

**Summary Report  
of  
*Ampelisca abdita* and *Eohaustorius estuaricus* tests  
Conducted with sediments from the St. Lucie Estuary, Florida**

**Submitted to**

**NOAA Ocean Service  
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**and**

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## INTRODUCTION

Fifteen sediments from the St. Lucie Estuary, Florida, were tested using 10-day solid phase survival tests with the amphipods *Ampelisca abdita* and *Eohaustorius estuaricus*. In addition, a fine-grained reference sediment was tested with the *Eohaustorius* bioassay to estimate the contribution of potential test sediment grain size effects.

## CONTROL AND REFERENCE SEDIMENTS

*Eohaustorius estuaricus* control sediment was collected from the amphipod collection site in Yaquina Bay, Oregon. During a previous study, NAS obtained grain size analysis of 1.0 mm-sieved sediment from this site:

| Gravel (%) | Sand (%) | Silt (%) | Clay (%) | Fines(%) |
|------------|----------|----------|----------|----------|
| 0.0        | 100      | 0.0      | 0.0      | 0.0      |

*Ampelisca abdita* control sediment was collected from the *Ampelisca* collection site in San Francisco Bay, California. NAS obtained grain size data of 0.5 mm-sieved sediment from this site from the Marine Pollution Studies Laboratory in Monterey, California:

| Gravel (%) | Sand (%) | Silt (%) | Clay (%) | Fines(%) |
|------------|----------|----------|----------|----------|
| 0.0        | 4.5      | 36.8     | 58.8     | 95.5     |

The *Ampelisca abdita* control sediment was also used as the fine-grained reference sediment in the *Eohaustorius estuaricus* tests.

## TESTS CONDUCTED

Four separate tests were conducted (two batches) in order to meet both holding time and laboratory resource constraints. Details of each test, and copies of all raw data, are provided in the individual test data reports.

## DATA ANALYSIS METHODS

Within each test, the percent amphipod survival at test termination was determined from the final observations according to the formula:

$$\text{Percent Survival} = 100 \times (\text{surviving amphipods}/\text{initial amphipods})$$

Another endpoint was the sum of observed daily sediment emergence events in a test beaker throughout the test. Control and treatment means and standard deviations for the biological endpoints described above and for water quality data were computed using Microsoft EXCEL 2000. Percent survival in each test sediment was compared against that in the control sediment, and in the *Eohaustorius* tests also against that in the reference sediment. The software used for within-test statistical comparisons was BioStat (Beta v.4.1 (EXCEL)) bioassay software developed by the U.S. Army Corps of Engineers, Seattle District. Following determination of normality and homogeneity of variances, a one-tailed Student T-test, Approximate T-test, I-sample T-test, Mann Whitney test, or Rankit Analysis was conducted at the 0.05 level of significance.

Following completion and analysis of all tests, between-species comparisons for each test sediment were made. Shapiro-Wilk's Test was used to test for normality, and an F-test for equality of variances. Then significance between species responses was determined using a 2-tailed homoscedastic or heteroscedastic t-test at the 0.05 level of significance. The software used for these comparisons was ToxCalc v.5.0.23N (Tidepool Scientific Software). Data analysis for between-species comparisons is included in Appendix I of this report.

Electronic data, including data entered into the client-specified format, is provided under separate cover.

## PROTOCOL DEVIATIONS

Protocol deviation details are included with each test data report. Overall, deviations were of a minor nature and not likely to have had any effect on the test results.

## RESULTS AND DISCUSSION

### Controls

The test negative control acceptance criteria for survival were met in all tests ( $\geq 90\%$  mean survival, not  $<80\%$  survival in any one replicate). All reference toxicant tests were within the laboratory control chart limits. Mean *Eohaustorius* survival in the fine reference sediment (= *Ampelisca* control sediment) was 80.0% and 86.0% in the first and second tests, respectively. These values were significantly different from mean *Eohaustorius* control survival, but within the  $\leq 20\%$  absolute difference from the control recommended by some regulatory programs (e.g. USACE 2000).

### Water quality summary

Ranges of water quality values are listed below in Table 1. All water quality measurements were within ASTM-specified ranges. The lowest dissolved oxygen measurement was recorded in Ampelisca test 691-2, 6.6 mg/L; at 19.6 °C and 29.0 ppt, this was 89% saturated.

Table 1. Summary of water quality measurement ranges in St. Lucie Estuary tests with the amphipods *Eohaustorius estuaricus* and *Ampelisca abdita*.

| Species:                  | <i>Eohaustorius</i> |                 | <i>Ampelisca</i> |              |
|---------------------------|---------------------|-----------------|------------------|--------------|
| Test number:              | 691-1               | 691-3           | 691-2            | 691-4        |
| Test date:                | 6-13-03             | 6-17-03         | 6-13-03          | 6-17-03      |
| <i>Overlying water</i>    |                     |                 |                  |              |
| Temperature (°C)          | 15.0 to 16.3        | 14.7 to 16.0    | 19.5 to 21.4     | 19.8 to 20.8 |
| Dissolved oxygen (mg/L)   | 7.8 to 8.6          | 7.6 to 8.8      | 6.6 to 7.6       | 6.8 to 7.7   |
| Salinity (‰)              | 26.0 to 29.0        | 26.5 to 30.0    | 27.0 to 29.5     | 26.0 to 30.0 |
| pH                        | 7.8 to 8.4          | 7.6 to 8.5      | 7.7 to 8.4       | 7.7 to 8.6   |
| Dissolved sulfide (mg/L)  | <0.02               | <0.02           | <0.02            | <0.02        |
| Total ammonia-N (mg/L)    | <0.5 to 1.5         | <0.5 to 2.0     | <0.5 to 2.0      | <0.5 to 2.0  |
| Unionized ammonia (mg/L)  | <0.012 to 0.063     | <0.014 to 0.088 | <0.015 to 0.101  | max 0.121    |
| <i>Interstitial water</i> |                     |                 |                  |              |
| Salinity (‰)              | 18.0 to 30.0        | 16.0 to 28.0    | 19.0 to 30.0     | 17.0 to 29.0 |
| pH                        | 7.1 to 7.5          | 7.4 to 7.8      | 6.8 to 7.5       | 7.4 to 7.7   |
| Dissolved Sulfide (mg/L)  | <0.5                | <0.5            | <0.5             | <0.5 to 4.0  |
| Total Ammonia-N (mg/L)    | <2.5 to 7.5         | <2.5 to 10      | <2.5 to 10       | <2.5 to 10   |
| Un-ionized ammonia (mg/L) | <0.009 to 0.045     | <0.021 to 0.069 | <0.010 to 0.064  | max 0.010    |

### Survival

Survival data from all tests is summarized below in Table 2.

For *Eohaustorius estuaricus*, seven test sediments (SLE005, SLE007, SLE009, SLE012, SLE015, SLE022, and SLE026) showed significantly lower survival than that in the control sediment. However, only sediments SLE005 and SLE026 had survival lower than 90% (acceptable control survival), and these were 87% and 88%, respectively. No test sediments had significantly lower survival than that in the fine-grained reference sediment, suggesting the possibility of a grain-size component to the *Eohaustorius* response.

Only four test sediments showed significantly lower survival than in the control sediment in the *Ampelisca abdita* test (SLE003, SLE005, SLE014, and SLE022). Mean percent survival in these sediments ranged from 75% to

*fishbone*

85%. One test sediment, SLE009, had a mean percent survival of 80% but was not significantly less than the control survival. Replicate percent survival in sediment SLE009 was 100%, 95%, 10%, 100%, and 95%. At test termination, the replicate which had only 10% survival was carefully examined, and ~~dark, bright~~ blue paint chips were discovered, along with an unusual odor. Sediments were thoroughly homogenized before adding them to the test beakers, but discrete particles may still partition into a particular replicate. This replicate is considered representative of heterogeneous contamination at the sample site, and therefore was included in the analysis.

Four sediments showed significantly different percent survival in the *Eohaustorius* vs. the *Ampelisca* tests: SLE003 (97% *Eohaustorius*, 85% *Ampelisca*), SLE014 (98% *Eohaustorius*, 75% *Ampelisca*), SLE021 (97% *Eohaustorius*, 89% *Ampelisca*), and SLE022 (90% *Eohaustorius*, 75% *Ampelisca*). Although these species have shown good agreement in sediment toxicity comparisons (e.g. Schlekat et. al. 1995), differences may reflect species differences in response to particular toxicants in these sediments. For example, *E. estuaricus* is known to be less sensitive to cadmium than other commonly-tested amphipod species (e.g. DeWitt et. al. 1989), but is more sensitive to tributyltin than *Rhepoxynius abronius* (Meador et. al. 1993).

Table 2. Summary of survival data from St. Lucie Estuary tests with the amphipods *Eohaustorius estuaricus* and *Ampelisca abdita*.

| Species:   | <i>Eohaustorius</i> |                  | <i>Ampelisca</i> |                  | <i>Ampelisca</i> and<br><i>Eohaustorius</i><br>survival<br>significantly<br>different? |
|--|---------------------|------------------|------------------|------------------|--|
|  | 691-1<br>6-13-03    | 691-3<br>6-17-03 | 691-2<br>6-13-03 | 691-4<br>6-17-03 |  |
| Sample:  |                     |                  |                  |                  |  |
| SLE002   | 90.0 ± 12.7         |                  | 93.0 ± 5.7       |                  | no   |
| SLE003   | 97.0 ± 6.7          |                  | 85.0 ± 3.5 *     |                  | yes  |
| SLE005   | 87.0 ± 7.6 *        |                  | 83.0 ± 9.7 *     |                  | no   |
| SLE007   |                     | 96.0 ± 4.2 *     |                  | 92.0 ± 2.7       | no   |
| SLE009   |                     | 96.0 ± 4.2 *     |                  | 80.0 ± 39.2 †    | no   |
| SLE012   |                     | 97.0 ± 2.7 *     |                  | 93.0 ± 5.7       | no   |
| SLE014   |                     | 98.0 ± 2.7       |                  | 75.0 ± 5.8 *     | yes  |
| SLE015   |                     | 96.0 ± 4.2 *     |                  | 93.0 ± 5.7       | no   |
| SLE017A1   | 93.0 ± 7.6          |                  | 95.0 ± 5.0       |                  | no   |
| SLE019   | 96.0 ± 4.2          |                  | 85.0 ± 10.6      |                  | no   |
| SLE021   | 97.0 ± 4.5          |                  | 89.0 ± 6.5       |                  | yes  |
| SLE022   |                     | 90.0 ± 3.5 *     |                  | 75.0 ± 10.0 *    | yes  |
| SLE026   | 88.0 ± 5.7 *        |                  | 92.0 ± 9.7       |                  | no   |
| SLE027   | 91.0 ± 6.5          |                  | 88.0 ± 9.1       |                  | no   |
| SLE029   |                     | 99.0 ± 2.2       |                  | 95.0 ± 3.5       | no   |
| <i>Eohaustorius</i> control                                | 97.0 ± 4.5          | 100.0 ± 0.0      | ---              | ---              | ---  |
| <i>Ampelisca</i> control/<br><i>Eohaustorius</i> reference | 80.0 ± 8.7 *        | 86.0 ± 7.4 *     | 94.0 ± 6.5       | 94.0 ± 4.2       | yes in first test,<br>no in second<br>test   |

\* Survival was significantly less than that in the control at p<0.05. (No samples in the *Eohaustorius* tests had significantly less survival than in the reference sediment.)

