APPENDIX 2. NEFSC PROPOSAL FOR ROCK CHAINS IN SCALLOP SURVEYS

Rock chains limit the size of rocks entering the NEFSC scallop survey gear and may increase safety for staff processing catches during the survey. NEFSC is considering using rock chains on all tows in certain rocky strata to improve safety, reduce damage to gear, and to save time. Results from a paired-tow experiment comparing the performance of the NMFS survey scallop dredge with and without rock chains on soft and rocky bottom types were reviewed to determine: 1) the strength of the statistical evidence for an effect of rock chains on sea scallop catch rates, particularly in rocky strata; 2) adequacy of potential correction factors for adjusting historical catch rates in rocky strata to equivalent catches with rock chains; and 3) tentative plans to continue collecting rock chain data.

Each station was assigned to a habitat type (either hard/rocky or soft/sandy) before the experiment based on historical survey data. Possible differences between catch rates for scallops for gear with and without rock chains were tested using a paired t-test with log-transformed catches. Data used in the test were the differences between log-transformed catches with and without rock chains at each station. For the hard bottom analysis, one of the tows by the gear with rock chains caught no scallops so the constant 1.0 was added to the catches from all tows before being the data were log transformed. The data were tested for normality to justify using the paired t-test. For all three sampling sites (pooled, hard, and soft) the log transformed values and the log-transformed values with the constant added were not significantly different from normal (Appendix Table 2-1).

Results for rocky habitats were most important because of plans to use rock chains in rocky areas. The paired t-test for rocky habitat with the constant added was significant (p value = 0.009) with a mean difference of 0.444 in the log scale and a standard deviation of 1.02. The 95% confidence interval was 0.770 to 0.119. Transformation of the mean to the original scale gave exp(0.444)=1.56 which suggests that rock chain catches average 56% larger than non-rock chain catches at the same site. This simple calculation ignores bias induced by exponentiation of lognormal random variables. Using an approximate bias correction, the conversion factor is $1.56 * \exp[(1.02)^2/2)] = 2.62$ (Appendix Table 2-2.).

The practice of adding a constant before log transformation may effect results and there is little guidance concerning what the value of the constant should be. The data for rocky habitats were reanalyzed without the constant after removing the station where one tow had no catch. The paired t-test was still significant (p=0.005). The mean log scale difference was 0.506 with a standard deviation of 1.06. Back transforming and applying the bias correction factor gives $1.66* \exp[(1.058)^2/2)] = 2.90$ (Appendix Table 2-2).

The simple bias correction factor used above is approximate and meant for large sample sizes. An "exact" correction factor (Smith 1988) gave similar results (2.84).

The mean catch in the standard dredge is 256.7 (var= 189,438.4) and 337.2 (var = 280,968.2) in the rock chain dredge. An alternative non-parametric test (Wilcoxon's rank sum test) on arithmetic catches (no log transformation or constant) and omitting the station with a zero tow was conducted for rocky habitat because of uncertainty about the normality of the data and potential effects of adding a constant (Appendix Figure 2-1). The nonparametric test was significant (p=0.029) suggesting a difference in catch between the two dredge types

The Invertebrate Subcommittee commended NEFSC survey staff on their work but noted the variability in potential correction factors and recommended that collection of more data from paired samples on hard bottom sites. Calculation and use of calibration constants with appropriate bias corrections can be deferred until the sample size for the experiment is increased and reviewed.

Preliminary results suggested that the performance of gear without rock chains might become increasingly impeded as more large rocks enter the gear (Appendix Figure 2-2). As the number of large rocks in the standard dredge increases, the log difference between the dredges increase. The effects of this problem on the above analyses should be investigated.

Appendix Table 2-1.

