Methods for examining in-season behavior of the cumulative discard estimation

Daniel W. Linden, Ph.D.
Greater Atlantic Regional Fisheries Office
National Marine Fisheries Service

This information is distributed solely for the purpose of predissemination peer review. It has not been formally disseminated by NOAA. It does not represent any final agency determination or policy.

October 31, 2016
Data Sources (2010–2016)

1. Total catch: $K$
   - Dealer, VTR
   - merged in DMIS

2. Observed catch/discard: $k, d$
   - Northeast Fisheries Observer Program (NEFOP)
   - At-Sea Monitors (ASM)
Discard estimation – ratio

- Follows Standardized Bycatch Reporting Methodology
- Ratio estimator: observed discard/kept
- Extrapolate observed to unobserved trips
- Stratification

\[
r_{jh} = \frac{\sum_{i=1}^{n_h} d_{jih}}{\sum_{i=1}^{n_h} k_{ih}}
\]

\[
\hat{D}_j = \sum_{h=1}^{L} K_h r_{jh}
\]

Wigley et al. (2007) - SBRM
Discard estimation – uncertainty

- Variance in observed discards
- Sample sizes
- Precision in estimates (CV)

\[
V(\hat{D}_j) = \sum_{h=1}^{L} K_h^2 \left( \frac{N_h - n_h}{n_h N_h} \right) \frac{1}{\left( \frac{\sum_{i=1}^{n_h} k_{ih}}{n_h} \right)^2} \left[ \sum_{i=1}^{n_h} \left( \frac{d_{jih}^2 + r_{jih}^2 k_{ih}^2 - 2r_{jih} d_{jih} k_{ih}}{n_h - 1} \right) \right]
\]

\[
CV(\hat{D}_j) = \frac{\sqrt{V(\hat{D}_j)}}{\hat{D}_j}
\]

Wigley et al. (2007) - SBRM
Discard estimation – cumulative

• Estimated weekly as trips occur
• Function of \([N, K]\) and \([n, r]\)
Discard estimation – transition rates

• Adjust early-season discard rate
• Use information from previous year
• Two approaches:
  1. Default \((n = 5)\)
  2. Moving window
Sampling simulations (bootstrap)

- Resample the observed trips
- Calculate discard rate and total discard
- Do this 1,000 times!
SCAL_WP_SNE
FY 2015: 5 trip based Transition Rate
BASELINE

2015 Catch Cap

Current estimate
Median
50%
95%
**Analysis Framework**

- **Reduce Data Dimensionality**
  - Gear
  - Area
  - Time

- **Stratification Candidate**
  - Area
  - Vessel Category

- **Evaluate Results**
  - CV performance
  - Probability of premature closure

- **Resample observed trips**
- **All years**
- **All catch caps**
- **All Stratifications**

*Image credit: Brant McAfee, GARFO*
Software tool

- Custom R package
- Current/future discard estimation
- Flexible and adaptable