Cumulative Discard Methodology Review

J. Michael Lanning, PhD
Chief, Monitoring and Analysis Section
APSD
Northeast Regional Office
J.Michael.Lanning@noaa.gov

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Cumulative Discard Methodology (CDM)

- Developed in 2010 for in-season groundfish discard estimation
- The 2010 peer reviewers' suggested a review of seasonality would be beneficial after several years
- Further expansion to other fisheries: butterfish discards in longfin fleet; haddock in herring fleet, and river herring in herring/mackerel fleet
- Requests to re-evaluate CDM to address specific concerns:
  - Evaluating whether or not seasonal cumulative rates would produce better estimates for species that migrate seasonally, such as butterfish;
  - Evaluating whether or not area-specific rates would be more appropriate for scallop area management

Cumulative Discard Methodology (CDM)

November 7 – 9 Greater Atlantic Regional Fisheries Office (GARFO)

Project Scope

- Methods to improve the current implementation of the cumulative discard method
- Alternative methods to estimate discards were not compared
- Alternatives for discard methods and ASM coverage rates for Northeast Multispecies will be reviewed in an upcoming council action
- Observer bias was not reviewed

Panelist Summary of Findings

A weakness noted by the reviewers in the bootstrapping assessment of stratification and transition rate approaches was its focus on precision and not accuracy.

The latter can only be addressed by a simulation study where the underlying truth is known.

Any comprehensive assessment of stratum definitions, data weighting schemes, or modeling structures would benefit from a well-developed simulation that compares estimates to a known truth regardless of whether a design-based or model-based approach is taken for estimating discards.

Cumulative Discard Methodology (CDM)

Center for Independent Experts:

- Robin Cook, Ph.D., University of Strathclyde, Glasgow, Scotland
- Shijie Zhou, Ph.D., CSIRO Oceans & Atmosphere, Australia

CDM Website:

https://www.greateratlantic.fisheries.noaa.gov/aps/discard/review/index.html

Panelist Summary of Findings

Recognizing that the principal thrust of the CDM analysis was to identify better stratification schemes and transition rates

Stating that a thorough analysis using the best available science was applied within the Terms of Reference limits

The reviewers noted

With the exception of the longfin squid fishery where trimester stratification was demonstrably better analyses tended not to show, definitively, improved stratification schemes.

The results did reveal possible further avenues of analysis, but it was not possible to firmly choose revised stratifications.

Panelist Summary of Findings

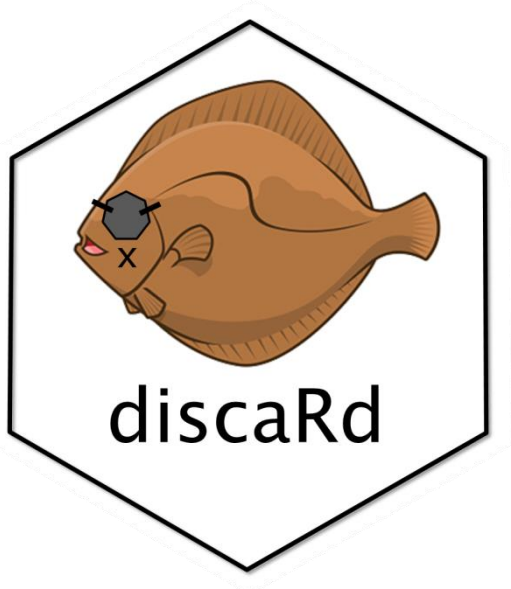
When highlighting several strengths and weaknesses of the CDM based on the separate ratio estimator identified as the preferred method at the 2010 review, the panelists noted that the use of a design-based ratio estimator limits the flexibility with which the discard rate can be estimated.

For this reason, both reviewers advocated for exploring a model-based approach to rate estimation.

