whether partial coverage is adequate for observer programs.

We strongly concur with the Working Group Report that gap analysis should be used to identify factors and data needed, including mechanisms for *a priori* identification of targeted fishing, clear effort metrics, use of advanced technologies for monitoring, and finer time and spatial scale standardization. In addition, we might add greater coverage of social and economic indicators. One example of this would be the quantity and quality of the dealer report data.

We note that fishery dependent CPUE data was thoroughly examined several years ago and deemed of limited usefulness, but improvements in technology, statistical methods, and increasing need by management suggests that this analysis should be revisited.

Should fishery dependent CPUE metrics be developed, thought would need to be given to its relationship to other metrics such as those from the survey, as well as other indicators from the past. Any new data set generated should have some

comparability to the past, so that, ideally, a single CPUE index could be generated combining historical data and new information collected.

Conclusion

The Working Group Report provides a clear, thorough and comprehensive analysis of how fishery dependent data can be used, the strengths and weaknesses of such data and how they compare in their characterization of the fishery relative to data gathered from fishery independent sources.

In this report, we expand slightly on the type of information that might be gathered from fishery dependent sources and why reconsideration of these data as input into stock assessment and management should be made.