Appendix C

Summary and Analysis of Sediment Bioassays for the Baseline Ecological Risk Assessment

Halaco Superfund Site, Oxnard, California

Remedial Investigation

Prepared for

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Acronyms and Abbreviations

°C	degrees Celsius
ANOVA	Analyses of Variance
BERA	baseline ecological risk assessment
COPEC	constituent of potential ecological concern
Halaco	Halaco Engineering Co.
LC_{50}	lethal concentration with 50 percent mortality
LOEC	lowest observed effect concentrations
ml	milliliter(s)
NCL	Nature Conservancy Land
OID	Oxnard Industrial Drain
PEC	probable effects concentration
RI	Remedial Investigation
Site	Halaco Engineering Co. Superfund Site
SLERA	screening-level ecological risk assessment
WMU	waste management unit

APPENDIX C

Summary and Analysis of Sediment Bioassays

This appendix provides a summary and analysis of the sediment bioassay testing that was performed as part of the "Tier 2" biological testing at the Halaco Engineering Co. Superfund Site (Halaco Site, or Site) in Oxnard, California. "Tier 2" biological samples were collected during June 2011 to evaluate potential ecological risks and support the preparation of the Baseline Ecological Risk Assessment (BERA) at the Halaco Site.

C.1 Objectives

Results of the Screening-Level Ecological Risk Assessment (SLERA; CH2M HILL, 2008) and the Remedial Investigation (RI) sampling and analysis results (CH2M HILL, 2011a, 2011b, 2011c, 2011d, 2012, 2013) for the Halaco Site suggested that concentrations of metals in sediment from the Site were sufficiently elevated to be toxic to resident benthic invertebrates. Sediment samples were collected and site-specific bioassays were conducted to provide more refined data on the potential toxicity of sediment.

C.2 Methods

C.2.1 Field

On June 23, 2011, sediment samples were collected from 15 locations representing low, medium, and high concentrations of constituents of potential ecological concern (COPECs) based on previous sampling results. A field duplicate was collected from one of these locations. Appendix A provides a summary of the sampling locations and field methods. Appendix B provides a summary of the previous sampling results, including analytical data tables and figures depicting lead concentrations in solid matrix media. Approximately 10 liters of sediment were collected for toxicity testing from each sampling location, and delivered to Nautilus Environmental laboratory (Nautilus) in San Diego, California. The sediment was transported and held in food-grade polyethylene plastic bags. Samples were bagged and shipped in coolers with wet ice.

C.2.2 Laboratory

Chronic, 42-day sediment bioassays using the freshwater amphipod *Hyalella azteca* were conducted by Nautilus. The tests measured survival, growth, and reproduction endpoints and were conducted following U.S. Environmental Protection Agency (EPA) *Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates* (EPA, 2000). A brief summary of the test method is presented below. Appendix A includes a copy of the laboratory report that provides additional information regarding the testing procedures.

The sediment bioassay consisted of exposure of 7- to 8-day-old *Hyalella azteca* to field-collected sediments for 42 days to determine the effects of sediment on survival, growth, and reproduction. Test chambers consisted of 1-liter glass jars fitted with the Zumwalt water renewal system. The test was conducted in an environmental chamber maintained at 23 (± 1) degrees Celsius (°C) under a 16-hour (light): 8-hour (dark) light cycle. The experimental design consisted of 12 replicate jars per treatment arranged in a predetermined random order. Four of the test chambers were used for an intermediate endpoint consisting of survival and growth on Day 28, while the remaining eight replicates were used for determination of survival, growth, and reproduction after a 42-day exposure[1]. An additional replicate (surrogate) was included for each site as a test chamber used for daily water quality and ammonia measurements. Approximately 2 centimeters of sediment was placed in each chamber; 400 milliliters (ml) of activated-carbon-filtered soft water was then added to each. Sediments were allowed to settle and the system was allowed to equilibrate for 24 hours prior to the addition of test organisms. Ten amphipods were randomly added to each test chamber after confirmation by two technicians that the correct number of

[1] Note that analyses were only conducted on the 42-day results.

test organisms was segregated and in healthy condition. A source of food was provided during the test period by adding 1 to 2 ml of a mixture of yeast, cerophyll, trout chow per chamber daily. Twice daily, 80 percent of the overlying water was renewed to maintain water quality conditions. Temperature, dissolved oxygen, pH, and conductivity were monitored daily in the surrogate replicate test chamber for each site.

Subsamples of interstitial porewater were collected prior to test initiation, and overlying water was collected from each surrogate at Days 0, 7, 14, 21, 28, 35, and 42 for analysis of total ammonia. On Day 28 of the test period, sediment in each test chamber was gently sieved through a 0.5-millimeter screen, and the number of surviving amphipods recorded. Amphipods in four pre-selected test chambers of each treatment and control were sacrificed for determination of dry weight. Amphipods in the remaining eight test chambers of each treatment were placed into clean jars without sediment and activated-carbon-filtered soft water. A nitex screen was added as a clean substrate for the amphipods. At Day 35, the young produced in each test chamber were recorded and removed. At Day 42, the number of young produced was again recorded for each test chamber. The number of surviving adult amphipods remaining was recorded, their gender determined, and they were then placed in an oven at 60°C for determination of dry weight.

A positive control reference toxicant test using copper chloride was conducted concurrently to estimate the sensitivity of the test organisms in relation to those historically tested at Nautilus. The sediment samples were tested in two batches: the first batch of eight samples was initiated on July 6, 2011; the second batch of eight samples was initiated on July 7, 2011. One sample was split and tested on both days (labeled as LGF-012 and LGF-112). Both of the amphipod tests contained concurrent negative controls, which consisted of fine beach sand thoroughly rinsed with deionized water prior to use; these were considered the laboratory controls.

C.3 Data Analyses

Multiple analytical methods were employed to describe distributions of bioassay responses and analytical chemistry measurements, to identify differences between bioassay responses in laboratory control and field collected samples, and to describe associations among bioassay responses and analytical chemistry measurements. All statistical analyses and data manipulations were performed using SAS software (SAS Institute, Inc. 2008).

Summary statistics (n, mean, standard deviation, minimum, median, maximum) were calculated for bioassay responses and analytical chemistry results in all media for descriptive purposes.

Analyses of Variance (ANOVA) of rank-transformed bioassay responses were performed to identify differences among responses in field-collected samples and laboratory controls. This approach is comparable to the Kruskal-Wallis nonparamatric ANOVA (SAS Institute, Inc. 1988). Differences were considered statistically significant if $p \leq 0.05$. If a statistically significant ANOVA was obtained, Student-Newman-Keuls tests were performed to identify which sample locations had responses that differed from one another.

Bivariate scatterplots of each bioassay response and concentrations of each analyte in each media were created and evaluated visually to identify possible dose-response trends. Published media-specific effect thresholds were overlaid on these scatterplots to guide determination of the potential that a given analyte may have been contributing to observed responses. For example, if concentrations in samples where statistically significant effects were observed are less than published effect levels, it is unlikely that this analyte is contributing to effects. Conversely, if the analyte concentrations are consistent with, or greater than, published effect levels, it is more likely that this analyte is contributing to effects.

Regression analyses, on untransformed and natural-log transformed data, were performed for each bioassay response and for chemical measurements in test media to determine the degree to which analyte concentrations were associated with bioassay responses. All regression analyses were performed with the response variable scaled as the proportion of the appropriate laboratory control response. The null

hypothesis for these tests was that bioassay responses are not significantly associated with the chemical measured in test media. Results were considered statistically significant if $p \leq 0.05$.

Ultimately, a weight-of-evidence approach was employed to identify which analytes were most likely to be associated with effects. Analytes with concentrations falling below the range of concentrations associated with effects reported in published literature were excluded as potential contributors to toxic effects. Similarly, analytes where the bioassay response at the maximum concentration was not statistically reduced relative to controls (for example, absence of toxicity at the highest concentrations tested) were excluded as potential contributors to toxic effects. The lack of statistically significant regressions was viewed as supporting a conclusion that an analyte was not contributing to observed effects, but that conclusion was not considered to be definitive. This is because analytes may not be correlated with effects over most samples, but may be present at potentially toxic concentrations in samples from specific locations.

C.4 Results

Summary statistics for 42-day survival, growth, and reproduction for *Hyalella azteca* exposed to sediments from the Halaco Site are summarized in Table C-1 and displayed in Figure C-1. Statistically significant effects relative to controls were observed only for survival and reproduction. No statistically significant reduction in growth was observed for any samples. Among observed effects, reduced survival was evident in a greater number of samples than was reduced reproduction.

Amphipod survival was significantly reduced relative to laboratory controls at 8 of 15 sample locations (note that samples LGF-012 and LGF-112 represent the same location). Areas displaying reduced survival included all samples from the northwest and southeast lagoon fingers, both samples from the main lagoon, and one of the Nature Conservancy Land (NCL)-East samples (Table C-1 and Figure C-1). Survival was not reduced in any sample from the waste management unit (WMU) ditch, northeast lagoon finger, nor two of three NCL-East samples. The two samples with the lowest survival were from the northwest lagoon finger (LGF-009) and NCL-East (NEL-007).

Reproduction was significantly reduced in only two samples, one from the northwest lagoon finger (LGF-009) and one from NCL-East (NEL-007). These two samples also displayed the lowest survival rates. No reproduction was observed for any replicates for either of these samples.

Evaluation of the scatterplots of bioassay responses versus COPEC concentrations in sediment indicates that clear dose-response relationships are not readily evident for most analytes. In many cases, samples with the lowest survival and reproduction occur at both low and high analyte concentrations. This suggests effects may be resulting from different causes depending upon the sample. COPEC concentrations for one of the samples with the lowest survival and reproduction (NEL-007) almost always represent the maximum concentration observed and frequently exceed literature-based effect thresholds (Figures C-2 through C-30). In contrast, the other sample with significantly reduced survival or reproduction (LGF-009) never exceeds any literature-based effect thresholds and consistently has among the lowest COPEC concentrations of any sample tested. All other samples that displayed significantly reduced survival (but not reduced reproduction) also had lower to moderate COPEC concentrations, and either never or only occasionally exceeded low literature-based effect thresholds. All of these samples, and LGF-009, however, generally displayed the largest median grain size (Figure C-24) and the lowest percentages of silt and clay (Figures C-27 and C-28, respectively). The interpretation of these data, therefore, is that whereas reduced survival and reproduction in sample NEL-007 is likely due to elevated concentrations of a number of metals, reduced survival and reproduction in sample LGF-009, and reduced survival in the other northwest and southeast lagoon finger samples and both samples from the main lagoon are likely driven by sediment grain size and not contamination.

The pyrethroid and organophosphate pesticides analyzed for in a subset of the bioassay samples collected from the Oxnard Industrial Drain (OID) Lagoon and WMU Ditch were not used in the statistical analysis of the bioassay data; however, a qualitative evaluation was conducted. Pyrethroid and organophosphate data

were available only for 5 of 16 sediment samples (15 native and 1 field duplicate), of which only 2 samples (LGF-007 and LGM-003) displayed effects relative to controls. Whereas one of these samples, LGM-003, had four pyrethroids that exceeded the LC_{50} (lethal concentration with 50 percent mortality) (see Appendix G), the other sample (LGF-007) did not. Only one organophosphate was detected in these two samples, and these concentrations did not exceed the LC_{50}. Because of the limited number of samples with pyrethroid data and the lack of a consistent finding of pyrethroid exceedances of LC_{50} in samples with effects, definitive conclusions concerning effects of pyrethroids and organophosphates cannot be made.

Regression analyses of untransformed and transformed data indicated few statistically significant relationships (Table C-2). Statistically significant relationships were not obtained for any analytes for growth, and only for one analyte (silver) for reproduction. For survival, silver, cadmium, and cobalt all displayed significant negative relationships, while percent silt and percent silt plus clay display significant positive relationships. These results support the interpretation that sediment characteristics are influencing bioassay responses in some samples and not COPEC concentrations.

C.5 Conclusions

Sediment bioassays were conducted on samples collected at or near the Halaco Site. Reduced survival was observed in 8 of 15 samples, including all samples from the northwest and southeast lagoon fingers, both samples from the main lagoon, and one of the NCL-East samples. Growth was not affected in any sample. Reproduction was reduced in only two samples, one from the northwest lagoon finger (LGF-009) and one from NCL-East (NEL-007).

Evaluation of scatterplots and regression analyses of these data suggest that bioassay responses in most samples are driven by sediment characteristics (larger grain size and lower percentage of silt and clay). Only in the single NCL-East sample (NEL-007) do elevated COPEC concentrations appear to be associated with effects (maximum concentrations that exceed published effect levels are observed in this sample for a number of COPECs).

Site-specific sediment lowest observed effect concentrations (LOECs) were therefore developed based on the NEL-007 bioassay sample results (Table C-3). These LOECs represent concentrations in sample NEL-007 that displayed significantly reduced survival and reproduction relative to controls. All concentrations were maximum for any sample tested. Many also exceeded probable effects concentration (PEC) values.

C.6 References

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Tables

TABLE C-1

Summary Statistics and Results of Rank ANOVA for Responses of Hyalella azteca Exposed to Sediments from the Halaco Site

Baseline Ecological Risk Assessment, Halaco Site, Oxnard, California

Sample ID	Area	Bioassay Response	n	mean	std	min	median	max	Results of Rank ANOVA[1,2]
Lab Control 1	Lab Control	42-day Survival (percent)	8	92.50	8.86	80	95	100	AB
Lab Control 2	Lab Control	42-day Survival (percent)	8	90.00	10.69	70	90	100	AB
DSA-001	WMU Ditch	42-day Survival (percent)	8	86.25	9.16	70	90	100	ABC
DSA-003	WMU Ditch	42-day Survival (percent)	8	95.00	7.56	80	100	100	A
DSA-006	WMU Ditch	42-day Survival (percent)	8	88.75	8.35	70	90	100	ABC
LGF-001	NE Lagoon Finger	42-day Survival (percent)	8	92.50	7.07	80	90	100	AB
LGF-003	NE Lagoon Finger	42-day Survival (percent)	8	78.75	16.42	50	80	100	BCD
LGF-007	NW Lagoon Finger	42-day Survival (percent)	8	67.50	12.82	50	65	90	DEF
LGF-008	NW Lagoon Finger	42-day Survival (percent)	8	56.25	21.34	30	60	90	DEFG
LGF-009	NW Lagoon Finger	42-day Survival (percent)	8	10.00	10.69	0	10	30	H
LGF-010	SE Lagoon Finger	42-day Survival (percent)	8	46.25	22.00	0	50	80	FGH
LGF-012	SE Lagoon Finger	42-day Survival (percent)	8	55.00	16.04	30	55	80	EFG
LGF-112	SE Lagoon Finger	42-day Survival (percent)	8	72.50	16.69	50	80	90	CDE
LGM-001	Lagoon Main	42-day Survival (percent)	8	63.75	15.98	40	70	90	DEF
LGM-003	Lagoon Main	42-day Survival (percent)	8	70.00	10.69	50	70	80	DEF
NEL-007	NCL East	42-day Survival (percent)	8	26.25	14.08	10	25	50	GH
NEL-009	NCL East	42-day Survival (percent)	8	78.75	16.42	50	80	100	BCD
NEL-021	NCL East	42-day Survival (percent)	8	77.50	17.53	40	85	90	BCD
Lab Control 1	Lab Control	42-Day Growth (mg/animal)	8	0.27	0.06	0.16	0.27	0.37	B
Lab Control 2	Lab Control	42-Day Growth (mg/animal)	8	0.29	0.03	0.24	0.29	0.33	AB
DSA-001	WMU Ditch	42-Day Growth (mg/animal)	8	0.34	0.04	0.27	0.345	0.37	AB
DSA-003	WMU Ditch	42-Day Growth (mg/animal)	8	0.24	0.11	0.12	0.21	0.43	B
DSA-006	WMU Ditch	42-Day Growth (mg/animal)	8	0.27	0.06	0.18	0.27	0.37	B
LGF-001	NE Lagoon Finger	42-Day Growth (mg/animal)	8	0.31	0.04	0.25	0.31	0.36	AB
LGF-003	NE Lagoon Finger	42-Day Growth (mg/animal)	8	0.31	0.06	0.25	0.3	0.43	AB
LGF-007	NW Lagoon Finger	42-Day Growth (mg/animal)	8	0.36	0.08	0.29	0.325	0.47	AB
LGF-008	NW Lagoon Finger	42-Day Growth (mg/animal)	8	0.48	0.29	0.13	0.45	0.93	AB
LGF-009	NW Lagoon Finger	42-Day Growth (mg/animal)	5	0.42	0.07	0.33	0.45	0.48	A
LGF-010	SE Lagoon Finger	42-Day Growth (mg/animal)	8	0.34	0.07	0.24	0.32	0.47	AB
LGF-012	SE Lagoon Finger	42-Day Growth (mg/animal)	8	0.46	0.11	0.3	0.455	0.68	A
LGF-112	SE Lagoon Finger	42-Day Growth (mg/animal)	8	0.41	0.15	0.17	0.395	0.68	AB
LGM-001	Lagoon Main	42-Day Growth (mg/animal)	8	0.49	0.20	0.17	0.45	0.87	A
LGM-003	Lagoon Main	42-Day Growth (mg/animal)	8	0.39	0.06	0.29	0.38	0.47	AB
NEL-007	NCL East	42-Day Growth (mg/animal)	8	0.32	0.16	0.04	0.35	0.52	AB
NEL-009	NCL East	42-Day Growth (mg/animal)	8	0.33	0.13	0.16	0.285	0.55	AB
NEL-021	NCL East	42-Day Growth (mg/animal)	8	0.32	0.16	0.18	0.29	0.68	AB
Lab Control 1	Lab Control	Reproduction (young/female)	8	3.52	1.39	1.625	3.63095	5.5	AB
Lab Control 2	Lab Control	Reproduction (young/female)	8	5.50	2.38	2.75	5.45833	8.75	A
DSA-001	WMU Ditch	Reproduction (young/female)	8	4.59	2.33	3	3.52083	9.75	A
DSA-003	WMU Ditch	Reproduction (young/female)	8	5.88	2.16	2.625	6	8.4	A
DSA-006	WMU Ditch	Reproduction (young/female)	8	2.91	1.71	1	2.7	6.4286	AB
LGF-001	NE Lagoon Finger	Reproduction (young/female)	8	3.44	1.11	1.66667	4	4.4	AB
LGF-003	NE Lagoon Finger	Reproduction (young/female)	8	2.78	0.95	1.4	3.08333	4	AB
LGF-007	NW Lagoon Finger	Reproduction (young/female)	8	4.94	2.75	1.33333	5.25	9	A
LGF-008	NW Lagoon Finger	Reproduction (young/female)	8	5.56	4.46	0.25	4.625	14	A
LGF-009	NW Lagoon Finger	Reproduction (young/female)	8	0.00	0.00	0	0	0	C
LGF-010	SE Lagoon Finger	Reproduction (young/female)	8	2.53	2.60	0	1.54167	6.3333	AB
LGF-012	SE Lagoon Finger	Reproduction (young/female)	8	1.02	1.10	0	0.66667	2.5	BC
LGF-112	SE Lagoon Finger	Reproduction (young/female)	8	6.89	4.23	0.66667	6.0119	14	A
LGM-001	Lagoon Main	Reproduction (young/female)	8	4.11	2.75	0	5.46667	6.5	A
LGM-003	Lagoon Main	Reproduction (young/female)	8	4.45	2.50	0	5	8.3333	A
NEL-007	NCL East	Reproduction (young/female)	8	0.00	0.00	0	0	0	C
NEL-009	NCL East	Reproduction (young/female)	8	5.61	2.95	2.66667	4.30952	10.5	A
NEL-021	NCL East	Reproduction (young/female)	8	4.94	3.94	0.5	4.875	12	A

Notes:

* Samples with the same letter do not differ significantly from each other

TABLE C-2

Summary of Regressions for *Hyalella azteca* Responses (scaled as proportion of lab controls) vs Analyte Concentrations (untransformed or LN transformed) in Sediment (all non-detects were excluded from the analysis)

