EOA, Inc.

DRAFT MEMORANDUM

TO: Lorrie Gervin/Dave Grabiec, City of Sunnyvale
Dan Bruinsma/Dave Tucker, City of San Jose

FROM: Kristin Kerr/ Tom Hall

DATE: January 14, 2003

SUBJECT: **DRAFT Additional Analysis of RMP Station BA30 Zinc Translator Information**

BACKGROUND

A Reasonable Potential Analysis (RPA) is required to be conducted during the permit renewal process to determine which effluent limits need to be included in the reissued permits. On behalf of the City of Sunnyvale and the City of San Jose, EOA prepared separate Draft RPAs memos during July 2002. These initial RPAs used Regional Monitoring Program Yerba Buena Island (Station BC10) data for receiving water background data and a hardness of 400 mg/L. RWQCB staff and their consultants prepared Draft RPAs for the three South Bay cities during July and August 2002 that differed in several ways from the approach used by EOA, primarily in the use of Dumbarton Bridge (Station BA30) data for background and the use of default metals conversion factors instead of site specific translators.

To facilitate subsequent discussion of these RPA approach differences and implications on effluent limit requirements, EOA prepared a follow-up memo titled *Draft Review of Key RPA Issues and Options* (09/24/02, revised 12/19/02 and 01/14/03). To simplify the comparisons, and since it made no difference on the outcome of the RPA results (when translators are used) a slightly modified RPA was included with the "Issues" memo that used a conservative default hardness of 100 mg/L instead of 400 mg/L. Tables were included that showed how the results would differ depending of whether BC10 or BA30 background data were used. There were very minor differences in BC10 vs BA30 calculated translator values. However, four additional constituents at BA30 vs at BC10 would have RP based solely on background concentrations exceeding the corresponding water quality objectives.

One key issue addressed in the "Issues" memo (pages 6-9 and intervening tables) was how to adjust California Toxics Rule (CTR) dissolved metals based water quality objectives (criteria) (WQO) and dissolved metals receiving water concentrations, to a total metals basis. This adjustment is required since Federal Regulations require that effluent limitations be expressed on a total metals basis and thus effluent data are collected and analyzed for total metals concentrations. Thus CTR WQOs need to be adjusted from dissolved to total concentration to allow comparison to the maximum effluent concentrations (MEC) in the EPA based RPA (the first RPA trigger). For consistency under the State Implementation Plan (SIP) RPA Section 1.3 Step 6 (the second RPA trigger), background receiving water dissolved metals concentrations need to be similarly adjusted to total metals to allow comparison to the adjusted CTR WQOs developed and used for the MEC comparison.

(Possible future revisions to the SIP may modify and improve the current RPA process. Both BACWA and RWQCB staff submitted comments to the SWRCB in mid-December 2002 on changes to the SIP regarding how translators should be applied. Another common comment was that background concentration exceedances of WQOs alone should not trigger RP).

CONVERSION FACTORS vs TRANSLATORS in RPAs

Four options for adjusting the WQOs and RMP Station BA30 (Dumbarton Bridge) background receiving water concentrations were presented in the “Issues” memo. Table A in the Attachments to this memo is an updated version of the table summarizing those options with a column added for Sunnyvale MEC values. The table shows (in bold) the four metals that could potentially be viewed as having RP depending on one’s assumptions about use of conversion factors versus site specific translators.

Hexavalent Chromium and Lead Even when hexavalent chromium and lead WQOs are adjusted with the conservative default conversion factors (instead of RMP translators), the only instance when there could be RP is the case where the RMP directly measured total metals background concentrations would be compared to the CF adjusted WQOs (Option 2). As noted above and in more detail in the “Issues” memo, this would be an internally inconsistent way of conducting an RP contrary to the SIP. When the dissolved background concentrations are instead converted to total metals using the CFs (Option 3) there is no RP (and by a wide margin) for hexavalent chromium or lead.

Mercury Total mercury concentrations are used in the RPAs instead of dissolved given that mercury is bioaccumulative and therefore the total metal concentration present is of concern. Two total mercury BA30 concentrations were above the CTR WQO of 0.051 ug/L. All MECs were well below the WQO.