† One replicate had only 10% survival; that replicate had a particularly strong odor when sieved, and contained large blue paint chips.

REFERENCES

- DeWitt, T.H., R.C. Swartz and J.O. Lamberson. 1989. Measuring the acute toxicity of estuarine sediments. Environmental Toxicology and Chemistry 8:1035-1048.
- Medor, J.P., U. Varanasi and C.A. Krone. 1993. Differential sensitivity of marine infaunal amphipods to tributyltin. Marine Biology 116: 231-239.
- Schlekat, C.E., K.J. Scott, R.C. Swartz, B. Albrecht, L. Antrim, K. Doe, S. Douglas, J.A. Ferretti, D.J. Hansen, D.W. Moore, C. Mueller and A. Tang. 1995. Interlaboratory comparison of a 10-day sediment toxicity test method using *Ampelisca abdita*, *Eohaustorius estuarinus*, and *Leptocheirus plumulosus*. Environmental Toxicology and Chemistry 14: 2163-2174.
- U. S. Army Corps of Engineers, Seattle District, U.S. EPA, Region 10, Washington Dept. of Natural Resources, and Washington Dept. of Ecology. 2000. Dredged material evaluation and disposal procedures: a user's manual for the Puget Sound Dredged Disposal Analysis (PSDDA) Program.

REPORT APPROVAL

Michele I. Caldwell 8-1-03  
Project Manager/ Study Director Date

Linda R. Jamieson 8-3-03  
Quality Assurance Unit Date

Richard S. Caldwell 8/4/03  
Laboratory Director Date

## **APPENDIX I**

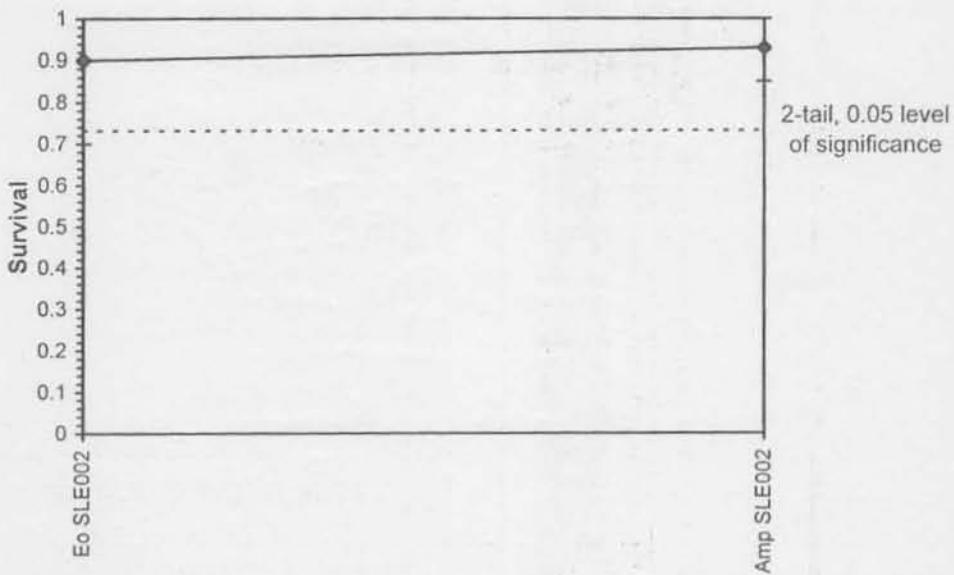
### **Between-species Data Analyses**

| Amphipod Sediment-Survival |         |           |                           |               |                            |  |  |  |  |
|----------------------------|---------|-----------|---------------------------|---------------|----------------------------|--|--|--|--|
| Start Date:                | 6/13/03 | Test ID:  | 691                       | Sample ID:    | SLE002                     |  |  |  |  |
| End Date:                  | 6/23/03 | Lab ID:   | ORNAS-Northwestern Aquati | Sample Type:  | SED-Sediment               |  |  |  |  |
| Sample Date:               |         | Protocol: | ASTM                      | Test Species: | Ampelisca and Eohaustorius |  |  |  |  |
| Comments:                  |         |           |                           |               |                            |  |  |  |  |
| Conc-                      | 1       | 2         | 3                         | 4             | 5                          |  |  |  |  |
| Eo SLE002                  | 0.7000  | 1.0000    | 1.0000                    | 0.9500        | 0.8500                     |  |  |  |  |
| Amp SLE002                 | 0.8500  | 1.0000    | 0.9500                    | 0.9500        | 0.9000                     |  |  |  |  |

| Conc-      | Transform: Arcsin Square Root |        |        |        |        |        |   | 2-Tailed |          |        |
|------------|-------------------------------|--------|--------|--------|--------|--------|---|----------|----------|--------|
|            | Mean                          | N-Mean | Mean   | Min    | Max    | CV%    | N | t-Stat   | Critical | MSD    |
| Eo SLE002  | 0.9000                        | 1.0000 | 1.2854 | 0.9912 | 1.4588 | 15.699 | 5 |          |          |        |
| Amp SLE002 | 0.9300                        | 1.0333 | 1.3143 | 1.1731 | 1.4588 | 8.246  | 5 | 0.282    | 2.306    | 0.2362 |

| Auxiliary Tests  | Statistic | Critical | Skew    | Kurt    |         |
|--|-----------|----------|---------|---------|---------|
| Shapiro-Wilk's Test indicates normal distribution ( $p > 0.01$ ) | 0.93158   | 0.781    | -0.635  | -0.1939 |         |
| F-Test indicates equal variances ( $p = 0.26$ )                  | 3.46674   | 23.1539  |         |         |         |
| Hypothesis Test (2-tail, 0.05)                                   | MSDu      | MSDp     | MSB     | MSE     |         |
| Homoscedastic t Test indicates no significant differences        | 0.16902   | 0.18357  | 0.00209 | 0.02623 | 0.78513 |
|  |           |          |         |         | df      |
|  |           |          |         |         | 1, 8    |

Dose-Response Plot

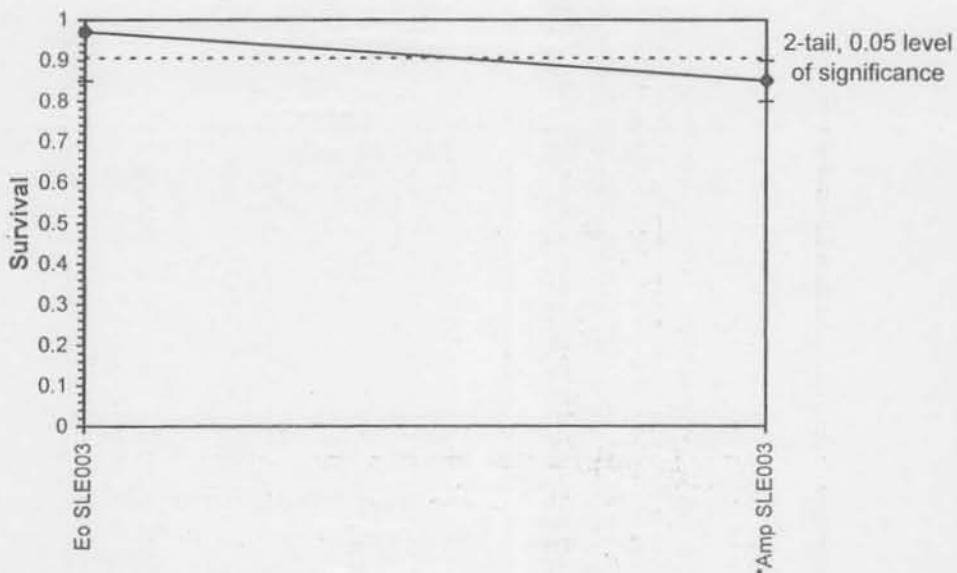


| Amphipod Sediment-Survival |         |           |                           |               |                            |  |  |  |  |
|----------------------------|---------|-----------|---------------------------|---------------|----------------------------|--|--|--|--|
| Start Date:                | 6/13/03 | Test ID:  | 691                       | Sample ID:    | SLE003                     |  |  |  |  |
| End Date:                  | 6/23/03 | Lab ID:   | ORNAS-Northwestern Aquati | Sample Type:  | SED-Sediment               |  |  |  |  |
| Sample Date:               |         | Protocol: | ASTM                      | Test Species: | Ampelisca and Eohaustorius |  |  |  |  |
| Comments:                  |         |           |                           |               |                            |  |  |  |  |
| Conc-                      | 1       | 2         | 3                         | 4             | 5                          |  |  |  |  |
| Eo SLE003                  | 1.0000  | 1.0000    | 1.0000                    | 1.0000        | 0.8500                     |  |  |  |  |
| Amp SLE003                 | 0.8000  | 0.8500    | 0.8500                    | 0.9000        | 0.8500                     |  |  |  |  |

| Transform: Arcsin Square Root |        |        |        |        |        |       |   | 2-Tailed |          |        |
|-------------------------------|--------|--------|--------|--------|--------|-------|---|----------|----------|--------|
| Conc-                         | Mean   | N-Mean | Mean   | Min    | Max    | CV%   | N | t-Stat   | Critical | MSD    |
| Eo SLE003                     | 0.9700 | 1.0000 | 1.4016 | 1.1731 | 1.4588 | 9.115 | 5 |          |          |        |
| *Amp SLE003                   | 0.8500 | 0.8763 | 1.1751 | 1.1071 | 1.2490 | 4.276 | 5 | 3.690    | 2.306    | 0.1416 |

| Auxiliary Tests   | Statistic | Critical | Skew    | Kurt    |
|---|-----------|----------|---------|---------|
| Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01) | 0.74524   | 0.781    | -2.011  | 4.43879 |
| F-Test indicates equal variances (p = 0.10)                       | 6.46525   | 23.1539  |         |         |
| Hypothesis Test (2-tail, 0.05)                                    | MSDu      | MSDp     | MSB     | MSE     |
| Homoscedastic t Test indicates significant differences            | 0.06514   | 0.06705  | 0.12829 | 0.00942 |
|   |           |          | F-Prob  | 0.00613 |
|   |           |          | df      | 1, 8    |

