JOHN HUNT
Guidance Pol
Admin Record
186

Society of Environmental Toxicology and Chemistry

ABSTRACT BOOK

14TH ANNUAL MEETING

Ecological Risk Assessment: Lessons Learned?

14 - 18 NOVEMBER 1993
WESTIN GALLERIA AND OAKS
HOUSTON, TEXAS

336

Developmental Status of Sediment Toxicity Bioassays, T.M. Dillon, D.W, Moore, T.S. Bridges. USAE Waterways Experiment Station, Vicksburg, MS. Sediment toxicity bioassays are required under *§103 of the Ocean Dumping Act and §404(b)(1) of the Clean Water Act* to evaluate the disposal of dredged material. Regulatory use of these tests implies that they are fully developed. This is not always true. While some bioassays are intuitively more appropriate than others, judging their developmental status has been difficult due to a lack of guidance. To fill this gap, input from users and developers of sediment bioassays was solicited over a 2 year period and is summarized in a three-phased developmental paradigm. Phase I outlines activities conducted often by the initial test proponent. These include species/endpoint selection, statistical/experimental design, QA/QC, interpretive guidance, etc. Phase II discusses what constitutes scientific acceptance of a particular test. Phase III describes a process for regulatory agencies (USEPA/USACE) to judge the appropriateness of bioassays *vis a vis* dredged material evaluations. For example, technically sound, widely accepted bioassays may still not be appropriate for regulatory usage. This developmental paradigm has several applications: 1) describes a logical, sequential framework for developing dredged material bioassays, 2) provides initial guidance for evaluating the relative developmental status of sediment bioassays, 3) identifies gaps in our knowledge where additional research is needed and 4) provides general guidance to other regulatory/scientific programs using sediment bioassays (e.g. CERCLA/SARA, NRDA, EMAP, etc).

337

Ammonia Toxicity to Four Benthic Marine and Estuarine Amphipod Species. C.E. Schlekat, A. Kuhn-Hines, and K.J. Scott. SAIC, Narragansett, RI. Pore water ammonia has increasingly been mentioned as a potential source of mortality in sediment toxicity tests. Ten-day water-only experiments were conducted to determine effects of aqueous ammonia to four species of amphipods commonly used in sediment testing, including *Ampelisca abdita, Eohaustorius estuarius, Leptocheirus plumulosus*, and *Rhepoxynius abronius*. To determine the influence of pH on ammonia toxicity, tests were conducted at pH 7.0, 7.7, and 8.4 for each species. A trend of increasing sensitivity to total ammonia with increasing pH was observed for all species, indicating that unionized ammonia was the more toxic form. However, sensitivity to unionized ammonia increased with decreasing pH, indicating that low pH may elicit an antagonistic effect on the toxicity of unionized ammonia. A ten-day exposure of *A. abdita* to sediment spiked with ammonia showed results similar to the water-only tests. Interpretation of study results will be used to evaluate potential effects of pore water ammonia to these amphipods in sediment toxicity tests as they are currently practiced.

338

Comparative Effects of Ammonia, Grain Size, and Contaminated Sediments on Larval Echinoderm and Oyster Sediment Elutriate Tests. T.A. Thompson, Science Applications International Corporation, Bothell WA,USA; J. Barton, UEPA, Region X, Seattle, WA, USA; D.R. Kendall and D. Fox, U.S. Army Corps of Engineers Seattle District, Seattle WA, USA

A series of experiments were conducted using larvae of the eastern Pacific sand dollar *Dendraster excentricus* and the Pacific oyster *Crassostrea gigas* to compare the differential mortality and abnormality responses to certain testing variables. The objective of the study was to provide regulatory agencies with a means of determining

- Under what conditions ammonia levels could cause a false positive response in a test.
- Under what conditions the presence of fine-grained material in a test could cause a false positive response.
- If the two species exhibit similar toxicological responses in the presence of sediment contaminants.
- To compare the results for the two species to sediment elutriate testing using protocols developed for Puget Sound, and the Ocean Disposal Testing Manual.

Results will be discussed in terms of utility to dredged sediment characterizations, marine site evaluations, and risk assessments.

