New England Fishery Management Council
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E.F. "Terry" Stockwell III, *Chairman* | Thomas A. Nies, *Executive Director*

MEMORANDUM

DATE: June 6, 2016

TO: Groundfish Committee

FROM: Groundfish Plan Development Team

SUBJECT: **CV standard for groundfish catch monitoring**

The Groundfish Plan Development Team (PDT) met on May 11, 2016 in Boston, Massachusetts to discuss the CV standard for groundfish catch monitoring.

A. Background

Committee Tasking

At its April 7, 2016 meeting, the Groundfish Committee tasked the Groundfish PDT with developing an analysis of the CV standard for groundfish catch monitoring. The Committee passed the following motion:

Task the PDT to:

1. Provide an analysis on how much variance would occur under alternate CVs using examples. For example, on a catch of 3 million lbs. of species "X" with a CV of 30 what is the variance in the discard rate. Changing the CV up and down provide the variance in lbs. so that we can understand how changes in the CV will affect our management strategy.

2. Provide a comparison of the differences in discard rates by gear type when the discard rate is calculated with only NEFOP data using the most recent fishing year for which the entire data set is available and the discard rate using NEFOP and ASM.

Rationale: These analyses would be helpful for managers and the public when understanding the benefits and risks of changing the CV standard. Regarding Task #1, we would like stock specific examples of how changing the CV standard may impact catch monitoring for sectors. Illustrate with examples of how altering the CV standard (i.e., increasing or decreasing it) for discard precision could affect catch monitoring for sectors. Include in the examples the distribution in pounds of discards. We request this analysis to understand how changes in the CV standard will affect our management strategy. The intent of the motion is to see the actual numbers using different CV values and a couple of different species as examples (as simple as possible with species and numbers, no graphs or complicated permutations necessary). Regarding Task #2, provide a comparison of the differences in stock-level discard estimates and CVs when the estimates are calculated with NEFOP data only versus using NEFOP and ASM. Also, include a comparison of these differences by gear type and mesh size (where available). Use data from the most recent fishing year for which the entire data set is available.

The following text summarizes PDT work in response to item #1 in the Committee's tasking motion. Item #2 requires additional work and due to time constraints was not completed in time for consideration at the June Committee meeting. The PDT plans to update the Committee on this work as soon as possible.

B. Approach

1. Methods

To address part 1 of this motion, the PDT completed its analysis using the example provided in the Committee's motion as a starting point.

- For this worked example, the true amount of discards for species "X" is assumed to be 3 million pounds.
- The distribution represents the likelihood of the estimate of the discards for species "X" deviating from the truth (i.e., 3 million pounds of discards of species "X") under different CVs distributions (i.e., 10%, 30%, 50% and 70%).
- More specifically, example distributions were estimated in Excel using 10,000 random iterations sampled from a lognormal distribution with a median "true" discards of 3 million pounds for species "X" under different CVs. Prior simulation work demonstrated that discard data follows a lognormal distribution rather than a normal distribution (i.e., the distribution of the data is not symmetrical around the mean).
- The example distributions are plotted for CVs of 10%, 30%, 50% and 70% (Figure 1). The inverse of the cumulative probabilities can be interpreted as the probability of the estimate being greater than or equal to the pounds on the x-axis, and is shown on the plots. The cumulative distribution (not shown on these plots) or 1minus the inverse distribution that is shown on the plots is the probability of the estimate being less than or equal to the pounds on the x-axis.

The plots are useful for illustrating the error or variation in potential estimates from the true discards of 3 million pounds. Probabilities can be picked directly off the curves in the plots. The plots also show the chance of being overcharged for larger amounts than the true discards due to the tendency of the discard data being distributed with a lognormal error structure.