Dose-Response Plot

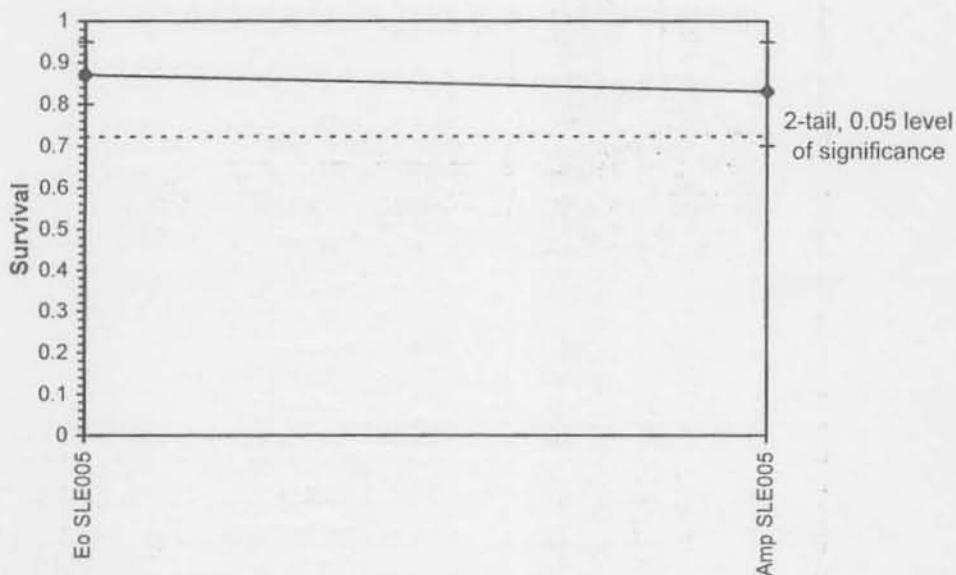


| Amphipod Sediment-Survival |         |           |                           |               |        |  |                            |  |  |
|----------------------------|---------|-----------|---------------------------|---------------|--------|--|----------------------------|--|--|
| Start Date:                | 6/13/03 | Test ID:  | 691                       | Sample ID:    |        |  | SLE005                     |  |  |
| End Date:                  | 6/23/03 | Lab ID:   | ORNAS-Northwestern Aquati | Sample Type:  |        |  | SED-Sediment               |  |  |
| Sample Date:               |         | Protocol: | ASTM                      | Test Species: |        |  | Ampelisca and Eohaustorius |  |  |
| Comments:                  |         |           |                           |               |        |  |                            |  |  |
| Conc-                      | 1       | 2         | 3                         | 4             | 5      |  |                            |  |  |
| Eo SLE005                  | 0.8000  | 0.8000    | 0.8500                    | 0.9500        | 0.9500 |  |                            |  |  |
| Amp SLE005                 | 0.9000  | 0.8000    | 0.7000                    | 0.9500        | 0.8000 |  |                            |  |  |

| Transform: Arcsin Square Root |        |        |        |        |        |        |   | 2-Tailed |          |        |  |
|-------------------------------|--------|--------|--------|--------|--------|--------|---|----------|----------|--------|--|
| Conc-                         | Mean   | N-Mean | Mean   | Min    | Max    | CV%    | N | t-Stat   | Critical | MSD    |  |
| Eo SLE005                     | 0.8700 | 1.0000 | 1.2156 | 1.1071 | 1.3453 | 9.988  | 5 |          |          |        |  |
| Amp SLE005                    | 0.8300 | 0.9540 | 1.1600 | 0.9912 | 1.3453 | 11.911 | 5 | 0.676    | 2.306    | 0.1897 |  |

| Auxiliary Tests  | Statistic | Critical | Skew    | Kurt    |
|--|-----------|----------|---------|---------|
| Shapiro-Wilk's Test indicates normal distribution (p > 0.01) | 0.90717   | 0.781    | 0.279   | -1.5243 |
| F-Test indicates equal variances (p = 0.81)                  | 1.29489   | 23.1539  |         |         |
| Hypothesis Test (2-tail, 0.05)                               | MSDu      | MSDp     | MSB     | MSE     |
| Homoscedastic t Test indicates no significant differences    | 0.1477    | 0.16803  | 0.00774 | 0.01691 |
|  |           |          |         | 0.51788 |
|  |           |          |         | 1, 8    |

Dose-Response Plot

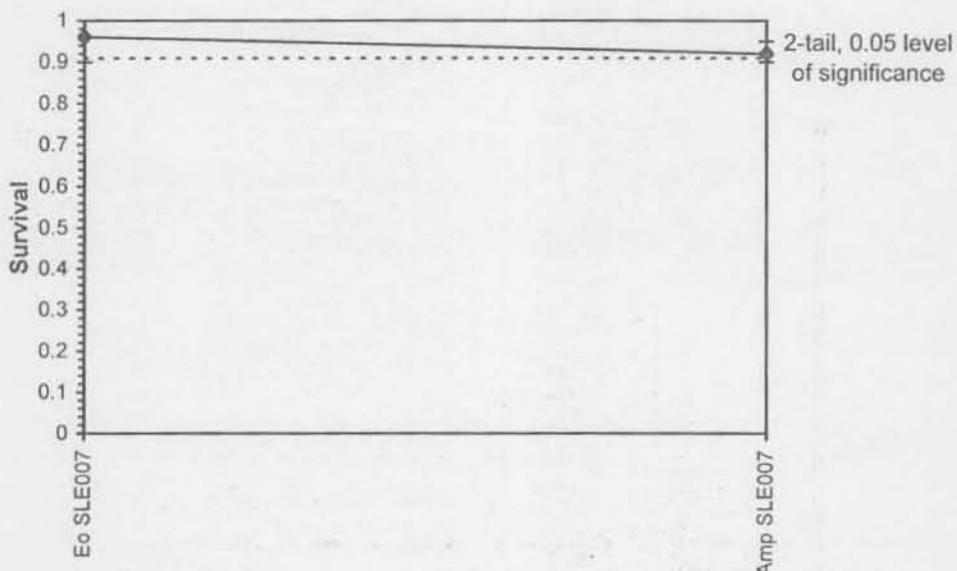


| Amphipod Sediment-Survival |         |           |                           |               |        |  |                            |  |  |
|----------------------------|---------|-----------|---------------------------|---------------|--------|--|----------------------------|--|--|
| Start Date:                | 6/17/03 | Test ID:  | 691                       | Sample ID:    |        |  | SLE007                     |  |  |
| End Date:                  | 6/27/03 | Lab ID:   | ORNAS-Northwestern Aquati | Sample Type:  |        |  | SED-Sediment               |  |  |
| Sample Date:               |         | Protocol: | ASTM                      | Test Species: |        |  | Ampelisca and Eohaustorius |  |  |
| Comments:                  |         |           |                           |               |        |  |                            |  |  |
| Conc-                      | 1       | 2         | 3                         | 4             | 5      |  |                            |  |  |
| Eo SLE007                  | 0.9500  | 0.9500    | 1.0000                    | 0.9000        | 1.0000 |  |                            |  |  |
| Amp SLE007                 | 0.9000  | 0.9000    | 0.9500                    | 0.9000        | 0.9500 |  |                            |  |  |

| Conc-      | Transform: Arcsin Square Root |        |        |        |        |       |   | 2-Tailed |          |        |
|------------|-------------------------------|--------|--------|--------|--------|-------|---|----------|----------|--------|
|            | Mean                          | N-Mean | Mean   | Min    | Max    | CV%   | N | t-Stat   | Critical | MSD    |
| Eo SLE007  | 0.9600                        | 1.0000 | 1.3714 | 1.2490 | 1.4588 | 6.481 | 5 |          |          |        |
| Amp SLE007 | 0.9200                        | 0.9583 | 1.2875 | 1.2490 | 1.3453 | 4.094 | 5 | 1.815    | 2.306    | 0.1066 |

| Auxiliary Tests  | Statistic | Critical | Skew    | Kurt    |
|--|-----------|----------|---------|---------|
| Shapiro-Wilk's Test indicates normal distribution ( $p > 0.01$ ) | 0.88251   | 0.781    | -0.137  | -0.7498 |
| F-Test indicates equal variances ( $p = 0.34$ )                  | 2.84309   | 23.1539  |         |         |
| Hypothesis Test (2-tail, 0.05)                                   | MSDu      | MSDp     | MSB     | MSE     |
| Homoscedastic t Test indicates no significant differences        | 0.05149   | 0.05359  | 0.01759 | 0.00534 |
|  |           |          | 0.10703 | 1, 8    |
|  |           |          |         |         |