Baseline Ecological Risk Assessment, Halaco Site, Oxnard, California

				Untransformed								Log transformed				
Analgrp	**Analyte**	**_DEPVAR_**	**_RMSE_**	**Intercept**	**slope**	**N**	**p-value**	**r-square**	**Analgrp**	**Analyte**	**_RMSE_**	**Intercept**	**slope**	**N**	**p-value**	**r-square**
Metal	Ag	surv42sc	0.1882	1.3109	-0.1891	32	<0.0001	0.688	Metal	Ag	0.2321	1.1668	-0.4316	32	<0.0001	0.525
Metal	Al	surv42sc	0.2946	0.7464	0.0000	128	0.3509	0.007	Metal	Al	0.2814	0.1826	0.0603	128	0.0004	0.094
Metal	As	surv42sc	0.2907	0.6484	0.0286	128	0.0405	0.033	Metal	As	0.2785	0.6182	0.1368	128	0.0001	0.112
Metal	Ba	surv42sc	0.2951	0.7411	0.0000	128	0.5410	0.003	Metal	Ba	0.2787	0.4541	0.0577	128	0.0001	0.111
Metal	Be	surv42sc	0.2953	0.7395	-0.0046	128	0.6333	0.002	Metal	Be	0.2795	0.7525	0.0671	128	0.0002	0.106
Metal	Ca	surv42sc	0.2778	0.6439	0.0000	128	<0.0001	0.117	Metal	Ca	0.2717	-0.2126	0.0950	128	<0.0001	0.155
Metal	Cd	surv42sc	0.2235	0.9778	-0.0703	80	<0.0001	0.203	Metal	Cd	0.2394	0.8839	-0.1070	80	0.0083	0.086
Metal	Co	surv42sc	0.2407	1.2989	-0.0726	56	<0.0001	0.277	Metal	Co	0.2583	1.5569	-0.4008	56	0.0017	0.167
Metal	Cr	surv42sc	0.2930	0.7537	-0.0004	128	0.1381	0.017	Metal	Cr	0.2869	0.5811	0.0518	128	0.0064	0.058
Metal	Cu	surv42sc	0.2944	0.7449	0.0000	128	0.3235	0.008	Metal	Cu	0.2764	0.5679	0.0421	128	<0.0001	0.125
Metal	Fe	surv42sc	0.2799	0.5416	0.0000	128	0.0002	0.103	Metal	Fe	0.2742	-1.1609	0.2062	128	<0.0001	0.140
Metal	K	surv42sc	0.2465	0.8465	0.0000	96	0.4054	0.007	Metal	K	0.2471	0.9489	-0.0181	96	0.6245	0.003
Metal	Mg	surv42sc	0.2941	0.7545	0.0000	128	0.2654	0.010	Metal	Mg	0.2833	0.0768	0.0777	128	0.0011	0.081
Metal	Mn	surv42sc	0.2948	0.7485	0.0000	128	0.4260	0.005	Metal	Mn	0.2834	0.3130	0.0761	128	0.0012	0.080
Metal	Na	surv42sc	0.2841	0.6662	0.0000	128	0.0016	0.076	Metal	Na	0.2803	-0.2332	0.1257	128	0.0003	0.101
Metal	Ni	surv42sc	0.2955	0.7364	-0.0002	128	0.7810	0.001	Metal	Ni	0.2799	0.5294	0.0755	128	0.0002	0.103
Metal	Pb	surv42sc	0.3035	0.7258	0.0001	120	0.7909	0.001	Metal	Pb	0.2786	0.5480	0.0660	120	<0.0001	0.158
Metal	Sb	surv42sc	0.2313	0.9197	-0.0261	80	0.0004	0.147	Metal	Sb	0.2449	0.8597	-0.0465	80	0.0638	0.043
Metal	Se	surv42sc	0.2854	0.5884	0.0705	40	0.0372	0.109	Metal	Se	0.2924	0.6343	0.1636	40	0.1113	0.065
Metal	V	surv42sc	0.2726	0.9071	-0.0040	128	<0.0001	0.149	Metal	V	0.2813	1.1738	-0.1245	128	0.0004	0.094
Metal	Zn	surv42sc	0.2955	0.7348	0.0000	128	0.8190	0.000	Metal	Zn	0.2781	0.4491	0.0578	128	<0.0001	0.114
Misc	Pct_TOC	surv42sc	0.2694	0.5584	0.2136	128	<0.0001	0.170	Misc	Pct_TOC	0.2645	0.8067	0.0932	128	<0.0001	0.199
Misc	pH	surv42sc	0.2864	3.6047	-0.3618	128	0.0050	0.061	Misc	pH	0.2864	6.6571	-2.8600	128	0.0049	0.061
PCDD/PCDF	1234678HpCDD	surv42sc	0.1939	0.8060	0.0006	72	0.0224	0.072	PCDD/PCDF	1234678HpCDD	0.1836	0.5886	0.0676	72	0.0004	0.167
PCDD/PCDF	1234678HpCDF	surv42sc	0.1708	0.8662	0.0003	64	0.0743	0.050	PCDD/PCDF	1234678HpCDF	0.1658	0.7137	0.0449	64	0.0089	0.105
PCDD/PCDF	1234789HpCDF	surv42sc	0.1030	1.0258	-0.0013	24	0.4706	0.024	PCDD/PCDF	1234789HpCDF	0.1039	1.0397	-0.0153	24	0.6952	0.007
PCDD/PCDF	123478HxCDD	surv42sc	0.1511	0.9046	0.0045	24	0.6240	0.011	PCDD/PCDF	123478HxCDD	0.1497	0.7986	0.0681	24	0.4286	0.029
PCDD/PCDF	123478HxCDF	surv42sc	0.1288	0.9619	0.0001	40	0.9059	0.000	PCDD/PCDF	123478HxCDF	0.1288	0.9617	0.0011	40	0.9653	0.000
PCDD/PCDF	123678HxCDD	surv42sc	0.1663	0.8943	0.0022	48	0.4259	0.014	PCDD/PCDF	123678HxCDD	0.1660	0.8382	0.0357	48	0.3572	0.018
PCDD/PCDF	123678HxCDF	surv42sc	0.1283	0.9573	-0.0005	32	0.5568	0.012	PCDD/PCDF	123678HxCDF	0.1266	1.0261	-0.0286	32	0.2950	0.036
PCDD/PCDF	123789HxCDD	surv42sc	0.1285	0.9807	-0.0013	40	0.6494	0.005	PCDD/PCDF	123789HxCDD	0.1284	1.0060	-0.0179	40	0.6112	0.007
PCDD/PCDF	123789HxCDF	surv42sc	0.1386	0.9457	0.0008	32	0.7998	0.002	PCDD/PCDF	123789HxCDF	0.1383	0.9147	0.0171	32	0.6795	0.006
PCDD/PCDF	12378PeCDD	surv42sc	0.1491	1.0759	-0.0168	24	0.3669	0.037	PCDD/PCDF	12378PeCDD	0.1482	1.2569	-0.1538	24	0.3012	0.048
PCDD/PCDF	12378PeCDF	surv42sc	0.1020	1.0346	-0.0027	24	0.3255	0.044	PCDD/PCDF	12378PeCDF	0.1035	1.0479	-0.0216	24	0.5623	0.015
PCDD/PCDF	234678HxCDF	surv42sc	0.1632	0.8816	0.0012	48	0.1248	0.050	PCDD/PCDF	234678HxCDF	0.1555	0.7243	0.0640	48	0.0094	0.138
PCDD/PCDF	23478PeCDF	surv42sc	0.1288	0.9661	0.0000	40	0.9740	0.000	PCDD/PCDF	23478PeCDF	0.1288	0.9812	-0.0054	40	0.8532	0.001
PCDD/PCDF	2378TCDD	surv42sc	0.0918	1.2608	-0.1368	16	0.0179	0.339	PCDD/PCDF	2378TCDD	0.0918	1.1618	-0.2620	16	0.0179	0.339
PCDD/PCDF	2378TCDF	surv42sc	0.1650	0.8582	0.0073	56	0.0476	0.071	PCDD/PCDF	2378TCDF	0.1598	0.7864	0.0744	56	0.0067	0.128
PCDD/PCDF	HpCDD_Total	surv42sc	0.1950	0.8106	0.0002	72	0.0353	0.062	PCDD/PCDF	HpCDD_Total	0.1852	0.5402	0.0652	72	0.0007	0.153
PCDD/PCDF	HpCDF_Total	surv42sc	0.1727	0.8764	0.0001	64	0.1822	0.029	PCDD/PCDF	HpCDF_Total	0.1683	0.7447	0.0344	64	0.0254	0.078
PCDD/PCDF	HxCDD_Total	surv42sc	0.1687	0.8837	0.0002	56	0.2145	0.028	PCDD/PCDF	HxCDD_Total	0.1659	0.7174	0.0412	56	0.0666	0.061
PCDD/PCDF	HxCDF_Total	surv42sc	0.1664	0.8732	0.0002	56	0.0842	0.054	PCDD/PCDF	HxCDF_Total	0.1638	0.7221	0.0402	56	0.0306	0.084
PCDD/PCDF	OCDD	surv42sc	0.2838	0.6154	0.0003	112	<0.0001	0.177	PCDD/PCDF	OCDD	0.2588	0.2424	0.0984	112	<0.0001	0.315
PCDD/PCDF	OCDF	surv42sc	0.1716	0.8674	0.0002	64	0.1073	0.041	PCDD/PCDF	OCDF	0.1696	0.7059	0.0420	64	0.0447	0.063
PCDD/PCDF	PeCDD_Total	surv42sc	0.1658	0.8740	0.0004	56	0.0643	0.062	PCDD/PCDF	PeCDD_Total	0.1565	0.7404	0.0448	56	0.0020	0.164
PCDD/PCDF	PeCDF_Total	surv42sc	0.1663	0.8743	0.0002	56	0.0788	0.056	PCDD/PCDF	PeCDF_Total	0.1593	0.6513	0.0549	56	0.0056	0.134
PCDD/PCDF	TCDD_Total	surv42sc	0.2461	0.7140	0.0021	72	0.0001	0.189	PCDD/PCDF	TCDD_Total	0.2138	0.4768	0.1145	72	<0.0001	0.388
PCDD/PCDF	TCDF_Total	surv42sc	0.2416	0.7494	0.0006	72	0.0011	0.143	PCDD/PCDF	TCDF_Total	0.2421	0.5851	0.0617	72	0.0013	0.139
Pesticide	44DDE	surv42sc	0.1188	0.7778	0.0000	8		0.000	Pesticide	44DDE	0.1188	0.7778	0.0000	8		0.000
Pesticide	Bifenthrin	surv42sc	0.1575	0.8721	-0.0012	40	0.5421	0.010	Pesticide	Bifenthrin	0.1521	0.8201	0.0246	40	0.0836	0.077

TABLE C-2

Summary of Regressions for *Hyalella azteca* Responses (scaled as proportion of lab controls) vs Analyte Concentrations (untransformed or LN transformed) in Sediment (all non-detects were excluded from the analysis)

Baseline Ecological Risk Assessment, Halaco Site, Oxnard, California

				Untransformed								Log transformed				
Analgrp	**Analyte**	**_DEPVAR_**	**_RMSE_**	**Intercept**	**slope**	**N**	**p-value**	**r-square**	**Analgrp**	**Analyte**	**_RMSE_**	**Intercept**	**slope**	**N**	**p-value**	**r-square**
Pesticide	Chlorpyrifos	surv42sc	0.1493	0.8880	-0.0020	32	0.1040	0.086	Pesticide	Chlorpyrifos	0.1560	0.8580	0.0025	32	0.8522	0.001
Pesticide	Permethrin	surv42sc	0.1286	0.7181	0.0211	32	0.0002	0.371	Pesticide	Permethrin	0.1335	0.8230	0.0465	32	0.0007	0.322
Phthalate	Bis(2-ethylhexyl)phthalate	surv42sc	0.3228	0.5688	0.0020	48	0.0013	0.203	Phthalate	Bis(2-ethylhexyl)phthalate	0.2919	-0.1811	0.2309	48	<0.0001	0.348
Phthalate	Dimethylphthalate	surv42sc	0.3300	0.3998	0.0036	56	0.0046	0.139	Phthalate	Dimethylphthalate	0.3366	-0.0424	0.1694	56	0.0152	0.104
grain	MedGrainSize	surv42sc	0.2736	0.8606	-0.5447	128	<0.0001	0.143	grain	MedGrainSize	0.2775	0.5419	-0.1000	128	<0.0001	0.119
grain	PctClay	surv42sc	0.2886	0.6593	0.0165	128	0.0141	0.047	grain	PctClay	0.2710	0.6673	0.0819	128	<0.0001	0.159
grain	PctSand-Fine	surv42sc	0.2909	0.8524	-0.0034	128	0.0461	0.031	grain	PctSand-Fine	0.2918	1.2285	-0.1412	128	0.0743	0.025
grain	PctSand-Medium	surv42sc	0.2784	0.8594	-0.0043	128	0.0001	0.113	grain	PctSand-Medium	0.2827	1.0183	-0.0948	128	0.0008	0.085
grain	PctSilt	surv42sc	0.2668	0.5602	0.0057	128	<0.0001	0.185	grain	PctSilt	0.2609	0.5211	0.0802	128	<0.0001	0.221
grain	PctSiltClay	surv42sc	0.2702	0.5713	0.0047	128	<0.0001	0.165	grain	PctSiltClay	0.2616	0.5023	0.0822	128	<0.0001	0.216
Metal	Ag	gro42sc	0.3987	0.9361	0.0399	32	0.4245	0.021	Metal	Ag	0.3994	0.9630	0.0952	32	0.46563659	0.018
Metal	Al	gro42sc	0.4854	1.3488	0.0000	128	0.0155	0.047	Metal	Al	0.4678	2.3080	-0.1126	128	0.00011165	0.115
Metal	As	gro42sc	0.4748	1.5111	-0.0789	128	0.0008	0.088	Metal	As	0.4708	1.4689	-0.2231	128	0.00025741	0.103
Metal	Ba	gro42sc	0.4864	1.3460	-0.0002	128	0.0207	0.043	Metal	Ba	0.4699	1.7459	-0.0961	128	0.00020155	0.107
Metal	Be	gro42sc	0.4844	1.3579	-0.0405	128	0.0116	0.051	Metal	Be	0.4690	1.2477	-0.1160	128	0.0001577	0.110
Metal	Ca	gro42sc	0.4969	1.2943	0.0000	128	0.7174	0.001	Metal	Ca	0.4971	1.3348	-0.0055	128	0.88186253	0.000
Metal	Cd	gro42sc	0.4420	1.2129	-0.0215	80	0.4924	0.006	Metal	Cd	0.4408	1.2010	-0.0682	80	0.3519	0.011
Metal	Co	gro42sc	0.4964	1.4840	-0.0461	56	0.1668	0.035	Metal	Co	0.4898	1.9782	-0.4307	56	0.0672	0.061
Metal	Cr	gro42sc	0.4875	1.3379	-0.0011	128	0.0282	0.039	Metal	Cr	0.4698	1.6283	-0.1190	128	0.0002	0.107
Metal	Cu	gro42sc	0.4857	1.3379	-0.0001	128	0.0170	0.045	Metal	Cu	0.4694	1.5417	-0.0664	128	0.0002	0.108
Metal	Fe	gro42sc	0.4841	1.5098	0.0000	128	0.0108	0.052	Metal	Fe	0.4815	3.4260	-0.2334	128	0.0052	0.062
Metal	K	gro42sc	0.4621	1.3531	0.0000	96	0.1335	0.024	Metal	K	0.4614	2.0805	-0.1112	96	0.1092	0.027
Metal	Mg	gro42sc	0.4879	1.3577	0.0000	128	0.0323	0.037	Metal	Mg	0.4744	2.4463	-0.1380	128	0.0007	0.090
Metal	Mn	gro42sc	0.4892	1.3553	-0.0002	128	0.0474	0.032	Metal	Mn	0.4797	1.9419	-0.1197	128	0.0031	0.069
Metal	Na	gro42sc	0.4958	1.3098	0.0000	128	0.4078	0.006	Metal	Na	0.4958	1.6539	-0.0486	128	0.4186	0.005
Metal	Ni	gro42sc	0.4822	1.3718	-0.0029	128	0.0063	0.059	Metal	Ni	0.4676	1.6461	-0.1352	128	0.0001	0.115
Metal	Pb	gro42sc	0.4915	1.3722	-0.0016	120	0.0043	0.069	Metal	Pb	0.4756	1.5638	-0.1009	120	<0.0001	0.128
Metal	Sb	gro42sc	0.4384	1.2281	-0.0179	80	0.1882	0.022	Metal	Sb	0.4339	1.2151	-0.0812	80	0.0677	0.042
Metal	Se	gro42sc	0.4902	1.2854	-0.0300	40	0.5956	0.007	Metal	Se	0.4906	1.2741	-0.0798	40	0.6382	0.006
Metal	V	gro42sc	0.4957	1.3386	-0.0013	128	0.3911	0.006	Metal	V	0.4950	1.5021	-0.0626	128	0.3051	0.009
Metal	Zn	gro42sc	0.4855	1.3502	-0.0001	128	0.0160	0.046	Metal	Zn	0.4736	1.7138	-0.0881	128	0.0006	0.093
Misc	Pct_TOC	gro42sc	0.4904	1.3999	-0.1451	128	0.0665	0.027	Misc	Pct_TOC	0.4888	1.2305	-0.0651	128	0.0418	0.033
Misc	pH	gro42sc	0.4958	-0.1280	0.1773	128	0.4236	0.005	Misc	pH	0.4959	-1.5949	1.3878	128	0.4267	0.005
PCDD/PCDF	1234678HpCDD	gro42sc	0.5528	1.3024	-0.0006	72	0.3769	0.011	PCDD/PCDF	1234678HpCDD	0.5426	1.6450	-0.0990	72	0.0670	0.047
PCDD/PCDF	1234678HpCDF	gro42sc	0.4598	1.2158	-0.0003	64	0.4816	0.008	PCDD/PCDF	1234678HpCDF	0.4519	1.4899	-0.0747	64	0.1047	0.042
PCDD/PCDF	1234789HpCDF	gro42sc	0.2912	0.7323	0.0098	24	0.0610	0.151	PCDD/PCDF	1234789HpCDF	0.2995	0.4405	0.1757	24	0.1291	0.102
PCDD/PCDF	123478HxCDD	gro42sc	0.3046	0.8669	0.0221	24	0.2356	0.063	PCDD/PCDF	123478HxCDD	0.3091	0.7345	0.1563	24	0.3798	0.035
PCDD/PCDF	123478HxCDF	gro42sc	0.2745	1.0124	0.0014	40	0.4820	0.013	PCDD/PCDF	123478HxCDF	0.2763	1.0412	0.0038	40	0.9439	0.000
PCDD/PCDF	123678HxCDD	gro42sc	0.4384	1.1820	-0.0020	48	0.7807	0.002	PCDD/PCDF	123678HxCDD	0.4368	1.3112	-0.0657	48	0.5181	0.009
PCDD/PCDF	123678HxCDF	gro42sc	0.2041	1.0272	0.0031	32	0.0441	0.128	PCDD/PCDF	123678HxCDF	0.2085	0.8874	0.0763	32	0.0945	0.090
PCDD/PCDF	123789HxCDD	gro42sc	0.2697	0.9549	0.0084	40	0.1778	0.047	PCDD/PCDF	123789HxCDD	0.2726	0.8797	0.0758	40	0.3135	0.027
PCDD/PCDF	123789HxCDF	gro42sc	0.2861	0.8933	0.0103	32	0.1141	0.081	PCDD/PCDF	123789HxCDF	0.2903	0.7588	0.1130	32	0.1995	0.054
PCDD/PCDF	12378PeCDD	gro42sc	0.2741	0.3904	0.0887	24	0.0148	0.241	PCDD/PCDF	12378PeCDD	0.2710	-0.4101	0.7350	24	0.0112	0.258
PCDD/PCDF	12378PeCDF	gro42sc	0.2840	0.7201	0.0174	24	0.0320	0.192	PCDD/PCDF	12378PeCDF	0.2949	0.5006	0.1890	24	0.0851	0.129
PCDD/PCDF	234678HxCDF	gro42sc	0.4349	1.2192	-0.0019	48	0.3686	0.018	PCDD/PCDF	234678HxCDF	0.4140	1.6196	-0.1498	48	0.0213	0.110
PCDD/PCDF	23478PeCDF	gro42sc	0.2745	1.0061	0.0019	40	0.4849	0.013	PCDD/PCDF	23478PeCDF	0.2762	1.0210	0.0107	40	0.8641	0.001
PCDD/PCDF	2378TCDD	gro42sc	0.2760	0.1198	0.4690	16	0.0085	0.401	PCDD/PCDF	2378TCDD	0.2760	0.4591	0.8981	16	0.0085	0.401
PCDD/PCDF	2378TCDF	gro42sc	0.4463	1.2200	-0.0094	56	0.3345	0.017	PCDD/PCDF	2378TCDF	0.4378	1.3653	-0.1271	56	0.0842	0.054
PCDD/PCDF	HpCDD_Total	gro42sc	0.5533	1.2960	-0.0002	72	0.4246	0.009	PCDD/PCDF	HpCDD_Total	0.5438	1.7138	-0.0952	72	0.0812	0.043
PCDD/PCDF	HpCDF_Total	gro42sc	0.4614	1.1913	-0.0001	64	0.8142	0.001	PCDD/PCDF	HpCDF_Total	0.4566	1.3958	-0.0478	64	0.2461	0.022

TABLE C-2

Summary of Regressions for *Hyalella azteca* Responses (scaled as proportion of lab controls) vs Analyte Concentrations (untransformed or LN transformed) in Sediment (all non-detects were excluded from the analysis)