Panelist Summary of Findings

As a modeling tool, the reviewers agreed that the *discaRd* package provides a useful and convenient framework for calculating the in-season discard rate and cumulative discard for a given species or stock, while allowing for multiple options regarding the weighting of data over time (i.e., transition rates) and stratification scenarios.

discaRd R package



- Custom R package
- Current/future discard estimation
- Flexible and adaptable
- Fully Documented
- European fisheries data* (*eflalo*) to demonstrate the major capabilities of the discaRd package.

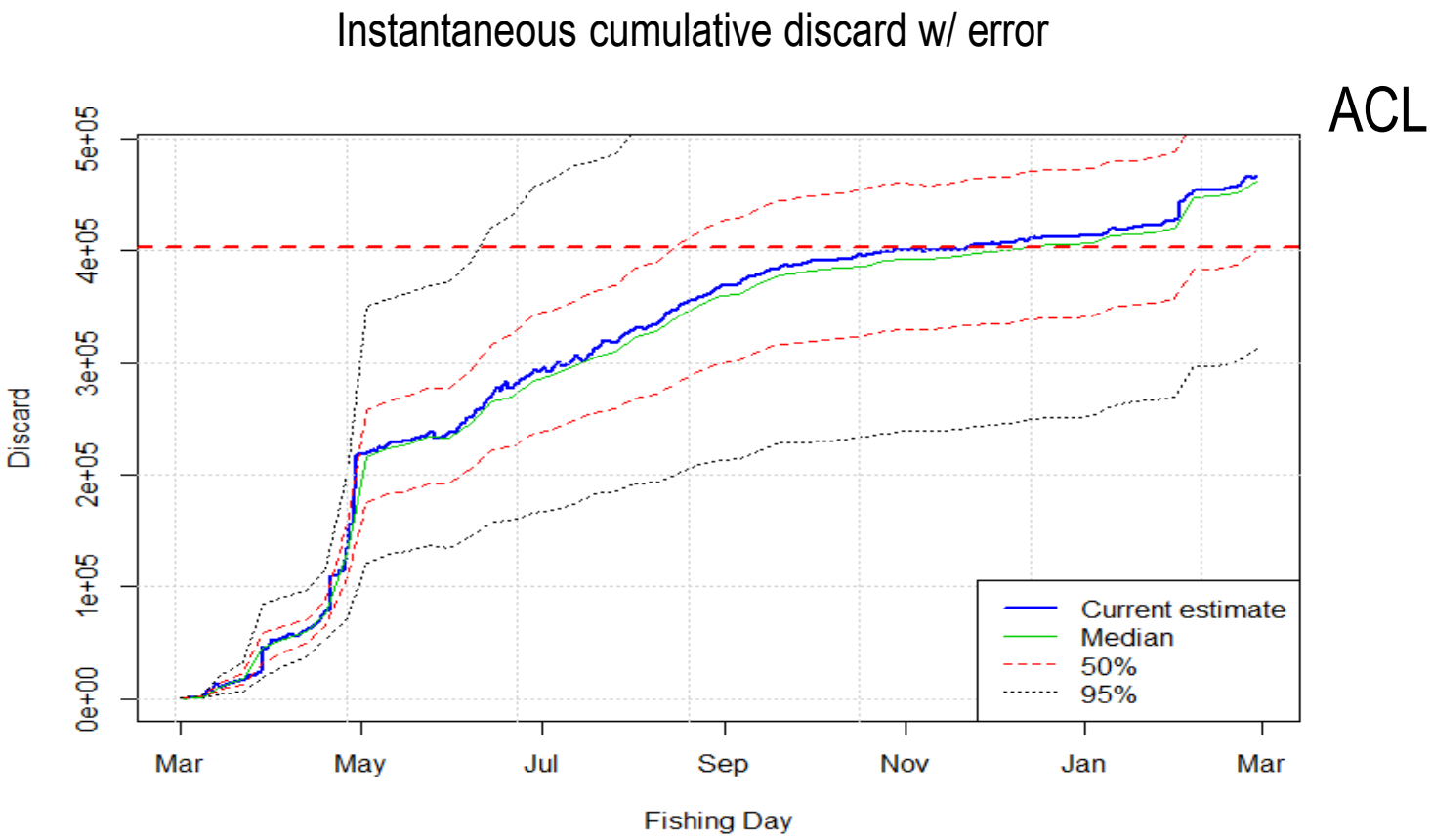
* This original data is courtesy of ICES (www.ices.dk) and Niels Hintzen, and can be found in the vmstools package for R