Dose-Response Plot

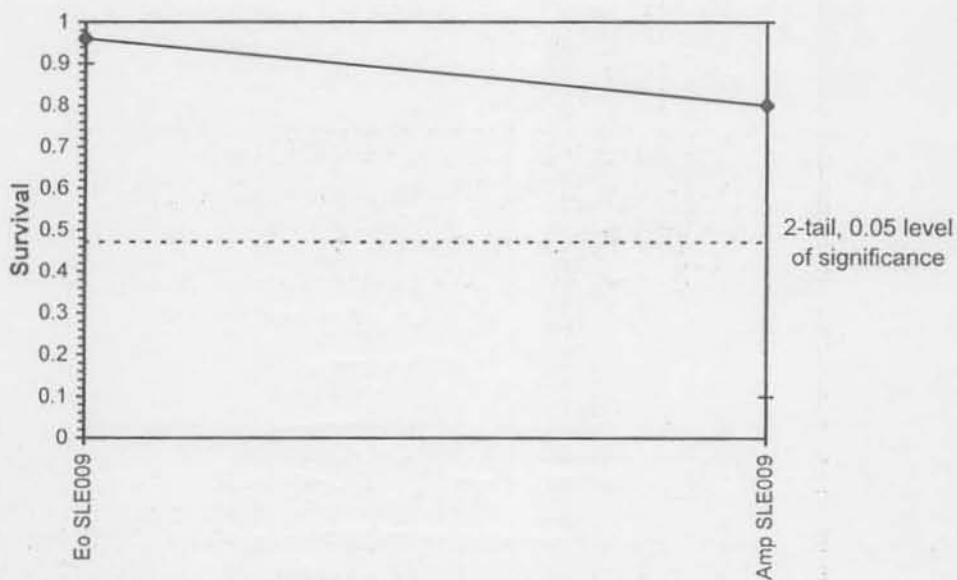


| Amphipod Sediment-Survival |                |          |                           |               |                            |              |              |  |  |  |  |  |
|----------------------------|----------------|----------|---------------------------|---------------|----------------------------|--------------|--------------|--|--|--|--|--|
| Start Date:                | 6/17/03        | Test ID: | 691                       |               | Sample ID:                 | SLE009       |              |  |  |  |  |  |
| End Date:                  | 6/27/03        | Lab ID:  | ORNAS-Northwestern Aquati |               |                            | Sample Type: | SED-Sediment |  |  |  |  |  |
| Sample Date:               | Protocol: ASTM |          |                           | Test Species: | Ampelisca and Eohaustorius |              |              |  |  |  |  |  |
| Comments:                  |                |          |                           |               |                            |              |              |  |  |  |  |  |
| Conc-                      | 1              | 2        | 3                         | 4             | 5                          |              |              |  |  |  |  |  |
| Eo SLE009                  | 0.9000         | 1.0000   | 0.9500                    | 0.9500        | 1.0000                     |              |              |  |  |  |  |  |
| Amp SLE009                 | 1.0000         | 0.9500   | 0.1000                    | 1.0000        | 0.9500                     |              |              |  |  |  |  |  |

| Conc-      | Transform: Arcsin Square Root |        |        |        |        |        |   | t-Stat | 2-Tailed Critical | MSD    |
|------------|-------------------------------|--------|--------|--------|--------|--------|---|--------|-------------------|--------|
|            | Mean                          | N-Mean | Mean   | Min    | Max    | CV%    | N |        |                   |        |
| Eo SLE009  | 0.9600                        | 1.0000 | 1.3714 | 1.2490 | 1.4588 | 6.481  | 5 |        |                   |        |
| Amp SLE009 | 0.8000                        | 0.8333 | 1.1860 | 0.3218 | 1.4588 | 41.016 | 5 | 0.839  | 2.776             | 0.6140 |

| Auxiliary Tests   | Statistic | Critical | Skew    | Kurt    |
|---|-----------|----------|---------|---------|
| Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01) | 0.73002   | 0.781    | -2.3157 | 6.20423 |
| F-Test indicates unequal variances (p = 6.13E-03)                 | 29.9534   | 23.1539  |         |         |
| Hypothesis Test (2-tail, 0.05)                                    | MSDu      | MSDp     | MSB     | MSE     |
| Heteroscedastic t Test indicates no significant differences       | 0.48872   | 0.50867  | 0.08599 | 0.12226 |
|   |           |          | F-Prob  | df      |
|   |           |          | 0.42601 | 1, 8    |

Dose-Response Plot

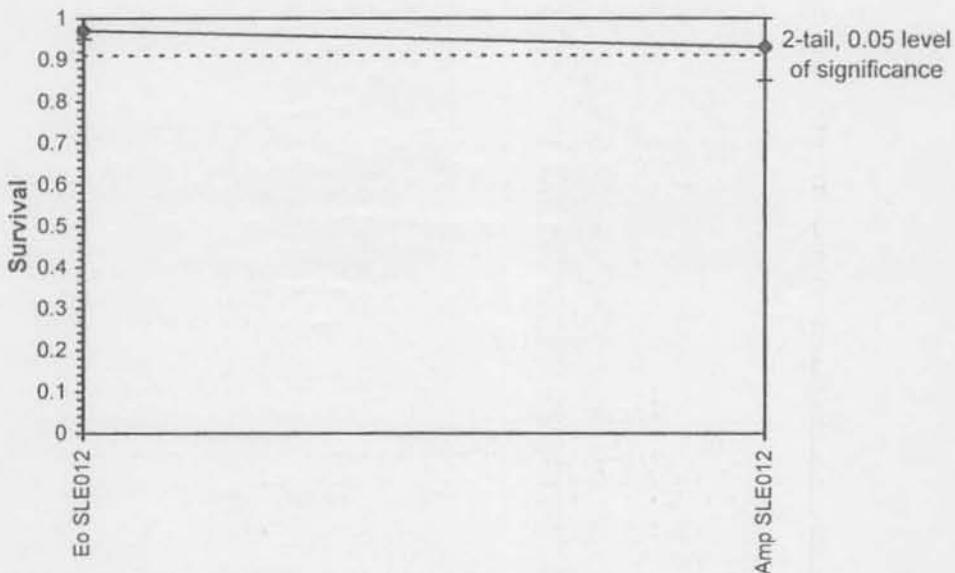


| Amphipod Sediment-Survival |         |           |                           |               |        |  |  |  |                            |
|----------------------------|---------|-----------|---------------------------|---------------|--------|--|--|--|----------------------------|
| Start Date:                | 6/17/03 | Test ID:  | 691                       | Sample ID:    |        |  |  |  | SLE012                     |
| End Date:                  | 6/27/03 | Lab ID:   | ORNAS-Northwestern Aquati | Sample Type:  |        |  |  |  | SED-Sediment               |
| Sample Date:               |         | Protocol: | ASTM                      | Test Species: |        |  |  |  | Ampelisca and Eohaustorius |
| Comments:                  |         |           |                           |               |        |  |  |  |                            |
| Conc-                      | 1       | 2         | 3                         | 4             | 5      |  |  |  |                            |
| Eo SLE012                  | 0.9500  | 1.0000    | 0.9500                    | 0.9500        | 1.0000 |  |  |  |                            |
| Amp SLE012                 | 1.0000  | 0.9500    | 0.9500                    | 0.8500        | 0.9000 |  |  |  |                            |

| Conc-      | Transform: Arcsin Square Root |        |        |        |        |       |   | t-Stat | 2-Tailed Critical | MSD    |
|------------|-------------------------------|--------|--------|--------|--------|-------|---|--------|-------------------|--------|
|            | Mean                          | N-Mean | Mean   | Min    | Max    | CV%   | N |        |                   |        |
| Eo SLE012  | 0.9700                        | 1.0000 | 1.3907 | 1.3453 | 1.4588 | 4.469 | 5 |        |                   |        |
| Amp SLE012 | 0.9300                        | 0.9588 | 1.3143 | 1.1731 | 1.4588 | 8.246 | 5 | 1.367  | 2.306             | 0.1288 |

| Auxiliary Tests  | Statistic | Critical | Skew    | Kurt    |        |      |
|--|-----------|----------|---------|---------|--------|------|
| Shapiro-Wilk's Test indicates normal distribution (p > 0.01) | 0.95755   | 0.781    | 0.07992 | -0.2184 |        |      |
| F-Test indicates equal variances (p = 0.31)                  | 3.04066   | 23.1539  |         |         |        |      |
| Hypothesis Test (2-tail, 0.05)                               | MSDu      | MSDp     | MSB     | MSE     |        |      |
| Homoscedastic t Test indicates no significant differences    | 0.06037   | 0.06237  | 0.01458 | 0.0078  | F-Prob | df   |
|  |           |          |         |         | 0.2088 | 1, 8 |

#### Dose-Response Plot

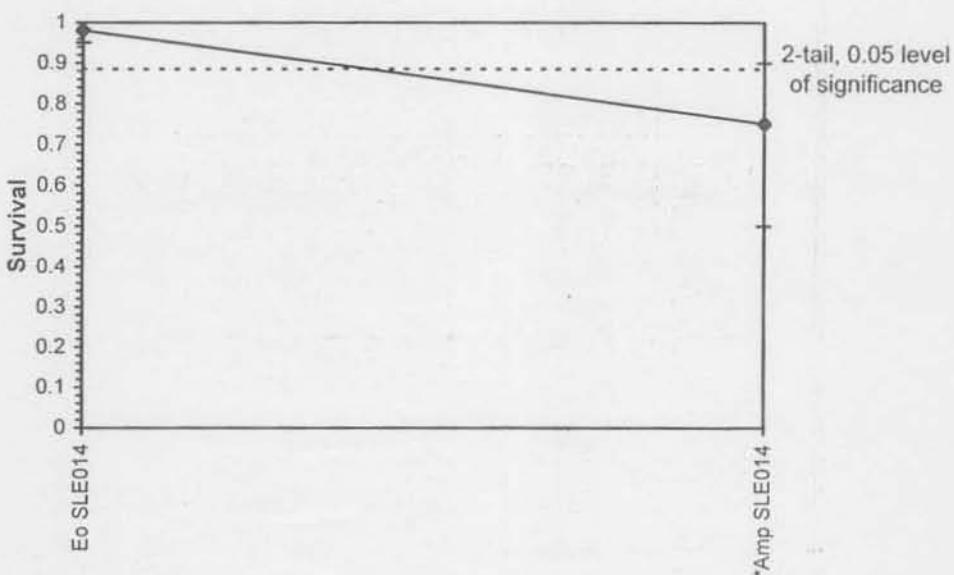


| Amphipod Sediment-Survival |                |          |                           |               |            |              |                            |  |  |
|----------------------------|----------------|----------|---------------------------|---------------|------------|--------------|----------------------------|--|--|
| Start Date:                | 6/17/03        | Test ID: | 691                       |               | Sample ID: | SLE014       |                            |  |  |
| End Date:                  | 6/27/03        | Lab ID:  | ORNAS-Northwestern Aquati |               |            | Sample Type: | SED-Sediment               |  |  |
| Sample Date:               | Protocol: ASTM |          |                           | Test Species: |            |              | Ampelisca and Eohaustorius |  |  |
| Comments:                  |                |          |                           |               |            |              |                            |  |  |
| Conc-                      | 1              | 2        | 3                         | 4             | 5          |              |                            |  |  |
| Eo SLE014                  | 0.9500         | 0.9500   | 1.0000                    | 1.0000        | 1.0000     |              |                            |  |  |
| Amp SLE014                 | 0.8500         | 0.5000   | 0.9000                    | 0.8000        | 0.7000     |              |                            |  |  |

| Conc-       | Transform: Arcsin Square Root |        |        |        |        |        |   | t-Stat | 2-Tailed Critical | MSD    |
|-------------|-------------------------------|--------|--------|--------|--------|--------|---|--------|-------------------|--------|
|             | Mean                          | N-Mean | Mean   | Min    | Max    | CV%    | N |        |                   |        |
| Eo SLE014   | 0.9800                        | 1.0000 | 1.4134 | 1.3453 | 1.4588 | 4.398  | 5 |        |                   |        |
| *Amp SLE014 | 0.7500                        | 0.7653 | 1.0612 | 0.7854 | 1.2490 | 17.047 | 5 | 4.117  | 2.306             | 0.1973 |

| Auxiliary Tests  | Statistic | Critical | Skew    | Kurt    |
|--|-----------|----------|---------|---------|
| Shapiro-Wilk's Test indicates normal distribution (p > 0.01) | 0.90675   | 0.781    | -0.9066 | 1.66242 |
| F-Test indicates equal variances (p = 0.06)                  | 8.47076   | 23.1539  |         |         |
| Hypothesis Test (2-tail, 0.05)                               | MSDu      | MSDp     | MSB     | MSE     |
| Homoscedastic t Test indicates significant differences       | 0.09603   | 0.09845  | 0.31011 | 0.01829 |
|  |           |          | F-Prob  | df      |
|  |           |          | 0.00336 | 1, 8    |