2. Results

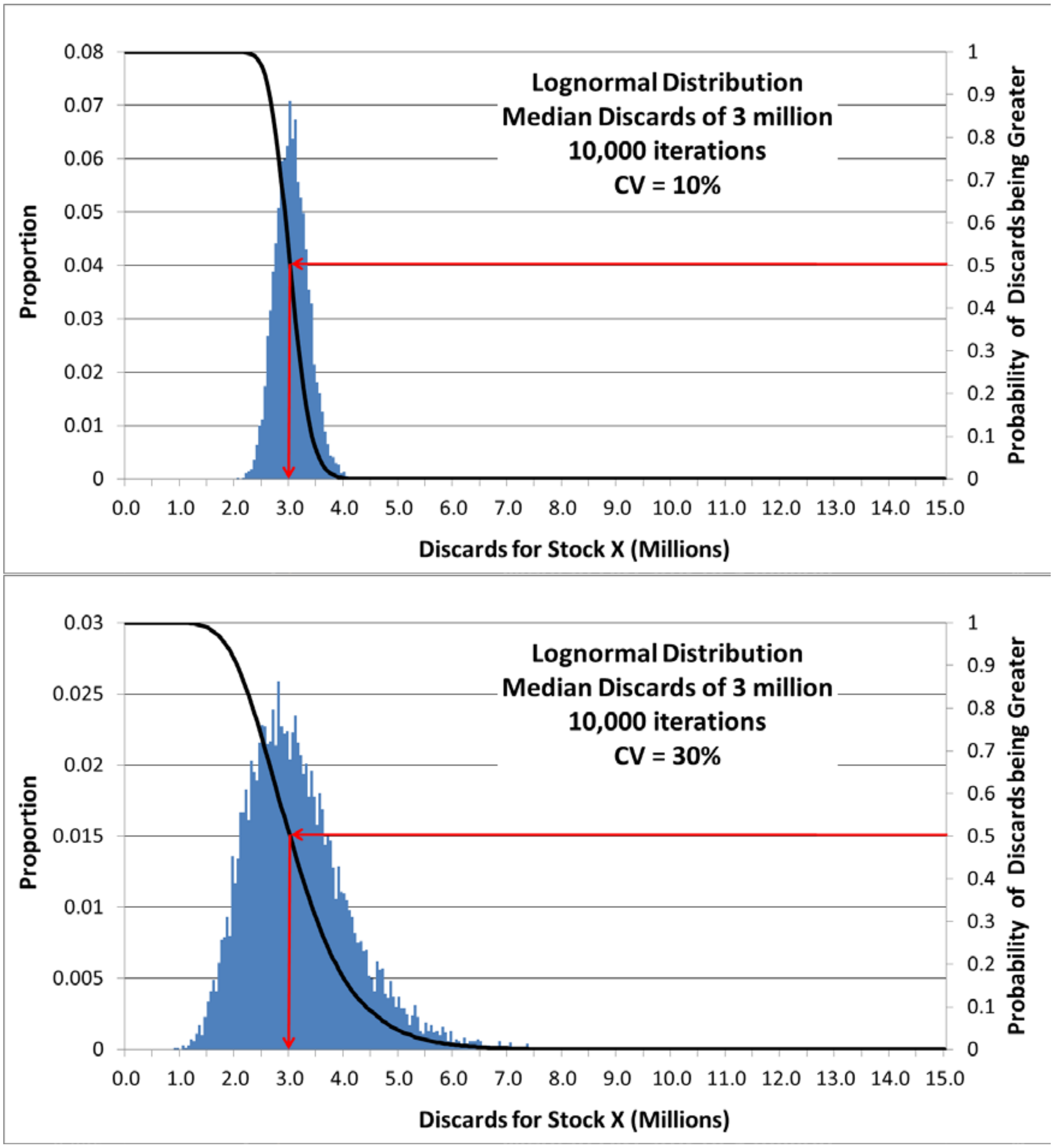
Table 1 summarizes the findings, when assuming true amount of the discards is 3 million pounds. Below are some example probability statements of calculated discards being twice (i.e., 6 million pounds) and three times higher (i.e., 9 million pounds) than the true discards of 3 million pounds under a CV of 10%, 30%, 50%, and 70% which is also reflected in the plots, include:

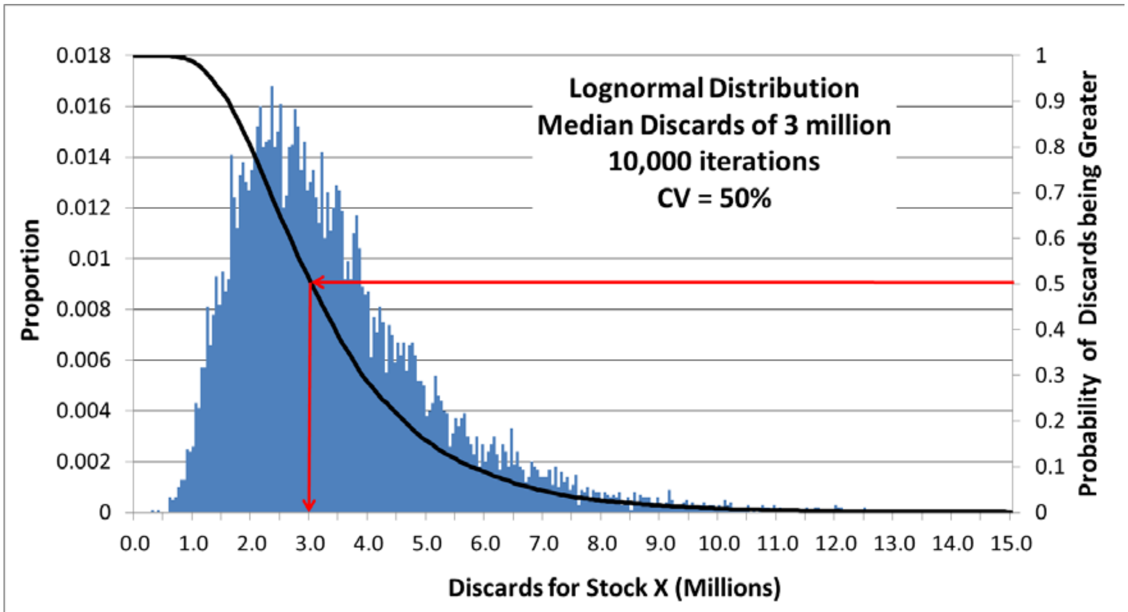
- Under a CV = 10% there is a 0% percent probability of discards being estimated twice as high or greater (> or = to 6 million) then the true discards. Therefore there is also a 0% chance of the estimate being three times higher than the truth.
- Under a CV = 30% there is a 1% percent probability of discards being estimated twice as high or greater (> or = to 6 million) then the true discards. There is a 0 % chance of the estimate being three times higher than the truth.
- Under a CV = 50% there is a 9% percent probability of discards being estimated twice as high or greater (> or = to 6 million) then the true discards. There is a 0.2 % chance of the estimate being three times higher than the truth.
- Under a CV = 70% there is a 16% percent probability of discards being estimated twice as high or greater (> or = to 6 million) then the true discards. There is a 0.6 % chance of the estimate being three times higher than the truth.