Baseline Ecological Risk Assessment, Halaco Site, Oxnard, California

					Untransformed								Log transformed			
Analgrp	**Analyte**	**_DEPVAR_**	**_RMSE_**	**Intercept**	**slope**	**N**	**p-value**	**r-square**	**Analgrp**	**Analyte**	**_RMSE_**	**Intercept**	**slope**	**N**	**p-value**	**r-square**
PCDD/PCDF	HxCDD_Total	gro42sc	0.4497	1.1682	-0.0001	56	0.7522	0.002	PCDD/PCDF	HxCDD_Total	0.4473	1.3848	-0.0497	56	0.4059	0.013
PCDD/PCDF	HxCDF_Total	gro42sc	0.4479	1.1935	-0.0002	56	0.4642	0.010	PCDD/PCDF	HxCDF_Total	0.4451	1.4084	-0.0547	56	0.2714	0.022
PCDD/PCDF	OCDD	gro42sc	0.5245	1.2978	-0.0001	112	0.5824	0.003	PCDD/PCDF	OCDD	0.5226	1.4186	-0.0292	112	0.3023	0.010
PCDD/PCDF	OCDF	gro42sc	0.4606	1.2082	-0.0002	64	0.6031	0.004	PCDD/PCDF	OCDF	0.4582	1.4265	-0.0533	64	0.3398	0.015
PCDD/PCDF	PeCDD_Total	gro42sc	0.4467	1.1999	-0.0005	56	0.3628	0.015	PCDD/PCDF	PeCDD_Total	0.4313	1.4704	-0.0834	56	0.0323	0.082
PCDD/PCDF	PeCDF_Total	gro42sc	0.4481	1.1899	-0.0002	56	0.4823	0.009	PCDD/PCDF	PeCDF_Total	0.4385	1.5754	-0.0895	56	0.0933	0.051
PCDD/PCDF	TCDD_Total	gro42sc	0.5508	1.2960	-0.0019	72	0.1099	0.036	PCDD/PCDF	TCDD_Total	0.5366	1.5304	-0.1101	72	0.0129	0.085
PCDD/PCDF	TCDF_Total	gro42sc	0.4564	1.2006	-0.0004	72	0.3133	0.015	PCDD/PCDF	TCDF_Total	0.4559	1.3053	-0.0377	72	0.2797	0.017
Pesticide	44DDE	gro42sc	0.2000	1.3362	0.0000	8		0.000	Pesticide	44DDE	0.2000	1.3362	0.0000	8		0.000
Pesticide	Bifenthrin	gro42sc	0.2117	1.2072	0.0024	40	0.3527	0.023	Pesticide	Bifenthrin	0.2134	1.2515	-0.0101	40	0.6039	0.007
Pesticide	Chlorpyrifos	gro42sc	0.2072	1.2288	0.0020	32	0.2403	0.046	Pesticide	Chlorpyrifos	0.2117	1.2516	0.0061	32	0.7363	0.004
Pesticide	Permethrin	gro42sc	0.2061	1.2982	-0.0115	32	0.1619	0.064	Pesticide	Permethrin	0.2043	1.2471	-0.0306	32	0.1143	0.081
Phthalate	Bis(2-ethylhexyl)phthalate	gro42sc	0.3102	1.1728	0.0001	48	0.8255	0.001	Phthalate	Bis(2-ethylhexyl)phthalate	0.3100	1.2497	-0.0164	48	0.7487	0.002
Phthalate	Dimethylphthalate	gro42sc	0.5452	1.4536	-0.0030	56	0.1434	0.042	Phthalate	Dimethylphthalate	0.5466	1.8693	-0.1543	56	0.1698	0.037
grain	MedGrainSize	gro42sc	0.4821	1.1407	0.6063	128	0.0060	0.060	grain	MedGrainSize	0.4860	1.4796	0.1038	128	0.0185	0.044
grain	PctClay	gro42sc	0.4862	1.3991	-0.0268	128	0.0194	0.044	grain	PctClay	0.4844	1.3463	-0.0795	128	0.0116	0.051
grain	PctSand-Fine	gro42sc	0.4970	1.2541	0.0007	128	0.8025	0.001	grain	PctSand-Fine	0.4969	1.0998	0.0511	128	0.7029	0.001
grain	PctSand-Medium	gro42sc	0.4840	1.1337	0.0051	128	0.0103	0.052	grain	PctSand-Medium	0.4873	0.9530	0.1089	128	0.0270	0.039
grain	PctSilt	gro42sc	0.4859	1.4257	-0.0048	128	0.0181	0.045	grain	PctSilt	0.4861	1.4465	-0.0618	128	0.0192	0.044
grain	PctSiltClay	gro42sc	0.4856	1.4267	-0.0042	128	0.0162	0.046	grain	PctSiltClay	0.4857	1.4662	-0.0653	128	0.0169	0.046
Metal	Ag	rep42sc	0.5708	1.3037	-0.2202	32	0.0040	0.245	Metal	Ag	0.6150	1.0594	-0.4089	32	0.0481	0.124
Metal	Al	rep42sc	0.6414	0.8748	0.0000	128	0.0425	0.032	Metal	Al	0.6512	0.9946	-0.0213	128	0.5829	0.002
Metal	As	rep42sc	0.6493	0.8920	-0.0316	128	0.3088	0.008	Metal	As	0.6513	0.8359	-0.0423	128	0.5987	0.002
Metal	Ba	rep42sc	0.6445	0.8631	-0.0001	128	0.0890	0.023	Metal	Ba	0.6516	0.8690	-0.0142	128	0.6779	0.001
Metal	Be	rep42sc	0.6442	0.8700	-0.0367	128	0.0821	0.024	Metal	Be	0.6516	0.7957	-0.0167	128	0.6803	0.001
Metal	Ca	rep42sc	0.6491	0.7478	0.0000	128	0.2869	0.009	Metal	Ca	0.6474	0.1755	0.0630	128	0.1836	0.014
Metal	Cd	rep42sc	0.5387	0.9739	-0.0777	80	0.0444	0.051	Metal	Cd	0.5483	0.8635	-0.1044	80	0.2528	0.017
Metal	Co	rep42sc	0.4950	1.5434	-0.1114	56	0.0013	0.176	Metal	Co	0.5137	1.9707	-0.6318	56	0.0116	0.112
Metal	Cr	rep42sc	0.6386	0.8778	-0.0015	128	0.0226	0.041	Metal	Cr	0.6508	0.8847	-0.0290	128	0.4956	0.004
Metal	Cu	rep42sc	0.6412	0.8644	-0.0001	128	0.0410	0.033	Metal	Cu	0.6515	0.8406	-0.0102	128	0.6629	0.002
Metal	Fe	rep42sc	0.6516	0.7535	0.0000	128	0.6820	0.001	Metal	Fe	0.6517	0.4463	0.0387	128	0.7218	0.001
Metal	K	rep42sc	0.5872	0.8157	0.0000	96	0.9323	0.000	Metal	K	0.5871	0.6777	0.0170	96	0.8467	0.000
Metal	Mg	rep42sc	0.6406	0.8985	0.0000	128	0.0356	0.035	Metal	Mg	0.6513	1.0417	-0.0286	128	0.5940	0.002
Metal	Mn	rep42sc	0.6431	0.8913	-0.0002	128	0.0628	0.027	Metal	Mn	0.6513	0.9481	-0.0268	128	0.6121	0.002
Metal	Na	rep42sc	0.6508	0.7702	0.0000	128	0.5033	0.004	Metal	Na	0.6515	0.5272	0.0357	128	0.6471	0.002
Metal	Ni	rep42sc	0.6437	0.8787	-0.0025	128	0.0725	0.025	Metal	Ni	0.6514	0.8591	-0.0217	128	0.6388	0.002
Metal	Pb	rep42sc	0.6228	0.8028	-0.0007	120	0.2964	0.009	Metal	Pb	0.6246	0.7027	0.0210	120	0.5058	0.004
Metal	Sb	rep42sc	0.5360	0.9364	-0.0369	80	0.0282	0.060	Metal	Sb	0.5454	0.8606	-0.0813	80	0.1441	0.027
Metal	Se	rep42sc	0.4245	0.2810	0.1300	40	0.0108	0.159	Metal	Se	0.4303	0.3185	0.3605	40	0.0194	0.136
Metal	V	rep42sc	0.6092	1.1594	-0.0082	128	0.0000	0.127	Metal	V	0.6224	1.7501	-0.2669	128	0.0006	0.089
Metal	Zn	rep42sc	0.6466	0.8553	-0.0001	128	0.1467	0.017	Metal	Zn	0.6516	0.8647	-0.0131	128	0.6978	0.001
Misc	Pct_TOC	rep42sc	0.6520	0.7933	0.0096	128	0.9251	0.000	Misc	Pct_TOC	0.6519	0.7948	-0.0077	128	0.8517	0.000
Misc	pH	rep42sc	0.6514	-0.3197	0.1411	128	0.6251	0.002	Misc	pH	0.6514	-1.4028	1.0636	128	0.6401	0.002
PCDD/PCDF	1234678HpCDD	rep42sc	0.5812	0.8724	0.0007	72	0.3257	0.014	PCDD/PCDF	1234678HpCDD	0.5852	0.9697	-0.0040	72	0.9446	0.000
PCDD/PCDF	1234678HpCDF	rep42sc	0.5448	0.8404	0.0009	64	0.0816	0.048	PCDD/PCDF	1234678HpCDF	0.5583	0.9077	0.0092	64	0.8703	0.000
PCDD/PCDF	1234789HpCDF	rep42sc	0.4690	0.2474	0.0270	24	0.0028	0.341	PCDD/PCDF	1234789HpCDF	0.4685	-0.8897	0.5893	24	0.0027	0.342
PCDD/PCDF	123478HxCDD	rep42sc	0.4635	0.5014	0.0590	24	0.0437	0.172	PCDD/PCDF	123478HxCDD	0.4610	-0.1912	0.5735	24	0.0382	0.181
PCDD/PCDF	123478HxCDF	rep42sc	0.4317	0.6650	0.0090	40	0.0048	0.191	PCDD/PCDF	123478HxCDF	0.4483	0.3019	0.2052	40	0.0239	0.127
PCDD/PCDF	123678HxCDD	rep42sc	0.4354	0.6051	0.0229	48	0.0021	0.187	PCDD/PCDF	123678HxCDD	0.4377	0.1477	0.3202	48	0.0027	0.179
PCDD/PCDF	123678HxCDF	rep42sc	0.4474	0.6635	0.0088	32	0.0106	0.199	PCDD/PCDF	123678HxCDF	0.4686	0.3104	0.2016	32	0.0512	0.121

TABLE C-2

Summary of Regressions for *Hyalella azteca* Responses (scaled as proportion of lab controls) vs Analyte Concentrations (untransformed or LN transformed) in Sediment (all non-detects were excluded from the analysis)

Baseline Ecological Risk Assessment, Halaco Site, Oxnard, California

				Untransformed								Log transformed				
Analgrp	**Analyte**	**_DEPVAR_**	**_RMSE_**	**Intercept**	**slope**	**N**	**p-value**	**r-square**	**Analgrp**	**Analyte**	**_RMSE_**	**Intercept**	**slope**	**N**	**p-value**	**r-square**
PCDD/PCDF	123789HxCDD	rep42sc	0.4267	0.5753	0.0307	40	0.0030	0.210	PCDD/PCDF	123789HxCDD	0.4301	0.1169	0.3575	40	0.0041	0.197
PCDD/PCDF	123789HxCDF	rep42sc	0.4303	0.4477	0.0349	32	0.0010	0.309	PCDD/PCDF	123789HxCDF	0.4226	-0.2581	0.4851	32	0.0005	0.333
PCDD/PCDF	12378PeCDD	rep42sc	0.4857	0.3749	0.0882	24	0.1522	0.091	PCDD/PCDF	12378PeCDD	0.4882	-0.2954	0.6684	24	0.1764	0.081
PCDD/PCDF	12378PeCDF	rep42sc	0.4730	0.3121	0.0416	24	0.0034	0.329	PCDD/PCDF	12378PeCDF	0.4681	-0.5049	0.5639	24	0.0026	0.343
PCDD/PCDF	234678HxCDF	rep42sc	0.4389	0.6844	0.0065	48	0.0032	0.174	PCDD/PCDF	234678HxCDF	0.4538	0.3760	0.1703	48	0.0172	0.117
PCDD/PCDF	23478PeCDF	rep42sc	0.4335	0.6267	0.0123	40	0.0057	0.184	PCDD/PCDF	23478PeCDF	0.4497	0.2388	0.2326	40	0.0271	0.122
PCDD/PCDF	2378TCDD	rep42sc	0.5441	0.6774	0.2609	16	0.4026	0.051	PCDD/PCDF	2378TCDD	0.5441	0.8662	0.4996	16	0.4026	0.051
PCDD/PCDF	2378TCDF	rep42sc	0.4842	0.6883	0.0280	56	0.0102	0.116	PCDD/PCDF	2378TCDF	0.4954	0.6102	0.1707	56	0.0416	0.075
PCDD/PCDF	HpCDD_Total	rep42sc	0.5819	0.8791	0.0003	72	0.3699	0.012	PCDD/PCDF	HpCDD_Total	0.5852	0.9837	-0.0061	72	0.9167	0.000
PCDD/PCDF	HpCDF_Total	rep42sc	0.5452	0.8493	0.0005	64	0.0862	0.047	PCDD/PCDF	HpCDF_Total	0.5584	0.9529	-0.0016	64	0.9750	0.000
PCDD/PCDF	HxCDD_Total	rep42sc	0.4853	0.7236	0.0010	56	0.0117	0.112	PCDD/PCDF	HxCDD_Total	0.4997	0.3234	0.1215	56	0.0725	0.059
PCDD/PCDF	HxCDF_Total	rep42sc	0.4864	0.7306	0.0008	56	0.0134	0.108	PCDD/PCDF	HxCDF_Total	0.5051	0.5128	0.0818	56	0.1491	0.038
PCDD/PCDF	OCDD	rep42sc	0.6137	0.6094	0.0003	112	0.0037	0.074	PCDD/PCDF	OCDD	0.6014	0.1703	0.1191	112	0.0003	0.111
PCDD/PCDF	OCDF	rep42sc	0.5446	0.8329	0.0007	64	0.0797	0.049	PCDD/PCDF	OCDF	0.5571	0.7798	0.0359	64	0.5958	0.005
PCDD/PCDF	PeCDD_Total	rep42sc	0.4846	0.7398	0.0014	56	0.0107	0.115	PCDD/PCDF	PeCDD_Total	0.5025	0.6198	0.0730	56	0.1045	0.048
PCDD/PCDF	PeCDF_Total	rep42sc	0.4857	0.7360	0.0008	56	0.0124	0.110	PCDD/PCDF	PeCDF_Total	0.5014	0.4100	0.1031	56	0.0912	0.052
PCDD/PCDF	TCDD_Total	rep42sc	0.5620	0.6475	0.0035	72	0.0036	0.115	PCDD/PCDF	TCDD_Total	0.5661	0.4389	0.1283	72	0.0063	0.102
PCDD/PCDF	TCDF_Total	rep42sc	0.5288	0.6312	0.0013	72	0.0022	0.126	PCDD/PCDF	TCDF_Total	0.5546	0.5221	0.0710	72	0.0960	0.039
Pesticide	44DDE	rep42sc	0.4539	0.8087	0.0000	8		0.000	Pesticide	44DDE	0.4539	0.8087	0.0000	8		0.000
Pesticide	Bifenthrin	rep42sc	0.5515	1.1989	-0.0120	40	0.0790	0.079	Pesticide	Bifenthrin	0.5378	1.2322	-0.1134	40	0.0258	0.124
Pesticide	Chlorpyrifos	rep42sc	0.5837	1.2408	-0.0084	32	0.0812	0.098	Pesticide	Chlorpyrifos	0.5710	1.2073	-0.1062	32	0.0373	0.137
Pesticide	Permethrin	rep42sc	0.5802	1.3034	-0.0244	32	0.2896	0.037	Pesticide	Permethrin	0.5701	1.2129	-0.0794	32	0.1411	0.071
Phthalate	Bis(2-ethylhexyl)phthalate	rep42sc	0.5504	0.4349	0.0040	48	0.0003	0.252	Phthalate	Bis(2-ethylhexyl)phthalate	0.5357	-0.7141	0.3716	48	0.0001	0.291
Phthalate	Dimethylphthalate	rep42sc	0.6788	0.5842	0.0013	56	0.5997	0.005	Phthalate	Dimethylphthalate	0.6803	0.5582	0.0267	56	0.8458	0.001
grain	MedGrainSize	rep42sc	0.6494	0.8681	-0.2815	128	0.3201	0.008	grain	MedGrainSize	0.6497	0.6996	-0.0537	128	0.3470	0.007
grain	PctClay	rep42sc	0.6520	0.7967	0.0010	128	0.9461	0.000	grain	PctClay	0.6518	0.7920	0.0117	128	0.7716	0.001
grain	PctSand-Fine	rep42sc	0.6519	0.7704	0.0008	128	0.8209	0.000	grain	PctSand-Fine	0.6518	0.6314	0.0481	128	0.7840	0.001
grain	PctSand-Medium	rep42sc	0.6490	0.8826	-0.0027	128	0.2790	0.009	grain	PctSand-Medium	0.6487	1.0201	-0.0722	128	0.2567	0.010
grain	PctSilt	rep42sc	0.6497	0.7277	0.0025	128	0.3469	0.007	grain	PctSilt	0.6517	0.7728	0.0108	128	0.7474	0.001
grain	PctSiltClay	rep42sc	0.6502	0.7371	0.0019	128	0.4084	0.005	grain	PctSiltClay	0.6517	0.7684	0.0117	128	0.7356	0.001

TABLE C-3

Site-specific Sediment LOECs (mg/kg)[1]

Baseline Ecological Risk Assessment, Halaco Site, Oxnard, California

Analyte	Value
Al	159000
Sb	11.4
Ba	2480
Be	10.3
Cd	5.8
Cr	342
Co	11
Cu	3190
Pb	274
Mg	42200
Mn	2100
Ni	158
Ag	4.9
V	125
Zn	2560

Notes:

[1] LOECs represent concentration in sample NEL-007 that displayed significantly reduced survival and reproduction relative to controls. All concentrations were maximum for any sample tested. Many also exceeded PEC values.

Figures

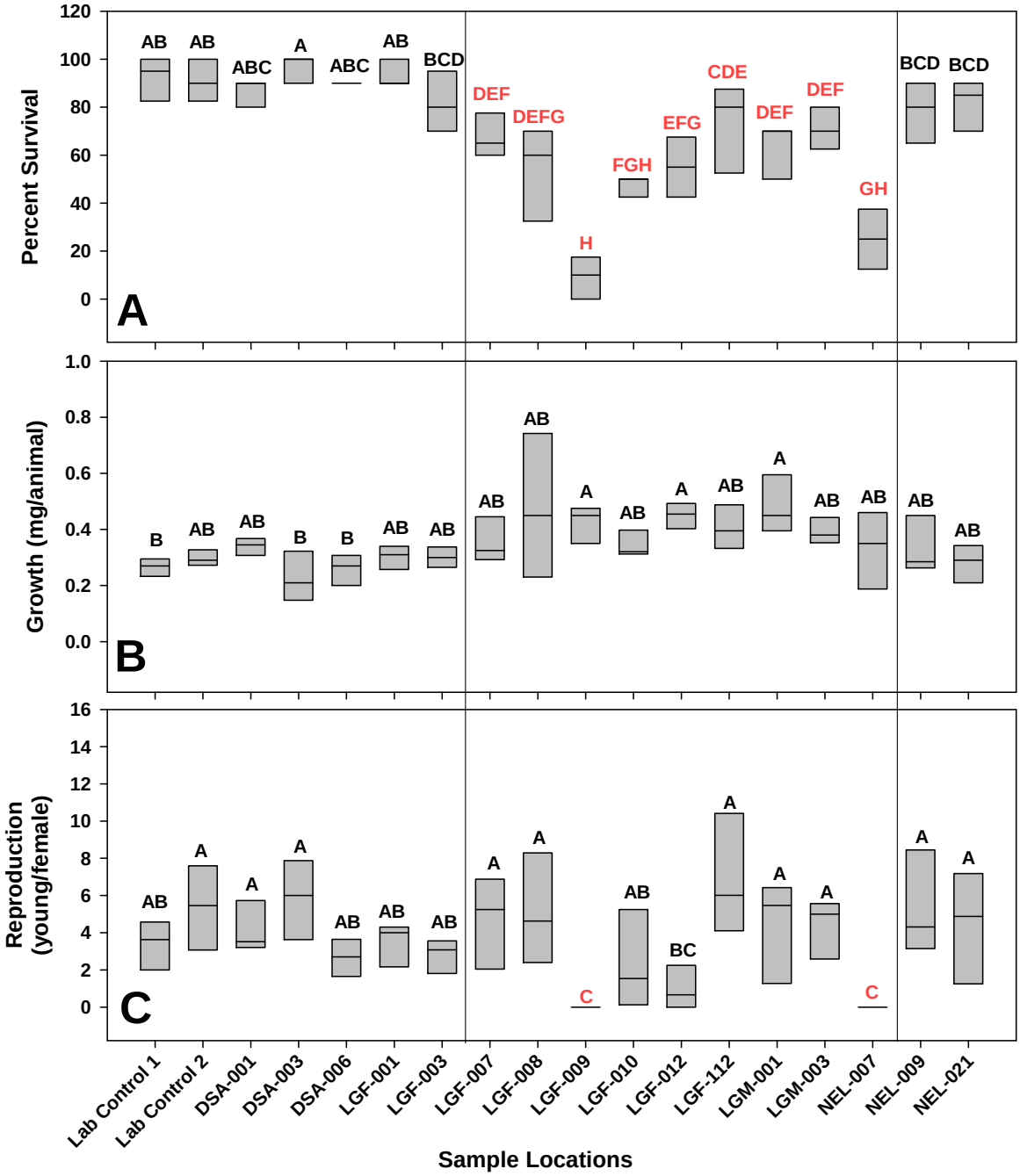


Figure C-1. Boxplots of 42-day percent survival (A), growth (B), and reproduction (C) of *Hyalella azteca* exposed to sediment from at and adjacent to the Halaco Superfund Site. Boxes with the same letters are not statistically different as determined by ANOVA of rank-transformed values. Boxes with red letters are statistically significantly reduced relative to controls.

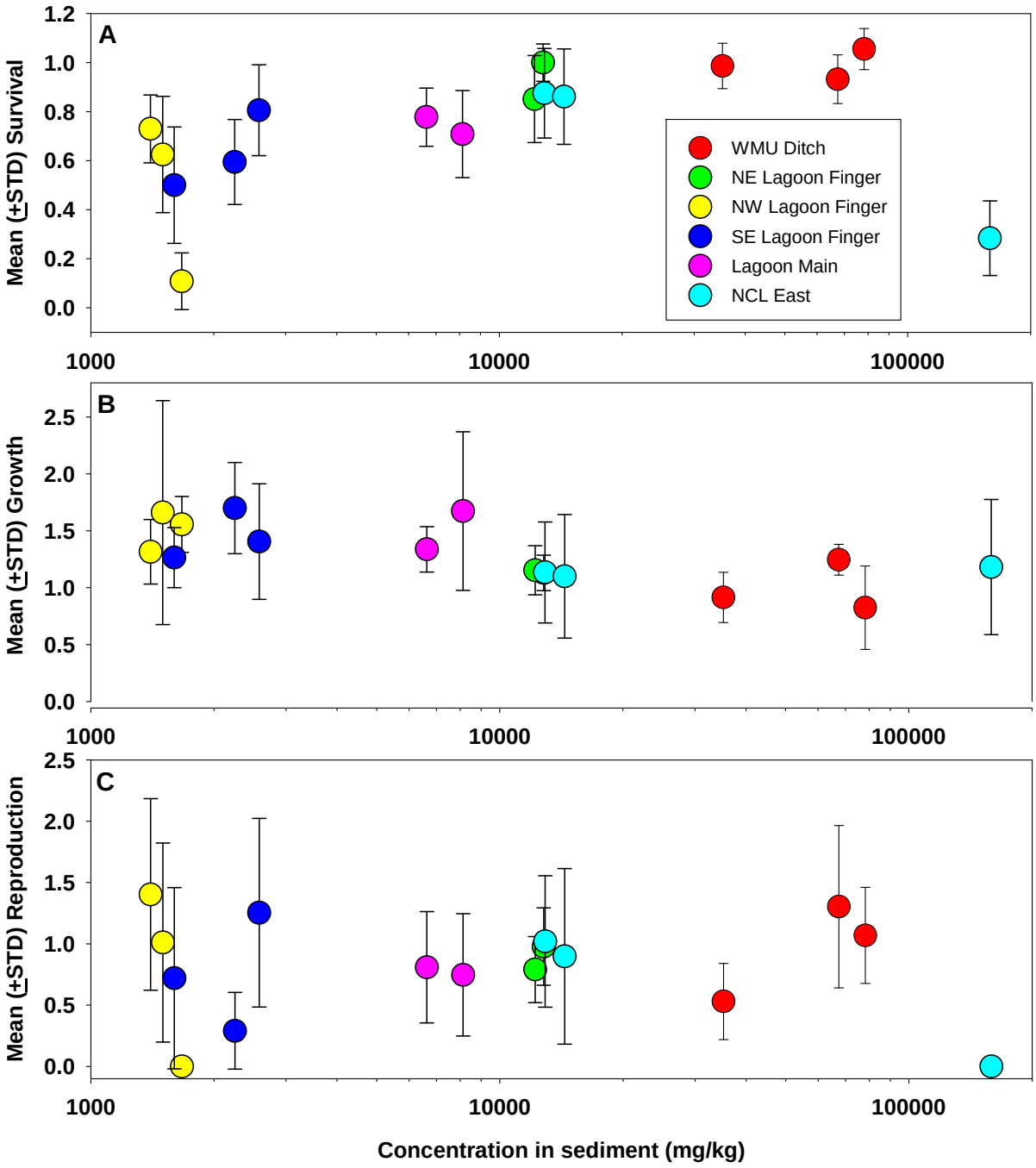


Figure C-2. Dose-response scatterplots for aluminum in sediment versus 42-day survival (A), 42-day growth (B), and reproduction (C) *Hyalella azteca*. All bioassay responses scaled to proportion of mean control response.