Dose-Response Plot

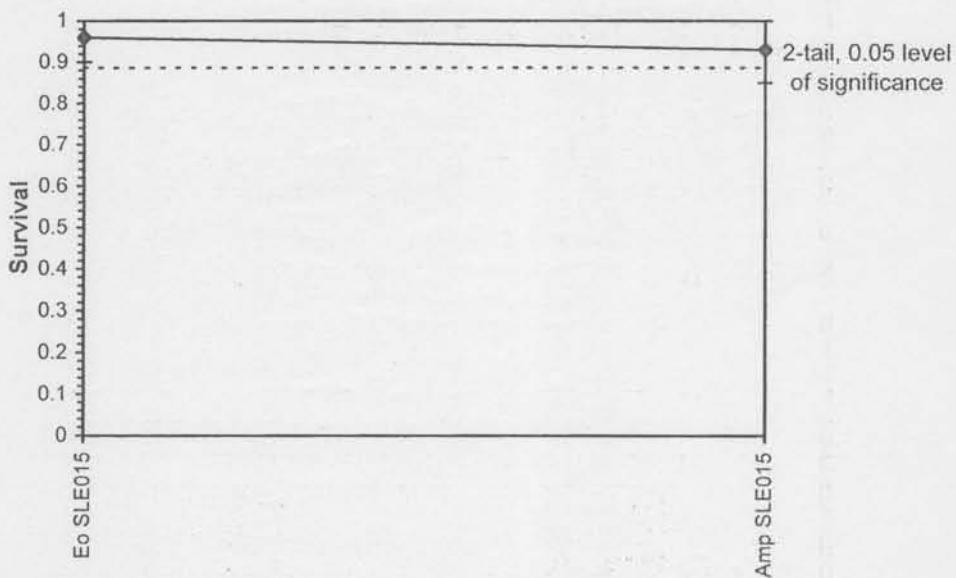


| Amphipod Sediment-Survival |         |           |                           |               |        |   |   |   |                            |
|----------------------------|---------|-----------|---------------------------|---------------|--------|---|---|---|----------------------------|
| Start Date:                | 6/17/03 | Test ID:  | 691                       | Sample ID:    |        |   |   |   | SLE015                     |
| End Date:                  | 6/27/03 | Lab ID:   | ORNAS-Northwestern Aquati | Sample Type:  |        |   |   |   | SED-Sediment               |
| Sample Date:               |         | Protocol: | ASTM                      | Test Species: |        |   |   |   | Ampelisca and Eohaustorius |
| Comments:                  |         |           |                           |               |        |   |   |   |                            |
| Conc-                      | 1       | 2         | 3                         | 4             | 5      | . | . | . | .                          |
| Eo SLE015                  | 1.0000  | 0.9500    | 1.0000                    | 0.9000        | 0.9500 |   |   |   |                            |
| Amp SLE015                 | 0.9000  | 0.9500    | 0.9500                    | 1.0000        | 0.8500 |   |   |   |                            |

| Conc-      | Transform: Arcsin Square Root |        |        |        |        |       |   | t-Stat | 2-Tailed Critical | MSD    |
|------------|-------------------------------|--------|--------|--------|--------|-------|---|--------|-------------------|--------|
|            | Mean                          | N-Mean | Mean   | Min    | Max    | CV%   | N |        |                   |        |
| Eo SLE015  | 0.9600                        | 1.0000 | 1.3714 | 1.2490 | 1.4588 | 6.481 | 5 |        |                   |        |
| Amp SLE015 | 0.9300                        | 0.9688 | 1.3143 | 1.1731 | 1.4588 | 8.246 | 5 | 0.911  | 2.306             | 0.1445 |

| Auxiliary Tests  | Statistic | Critical | Skew    | Kurt    |
|--|-----------|----------|---------|---------|
| Shapiro-Wilk's Test indicates normal distribution (p > 0.01) | 0.96165   | 0.781    | -0.0944 | -0.9194 |
| F-Test indicates equal variances (p = 0.71)                  | 1.48696   | 23.1539  |         |         |
| Hypothesis Test (2-tail, 0.05)                               | MSDu      | MSDp     | MSB     | MSE     |
| Homoscedastic t Test indicates no significant differences    | 0.07446   | 0.0775   | 0.00816 | 0.00982 |
|  |           |          | F-Prob  | df      |
|  |           |          | 0.3887  | 1, 8    |

#### Dose-Response Plot

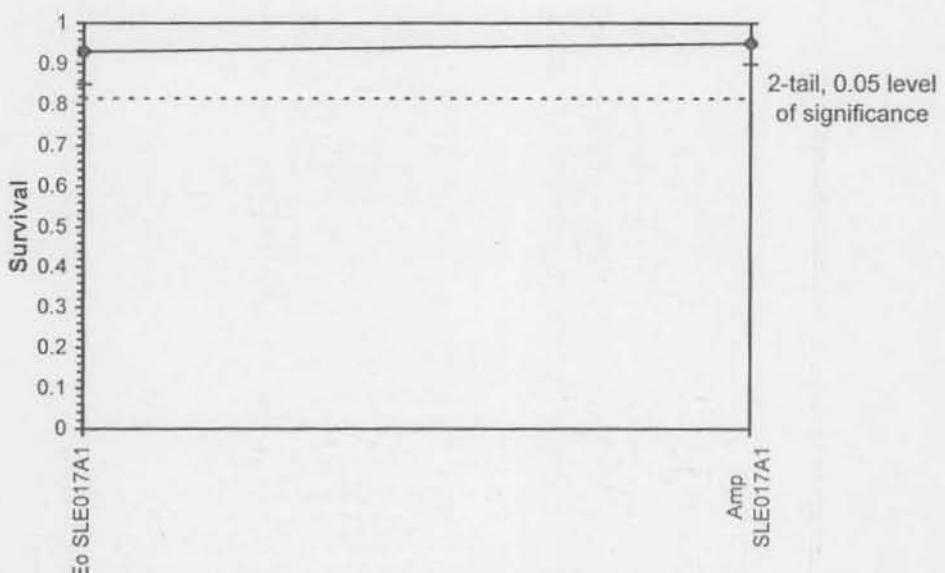


| Amphipod Sediment-Survival |         |           |                           |               |        |  |  |  |                            |
|----------------------------|---------|-----------|---------------------------|---------------|--------|--|--|--|----------------------------|
| Start Date:                | 6/13/03 | Test ID:  | 691                       | Sample ID:    |        |  |  |  | SLE0017A1                  |
| End Date:                  | 6/23/03 | Lab ID:   | ORNAS-Northwestern Aquati | Sample Type:  |        |  |  |  | SED-Sediment               |
| Sample Date:               |         | Protocol: | ASTM                      | Test Species: |        |  |  |  | Ampelisca and Eohaustorius |
| Comments:                  |         |           |                           |               |        |  |  |  |                            |
| Conc-                      | 1       | 2         | 3                         | 4             | 5      |  |  |  |                            |
| Eo SLE017A1                | 0.8500  | 0.8500    | 1.0000                    | 1.0000        | 0.9500 |  |  |  |                            |
| mp SLE017A1                | 0.9500  | 1.0000    | 0.9000                    | 0.9000        | 1.0000 |  |  |  |                            |

| Conc-       | Transform: Arcsin Square Root |        |        |        |        |        |   | t-Stat | 2-Tailed Critical | MSD    |
|-------------|-------------------------------|--------|--------|--------|--------|--------|---|--------|-------------------|--------|
|             | Mean                          | N-Mean | Mean   | Min    | Max    | CV%    | N |        |                   |        |
| Eo SLE017A1 | 0.9300                        | 1.0000 | 1.3218 | 1.1731 | 1.4588 | 10.851 | 5 |        |                   |        |
| mp SLE017A1 | 0.9500                        | 1.0215 | 1.3522 | 1.2490 | 1.4588 | 7.760  | 5 | 0.382  | 2.306             | 0.1833 |

| Auxiliary Tests  | Statistic | Critical | Skew    | Kurt    |
|--|-----------|----------|---------|---------|
| Shapiro-Wilk's Test indicates normal distribution ( $p > 0.01$ ) | 0.86063   | 0.781    | -0.1001 | -1.9397 |
| F-Test indicates equal variances ( $p = 0.56$ )                  | 1.86862   | 23.1539  |         |         |
| Hypothesis Test (2-tail, 0.05)                                   | MSDu      | MSDp     | MSB     | MSE     |
| Homoscedastic t Test indicates no significant differences        | 0.11478   | 0.1222   | 0.00231 | 0.01579 |
|  |           |          | 0.71223 | 1, 8    |
|  |           |          |         | F-Prob  |