339

Statistical Analysis of 10-Day Solid Phase Toxicity Data for Amphipods. G.B. Thursby and C.E. Schlekat, SAIC Environmental Testing Center, Narragansett, RI USA. The ten-day solid phase test using amphipods has become a standard test procedure for assessing toxicity of marine and estuarine sediments. Because of the variability of statistical performance from test run to test run, information on overall test performance is needed for each species being used. The purpose of this paper is to examine statistical power of the test using minimum detectable differences for alpha levels of 0.01, 0.05 and 0.10; to present statistical power based on the number of replicates used; to present test precision data for reference toxicant tests; and to make recommendations for test design based on the specific question(s) being asked. Data are available for the marine amphipod *Ampelisca abdita* from over 50 test series conducted under static conditions in the same laboratory on approximately 900 sediment samples from 1990 through 1993. Although the primary focus will be on *A. abdita*, test performance data also will be presented for the following amphipods, *Rhepoxynius abronius, Leptocheirus plumulosus*, and *Eohaustorius estuarius*. The information will be useful for making future data quality judgments within the regulatory community, where decisions often must be based on small data sets.

UNIVERSITY OF CALIFORNIA, SANTA CRUZ

BERKELEY • DAVIS • IRVINE • LOS ANGELES • RIVERSIDE • SAN DIEGO • SAN FRANCISCO SANTA BARBARA • SANTA CRUZ

INSTITUTE OF MARINE SCIENCES
EARTH AND MARINE SCIENCES BUILDING
TEL: (408) 459-4026
FAX: (408) 459-4882

SANTA CRUZ, CALIFORNIA 95064

June 12, 1998

Marine Pollution Studies Laboratory
33500 Highway 1, Granite Canyon
Monterey, CA 93940
408-624-0947

Craig J. Wilson
Bays and Estuaries Unit
Division of Water Quality
State Water Resources Control Board
Fax: 916-657-2388; 5 pages transmitted

Dear Craig,

Here are the references cited in my recent correspondence regarding statistical significance of toxicity data.

Sincerely,

John Hunt
Research Specialist

336

Developmental Status of Sediment Toxicity Bioassays. *T.M. Dillon, D.W. Moore,* T.S. Bridges. USAE Waterways Experiment Station, ...burg, MS. Sediment toxicity bioassays are required under §103 of the Ocean Dumping Act and §404(b)(1) of the Clean Water Act ...evaluate the disposal of dredged material. Regulatory use *of these tests implies* that they are fully developed. This is not always true. ...some bioassays are intuitively more appropriate than others, judging their developmental status has been difficult due to a lack ...dance. To fill this gap, input from users and developers *of sediment bioassays* was solicited over a 2 year period and is summarized ...three phased developmental paradigm. Phase I outlines activities conducted often by the initial test proponent. These include ...endpoint selection, statistical/experimental design, QA/QC, *interpretive* guidance, etc. Phase II discusses what constitutes ...acceptance of a particular test. Phase III describes a process for regulatory agencies (USEPA/USACE) to judge the ...propriateness of bioassays *vis a vis* dredged material *evaluations. For example,* technically sound, widely accepted bioassays may ...not be appropriate for regulatory usage. This developmental paradigm has several applications: 1) describes a logical, sequential ...ework for developing dredged material bioassays, 2) provides *initial guidance for evaluating* the relative developmental status of ...ment bioassays, 3) identifies gaps in our knowledge where additional research is needed and 4) provides general guidance to other ...ato-y/scientific programs using sediment bioassays (e.g. CERCLA/SARA, NRDA, EMAP, etc).

337

Ammonia Toxicity to Four Benthic Marine and Estuarine Amphipod Species. C.E. Schlekat, A. Kuhn-Hines, and K.J. Scott. SAIC, ...agansett, RI. Pore water ammonia has increasingly been mentioned as a potential source of mortality in sediment toxicity tests. ...day water-only experiments were conducted to determine effects of aqueous ammonia to four species of amphipods commonly used ...*sediment testing, including Ampelisca abdita, Eohaustorius estuarius, Leptocheirus plumulosus,* and *Rhepoxynius abronius.* To ...mine the influence of pH on ammonia toxicity, tests were conducted at pH 7.0, 7.7, and 8.4 for each species. A *trend of increasing* ...ivity to *total ammonia* with increasing pH was observed for all species, indicating that unionized ammonia was the more toxic form. ...level sensitivity to *unionized ammonia* increased with decreasing pH, indicating that low pH may elicit an antagonistic *effect on the* ...ity of *unionized ammonia.* A ten-day exposure of *A. abdita* to sediment spiked with ammonia showed results similar to the ...r-only tests. Interpretation of study results will be used to evaluate potential effects of pore water ammonia to these *amphipods* ...*sediment toxicity tests as they are* currently practiced.