Zinc Zinc is the only effluent metal where the Sunnyvale and San Jose MECs (110 and 102 ug/L respectively) could show RP, and only if one were to use the default CFs to adjust the CTR WQOs instead of translators. As shown in Table 1 below, the lowest WQO adjusted with the EPA conversion factor (0.946) is 85.6 ug/L while the lowest WQO adjusted with RMP BA30 translators is 170 ug/L. It is somewhat unusual that the translated CMC resulted in a lower WQO than the translated CCC. This appears to be due at least in part to the fact that for most other metals the chronic (CCC) values are at least two times lower than the acute (CMC) values rather than only about 10% lower for zinc.

Table 1. RPAs for Zinc: MECs Compared to Differently Adjusted WQOs

	Default EPA Conversion Factor	**BA30 RMP Translator**
Saltwater CMC	90	90
CMC Translator	0.946	0.53
Acute WQO Adjusted	95	170
Saltwater CCC	81	81
CCC Translator	0.946	0.2
Chronic WQO Adjusted	85.6	405
Lowest WQO	85.6	170
Sunnyvale MEC	110	110
Sunnyvale Zinc RP?	**Yes**	**No**
San Jose MEC	102	102
San Jose Zinc RP?	**Yes**	**No**

The SIP Section 1.4.1 specifies the use of default EPA conversion factors (i.e. divide the dissolved WQO by the applicable conversion factor to calculate a total recoverable WQO) unless site specific translators have been developed. Permit Work Group (PWG) members have generally been supportive of the use of site specific metals translators based on Regional Monitoring Program data versus the use of default EPA conversion factors. However, in a November 16, 2002 email RWQCB staff requested additional supporting analysis of how these RMP based translators should be calculated.

The direct ratio approach has been used to date, based on the very similar results obtained previously in the Lower South Bay (LSB) for copper and nickel translators using more complex methods.

Given that zinc is the only constituent for which translators are potentially an issue (in the Sunnyvale and San Jose RPAs), this memo presents additional analysis of alternative approaches using available data to derive zinc translators. Until further information is available to more definitively identify the most hydrodynamically appropriate background station for the LSSFB, the RMP Dumbarton Bridge station (BA30) data are being used for background for these analyses.

INITIAL TRANSLATOR DETERMINATION APPROACH

EOA developed proposed site specific copper and nickel translators for the LSSFB as part of the prior (1998) permit reissuance process (*Case Study: Investigation of Metals Translators for the Sunnyvale WPCP, August 1997)*. That memorandum (see Attachment B) described in considerable detail the rationale for translators, and three alternative approaches for deriving translators based on the June 1996 EPA translator guidance document. Readers interested in more background information on translators are referred to Attachment B.

The EOA 1997 translator study looked at the relationship between TSS, TOC, DOC, DO, pH and translators and found that the only consistently statistically significant relationship was with the natural log of TSS. The study found that the direct ratio computation method and the regression with ln(TSS) method produced South Bay translator values that only varied by 0.03 (0.63 vs 0.66, respectively).

The SIP outlines two approaches for developing site specific translators. If existing data are not available from which to calculate translators, dischargers have up to two years from the date of permit issuance to develop a workplan (that must be approved by the RWQCB staff after consultation with the Department of Fish and Game), to collect the necessary data, and submit the results and proposed translators. Several translator studies have been conducted around the Bay (generally for copper and nickel) including work by Sonoma Valley County Sanitation District, Las Gallinas Valley Sanitary District, City of Petaluma, Union Sanitary District for Hayward Marsh, and the City of Sunnyvale.

As an alternate to conducting a new translator study after permit adoption, the SIP allows for the RWQCB to consider applying translators

> “based on a study completed prior to the adoption of this Policy if the RWQCB believes the translator adequately reflects existing conditions (including spatial and/or seasonal variability) in the areas of the water body affected by the discharger’s effluent”.

This was the approach used in the Sunnyvale RPA, namely to make use of the existing high quality RMP data to calculate translators for metals other than copper and nickel (which have already been developed and approved as part of the May 2002 site specific objective Basin Plan Amendment). The USEPA translator guidance document (June 1996) recommends using a minimum of 8 to 10 pairs of data points (dissolved and total metals) that are representative spatially and temporally (seasonally) of the receiving water to calculate a translator. There are generally 21 RMP data points available from 1993 – 1999 sampled at three different times during the year. Therefore by these criteria, the available RMP data should be adequate and sufficient to calculate translators for the remaining metals.