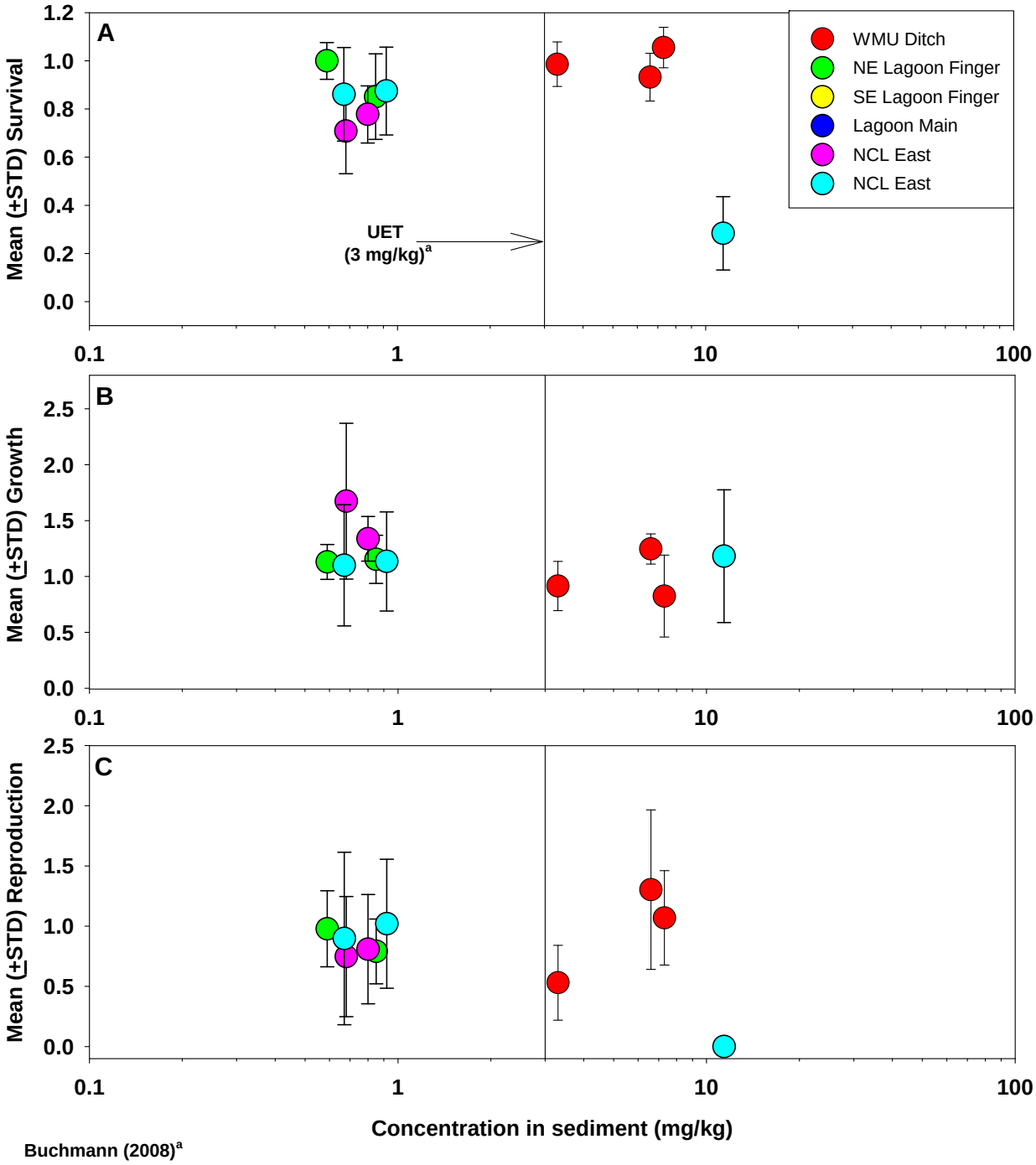


Figure C-3. Dose-response scatterplots for antimony in sediment versus 42-day survival (A), 42-day growth (B), and reproduction (C) *Hyalella azteca*. All bioassay responses scaled to proportion of mean control response. Only detected concentrations presented.

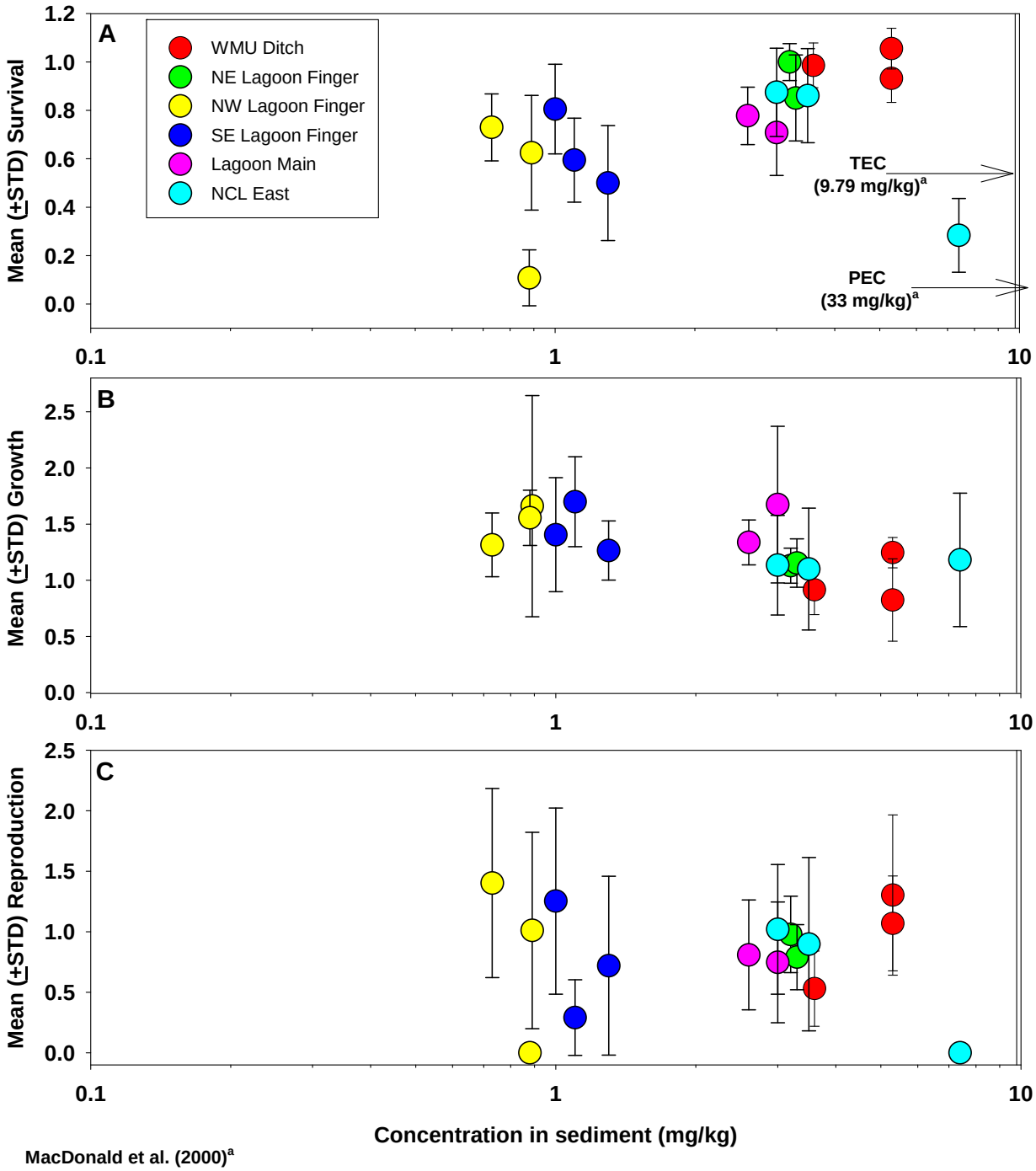


Figure C-4. Dose-response scatterplots for arsenic in sediment versus 42-day survival (A), 42-day growth (B), and reproduction (C) *Hyalella azteca*. All bioassay responses scaled to proportion of mean control response. Only detected concentrations presented.

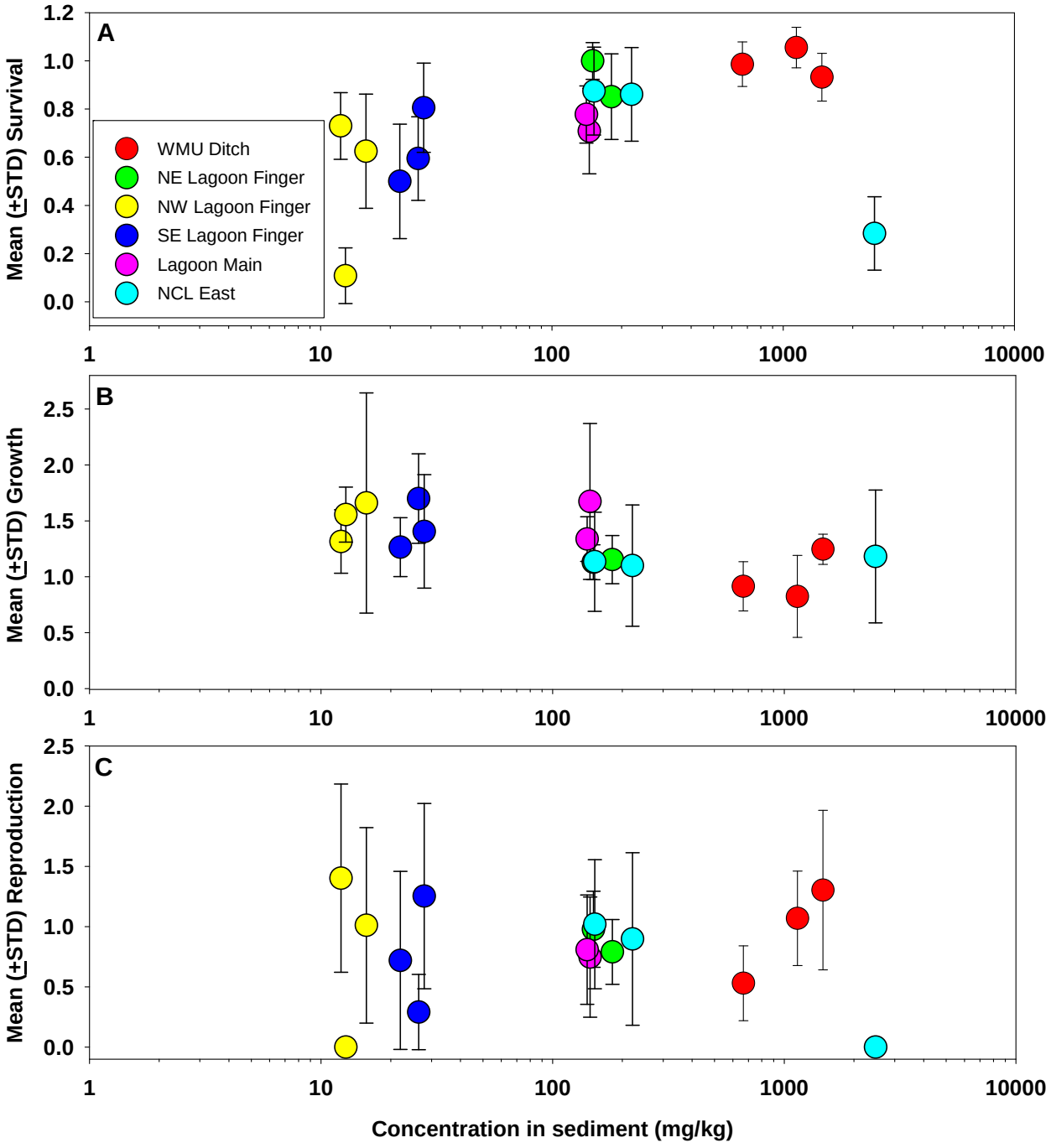


Figure C-5. Dose-response scatterplots for barium in sediment versus 42-day survival (A), 42-day growth (B), and reproduction (C) *Hyalella azteca*. All bioassay responses scaled to proportion of mean control response. Only detected concentrations presented.

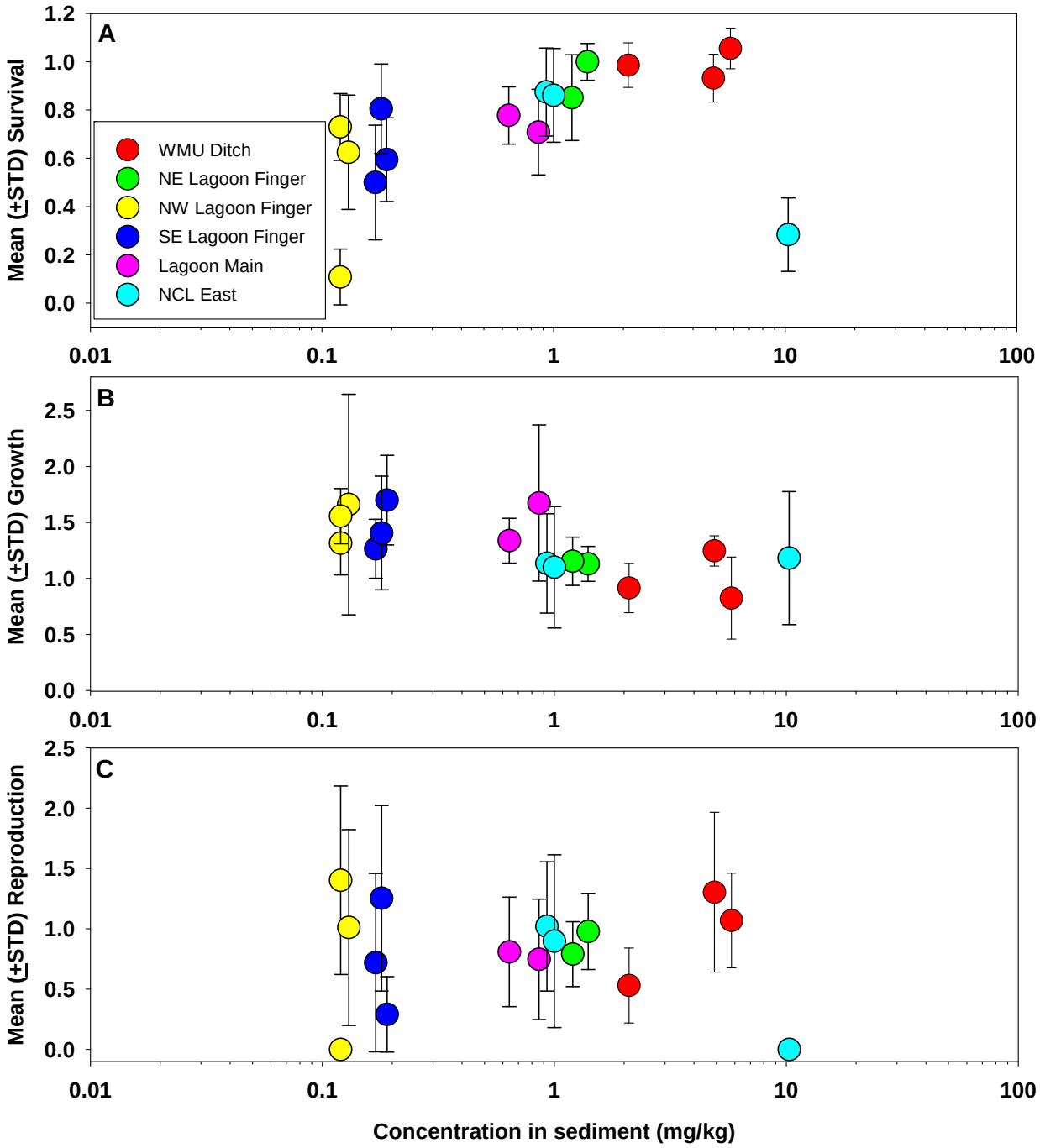


Figure C-6. Dose-response scatterplots for beryllium in sediment versus 42-day survival (A), 42-day growth (B), and reproduction (C) *Hyalella azteca*. All bioassay responses scaled to proportion of mean control response. Only detected concentrations presented.

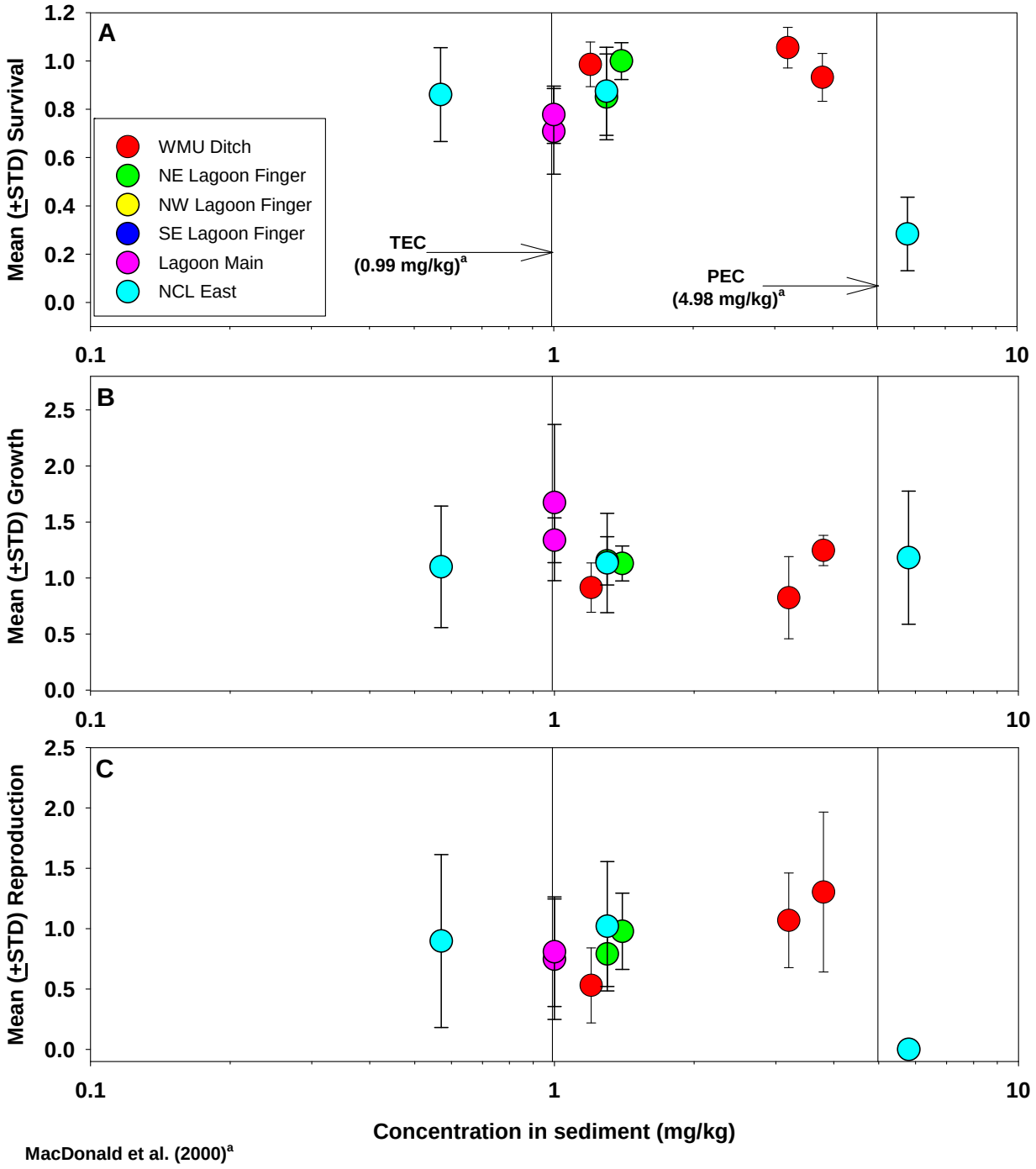


Figure C-7. Dose-response scatterplots for cadmium in sediment versus 42-day survival (A), 42-day growth (B), and reproduction (C) *Hyalella azteca*. All bioassay responses scaled to proportion of mean control response. Only detected concentrations presented.

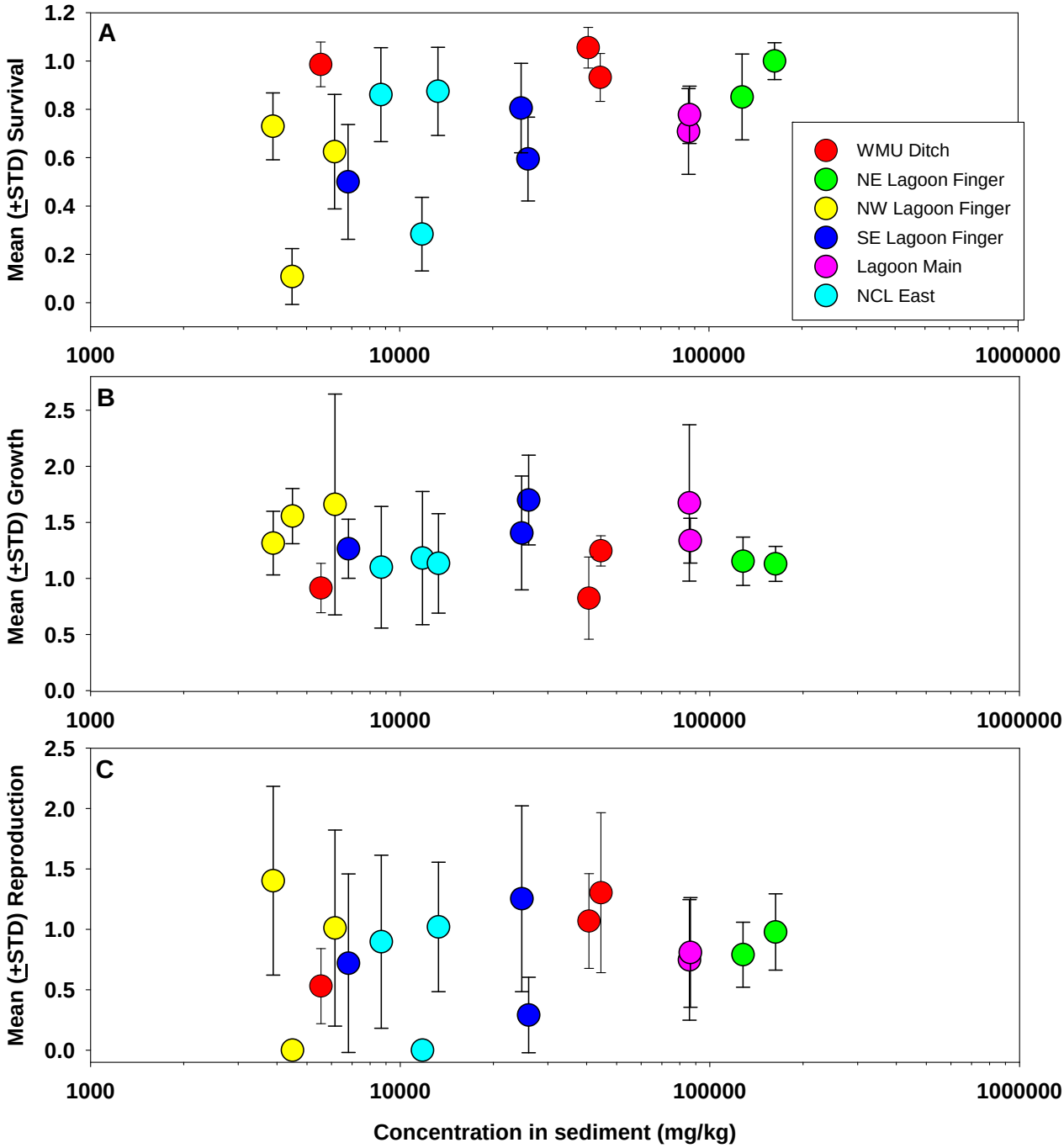


Figure C-8. Dose-response scatterplots for calcium in sediment versus 42-day survival (A), 42-day growth (B), and reproduction (C) *Hyalella azteca*. All bioassay responses scaled to proportion of mean control response. Only detected concentrations presented.