338

...parative Effects of Ammonia, Grain Size, and Contaminated Sediments on Larval Echinoderm and Oyster Sediment Elutriate Tests. ...A. Thompson, Science Applications International *Corporation,* Bothell WA,USA; J. Barton, UEPA, Region X, Seattle, WA, USA; D.R. ...dall and D. Fox, U.S. Army Corps of Engineers Seattle District, Seattle WA, USA

...eries of experiments were conducted using larvae of the eastern Pacific sand dollar *Dendraster excentricus* and the Pacific oyster ...*Crassostrea gigas* to compare the *differential mortality and abnormality* responses to certain testing variables. The objective of the study ...s to provide regulatory agencies with a means of determining

- Under what conditions ammonia levels *could cause a false* positive response in a test.
- Under what conditions the presence of fine-grained material in a test could cause a false positive response.
- If the two species exhibit similar toxicological responses *in the presence of* sediment contaminants.
- To compare the results for the two species to sediment elutriate testing using protocols developed for Puget Sound, and the Ocean Disposal Testing Manual

...sults will be discussed in terms of utility to dredged sediment characterizations, marine *site evaluations, and risk* assessments.

339

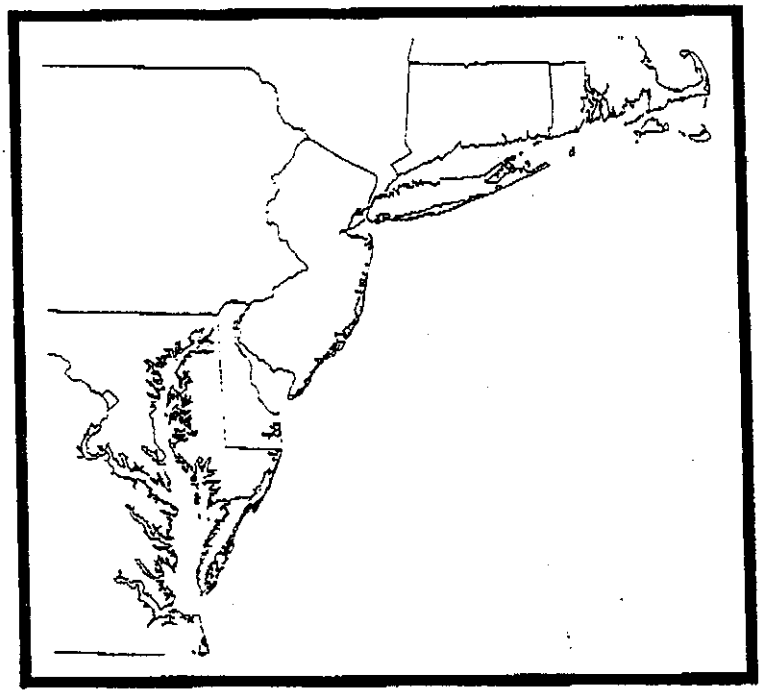
...tistical Analysis of 10 Day Solid Phase Toxicity Data for Amphipods. G.B. Thursby and C.E. Schlekat, SAIC Environmental *Testing* ...nter, Narragansett, RI USA. *The ten day solid phase* test using amphipods has become a standard test procedure for assessing toxicity ...marine and estuarine sediments. Because of the variability of statistical performance from test run to test run, information on *overall* ...st performance is needed *for each species being used.* The purpose of this paper is to examine statistical power of the test using ...imum detectable differences for alpha levels of 0.01, 0.05 and 0.10; to present statistical power based on the number of replicates ...ed to present test precision data *for reference toxicant tests;* and to make recommendations for test design based on the specific ...est aim(s) being asked. Data are available for the marine amphipod *Ampelisca abdita* from over 50 test series conducted under static ...ditions in the same laboratory on *approximately 900 sediment* samples from 1990 through 1993. Although the primary focus will ...be on *A. abdita*, test performance data also will be presented for the following amphipods, *Rhepoxynius abronius, Leptocheirus ...plumulosus,* and *Eohaustorius estuarius. The information will be useful* for making future data quality judgments within the regulatory ...community where decisions often must be based on small data sets.