The Regional Board Response to EOA, Inc. Translator Analysis (November 16, 2002) supported the use of site specific data in developing site-specific metals translators for dissolved water quality objectives, and took no issue with the use of RMP data. However the staff recommended that "methods to develop translators be consistent both with EPA guidance, and with those used in the Lower South San Francisco Bay (LSSFB) to develop metals translators for copper and nickel."

EOA, Inc. is very familiar with the methods used in the LSSFB SSO. EOA worked with Tetra Tech as part of the copper/nickel TMDL SSO workgroup in the developing of the translator methods and performing the analyses of the data that is documented in Appendix D (pp. 76-80) of the May 2002 SSO Basin Plan Amendment (BPA) staff report. The LSSFB SSO work developed translators using both the direct ratio method and the regression against TSS approach referenced in the 1986 EPA guidance document. Results from the two methods only varied by 0.03 (0.45 vs 0.42, respectively). The LSSFB SSO work also used the Classification and Regression Tree (CART) program to evaluate the potential effect of other variables on translator results. As in the EOA 1997 analysis, TSS was again found to be the only significant variable in predicting translators.

The July 2002 Sunnyvale and San Jose Draft RPAs and the follow-up September 24, 2002 "Issues" memo used the direct ratio translator calculation method in large part based on these prior experiences that showed very similar results with regression derived translators. Given that BA30 is effectively part of the LSSFB, it was not expected that ancillary water quality constituent data would vary appreciably from that evaluated in 1997 or for the 2002 SSO be useful in explaining/deriving translators.

However, as requested, results from additional regression and CART analyses are presented below for zinc and ancillary water quality data from the RMP Dumbarton Bridge BA30 station. It needs to be kept in mind that the purpose, and scope, of these additional analyses is to document the potential range of technically defensible zinc translators based on the approach used in the LSSFB in a manner appropriate to the available BA30 data. The bottom line is to then revisit the MEC RPA determination and verify that there is or is not RP for zinc based on the resultant translator(s).

It is beyond scope of this analysis to address the multitude of technical and policy issues that need to be resolved as part of developing a reasonable and practical region-wide approach for translator development and application.

ADDITIONAL BA30 DATA AND TRANSLATOR ANALYSES

Raw Data and Bar Charts

RMP sampling at BA30 was conducted three times per year from 1993 – 1999, typically in February, April, and July (Winter, Spring, Summer) to capture the range of Delta outflows (from high to low flows). Attachment A includes a table of raw data and associated summary statistics for dissolved and total zinc, direct dissolved to total zinc ratio based translators, and available physicochemical data (TSS, DOC, DO, pH, silicate and temperature).

Bar charts showing total and dissolved zinc, ratio based translators, and TSS are also included in Attachment A with the bars color coded by season. Visual inspection shows that total zinc and TSS concentrations track fairly closely but that there is not a consistent relationship between dissolved zinc and TSS. There was also not consistent relationship between total and dissolved zinc. Dissolved zinc concentrations were consistently higher in winter samples. The zinc translator with TSS overlay bar chart shows higher translators during winter but no consistent relationship to TSS. Some factor(s) other than or in addition to TSS appear to be affecting dissolved zinc concentrations.

Physiochemical Parameters as Potential Predictors of Translators

Regional Board staff recommended evaluating the RMP data to determine if a statistically significant relationship exists between physicochemical data and individual total to dissolved ratios. This approach was suggested for any metal having a range of total to dissolved ratios where the maximum is at least three times the minimum (e.g., T:D ratios range between 2 and 6). It is assumed that this suggestion is directed at evaluating the potential relationship between other constituents and particularly variable (and low) translators. It is not clear why T:D terminology is being introduced instead of referring directly to translators. The suggested screening range is equivalent to translators (D:T) in the range of 0.50 to 0.167. (To minimize confusion, this memo will continue with translator terminology.)

With three exceptions (0.63, 0.53, and 0.53) all the zinc data fall into the suggested range deserving investigation. Probability plots (Attachment A) of total and dissolved zinc using both arithmetic and log scales demonstrate the data to more closely fit a log-normal distribution (as often occurs with environmental data). Therefore the translator versus physiochemical data evaluations are presented in log-log X/Y scatter plots with regression lines (Attachment A).