Dose-Response Plot

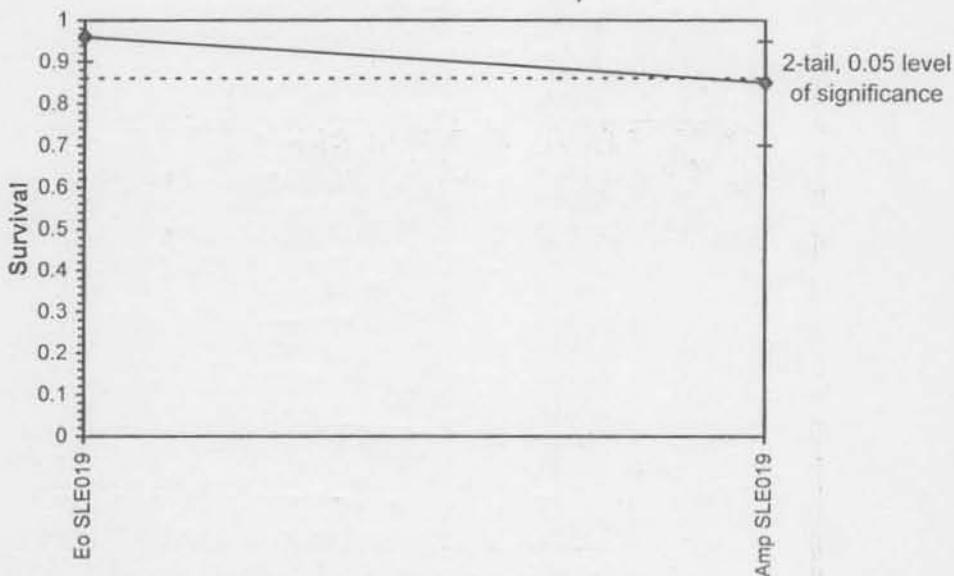


| Amphipod Sediment-Survival |         |            |                           |               |        |        |                            |  |  |
|----------------------------|---------|------------|---------------------------|---------------|--------|--------|----------------------------|--|--|
| Start Date:                | 6/13/03 | Test ID:   | 691                       | Sample ID:    |        |        | SLE019                     |  |  |
| End Date:                  | 6/23/03 | Lab ID:    | ORNAS-Northwestern Aquati | Sample Type:  |        |        | SED-Sediment               |  |  |
| Sample Date:               |         | Protocol:  | ASTM                      | Test Species: |        |        | Ampelisca and Eohaustorius |  |  |
| Comments:                  |         | Conc-      | 1                         | 2             | 3      | 4      | 5                          |  |  |
|                            |         | Eo SLE019  | 1.0000                    | 1.0000        | 0.9000 | 0.9500 | 0.9500                     |  |  |
|                            |         | Amp SLE019 | 0.9500                    | 0.9500        | 0.8000 | 0.7000 | 0.8500                     |  |  |

| Conc-      | Transform: Arcsin Square Root |        |        |        |        |        |   | t-Stat | 2-Tailed Critical | MSD    |
|------------|-------------------------------|--------|--------|--------|--------|--------|---|--------|-------------------|--------|
|            | Mean                          | N-Mean | Mean   | Min    | Max    | CV%    | N |        |                   |        |
| Eo SLE019  | 0.9600                        | 1.0000 | 1.3714 | 1.2490 | 1.4588 | 6.481  | 5 |        |                   |        |
| Amp SLE019 | 0.8500                        | 0.8854 | 1.1924 | 0.9912 | 1.3453 | 12.917 | 5 | 2.251  | 2.306             | 0.1834 |

| Auxiliary Tests  | Statistic | Critical | Skew    | Kurt    |
|--|-----------|----------|---------|---------|
| Shapiro-Wilk's Test indicates normal distribution ( $p > 0.01$ ) | 0.94068   | 0.781    | -0.1805 | -0.8835 |
| F-Test indicates equal variances ( $p = 0.31$ )                  | 3.00292   | 23.1539  |         |         |
| Hypothesis Test (2-tail, 0.05)                                   | MSDu      | MSDp     | MSB     | MSE     |
| Homoscedastic t Test indicates no significant differences        | 0.10026   | 0.10435  | 0.08013 | 0.01581 |
|  |           |          |         | 0.05446 |
|  |           |          | df      | 1, 8    |

Dose-Response Plot

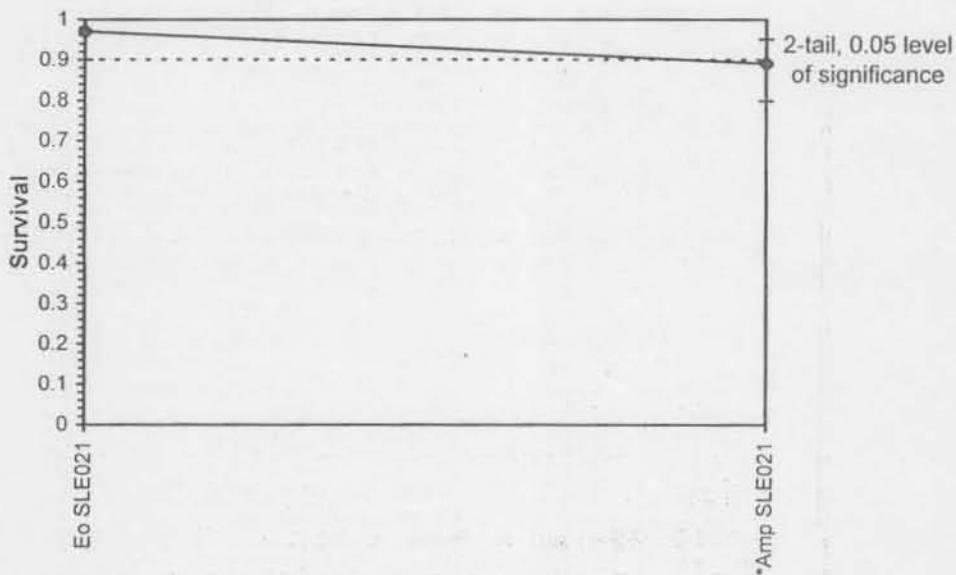


| Amphipod Sediment-Survival |         |           |                           |               |        |  |  |  |                            |
|----------------------------|---------|-----------|---------------------------|---------------|--------|--|--|--|----------------------------|
| Start Date:                | 6/13/03 | Test ID:  | 691                       | Sample ID:    |        |  |  |  | SLE021                     |
| End Date:                  | 6/23/03 | Lab ID:   | ORNAS-Northwestern Aquati | Sample Type:  |        |  |  |  | SED-Sediment               |
| Sample Date:               |         | Protocol: | ASTM                      | Test Species: |        |  |  |  | Ampelisca and Eohaustorius |
| Comments:                  |         |           |                           |               |        |  |  |  |                            |
| Conc-                      | 1       | 2         | 3                         | 4             | 5      |  |  |  |                            |
| Eo SLE021                  | 1.0000  | 0.9000    | 0.9500                    | 1.0000        | 1.0000 |  |  |  |                            |
| Amp SLE021                 | 0.9500  | 0.9500    | 0.8000                    | 0.9000        | 0.8500 |  |  |  |                            |

| Conc-       | Transform: Arcsin Square Root |        |        |        |        |       |   | 2-Tailed |          |        |
|-------------|-------------------------------|--------|--------|--------|--------|-------|---|----------|----------|--------|
|             | Mean                          | N-Mean | Mean   | Min    | Max    | CV%   | N | t-Stat   | Critical | MSD    |
| Eo SLE021   | 0.9700                        | 1.0000 | 1.3941 | 1.2490 | 1.4588 | 6.802 | 5 |          |          |        |
| *Amp SLE021 | 0.8900                        | 0.9175 | 1.2440 | 1.1071 | 1.3453 | 8.460 | 5 | 2.370    | 2.306    | 0.1461 |

| Auxiliary Tests  | Statistic | Critical | Skew    | Kurt    |
|--|-----------|----------|---------|---------|
| Shapiro-Wilk's Test indicates normal distribution (p > 0.01) | 0.87526   | 0.781    | -0.5273 | -1.3552 |
| F-Test indicates equal variances (p = 0.84)                  | 1.23165   | 23.1539  |         |         |
| Hypothesis Test (2-tail, 0.05)                               | MSDu      | MSDp     | MSB     | MSE     |
| Homoscedastic t Test indicates significant differences       | 0.06972   | 0.07194  | 0.05636 | 0.01003 |
|  |           |          | 0.04523 | 1, 8    |
| F-Prob   | df        |          |         |         |

#### Dose-Response Plot

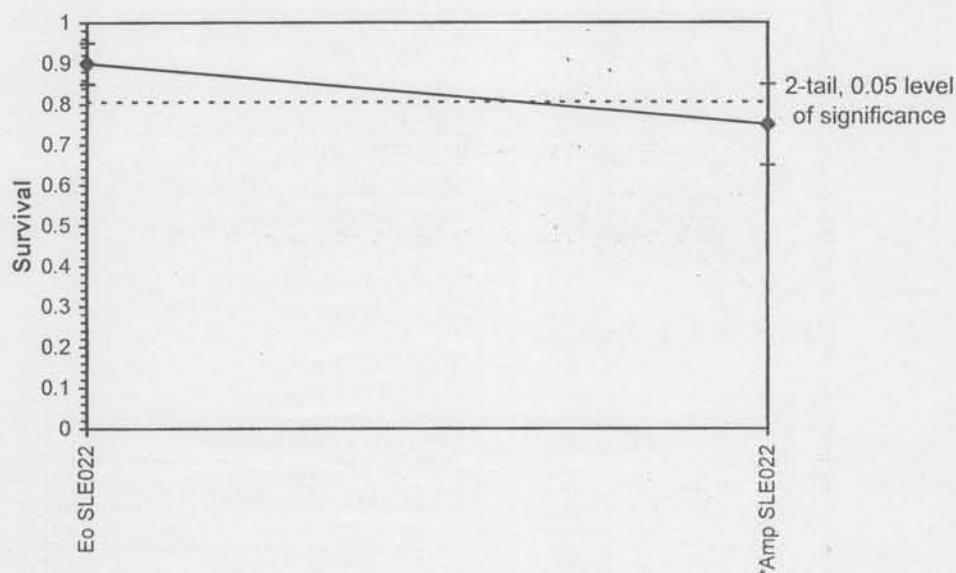


| Amphipod Sediment-Survival |         |           |                           |               |                            |  |  |  |  |
|----------------------------|---------|-----------|---------------------------|---------------|----------------------------|--|--|--|--|
| Start Date:                | 6/17/03 | Test ID:  | 691                       | Sample ID:    | SLE022                     |  |  |  |  |
| End Date:                  | 6/27/03 | Lab ID:   | ORNAS-Northwestern Aquati | Sample Type:  | SED-Sediment               |  |  |  |  |
| Sample Date:               |         | Protocol: | ASTM                      | Test Species: | Ampelisca and Eohaustorius |  |  |  |  |
| Comments:                  |         |           |                           |               |                            |  |  |  |  |
| Conc-                      | 1       | 2         | 3                         | 4             | 5                          |  |  |  |  |
| Eo SLE022                  | 0.9500  | 0.9000    | 0.8500                    | 0.9000        | 0.9000                     |  |  |  |  |
| Amp SLE022                 | 0.8500  | 0.6500    | 0.6500                    | 0.8500        | 0.7500                     |  |  |  |  |

| Conc-       | Transform: Arcsin Square Root |        |        |        |        |        |   | t-Stat | 2-Tailed Critical | MSD    |
|-------------|-------------------------------|--------|--------|--------|--------|--------|---|--------|-------------------|--------|
|             | Mean                          | N-Mean | Mean   | Min    | Max    | CV%    | N |        |                   |        |
| Eo SLE022   | 0.9000                        | 1.0000 | 1.2531 | 1.1731 | 1.3453 | 4.878  | 5 |        |                   |        |
| *Amp SLE022 | 0.7500                        | 0.8333 | 1.0538 | 0.9377 | 1.1731 | 11.173 | 5 | 3.360  | 2.306             | 0.1368 |

| Auxiliary Tests  | Statistic | Critical | Skew    | Kurt    |
|--|-----------|----------|---------|---------|
| Shapiro-Wilk's Test indicates normal distribution (p > 0.01) | 0.88573   | 0.781    | 0.10922 | -1.1957 |
| F-Test indicates equal variances (p = 0.23)                  | 3.70931   | 23.1539  |         |         |
| Hypothesis Test (2-tail, 0.05)                               | MSDu      | MSDp     | MSB     | MSE     |
| Homoscedastic t Test indicates significant differences       | 0.09515   | 0.10544  | 0.09933 | 0.0088  |
|  |           |          | F-Prob  | df      |
|  |           |          | 0.00993 | 1, 8    |