discaRd R package

Estimates from all observed trips during focal year

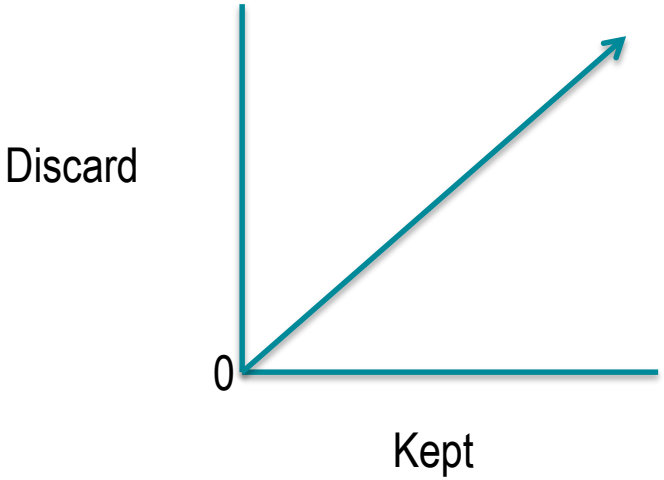
```
dest2 <- get.cochran.ss.by.strat(bydat_focal, trips_focal, targCV =.3, strata
_name = "STRATA", strata_complete = strata_complete)

data.table(dest2$C)

##            STRATA    N   n       r_mean        r_var         r_se
## 1: 046_MID_dredge 1514 178 0.0002171917 2.104664e-09 4.587662e-05
## 2: 046_SNE_dredge  524  98 0.0076819380 3.014883e-06 1.736342e-03
## 3: 047_MID_dredge 2331  94 0.0017150358 1.553467e-07 3.941404e-04
## 4:  047_MID_trawl  284   3 0.0001276292 5.955807e-09 7.717387e-05
## 5: 047_SNE_dredge 1224  77 0.0054396970 9.072881e-07 9.525167e-04
## 6:  047_SNE_trawl  290   7 0.0136161114 3.885237e-05 6.233167e-03
##        r_rse CV_TARG REQ_SAMPLES    REQ_COV REQ_SEADAYS           D
## 1: 0.2112264     0.3    93.80288 0.06195699   628.07671  33489.1252
## 2: 0.2260291     0.3    60.52430 0.11550438   534.89506 378499.8736
## 3: 0.2298147     0.3    56.09677 0.02406554   622.70195  19226.1523
## 4: 0.6046727     0.3    11.80571 0.04156941   163.05001    171.6202
## 5: 0.1751047     0.3    27.36789 0.02235938   260.88201  23531.3661
## 6: 0.4577788     0.3    15.79280 0.05445794    78.11797  11066.3207
##              K           k       d
## 1: 154191578.8 10673522.10  2318.2
## 2:  49271404.3  3616027.62 27778.1
## 3:  11210350.7   479815.07   822.9
## 4:   1344678.8    15670.40     2.0
## 5:   4325859.7   231685.70  1260.3
## 6:    812737.2    18823.29   256.3
```

discaRd R package



Model Based Approach

In addition to the simplicity of the calculation and its explanation, a primary benefit of the ratio estimator is the increased precision that results when the numerators (discards) and denominator (fishing effort) are highly correlated (related *linearly*).



Model Based Approach

Gain for trading a one model approach and simplicity of explanation:

Adapt to the specific conditions/complexity of a given fishery
(non linearity, latent variables, covariates, variable interactions)

Chosen according to the quality of the model's fit
(No more complex than needed)

Improve the ability to pool discard rates within appropriate strata.
Capture complex within-season trends

Questions / Other?