Fishery Data for Stock Assessment Working Group Report

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New England Fishery Management Council
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DRAFT Report Outline

• Executive Summary
• Background
• Deliverable 1: how fishery-dependent and fishery-independent data are used in stock assessments.
• Deliverable 2: utility and limitations of CPUE as an index of abundance for Northeast Multispecies stocks.
• Deliverable 3: identify the fishery factors and fishery-dependent data needed to a CPUE index of abundance for Northeast Multispecies stocks.
• Deliverable 4: compare the desired factors identified with existing conditions and data
• Appendices
  1. Use of fishery-dependent Indices of Abundance in SEDAR Assessments
  2. CPUE as an Index of Abundance in Stock Assessments (Hennen 2018)
  3. Fishery-dependent Data in New England Groundfish Stock Assessments (O’Keefe et al. 2015)
  4. Introduction of Bias in CPUE from case selection based on relative fraction of target species
  5. Use of Fishermen’s Questionnaires in ICES Assessments
Presentation Outline

• Background
• Deliverables
  1. how fishery-dependent and fishery-independent data are used in stock assessments.
  2. utility and limitations of CPUE as an index of abundance for Northeast Multispecies stocks.
  3. fishery factors and fishery-dependent data needed for a reliable CPUE index
  4. desired factors and existing conditions
• Recommendations

Background
• Amendment 23 to the Multispecies Fishery Management Plan
  • to implement measures to improve reliability and accountability of catch reporting and to ensure a precise and accurate representation of catch (landings and discards).
• www.nefmc.org/library/amendment-23
Fishery Data for Stock Assessments

• The Council formed a working group to discuss the topic of how fishery-dependent data can be used to inform stock abundance to address four main deliverables:

1. explain how fishery-dependent and fishery-independent data are used in stock assessments,
2. summarize the utility and limitations of using fishery catch rates (CPUE, catch per unit effort) as an index of abundance for Northeast Multispecies stocks,
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, and
4. compare the desired factors identified with existing conditions and data for the fishery.

Working Group

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Working Group Process

• Four meetings were held at SMAST (April 26 2018, June 25 2018, August 6 2018, September 7, 2018) to review the expected deliverables, develop a work plan, review information relevant to deliverables and form recommendations.

• Recommendations were reviewed on a conference call (November 2, 2018), and the consensus report was developed by correspondence.

• Draft report presented to SSC review panel November 30 2018, Providence RI.
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How fishery-dependent and fishery-independent data are used in stock assessments

- Population models are fit to the available fishery and fishery-independent data to estimate a time series of stock abundance, age structure and fishing mortality.
  1. A time series of total fishery removals is derived from several fishery monitoring programs (commercial landings, commercial discards, recreational landings, and recreational discards)
  2. Fishery-independent surveys or fishery catch rates provide indices of relative stock abundance
  3. Size or age composition of the stock and of the fishery

http://www.st.nmfs.noaa.gov/
Example Stock Assessment

• 2013 benchmark stock assessment of white hake (NEFSC 2013)
  • Relatively recent
  • Relatively non-controversial (rare for a groundfish stock!)
  • Demonstrates typical data components and features
  • Appears to be promising for considering fishery catch rates
The times series of fishery removals is used in the stock assessment for:

1. minimum stock sizes
2. amount of sustained productivity.

The assessment also accounts for some natural mortality and survival each year based on age composition and stock abundance indices.
Fishery Age Composition

Survey Age Composition

Lower Survival

Higher Survival

Weaker Recruitment

Stronger Recruitment

NEFSC (2013)
How fishery-dependent and fishery-independent data are used in stock assessments

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Using CPUE as an Index of Abundance

- Fishery catch rates (CPUE) are used in many stock assessment models as an index of stock abundance.
  - These applications assume that catch rates are proportional to stock abundance, but this assumption is only valid in some situations.
  - Fisheries are not designed to representatively sample a fish population, so trends in catch rates may not reflect trends in the stock.
  - Fishery catch rates can be standardized to account for factors like changing patterns in fishing area, fishing season, or vessel characteristics, but some factors cannot be effectively standardized.

Using CPUE as an Index of Abundance

- Stock assessments of New England groundfish currently do not use fishery catch rates as an index of abundance in the stock assessment model.
  - Fishery catch rates are used in other northeast U.S. stock assessments and was previously used in most groundfish assessments before 2008.
  - Several more recent groundfish assessments considered fishery catch rates but did not include it as an index of abundance.
Using CPUE as an Index of Abundance

- Despite the limitations of using fishery catch rates as an index of abundance in some situations, including CPUE in a stock assessment can be informative.

- Including CPUE as an index of abundance has the potential to improve performance of groundfish assessments if the index is sufficiently standardized, particularly during periods with changes to survey operations.

Considering CPUE in a Stock Assessment

- Even if it is not used in the stock assessment model, fishery data can provide information with high spatial and temporal resolution to help understand fishery dynamics.

- Including fishery perceptions may also improve the acceptance of stock assessment results by the fishing industry.
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Requirements for a Reliable CPUE Index

- Several aspects of fisheries and data are needed to create a reliable index of abundance for Northeast Multispecies stocks:
  - Differences in fishing power need to be standardized.
  - Information on target species is helpful to exclude effort that is avoiding ‘choke stocks’.
  - Catch estimates need to be accurate.
  - An understanding of fishing effort is needed for each type of fishery.
  - Fine-scale temporal and spatial information is helpful for standardizing fishing effort.
  - Inclusion probabilities of fishery observations (i.e., the chance of each time/location observation being sampled) should be known.
Southeast Data & Assessment Review (SEDAR) Guidelines

Appendix 1

2013 White Hake Benchmark Assessment

- Fishery catch rate indices were not expected to perform well because of management changes affecting effort.