United States Environmental Protection Agency
Office of Research and Development Washington DC 20460
EPA/620/R-94/005 March 1994

EPA

Statistical Summary

EMAP-Estuaries Virginian Province-1991



EMAP

Environmental Monitoring and Assessment Program

EPA/620/R-94/005
March 1994

Statistical Summary
EMAP-Estuaries
Virginian Province - 1991

by

Steven C. Schimmel
Brian D. Melzian
U.S. Environmental Protection Agency
Environmental Research Laboratory
Narragansett, RI 02882

Daniel E. Campbell
University of Rhode Island
Graduate School of Oceanography

Charles J. Strobel
Sandra J. Benyi
Science Applications International Corporation

Jeffrey S. Rosen
Henry W. Buffum
Computer Sciences Corporation

Virginian Province Manager
Norman I. Rubinstein

Project Officer
Brian Melzian

United States Environmental Protection Agency
Environmental Research Laboratory
27 Tarzwell Drive
Narragansett, RI 02882

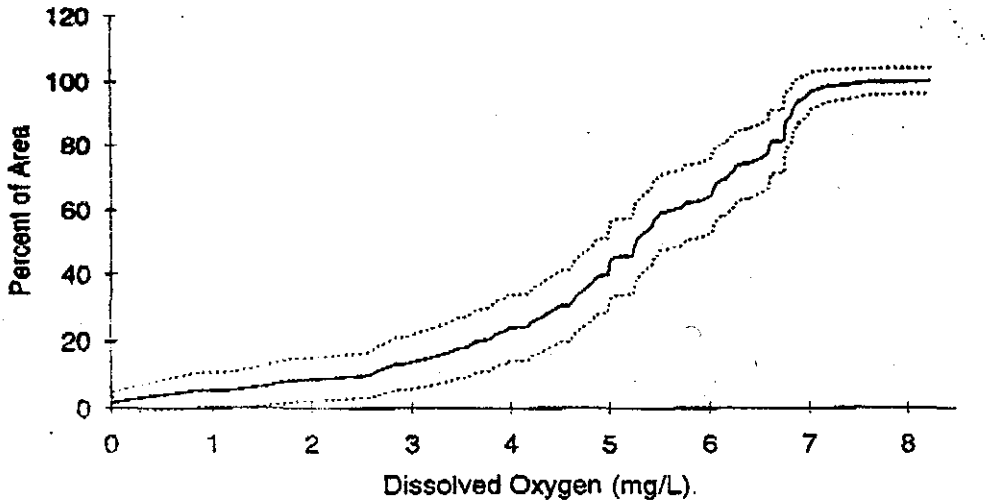


Figure 3-15. Cumulative distribution of the minimum bottom oxygen concentration measured over a 24-hour period as a percent of area in the Virginian Province, 1991. (Dashed lines are the 95% confidence intervals).

The percent area classified as degraded based on a value of ≤2 mg/L in the Virginian Province calculated from continuous and instantaneous DO measurements do not differ significantly. Data collected during the 1990 Demonstration Project show that temporal variability in DO concentration is less diurnal than in other regions (*i.e.*, the Gulf of Mexico), and that a much longer time series is required to "better" classify a station as degraded than a simple point measurement. Thus, in addition to the logistics and additional cost involved in the relatively short-term deployment of the DataSondes, resulted in this measurement being discontinued after 1991.

3.2.1.3 Dissolved Oxygen Stratification

The difference between surface and bottom DO concentrations measured at base sampling stations is illustrated in Figure 3-16. Differences between bottom and surface DO were less than 1 mg/L in 67 ± 10% of the area of the Province. Approximately 8 ± 6% of the area of the Province showed differences greater than 5 mg/L. This agrees with the data presented on stratification in Section 3.3.5 in which 76 ± 10% of the Province was found to be well-mixed and 7 ± 7% significantly stratified.

Figure 3-17 illustrates DO differences by estuarine class. All of the highly stratified area was found in the large estuaries and large tidal rivers (8 ± 8% and 17 ± 32%, respectively, exceeding 5 mg/L), with the largest Δ DO measured being 7.8 mg/L.

3.2.2 *Sediment Toxicity*

Sediment toxicity tests were performed on the composite sample of surficial sediments collected from each sampling site. Solid-phase sediment toxicity tests (Swartz *et al.*, 1985) with the tube-dwelling amphipod, *Ampelisca abdita*, were conducted according to procedures described in U.S. EPA/ACE (1991) and ASTM (1991). Sediments were classified as toxic if amphipod survival in the test sediment was less than 80% of that in the control sediment and significantly different. Approximately 21 ± 10% of the sampled area of the Virginian Province exhibited toxic sediments (Figure 3-18). However, only 1 ± 10% of the area had sediments where survival fell below 60% of control survival (*i.e.*, sediments were very toxic). The estuarine class with the largest proportion of toxic sediments was the large estuarine class (24 ± 13%); with the small estuaries and large tidal river classes exhibiting a lesser extent of toxicity (19 ± 14% and 10 ± 7%, respectively: Figure 3-19). However, the confidence intervals around all these

Based on t-test