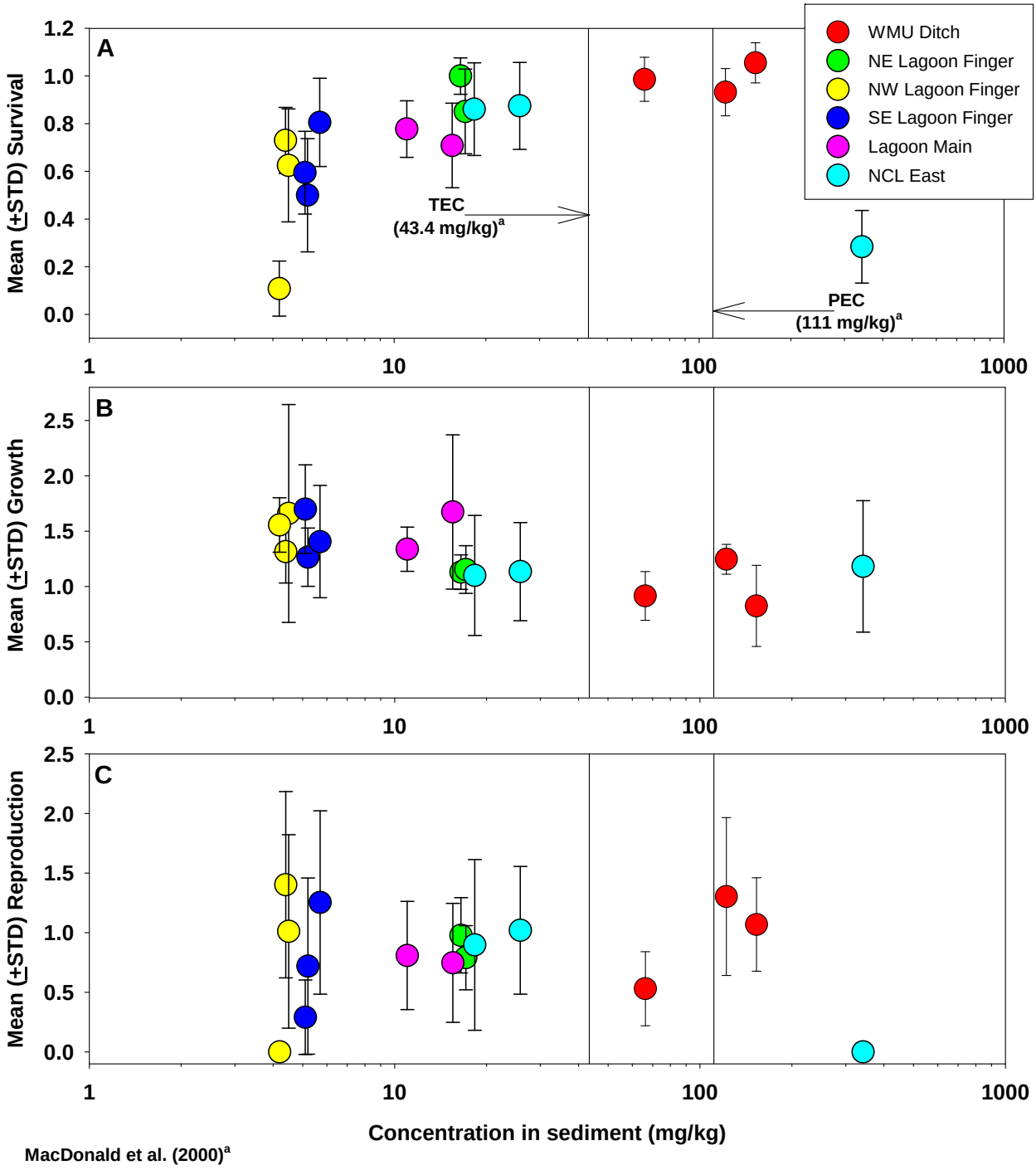


Figure C-9. Dose-response scatterplots for chromium in sediment versus 42-day survival (A), 42-day growth (B), and reproduction (C) *Hyalella azteca*. All bioassay responses scaled to proportion of mean control response. Only detected concentrations presented.

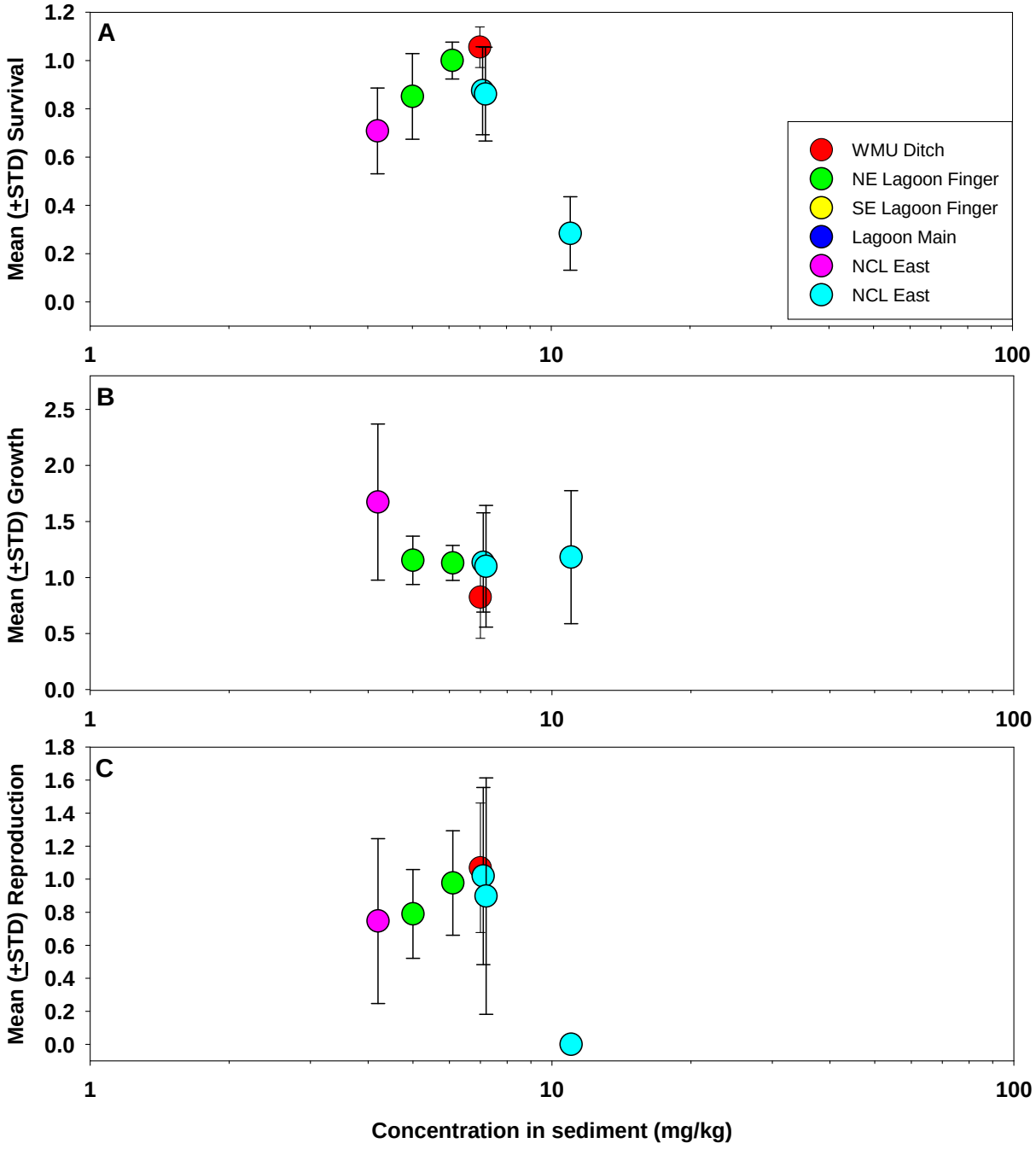


Figure C-10. Dose-response scatterplots for cobalt in sediment versus 42-day survival (A), 42-day growth (B), and reproduction (C) *Hyalella azteca*. All bioassay responses scaled to proportion of mean control response. Only detected concentrations presented.

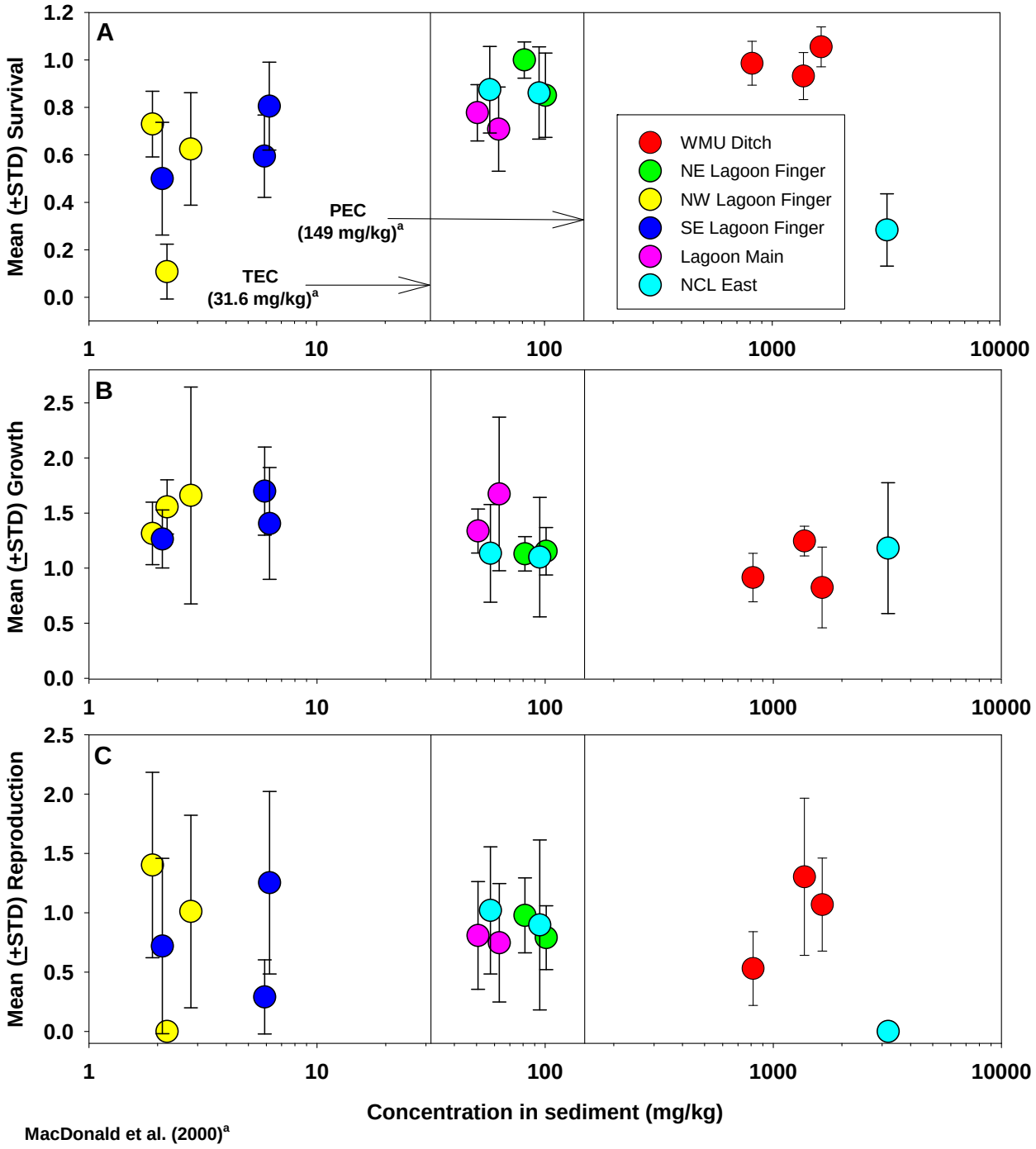


Figure C-11. Dose-response scatterplots for copper in sediment versus 42-day survival (A), 42-day growth (B), and reproduction (C) *Hyalella azteca*. All bioassay responses scaled to proportion of mean control response. Only detected concentrations presented.

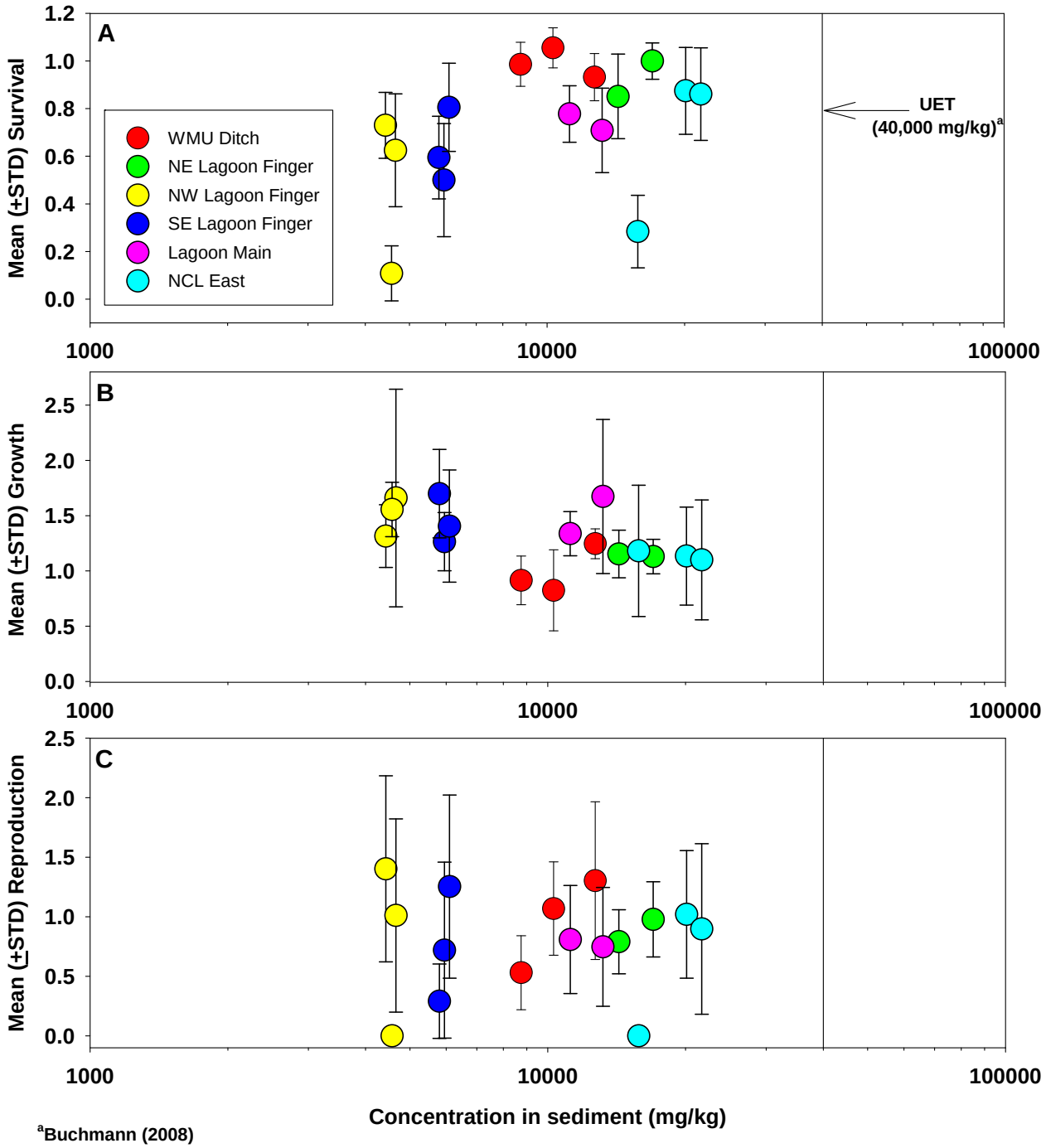


Figure C-12. Dose-response scatterplots for iron in sediment versus 42-day survival (A), 42-day growth (B), and reproduction (C) *Hyalella azteca*. All bioassay responses scaled to proportion of mean control response. Only detected concentrations presented.

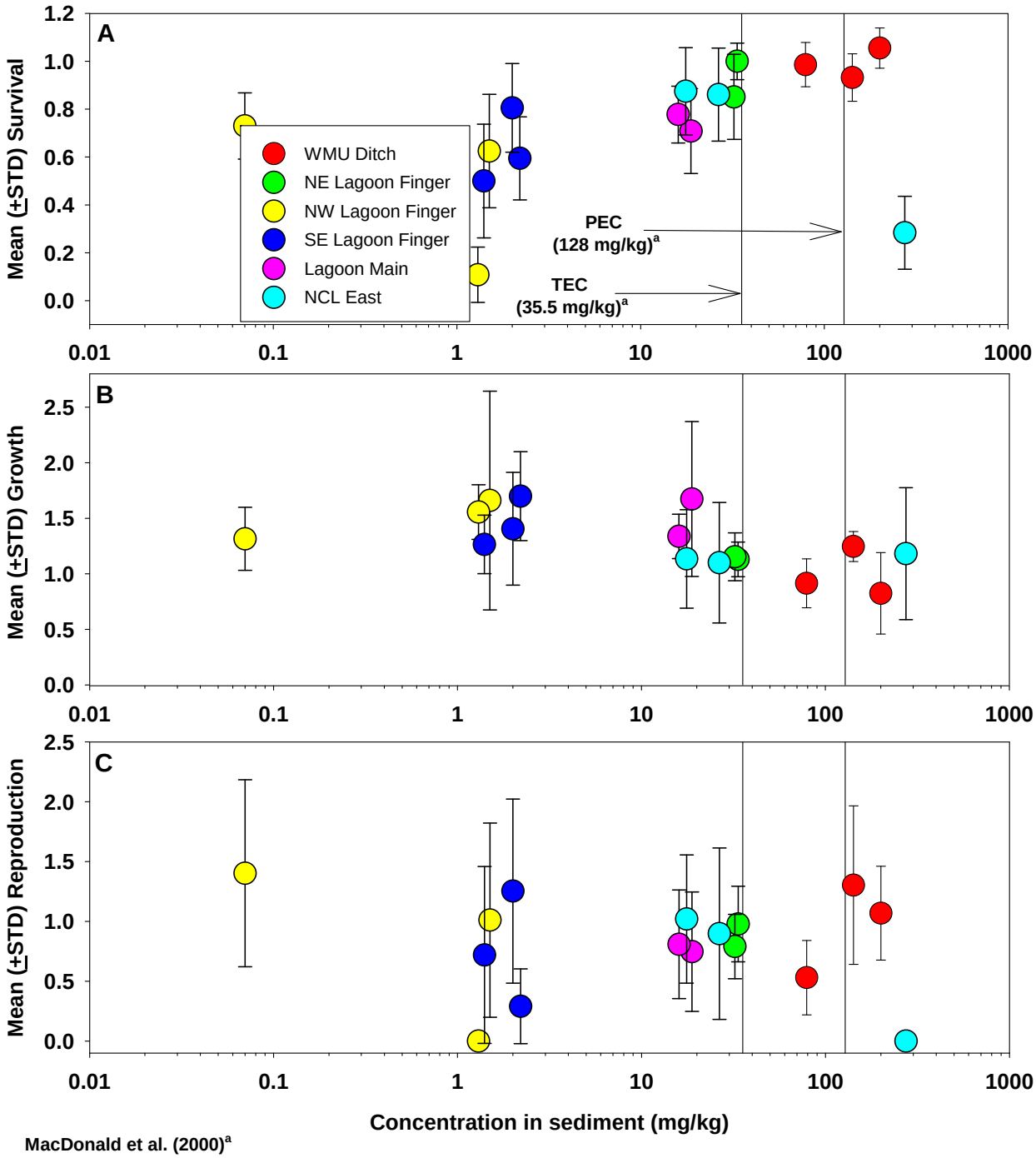


Figure C-13. Dose-response scatterplots for lead in sediment versus 42-day survival (A), 42-day growth (B), and reproduction (C) *Hyalella azteca*. All bioassay responses scaled to proportion of mean control response. Only detected concentrations presented.