None of the plots of direct ratio zinc translator versus TSS, DOC, DO, silicates, temperature, or chlorophyll a showed any significant relationships, nor did plots of total versus dissolved zinc. This is consistent with the prior two translator study results, except that in this instance TSS was only weakly related to the translators. The RWQCB commentors also observed (based on Yerba Buena station data) little relationship between these variables and translators. The correlation coefficients for these plots are shown in Table 2 below.

Table 2. Correlation Coefficients for Scatter Plots

	Correlation Coefficient (r^2 value)
Zinc Translator versus TSS	0.21
Zinc Translator versus DOC	0.0005
Zinc Translator versus DO	0.10
Zinc Translator versus Silicates	0.04
Zinc Translator versus Temperature	0.28
Zinc Translator versus Chlorophyll a	0.13
Zinc Translator versus pH	0.09
Total Zinc versus Dissolved Zinc	0.05

Outlier Analysis

Regional Board staff recommended screening the data for statistical outliers. Graphical displays of the dissolved to total ratio against physicochemical parameters were suggested to help evaluate if one individual sampling event were driving a supposed relationship. Visual inspection of the X/Y scatter plots did not indicate the existence of readily obvious outliers.

The log-log plot of the zinc translator vs TSS has a regression line with an r-square value of 0.21. One point with a value of 0.17 and TSS of 3 mg/L was evaluated as a possible outlier (4/16/97 sample). There is a corresponding point (2/02/95) with an almost identical TSS of 3.2 mg/L that has a value of 0.53, the third highest translator in the dataset. The two events had similar DOC values of 2.8 and 3.3 mg/L, respectively. Silicates were lower at 2 vs 4.2 mg/L and chlorophyll a higher at 22.3 vs 14.5 mg/m3 in the 1997 vs 1995 events, perhaps indicating the presence of a phytoplankton bloom during the 4/16/97 event based on the lower silica (used in diatom cell walls) and higher chlorophyll a present (an indicator of phytoplankton biomass). Spring phytoplankton blooms are common in the LSSFB.

It not clear that there is a strong basis based on the ancillary data for calling the 0.17 value an outlier and the 0.53 value not an outlier. If the 0.17 value were to be removed from the data set the relationship of zinc translator to TSS does improve somewhat from an r-squared of 0.21 to 0.31 and the slope of the regression line increases in the manner expected (higher translators with lower TSS). If the 0.53 value is removed from the data set the relationship of zinc translator to TSS worsens somewhat from an r-squared of 0.21 to 0.12 and the slope of the regression line decreases.

In the same respect, at the highest TSS values there are two data points that appear perhaps disproportionately distant from the regression line. If the high zinc translator value, 0.33, at the high TSS value of 81 mg/L were to be removed from the dataset, the relationship of zinc translator to TSS does improve somewhat from an r-squared of 0.21 to 0.31 and the slope of the regression line increases in the manner expected (lower translators with higher TSS). If the lower zinc translator value, 0.07, at the high TSS value of 72.3 mg/L were to be is removed from the dataset, the relationship of zinc translator to TSS would worsen somewhat from an r-squared of 0.21 to 0.13.

Given the current unresolved status of how and when it is appropriate to classify and censor a datapoint as an outlier, all of the data have been retained and used in these analyses.

Multiple Parameter Influence on Translators

The RWQCB commentors noted that TSS alone may not be a useful predictor of translators and suggested that multiple factors together be examined to attempt to account for multiple parameters or interactions between parameters. To address this same issue, the LSSFB SSO effort used the Classification and Regression Tree (CART) program. CART is a software implementation (Salford Systems) of a nonparametric multivariate analysis technique known as Regional Sensitivity Analysis (Spear and Hornberger, 1980; Breiman et al., 1984).