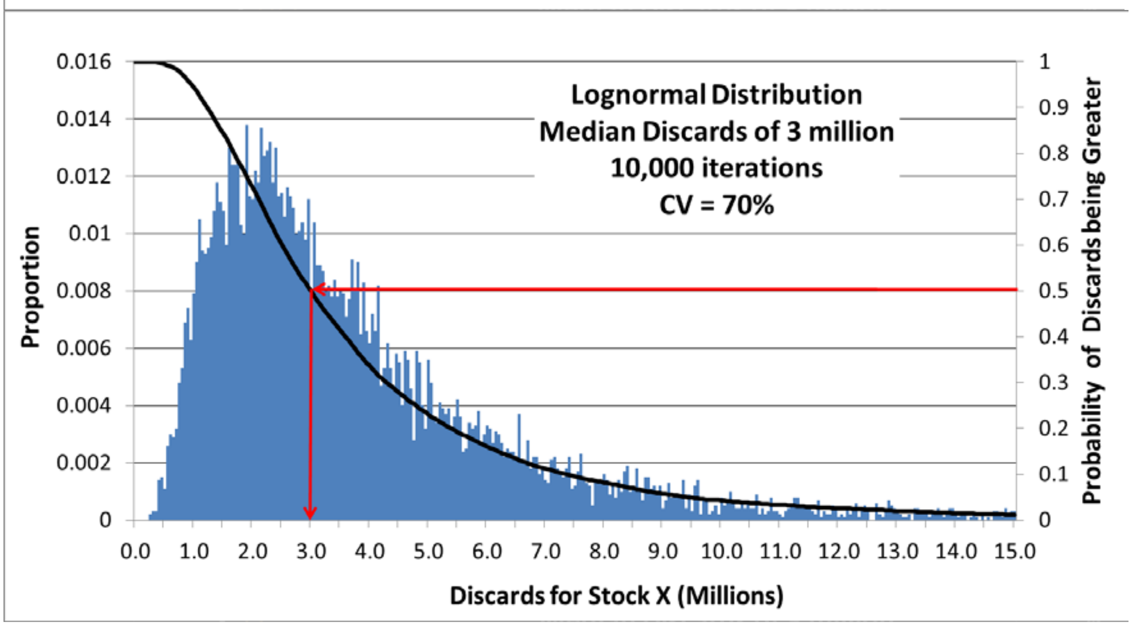
Table 1- Summary of the probability of estimated discards in a particular stratum (e.g., stock, gear, sector combination) being one half or smaller (< or = 1.5 million pounds), double or larger (> or = 6 million pounds) and triple or larger (> or = 9 million pounds) than the true discards of 3 million pounds. Combinations of other poundage probabilities can be directly picked off the distribution plots, see Figure 1. The true discards is 3 million pounds in this stratum stock example.

	This is the risk that the estimated discards in a stratum being half, double and triple the true discards of 3 million pounds….		
At this CV…	**1.5 million lb.** **(half the true amount)**	**6 million lb.** **(2x the true amount)**	**9 million lb.** **(3X the true amount)**
CV10	0%	0%	0%
CV30	1%	1%	0%
CV50	9%	9%	0.20%
CV70	16%	16%	0.60%

Figure 1- Lognormal distributions with a median discards of 3 million pounds for species "X" under CVs of 10%, 30%, 50% and 70% calculated from 10,000 iterations in Excel. The inverse of the cumulative probabilities are also shown using the second y-axis.




Lognormal Distribution
Median Discards of 3 million
10,000 iterations
CV = 50%
Proportion
0.018
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Probability of Discards being Greater
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0
Discards for Stock X (Millions)


Lognormal Distribution
Median Discards of 3 million
10,000 iterations
CV = 70%
Proportion
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Probability of Discards being Greater
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0
Discards for Stock X (Millions)