Dose-Response Plot

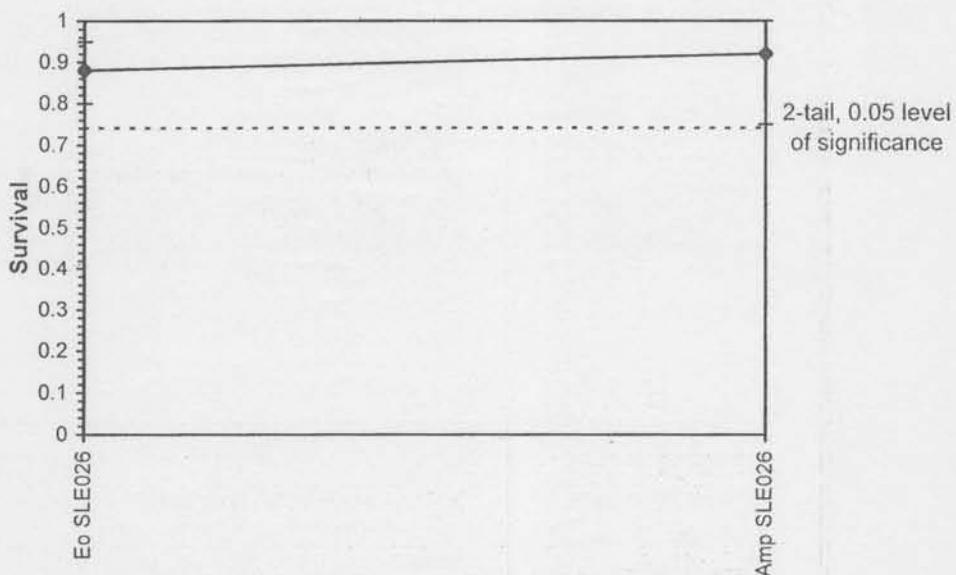


| Amphipod Sediment-Survival |         |           |                           |               |                            |  |  |
|----------------------------|---------|-----------|---------------------------|---------------|----------------------------|--|--|
| Start Date:                | 6/13/03 | Test ID:  | 691                       | Sample ID:    | SLE026                     |  |  |
| End Date:                  | 6/23/03 | Lab ID:   | ORNAS-Northwestern Aquati | Sample Type:  | SED-Sediment               |  |  |
| Sample Date:               |         | Protocol: | ASTM                      | Test Species: | Ampelisca and Eohaustorius |  |  |
| Comments:                  |         |           |                           |               |                            |  |  |
| Conc-                      | 1       | 2         | 3                         | 4             | 5                          |  |  |
| Eo SLE026                  | 0.8000  | 0.9000    | 0.9500                    | 0.8500        | 0.9000                     |  |  |
| Amp SLE026                 | 0.9500  | 0.9500    | 0.7500                    | 1.0000        | 0.9500                     |  |  |

| Transform: Arcsin Square Root |        |        |        |        |        |        |   | 2-Tailed |          |        |  |
|-------------------------------|--------|--------|--------|--------|--------|--------|---|----------|----------|--------|--|
| Conc-                         | Mean   | N-Mean | Mean   | Min    | Max    | CV%    | N | t-Stat   | Critical | MSD    |  |
| Eo SLE026                     | 0.8800 | 1.0000 | 1.2247 | 1.1071 | 1.3453 | 7.327  | 5 |          |          |        |  |
| Amp SLE026                    | 0.9200 | 1.0455 | 1.3084 | 1.0472 | 1.4588 | 11.774 | 5 | 1.049    | 2.306    | 0.1838 |  |

| Auxiliary Tests  | Statistic | Critical | Skew    | Kurt    |
|--|-----------|----------|---------|---------|
| Shapiro-Wilk's Test indicates normal distribution (p > 0.01) | 0.88581   | 0.781    | -1.1783 | 1.76447 |
| F-Test indicates equal variances (p = 0.32)                  | 2.94706   | 23.1539  |         |         |
| Hypothesis Test (2-tail, 0.05)                               | MSDu      | MSDp     | MSB     | MSE     |
| Homoscedastic t Test indicates no significant differences    | 0.14043   | 0.15869  | 0.01749 | 0.01589 |
|  |           |          | F-Prob  | 0.3248  |
|  |           |          | df      | 1, 8    |

Dose-Response Plot

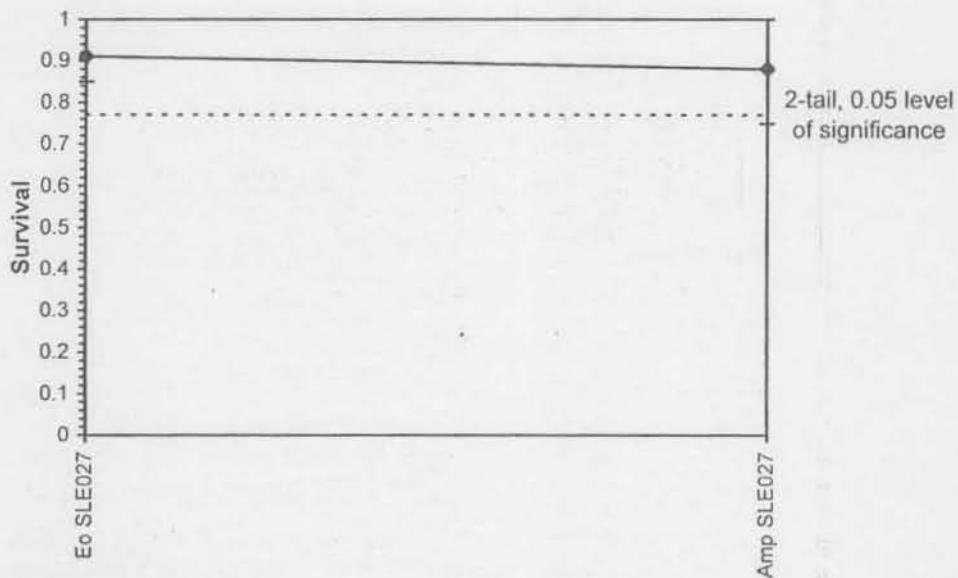


| Amphipod Sediment-Survival |         |           |                           |               |        |  |  |  |                            |
|----------------------------|---------|-----------|---------------------------|---------------|--------|--|--|--|----------------------------|
| Start Date:                | 6/13/03 | Test ID:  | 691                       | Sample ID:    |        |  |  |  | SLE027                     |
| End Date:                  | 6/23/03 | Lab ID:   | ORNAS-Northwestern Aquati | Sample Type:  |        |  |  |  | SED-Sediment               |
| Sample Date:               |         | Protocol: | ASTM                      | Test Species: |        |  |  |  | Ampelisca and Eohaustorius |
| Comments:                  |         |           |                           |               |        |  |  |  |                            |
| Conc-                      | 1       | 2         | 3                         | 4             | 5      |  |  |  |                            |
| Eo SLE027                  | 1.0000  | 0.8500    | 0.8500                    | 0.9500        | 0.9000 |  |  |  |                            |
| Amp SLE027                 | 0.8500  | 0.7500    | 0.9000                    | 1.0000        | 0.9000 |  |  |  |                            |

| Conc-      | Transform: Arcsin Square Root |        |        |        |        |        |   | 2-Tailed |          |        |
|------------|-------------------------------|--------|--------|--------|--------|--------|---|----------|----------|--------|
|            | Mean                          | N-Mean | Mean   | Min    | Max    | CV%    | N | t-Stat   | Critical | MSD    |
| Eo SLE027  | 0.9100                        | 1.0000 | 1.2799 | 1.1731 | 1.4588 | 9.572  | 5 |          |          |        |
| Amp SLE027 | 0.8800                        | 0.9670 | 1.2354 | 1.0472 | 1.4588 | 12.112 | 5 | 0.514    | 2.306    | 0.1994 |

| Auxiliary Tests  | Statistic | Critical | Skew    | Kurt    |
|--|-----------|----------|---------|---------|
| Shapiro-Wilk's Test indicates normal distribution ( $p > 0.01$ ) | 0.95585   | 0.781    | 0.50396 | -0.3407 |
| F-Test indicates equal variances ( $p = 0.71$ )                  | 1.49195   | 23.1539  |         |         |
| Hypothesis Test (2-tail, 0.05)                                   | MSDu      | MSDp     | MSB     | MSE     |
| Homoscedastic t Test indicates no significant differences        | 0.13952   | 0.15203  | 0.00493 | 0.0187  |
|  |           |          |         | F-Prob  |
|  |           |          |         | 0.62135 |
|  |           |          |         | 1, 8    |