Input Controls to End Overfishing

International Total Allowable Catch

Port interviews Logbooks

WGOM & Cashes closures

Days at Sea for ‘Optimum Yield’
2013 White Hake Benchmark Assessment

• Several LPUE (Landings per unit effort) indices were developed:
  • Trawl (standardized by statistical area, quarter-year and vessel tonnage)
  • Directed trawl (white hake >40% catch, standardized by statistical area, quarter-year and vessel tonnage)
  • Sink gillnet (standardized by statistical area, quarter-year and vessel tonnage)

• Fishery catch rate indices were correlated well with the survey trends, but there was little interest in using it in the model.

• Although the LPUE indices were not included in the stock assessment model, they were more strongly correlated to the stock estimates than survey indices.
Catch Rates from Directed Fishing Effort

- Selecting targeted effort helps to remove ‘avoidance’ fishing behavior.
- Selecting trips that caught a large proportion of the target species increases the value of LPUE (Appendix 4), and the bias can change over time.
- An alternative is to collaborate with fishermen to identify criteria (seasons, areas, gears, …) to define a ‘footprint’ of targeted fishing effort.

Indices that are Not Proportional to Abundance

- Most stock assessments assume that indices are directly proportional to abundance, but some are not.
  - **Hyperstability**: fishing effort is concentrated in areas of abundance, and CPUE is not sensitive to decreased population abundance, only local density
  - **Hyperdepletion**: CPUE decreases faster than abundance due to patterns of fish behavior
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Desired Factors and Existing Conditions

A large amount of fishery-dependent data is currently collected from fishermen in the Northeast multispecies fishery, but fishery catch rates are not currently being used in groundfish stock assessment models because of:

• limitations in the monitoring programs (e.g., data resolution, mis-reporting, observer bias),
• constraints of the stock assessment process (e.g., increasing scope of assessments with limited time and resources), and
• challenges posed by current conditions in the groundfish fishery (e.g., avoidance behavior).
Logbooks

• Vessel Trip Reports (VTRs) do not record fine-scale effort data.
  • Many VTRs report aggregate effort and by statistical fishing areas.
  • The data in VTRs is self-reported but is not verified (e.g., location, discarded catch).
  • Vessel Monitoring System (VMS) information could be used to verify VTR location information, but such evaluations are rare.

Observer Bias

• At-sea observer coverage is based on achieving a standard of precision for discard estimates but does not account for ‘observer bias’ (i.e., observed trips do not represent unobserved trips because of nonrandom sampling of trips and differences in fishing behavior).

Appendix 5. Demarest 2018
Dealer Reports

• Federally permitted seafood dealers submit weekly electronic reports.
  • Total landings derived from dealer reports are assumed to be a census of fishery landings, but recent violations document substantial mis-reporting.
  • The magnitude of misreporting and bias in estimates of landings are unknown.

New Technologies

• Study fleets and Electronic Monitoring (EM) projects have the potential to provide greater spatial and temporal resolution of catch and effort.
  • Both systems integrate logbooks with vessel positioning systems, and both have options for verifiable self-reported data.
  • eVTRs and EM are used to monitor a portion of the groundfish fleet, but the data are not routinely used to derive CPUE.
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Recommendations

1. As a routine term of reference, a time series of fishery catch rates should be evaluated and considered as an index of abundance in all benchmark stock assessments, not necessarily accepted as an index of abundance in the final stock assessment model.

2. For fishery catch rates to be considered as an index of abundance in stock assessment models, catch rates must be sufficiently standardized to account for changes in vessel efficiency, gear selectivity, targeting/avoidance behavior, inclusion probabilities, spatial aggregation of fish, and hyperstability (e.g., SEDAR checklist, Appendix 1).

3. Identifying best practices for developing a standardized fishery catch rate index using northeast fishery monitoring data would be an appropriate topic for a research track assessment for all groundfish stocks.
Recommendations

4. Simulation analysis should be used to evaluate the performance of alternative approaches to developing standardized fishery catch rate as an index of abundance.

5. Processes for soliciting fishermen’s expertise for understanding factors of catch rates, fishing patterns, and targeting or avoidance behavior should be included in the stock assessment process such as workshops and questionnaires.

6. Study fleets that have similar gear, vessel size, vessel power and target species should be considered for the development of fishery catch rate indices.

7. At-sea observer data should be used in the development of fishery catch rate indices with fine-scale standardization, but ‘observer bias’ should be considered.

8. Advanced technologies (e.g., electronic monitoring systems) should be considered in the development of fishery catch rate indices with fine-scale standardization.

9. Criteria should be developed to identify targeted fishing effort by species, including historical, fishery “footprints.”

10. Appropriate units of fishing effort should be developed for each type of fishery (e.g., trawl, gillnet, and hook gears).
Next Steps

• Working Group meeting to address technical feedback from SSC review
• Propose options for implementing recommendations

New England Fishery Management Council

DATE: January XX, 2019
TO: Tom Nies, Council Executive Director
FROM: Fishery Data for Stock Assessment Working Group
SUBJECT: Planned changes to the report in response to the SSC review