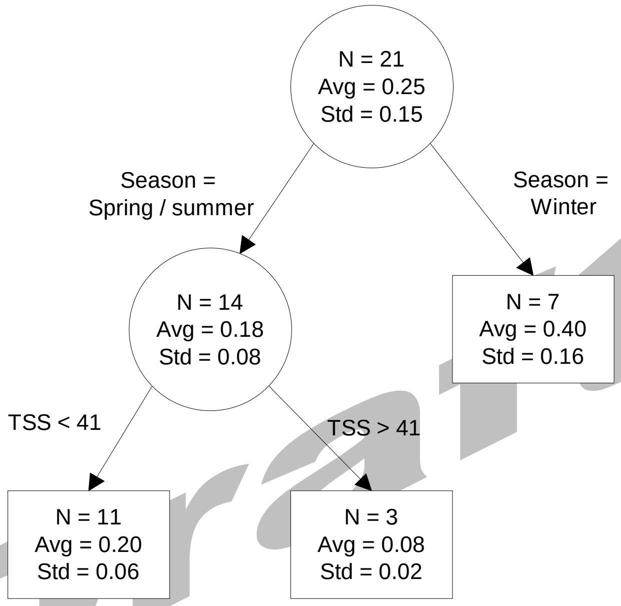
Multivariate analysis is motivated by the fact that various types of parameter interactions may be important with respect to the output variable (in this case the output variable is the translator for Zn at the BA30 station). CART analysis leads to classification rules based on inequality constraints applied to individual parameter values or to linear combinations of parameters. The analysis produces a tree structure in which a parametric division is made at each node by an inequality. Observations satisfying the condition are sent to the left node, otherwise they are sent to the right node. Splits in the data are chosen that minimize the classification error. When a split is chosen, the node is replaced by two daughter nodes. Splitting continues until a prespecified stopping rule is satisfied.

The LSSFB work used translators as the CART response variable and site, season (wet or dry), TSS, and tide as input variables. There were 12 stations and nearly 600 metals datapoints in the LSSFB work. The most important variable in predicting translators was TSS, with site slightly more important than season or tide. Based in part on these results, two slough sites were dropped from the translator calculations because they did not appear to be representative of LSSFB conditions.

CART analysis conducted for the zinc translator investigation was carried out using the RMP BA30 zinc translator data collected between March 1993 and July 1999 (21 sample events). Other parameters used in the CART analysis were DO, DOC, pH, silicates, temperature, TSS and season (winter, spring, summer). Since data from only the one BA30 station are being used in this analysis, station was not a relevant variable for CART analysis. Each variable in the CART tree has an importance score based on how often and with what significance it served as primary or surrogate splitter throughout the tree. The scores reflect the contribution each variable makes in classifying or predicting the target variable, with the contribution stemming from the variable's role in primary splits. Season had a relative score of 100, TSS a relative score of 45 and DOC, pH, silica, and temperature all had relative scores of 0.

Results from the CART analysis are presented graphically below. The figure indicates the first splitting occurs on the parameter “Season”. CART grouped spring and summer together and winter separately. The average translator value during the winter season (N=7) was 0.40, slightly higher than the average for the entire dataset of 0.25 (N=21). The average translator value for Spring/ Summer observations (N=14) is 0.18. CART found that these Spring/Summer observations could be further split into categories of observations with TSS values above and below 41 mg/L. As shown, spring/summer observations with TSS values greater than 41 mg/L (N=3) had an average translator value of 0.08, and those with TSS less than 41 mg/L (N=11) had an average TSS value of 0.20.

Further division of the spring/summer data is possible, however such splitting does not appreciably enhance the interpretation of the translator values and produces results of increasingly questionable relevance. CART did not suggest further splitting of the winter dataset, apparently indicating that none of the other input variables were significant in explaining the higher winter translator values.



TSS-Translator Regression Analyses

According to the EPA translator guidance document, if translators are found to be dependent on TSS, regression equations relating to TSS can be developed. The EOA 1997 study and the 2002 LSSFB SSO study developed translators based on regression equations with values that were nearly identical to those developed based on direct ratio calculations. Per EPA guidance, median TSS concentrations were inserted into the regression equations to derive the translators. For the LSSFB work upper and lower 95% confidence intervals and associated equations were also generated. RWQCB commentors recommended conducting a similar regression analysis to that performed in the LSSFB.