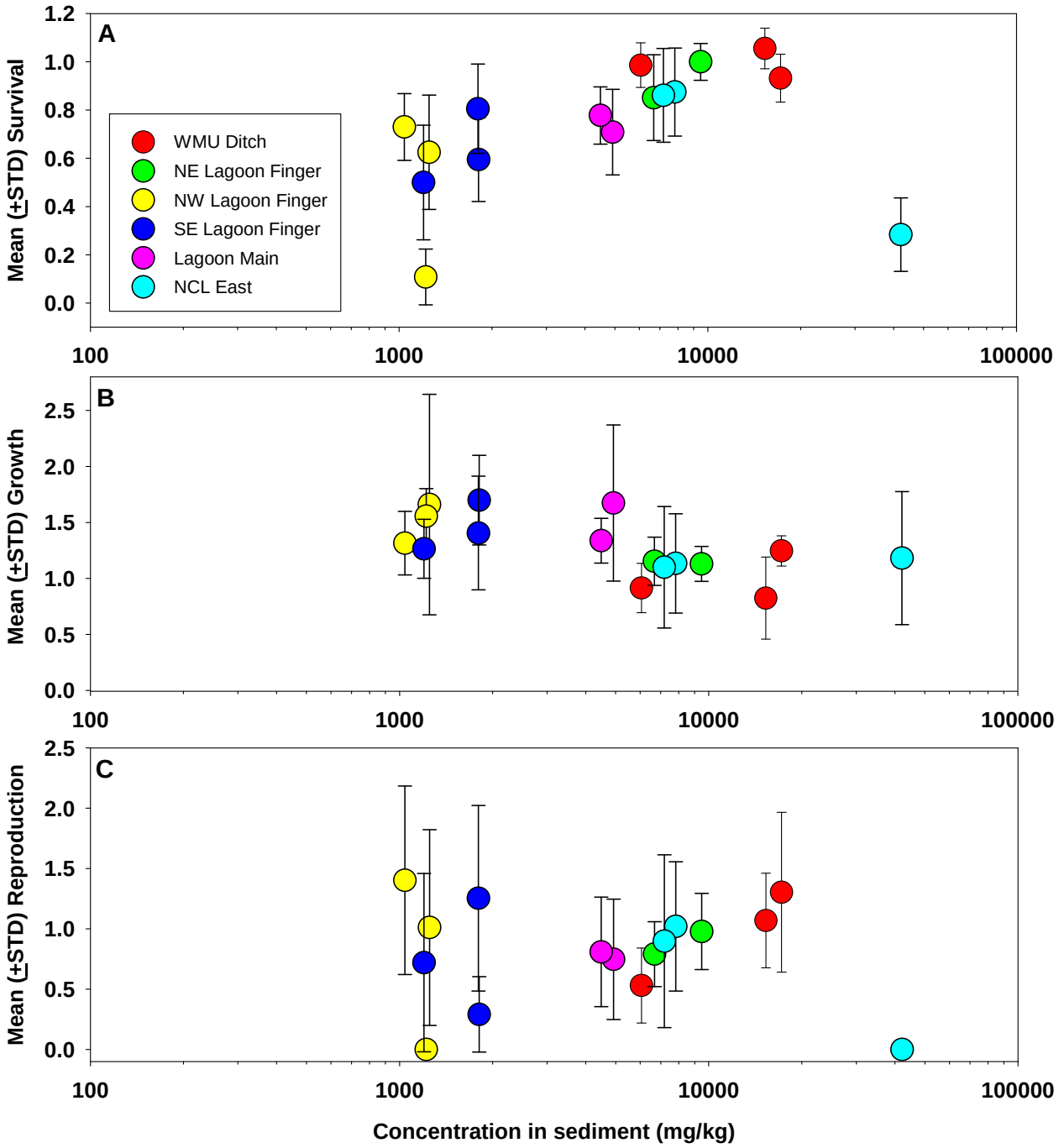


Figure C-14. Dose-response scatterplots for magnesium in sediment versus 42-day survival (A), 42-day growth (B), and reproduction (C) *Hyalella azteca*. All bioassay responses scaled to proportion of mean control response. Only detected concentrations presented.

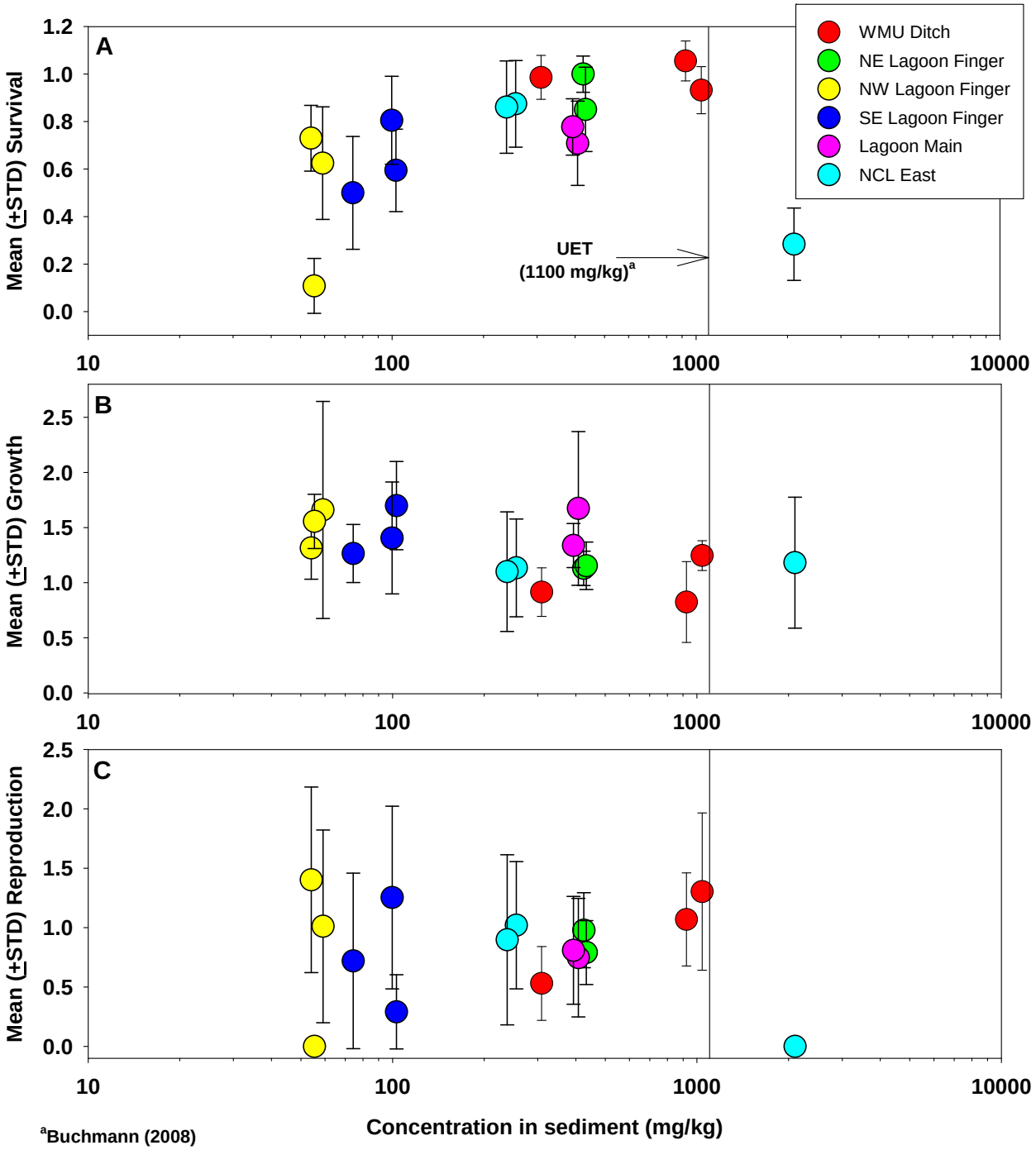


Figure C-15. Dose-response scatterplots for manganese in sediment versus 42-day survival (A), 42-day growth (B), and reproduction (C) *Hyalella azteca*. All bioassay responses scaled to proportion of mean control response. Only detected concentrations presented.

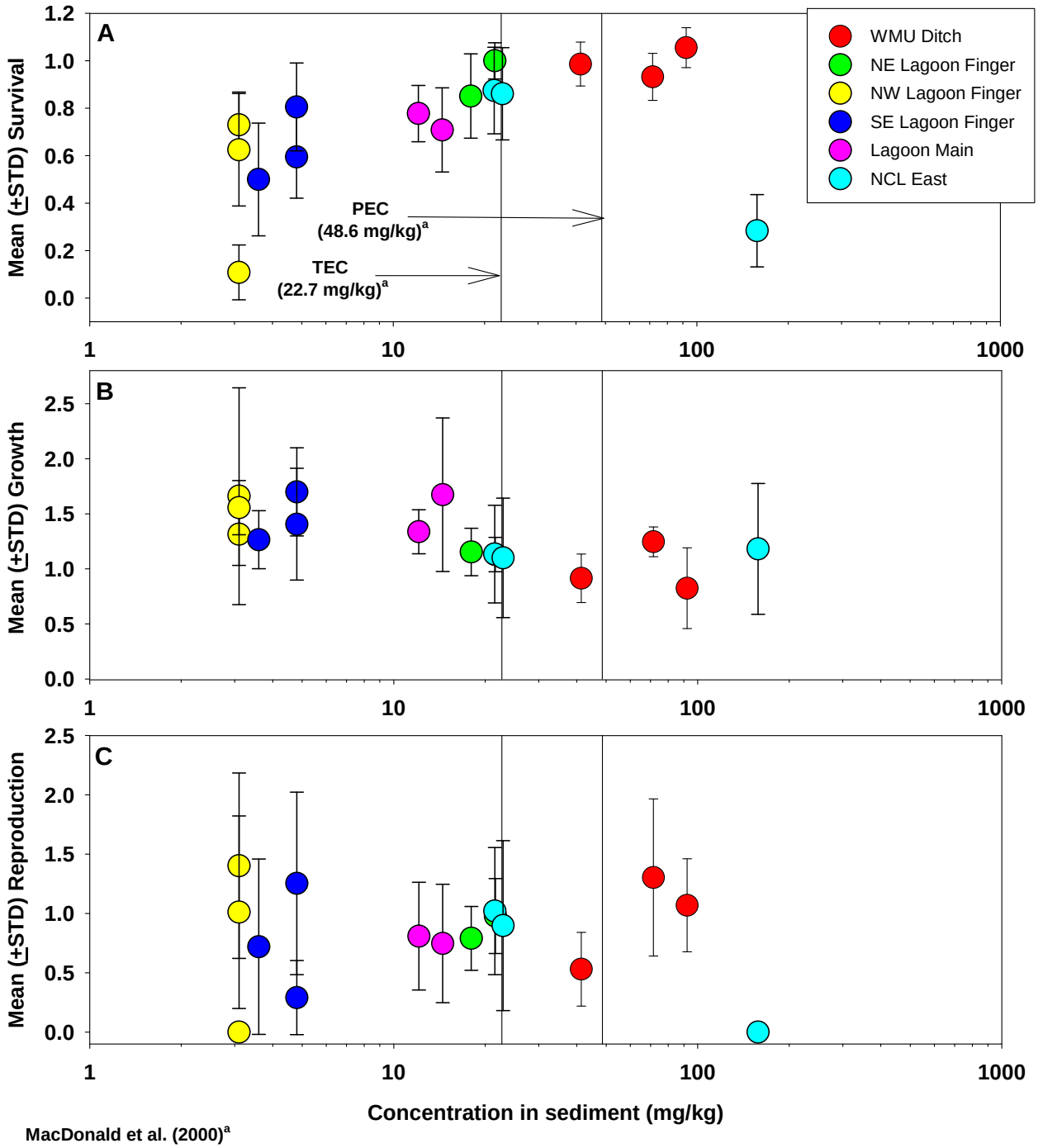


Figure C-16. Dose-response scatterplots for nickel in sediment versus 42-day survival (A), 42-day growth (B), and reproduction (C) *Hyalella azteca*. All bioassay responses scaled to proportion of mean control response. Only detected concentrations presented.

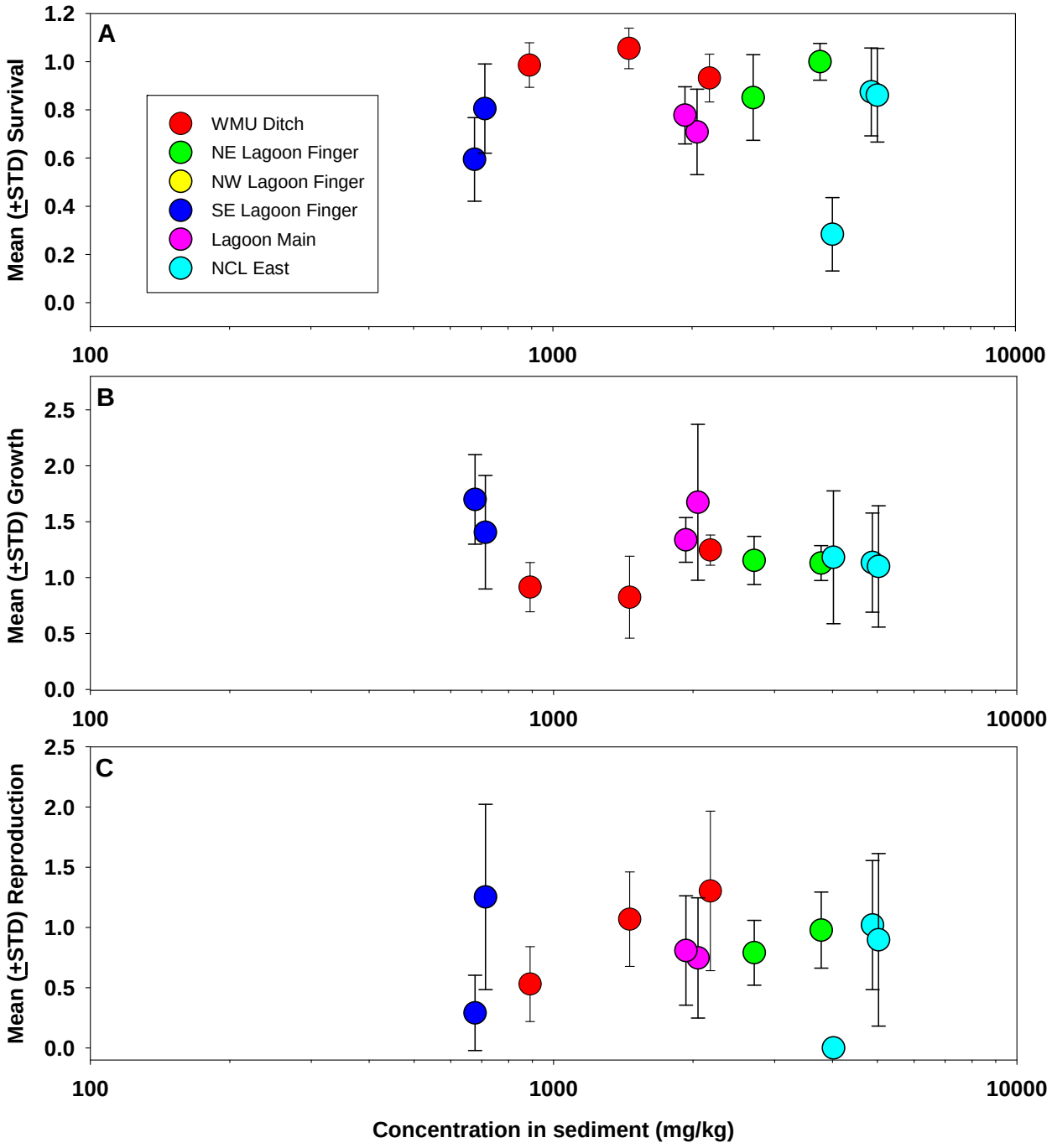


Figure C-17. Dose-response scatterplots for potassium in sediment versus 42-day survival (A), 42-day growth (B), and reproduction (C) *Hyalella azteca*. All bioassay responses scaled to proportion of mean control response. Only detected concentrations presented.

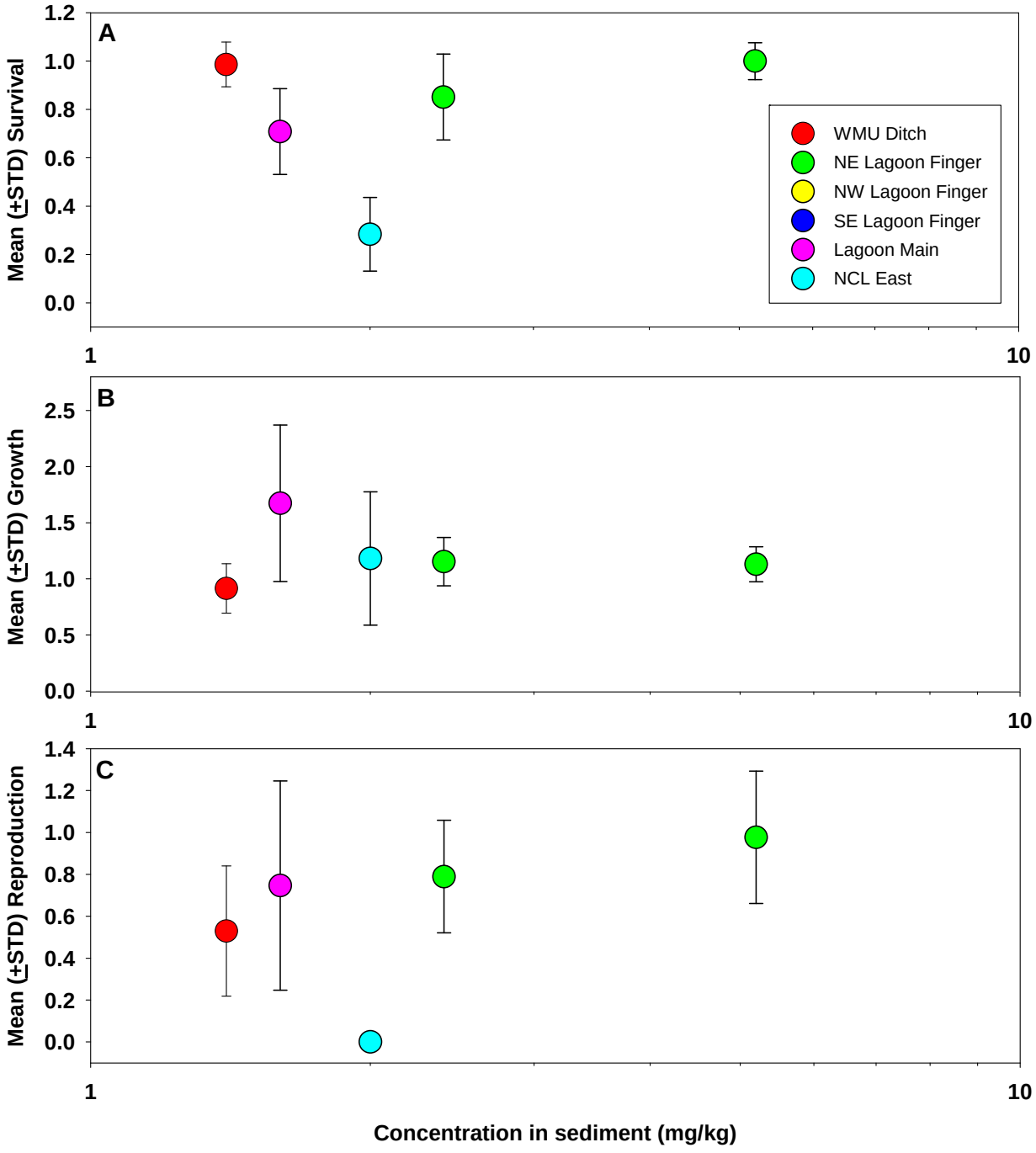
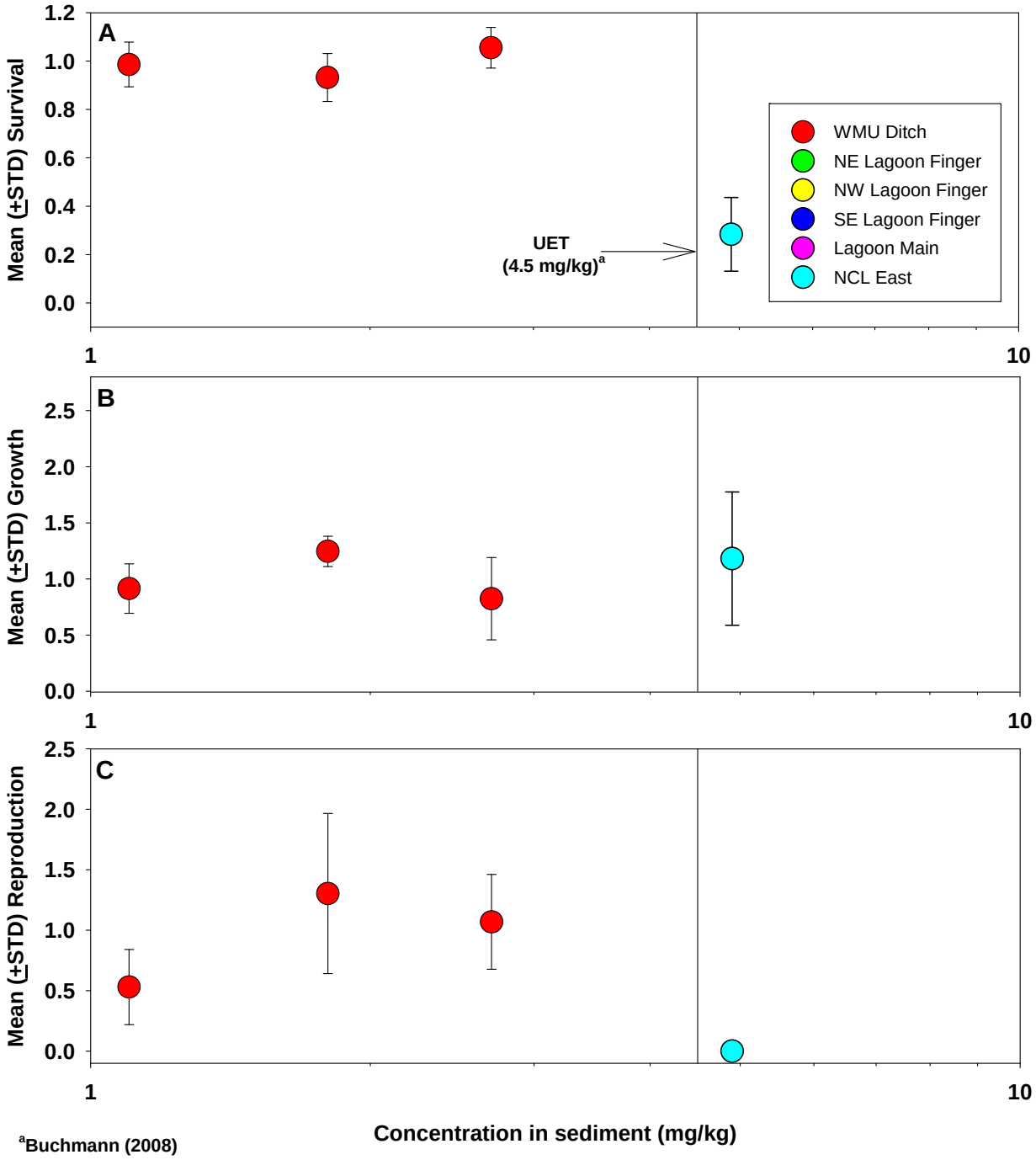


Figure C-18. Dose-response scatterplots for selenium in sediment versus 42-day survival (A), 42-day growth (B), and reproduction (C) *Hyalella azteca*. All bioassay responses scaled to proportion of mean control response. Only detected concentrations presented.