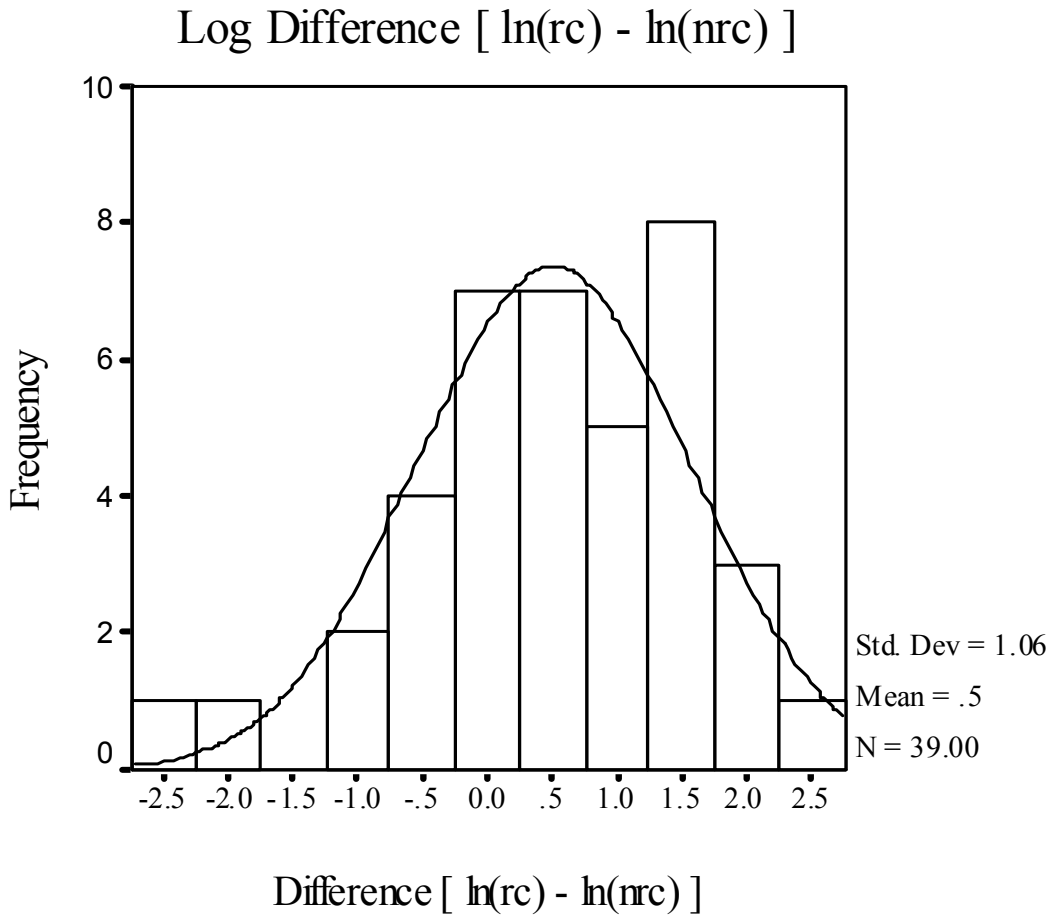
Test of Normality (Kolmogorov-Smirnov Test[a])				
Habitat	Trans.	Sig.	Df	Statistic
Pooled	ln(x+1)	0.20*	68	0.07
	ln(x)	0.20*	61	0.07
Hard	ln(x+1)	0.20*	40	0.10
	ln(x)	0.20*	39	0.09
Soft	ln(x+1)	0.06	28	0.16
	ln(x)	0.20*	22	0.12
*. This is the lower bound of the true sign.				
a. Lilliefors Significance Correction				

Appendix Table 2-2.

Paired T-test, sample pairs = 40, ln(x+1)		
		Exp.
Mean	0.44	1.56
S.D.	1.02	
C.I. Lower	0.12	1.13
C.I. Upper	0.77	2.16
Bias Correction exp(S.D.^{2}/2)		1.68
Calibration Factor (bias * exp(Mean))		2.62

Paired T-test, sample pairs = 39, ln(x) Approximate		
		Exp.
Mean	0.51	1.66
S.D.	1.06	
C.I. Lower	0.16	1.18
C.I. Upper	0.85	2.34
Bias Correction exp(S.D.^{2}/2)		1.75
Calibration Factor (bias * exp(Mean))		2.90

Appendix Figure 2-1. Distribution of differences between log survey catches with and without rock chains.



Appendix Figure 2-2. Difference in log survey catches with and without rock chains as a quantity of large (Category 4) rocks in the tow without rock chains.