It should be noted that the results reported above show a relatively weak relationship between translators and TSS. In the case of the LSSFB work, there was a strong relationship as evidenced by the r-squared value of 0.72. Similar analysis of the complete BA30 data showed an r-squared value of

0.21. The regression line and 95% confidence intervals are shown graphically (Attachment A) and the resultant total dataset equations are as follows:

Linear Regression Line (All Data):
Log(translator) = -0.293 – 0.294 * Log(TSS)

95% confidence interval:
X+/- t(v,z) * (s/n^05)

Where x = mean, s = standard deviation, t(v,z) = t statistic for v=n-1 degrees of freedom and z=1.96

Based on the CART results showing seasonal differences between translators, additional regressions were developed for the winter and for the spring/summer translator/TSS datasets. The winter regression showed an r-squared value of 0.32. The spring/summer regression showed an r-squared value of 0.39. The plots and regression equations are in Attachment A. Translators resulting from use of each of these equations and various TSS concentrations are presented below.

TRANSLATOR CALCULATION OPTIONS

The most direct method of calculating a translator, as described above, is the dissolved to total ratio. The SIP recommends (Section 1.4.1) using a median of the data for translation of chronic criteria and a 90th percentile of data for translation of acute criteria. EPA guidance recommends using a geometric mean of the calculated translators as an estimate of the central tendency. A summary of the dissolved to total ratio based translator results are shown below.

Table 3. Direct Ratio Based Translator Options: All Data

	Arithmetic	**Geometric**
Min	0.07	
Max	0.63	
Mean	0.25	0.21
Standard deviation	0.15	1.82
90th percentile	**0.53**	**0.53**
Median	0.20	0.20

The CART analysis showed a difference in translator values between winter and summer/spring seasons. Therefore, a summary of the direct ratio translators divided into those two categories is shown below.

Table 4. Direct Ratio Based Translator Options: Seasonal

	Summer/Spring		**Winter**	
	Arithmetic	**Geometric**	**Arithmetic**	**Geometric**
Min	0.07		0.18	
Max	0.35		0.63	
Mean	0.18	0.16	0.40	0.37
Standard deviation	0.08	1.59	0.17	1.57
90th percentile	0.27	0.27	**0.58**	**0.58**

The TSS vs translator regression line can also be used to calculate a translator value by plugging in a TSS value in the regression line equations or associated 95th percentile confidence intervals (representing an upper bound). Options for TSS values to use would be the arithmetic or geometric means (representing the central tendency), or separate median TSS values for the summer/spring and winter seasons. The resultant options for translators based on the assumption of a linear relationship with TSS are shown below.

Table 5. TSS-Translator Regression Based Options: All Data

TSS Options for Regression Equation	TSS value	Translator calculated from Linear Regression Equation	Translator from graph upper 95% Conf. Interval
Arithmetic average	28.2	0.19	0.25
Geometric mean	20	0.21	0.3
Geo. Mean Spring/Summer	20.2	0.21	0.3
Geo. Mean Winter	19.8	0.21	0.3

Note: The translators from the graph 95% confidence interval were visually estimated, therefore, only one decimal place is shown in most cases.

The CART Analysis showed there was a difference in the translator values for the winter and spring/summer seasons. This can be seen in the difference between the geometric mean of the winter translator, 0.37, and the spring/summer translator, 0.16. However, there is little difference between the geometric mean of the TSS concentration in winter, 19.8 mg/L and in spring/summer, 20.2 mg/L. Using the linear regression equation to calculate the translator values for the different seasons yields the same translator value of 0.21.

Table 6. TSS-Translator Regression Based Options: Winter Season

TSS Options for Regression Equation	TSS value	Translator calculated from Linear Regression Equation	Translator from graph upper 95% Conf. Interval
Arithmetic average	30.3	0.33	0.5
Geometric mean	19.8	0.37	0.5

Note: The translators from the graph 95% confidence interval were visually estimated so only one decimal place is shown.

Table 7. TSS-Translator Regression Based Options: Spring/Summer Season

TSS Options for Regression Equation	TSS value	Translator calculated from Linear Regression Equation	Translator from graph upper 95% Conf. Interval
Arithmetic average	27.2	0.15	0.2
Geometric mean	20.2	0.16	0.2

TRANSLATOR SUMMARY AND REASONABLE POTENTIAL CONCLUSIONS

The CART analysis found there to be some difference in translators attributable to season (defined as winter, spring, and summer) and grouped the data into two categories: winter and spring/summer. However, there turned out to be relatively little difference in calculated 90th percentile (CMC) translators based on whether all data were used, seasonal data used, or TSS regressions used. Values ranged from 0.5 (upper 95th percentile of TSS regression), to 0.53 (original direct ratio value using all data), to 0.58 (90th percentile of the log transformed winter zinc translators). The maximum observed direct ratio value (3/2/93) was 0.63.