[a]Buchmann (2008)

Figure C-19. Dose-response scatterplots for silver in sediment versus 42-day survival (A), 42-day growth (B), and reproduction (C) *Hyalella azteca*. All bioassay responses scaled to proportion of mean control response. Only detected concentrations presented.

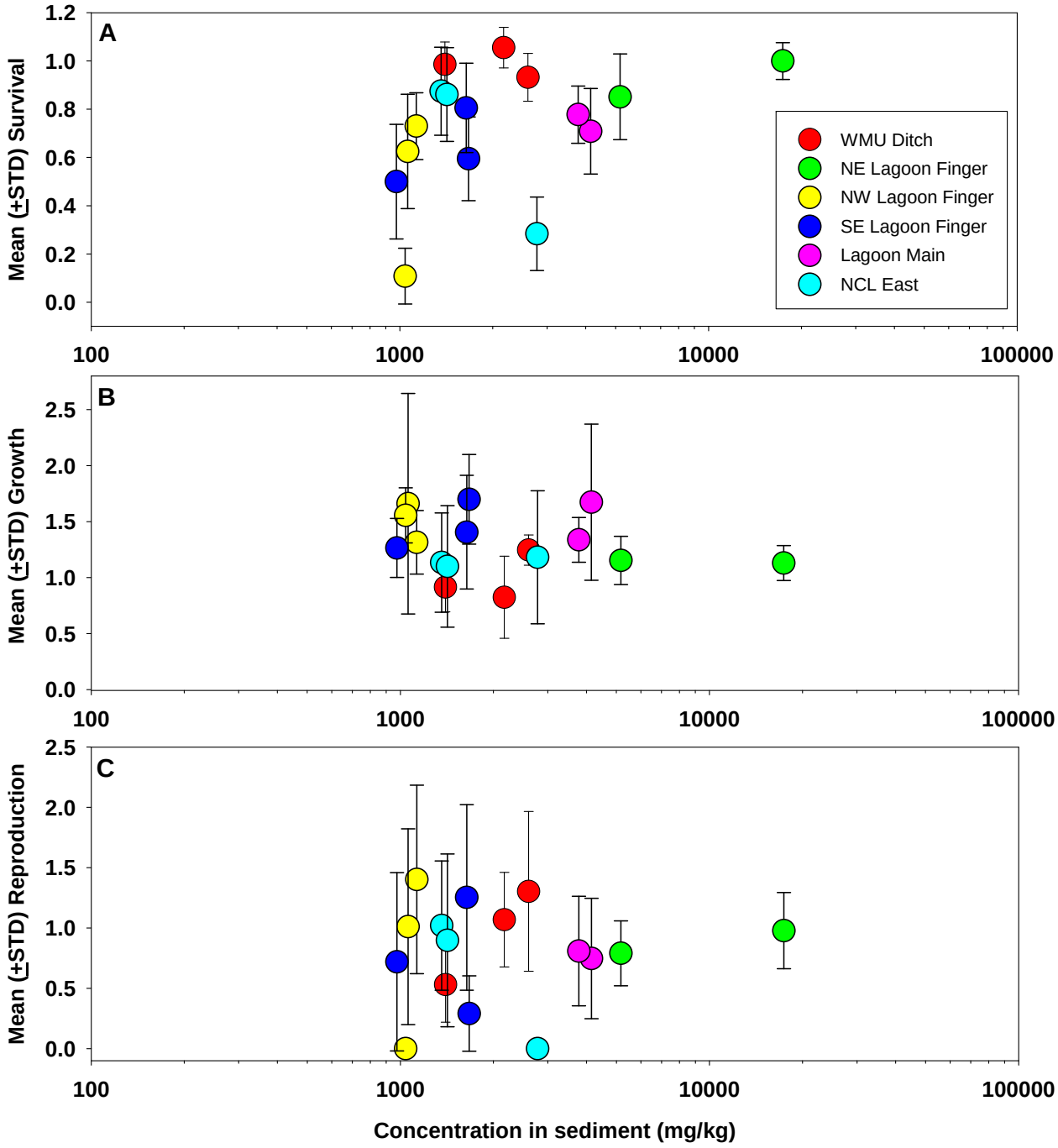


Figure C-20. Dose-response scatterplots for sodium in sediment versus 42-day survival (A), 42-day growth (B), and reproduction (C) *Hyalella azteca*. All bioassay responses scaled to proportion of mean control response. Only detected concentrations presented.

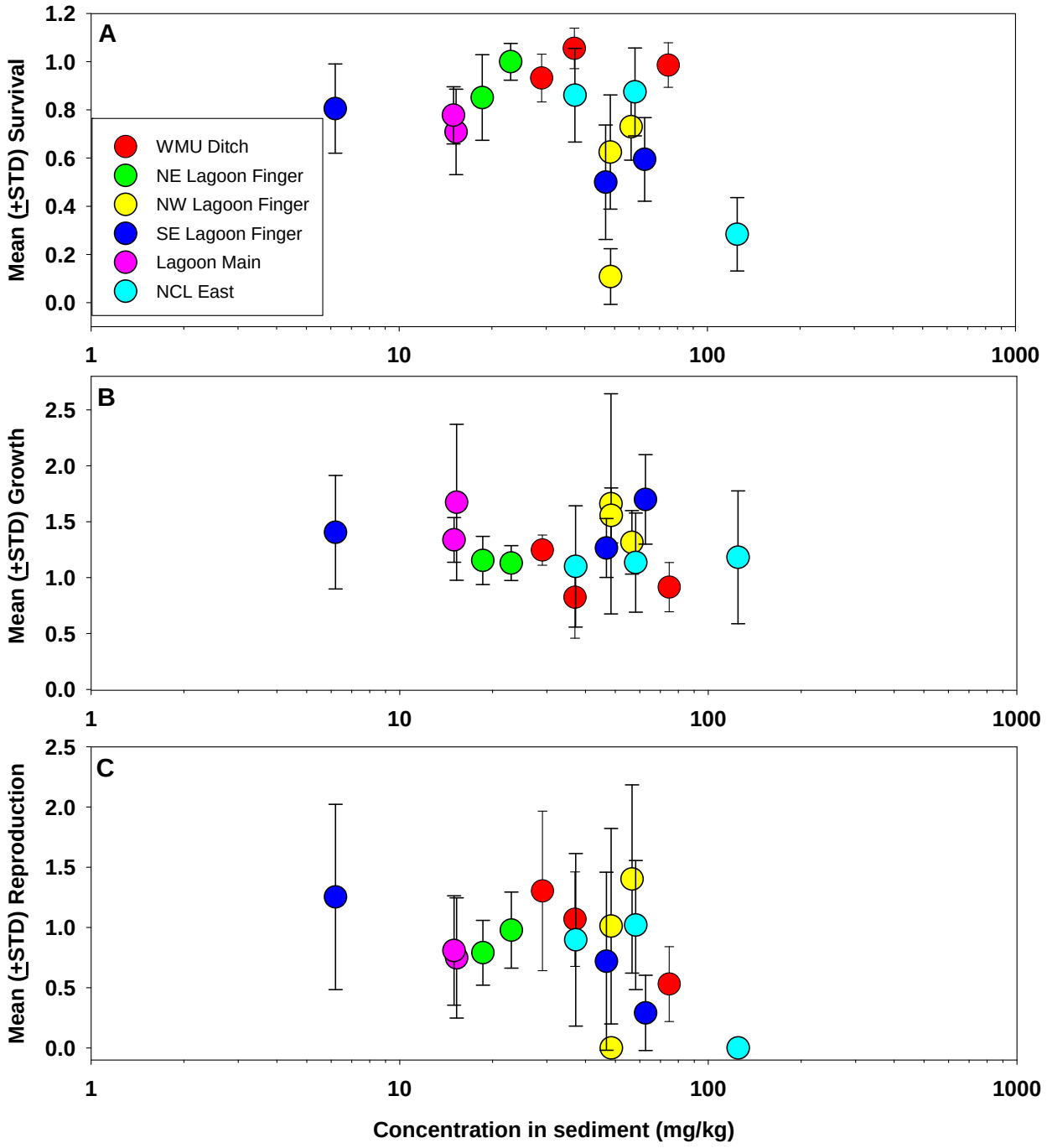


Figure C-21. Dose-response scatterplots for vanadium in sediment versus 42-day survival (A), 42-day growth (B), and reproduction (C) *Hyalella azteca*. All bioassay responses scaled to proportion of mean control response. Only detected concentrations presented.

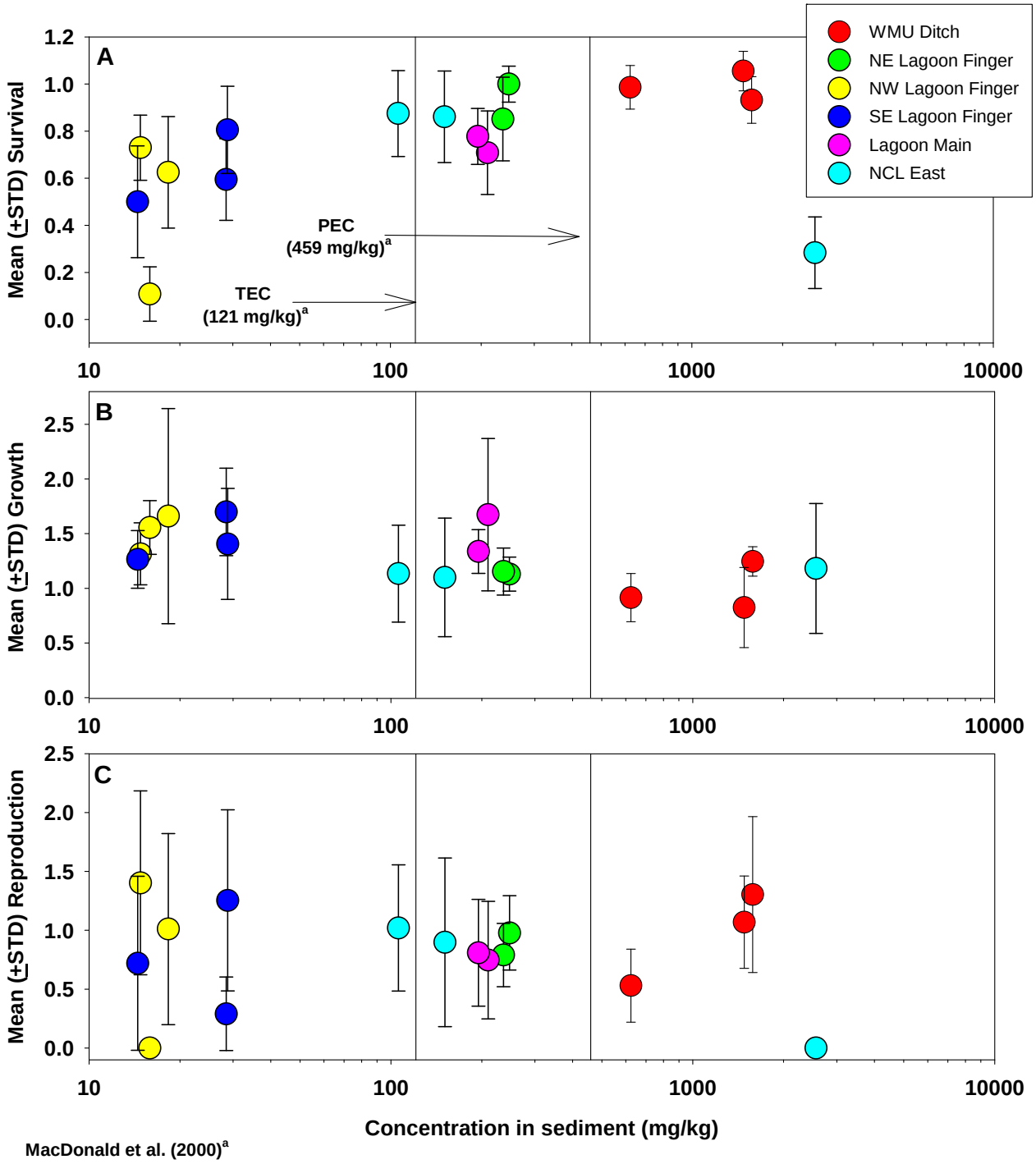


Figure C-22. Dose-response scatterplots for zinc in sediment versus 42-day survival (A), 42-day growth (B), and reproduction (C) *Hyalella azteca*. All bioassay responses scaled to proportion of mean control response. Only detected concentrations presented.

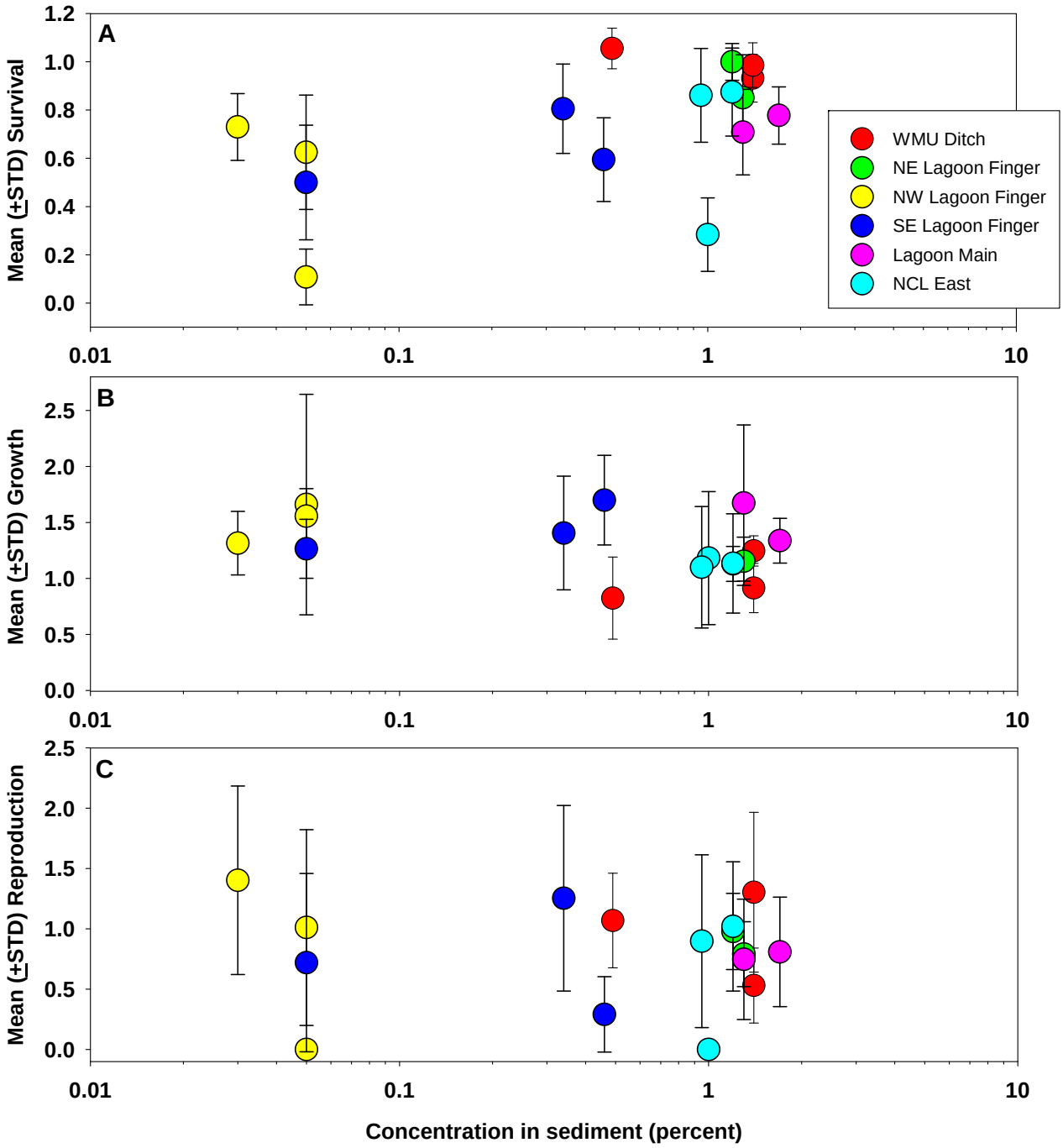


Figure C-23. Dose-response scatterplots for TOC in sediment versus 42-day survival (A), 42-day growth (B), and reproduction (C) *Hyalella azteca*. All bioassay responses scaled to proportion of mean control response. Only detected concentrations presented.

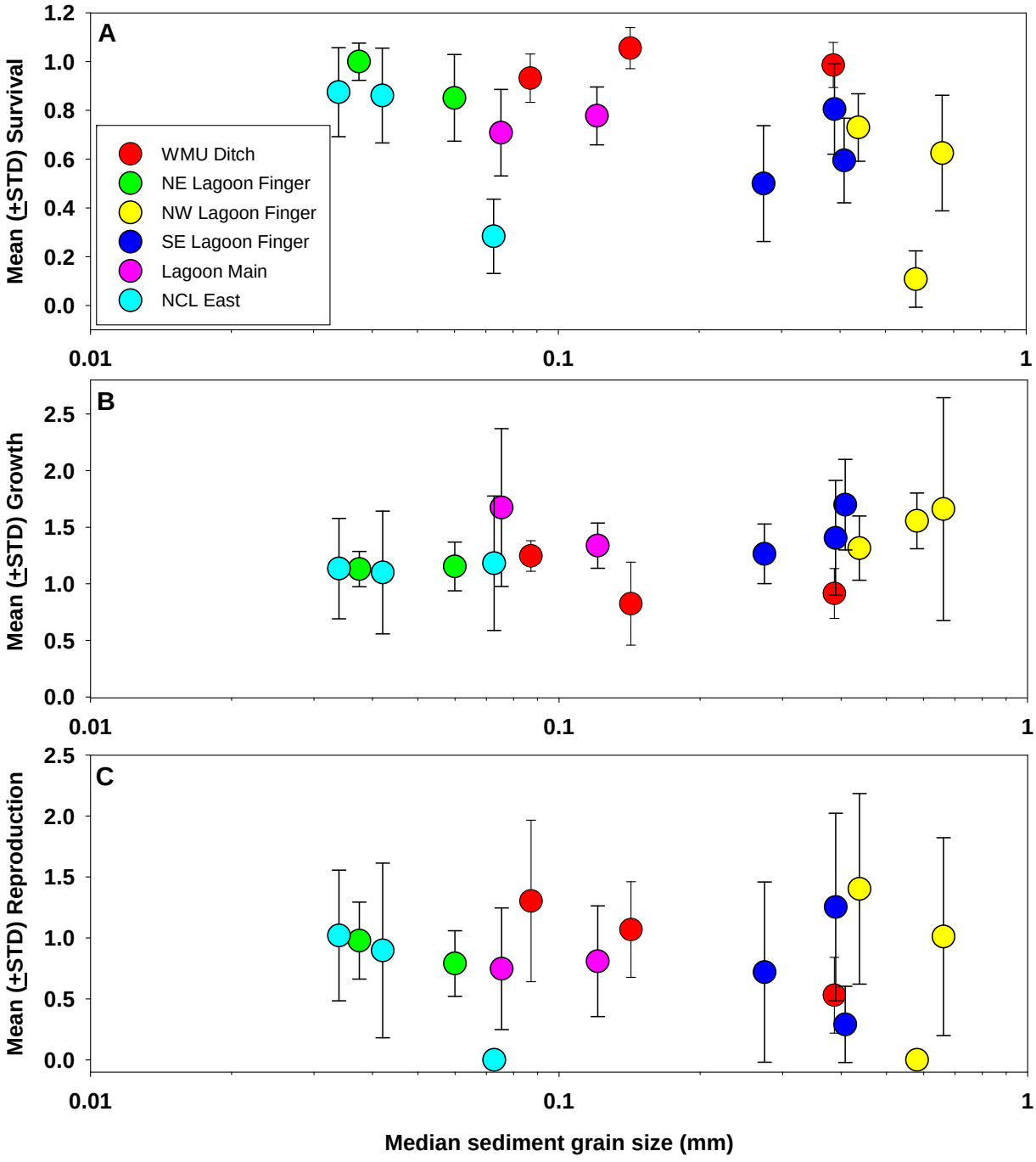


Figure C-24. Dose-response scatterplots for sediment grain size versus 42-day survival (A), 42-day growth (B), and reproduction (C) *Hyalella azteca*. All bioassay responses scaled to proportion of mean control response. Only detected concentrations presented.