Dose-Response Plot

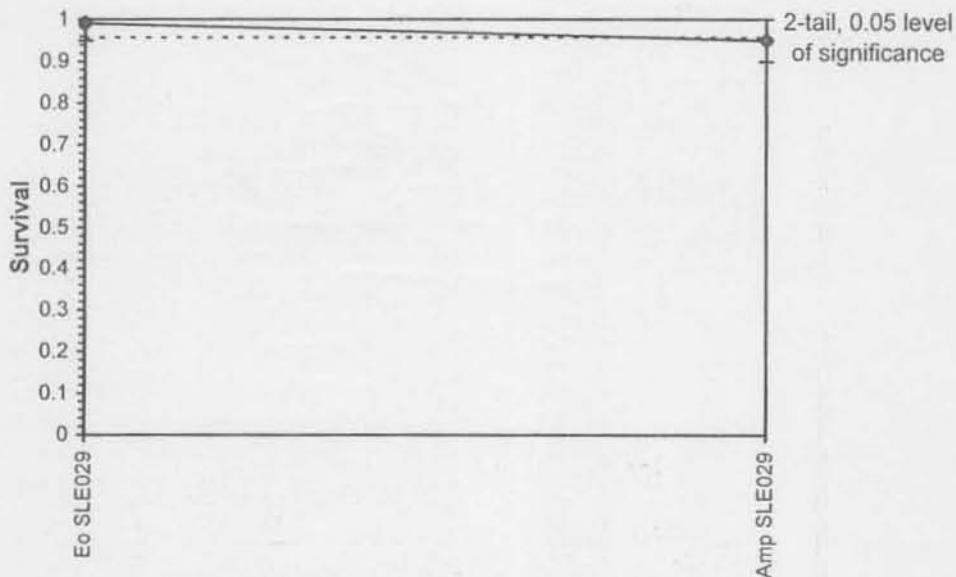


| Amphipod Sediment-Survival |                |          |                           |               |        |        |                            |  |  |  |
|----------------------------|----------------|----------|---------------------------|---------------|--------|--------|----------------------------|--|--|--|
| Start Date:                | 6/17/03        | Test ID: | 691                       | Sample ID:    |        |        | SLE029                     |  |  |  |
| End Date:                  | 6/27/03        | Lab ID:  | ORNAS-Northwestern Aquati | Sample Type:  |        |        | SED-Sediment               |  |  |  |
| Sample Date:               | Protocol: ASTM |          |                           | Test Species: |        |        | Ampelisca and Eohaustorius |  |  |  |
| Comments:                  | Conc-          | 1        | 2                         | 3             | 4      | 5      |                            |  |  |  |
|                            | Eo SLE029      | 0.9500   | 1.0000                    | 1.0000        | 1.0000 | 1.0000 |                            |  |  |  |
|                            | Amp SLE029     | 0.9500   | 0.9000                    | 1.0000        | 0.9500 | 0.9500 |                            |  |  |  |

| Conc-      | Transform: Arcsin Square Root |        |        |        |        |       |   | 2-Tailed |          |        |
|------------|-------------------------------|--------|--------|--------|--------|-------|---|----------|----------|--------|
|            | Mean                          | N-Mean | Mean   | Min    | Max    | CV%   | N | t-Stat   | Critical | MSD    |
| Eo SLE029  | 0.9900                        | 1.0000 | 1.4361 | 1.3453 | 1.4588 | 3.534 | 5 |          |          |        |
| Amp SLE029 | 0.9500                        | 0.9596 | 1.3487 | 1.2490 | 1.4588 | 5.509 | 5 | 2.170    | 2.306    | 0.0928 |

| Auxiliary Tests  | Statistic | Critical | Skew    | Kurt    |
|--|-----------|----------|---------|---------|
| Shapiro-Wilk's Test indicates normal distribution ( $p > 0.01$ ) | 0.86687   | 0.781    | -0.2317 | 0.95986 |
| F-Test indicates equal variances ( $p = 0.48$ )                  | 2.14329   | 23.1539  |         |         |
| Hypothesis Test (2-tail, 0.05)                                   | MSDu      | MSDp     | MSB     | MSE     |
| Homoscedastic t Test indicates no significant differences        | 0.03283   | 0.03344  | 0.01907 | 0.00405 |
|  |           |          |         | 0.06177 |
|  |           |          | df      | 1, 8    |

Dose-Response Plot

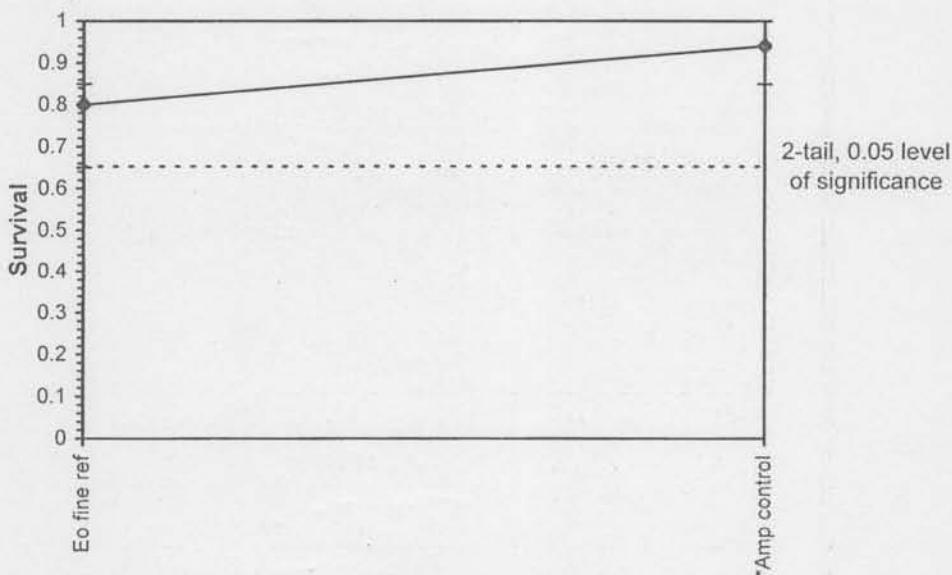


| Amphipod Sediment-Survival |         |          |        |            |   |  |  |  |  |         |
|----------------------------|---------|----------|--------|------------|---|--|--|--|--|---------|
| Start Date:                | 6/13/03 | Test ID: | 691    | Sample ID: | Eohaustorius fine reference=Ampelisca<br>Lab ID: ORNAS-Northwestern Aquati Sample Type:<br>Protocol: ASTM |  |  |  |  | central |
| End Date:                  | 6/23/03 |          |        |            | SED-Sediment  |  |  |  |  |         |
| Sample Date:               |         |          |        |            | Test Species:<br>Ampelisca and Eohaustorius   |  |  |  |  |         |
| Comments:                  |         |          |        |            |   |  |  |  |  |         |
| Conc-                      | 1       | 2        | 3      | 4          | 5   |  |  |  |  |         |
| Eo fine ref                | 0.8500  | 0.8500   | 0.8500 | 0.6500     | 0.8000  |  |  |  |  |         |
| Amp control                | 1.0000  | 0.9500   | 0.9000 | 1.0000     | 0.8500  |  |  |  |  |         |

| Conc-        | Transform: Arcsin Square Root |        |        |        |        |       |   | 2-Tailed |          |        |
|--------------|-------------------------------|--------|--------|--------|--------|-------|---|----------|----------|--------|
|              | Mean                          | N-Mean | Mean   | Min    | Max    | CV%   | N | t-Stat   | Critical | MSD    |
| Eo fine ref  | 0.8000                        | 1.0000 | 1.1128 | 0.9377 | 1.1731 | 9.162 | 5 |          |          |        |
| *Amp control | 0.9400                        | 1.1750 | 1.3370 | 1.1731 | 1.4588 | 9.484 | 5 | 3.080    | 2.306    | 0.1678 |

| Auxiliary Tests  | Statistic | Critical | Skew    | Kurt    |
|--|-----------|----------|---------|---------|
| Shapiro-Wilk's Test indicates normal distribution (p > 0.01) | 0.88565   | 0.781    | -0.6727 | -0.8707 |
| F-Test indicates equal variances (p = 0.68)                  | 1.54675   | 23.1539  |         |         |
| Hypothesis Test (2-tail, 0.05)                               | MSDu      | MSDp     | MSB     | MSE     |
| Homoscedastic t Test indicates significant differences       | 0.14759   | 0.18345  | 0.12561 | 0.01324 |
|  |           |          | F-Prob  | 0.01511 |
|  |           |          | df      | 1, 8    |

#### Dose-Response Plot



| Amphipod Sediment-Survival |         |           |                           |               |        |  |  |  |  |
|----------------------------|---------|-----------|---------------------------|---------------|--------|--|--|--|--|
| Start Date:                | 6/17/03 | Test ID:  | 691                       | Sample ID:    |        | Eohaustorius fine ref=Ampelisca contro |  |  |  |
| End Date:                  | 6/27/03 | Lab ID:   | ORNAS-Northwestern Aquati | Sample Type:  |        | SED-Sediment                           |  |  |  |
| Sample Date:               |         | Protocol: | ASTM                      | Test Species: |        | Ampelisca and Eohaustorius             |  |  |  |
| Comments:                  |         |           |                           |               |        |  |  |  |  |
| Conc-                      | 1       | 2         | 3                         | 4             | 5      |  |  |  |  |
| Eo fine ref                | 0.7500  | 0.9500    | 0.8500                    | 0.9000        | 0.8500 |  |  |  |  |
| Amp control                | 1.0000  | 0.9000    | 0.9000                    | 0.9500        | 0.9500 |  |  |  |  |

| Transform: Arcsin Square Root |        |        |        |        |        |       |   | 2-Tailed |          |        |  |
|-------------------------------|--------|--------|--------|--------|--------|-------|---|----------|----------|--------|--|
| Conc-                         | Mean   | N-Mean | Mean   | Min    | Max    | CV%   | N | t-Stat   | Critical | MSD    |  |
| Eo fine ref                   | 0.8600 | 1.0000 | 1.1975 | 1.0472 | 1.3453 | 9.174 | 5 |          |          |        |  |
| Amp control                   | 0.9400 | 1.0930 | 1.3295 | 1.2490 | 1.4588 | 6.530 | 5 | 2.107    | 2.306    | 0.1444 |  |

| Auxiliary Tests  | Statistic | Critical | Skew    | Kurt    |
|--|-----------|----------|---------|---------|
| Shapiro-Wilk's Test indicates normal distribution ( $p > 0.01$ ) | 0.96331   | 0.781    | 0.18116 | -0.4358 |
| F-Test indicates equal variances ( $p = 0.66$ )                  | 1.60119   | 23.1539  |         |         |
| Hypothesis Test (2-tail, 0.05)                                   | MSDu      | MSDp     | MSB     | MSE     |
| Homoscedastic t Test indicates no significant differences        | 0.11191   | 0.12907  | 0.04352 | 0.0098  |
|  |           |          |         | F-Prob  |
|  |           |          |         | 0.0682  |
|  |           |          |         | df      |
|  |           |          |         | 1, 8    |

Dose-Response Plot