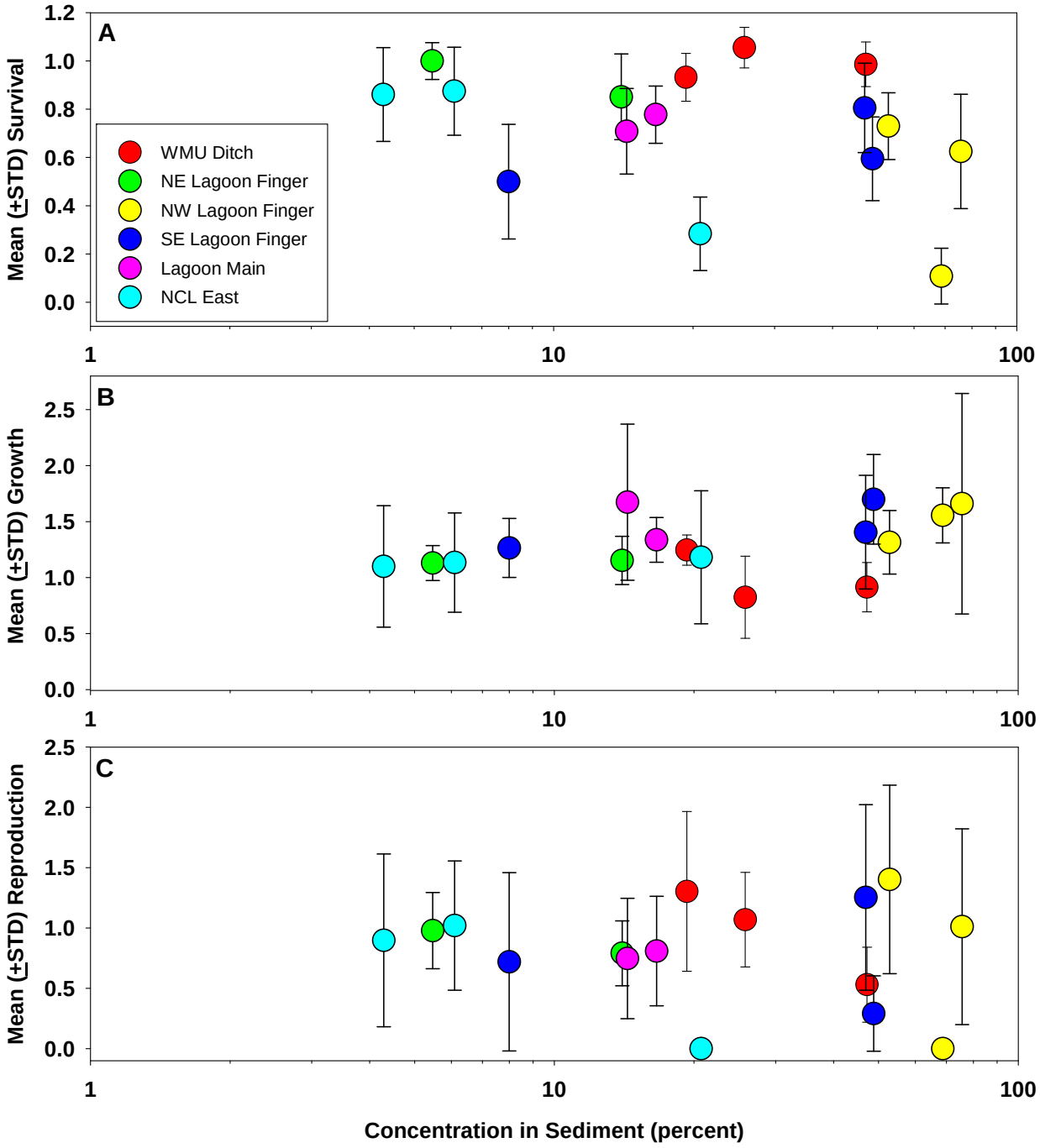


Figure C-25. Dose-response scatterplots for medium sand versus 42-day survival (A), 42-day growth (B), and reproduction (C) *Hyalella azteca*. All bioassay responses scaled to proportion of mean control response. Only detected concentrations presented.

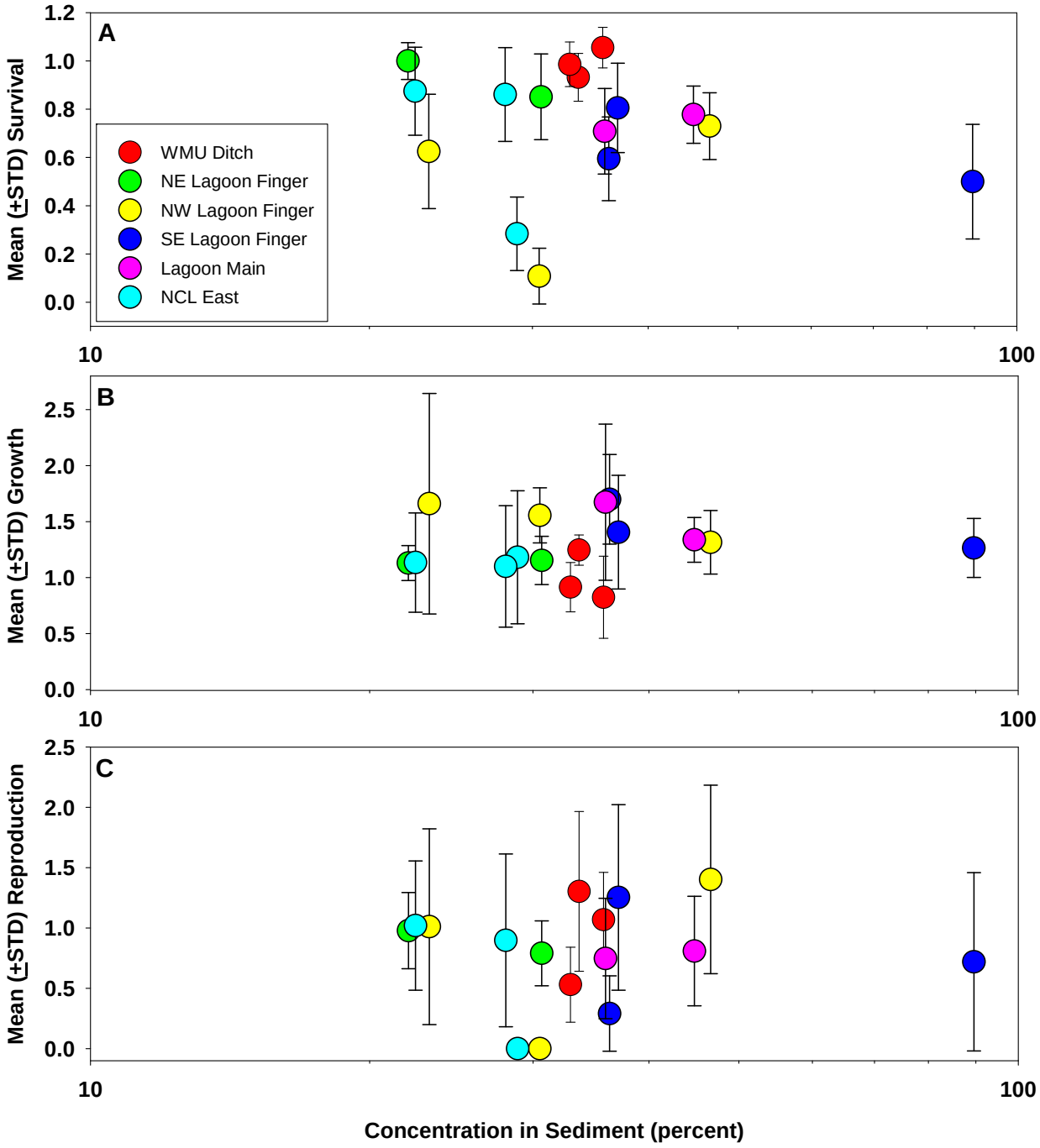


Figure C-26. Dose-response scatterplots for fine sand versus 42-day survival (A), 42-day growth (B), and reproduction (C) *Hyalella azteca*. All bioassay responses scaled to proportion of mean control response. Only detected concentrations presented.

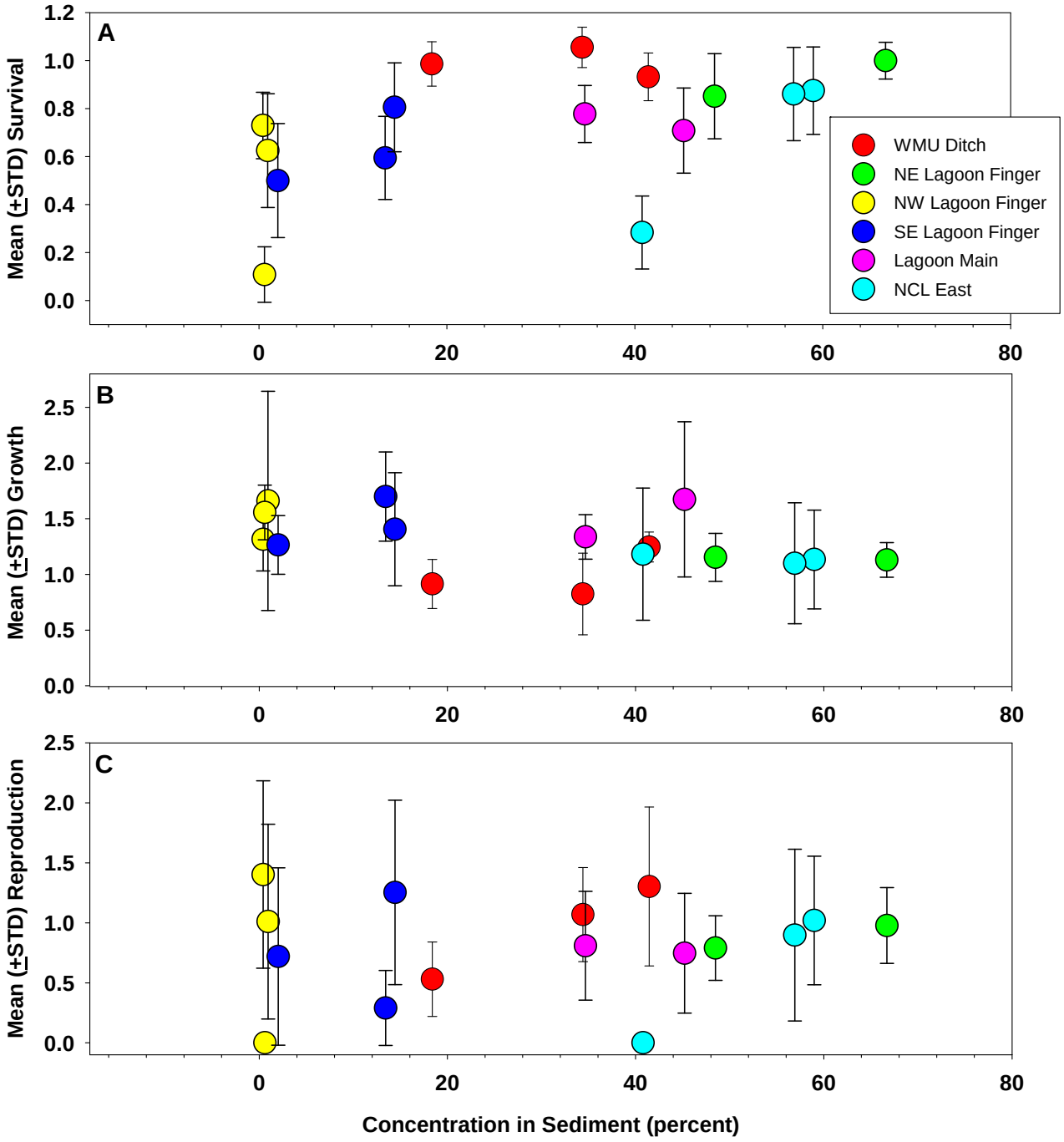


Figure C-27. Dose-response scatterplots for silt versus 42-day survival (A), 42-day growth (B), and reproduction (C) *Hyalella azteca*. All bioassay responses scaled to proportion of mean control response. Only detected concentrations presented.

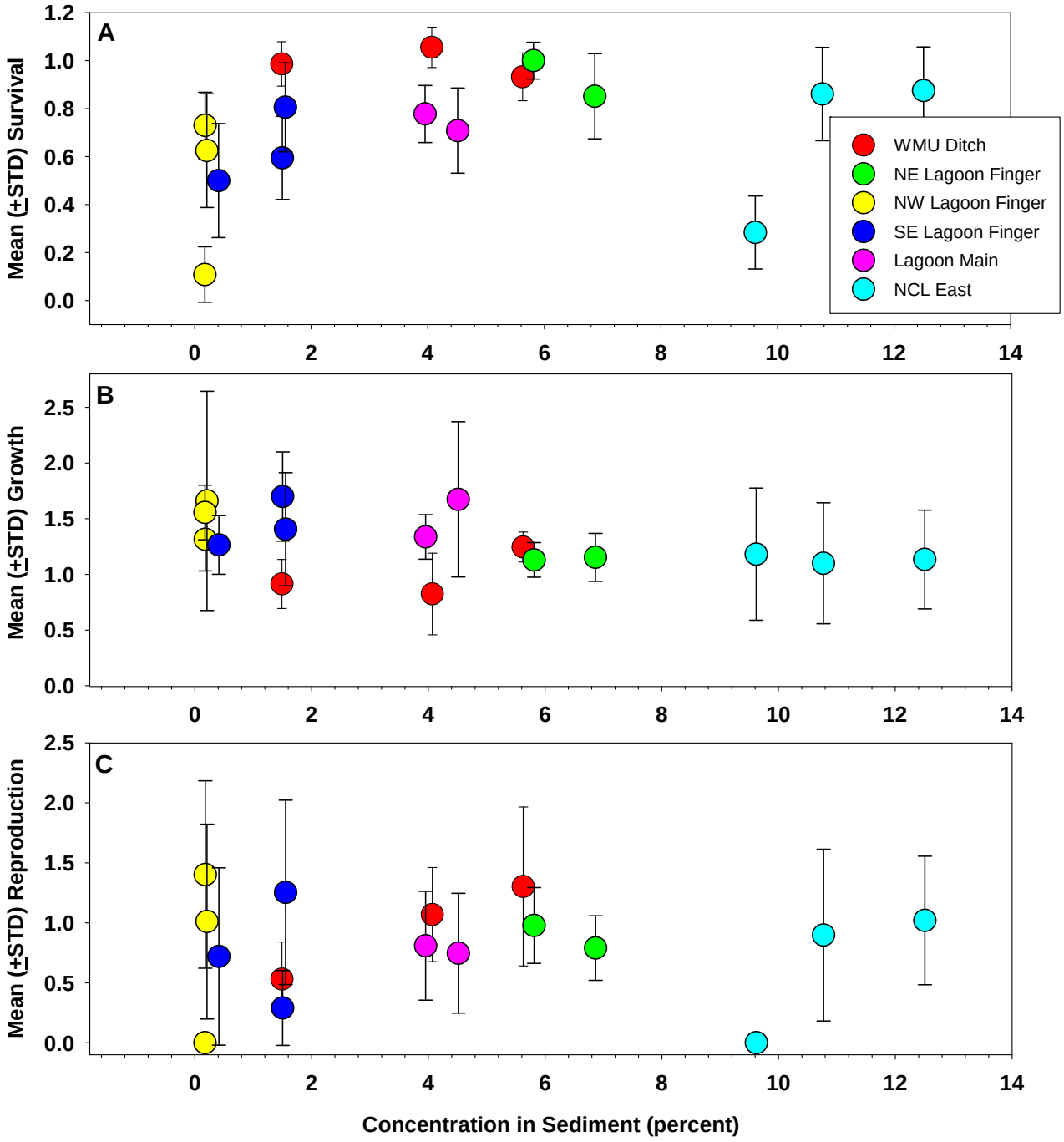


Figure C-28. Dose-response scatterplots for clay versus 42-day survival (A), 42-day growth (B), and reproduction (C) *Hyalella azteca*. All bioassay responses scaled to proportion of mean control response. Only detected concentrations presented.

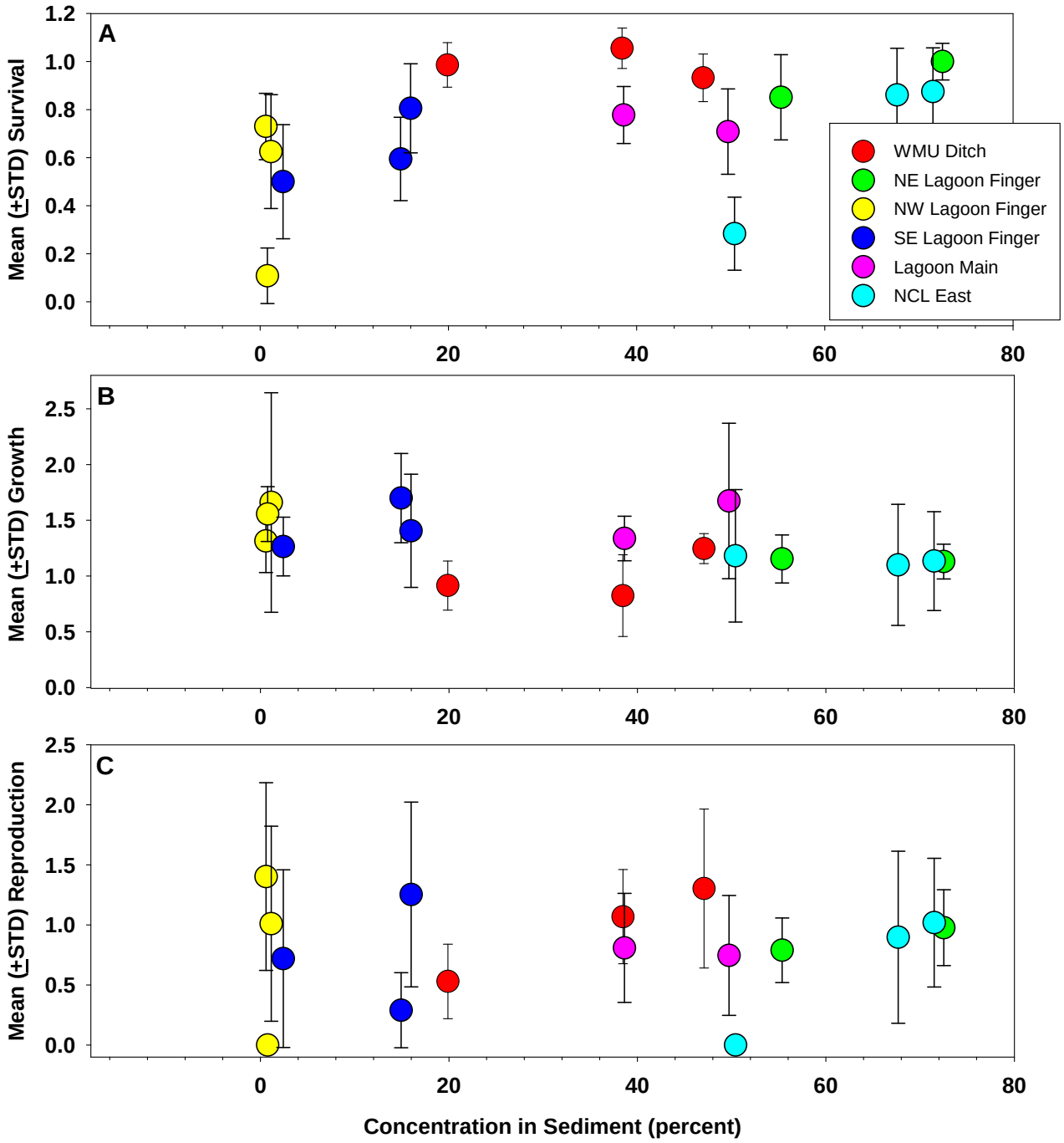


Figure C-29. Dose-response scatterplots for silt and clay versus 42-day survival (A), 42-day growth (B), and reproduction (C) *Hyalella azteca*. All bioassay responses scaled to proportion of mean control response. Only detected concentrations presented.

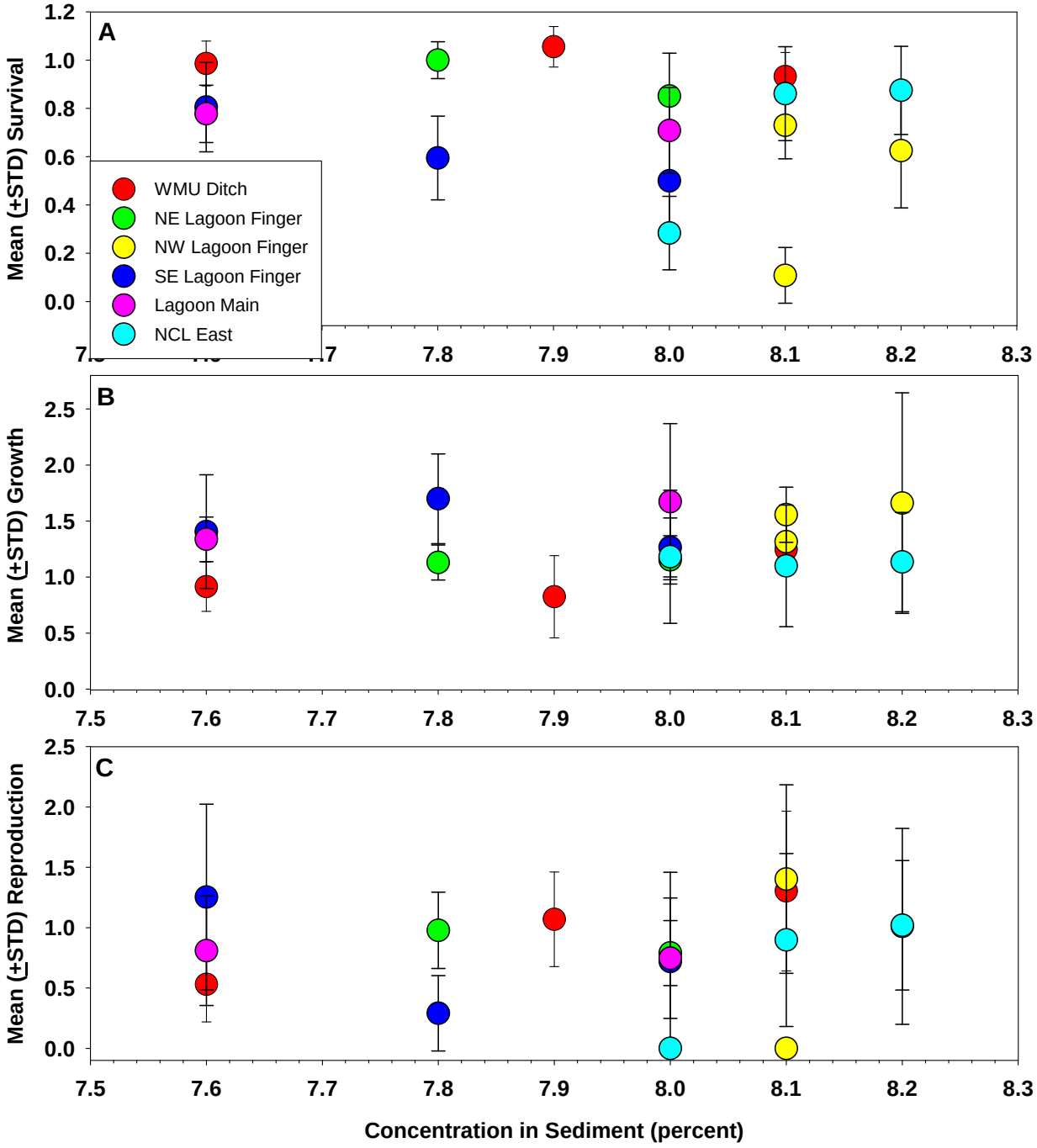


Figure C-30. Dose-response scatterplots for pH versus 42-day survival (A), 42-day growth (B), and reproduction (C) *Hyalella azteca*. All bioassay responses scaled to proportion of mean control response. Only detected concentrations presented.