No RP

The CTR zinc saltwater CMC is 90 ug/L and the CCC is 81 ug/L. Using the most conservative 0.58 translator with either of these criteria would produce adjusted WQOs of 155 and 140 ug/L, respectively. Both WQOs are greater than the Sunnyvale and San Jose MECs of 110 and 102 ug/L. Therefore, there is no RP for zinc when this 0.58 translator or any other of the various RMP translator permutations investigated is used.

Limited MEC Values

The complete effluent zinc datasets for the Cities are included in Attachment A. Sunnyvale had only the one 110 ug/L value that would have triggered RP if the default conversion factor of 0.946 had been used to produce an adjusted WQO of 85.6. San Jose would have had either two or four exceedances (102, 91, 86, 86 ug/L) depending on significant figure rounding assumptions.

Potable Water Zinc Source

Santa Clara Valley Water District (SCVWD) adds zinc orthophosphate to its treated potable water for corrosion control in the distribution system. SCVWD potable water zinc concentrations measured at a Sunnyvale turnout receiving all SCVWD water averaged 383 ug/L during calendar years 1999-2001, with maximum values exceeding 600 ug/L. The Cities have no control over this significant source of zinc to their wastewater treatment plants.

ATTACHMENT A

RMP DATA AND GRAPHS

Table A. Sunnyvale MEC and Background Metals Reasonable Potential Analysis
Adjusted WQOs and Background Total Metals Concentrations (ug/L) Derivation Options Using CTR Default Conversion Factors and RMP BA30 (Dumbarton Bridge) Translator Data (1/14/03 corrected version)

	Option 1			Option 2		Option 3			Option 4			
	Max. Effluent Conc. (MEC) (ug/L)	**RMP Max (Dissolved) (ug/L)**	**Lowest CTR WQO (Not Adjusted) (ug/L)**	**RMP Max (Total) (ug/L)**	**Lowest CTR WQO (Adjusted by CF) (ug/L)**	**CTR Default Conv. Factor**	**RMP Dissolved Adjusted to Total by CF (ug/L)**	**Lowest CTR WQO (Adjusted by CF) (ug/L)**	**RMP Translator**	**RMP Dissolved (Adjusted by RMP Translator) (ug/L)**	**Lowest CTR WQO (Adjusted By RMP Translator) (ug/L)**	**Basis of Lowest WQO**
Arsenic	3.1	4.05	36	4.59	36	1.000	4.05	36	0.91	4.45	38	Salt. CCC
Cadmium	0.2	0.22	2.2	0.17	2.4	0.909	0.24	2.4	0.95	0.23	2.3	Fresh. CCC
Chromium (VI)	7	0.49	11	**14.74**	11.4	0.962	0.51	11.4	0.08	6.1	200	Fresh. CMC
Copper	6.2	3.74	6.9 (SSO)	7.19	13	0.83	3.70	13	0.53	7.06	13	SSO
Lead	1.8	0.10	2.5	**3.78**	3.3	0.791	0.13	2.5	0.05	2.00	50	Fresh. CCC
Mercury	0.009	NA	0.051	**0.0680**	0.051	1	**0.0680**	0.051	1	**0.068**	0.051	Org.Cnsp.
Nickel	4.6	3.42	11.9 (SSO)	13.03	27	0.99	3.45	27	0.44	7.77	27	SSO
Selenium	2.7	0.53	5	0.63	5	1	0.53	5	1	0.63	5.0	Fresh. CCC
Silver	1	0.01	1.9	0.12	2.2	0.85	0.01	2.2	0.54	0.02	3.5	Salt.CMC
Zinc	110	3.2	***81*** [3]	14.85	***85.6*** [3]	0.946	3.38	***85.6*** [3]	0.53 [1]	6.00	170 [1]	Salt. CMC [1]
Zinc	110								0.58 [6]	5.5	140	Salt. CMC

Notes:

1. Option 4 for zinc uses the saltwater CMC of 90 ug/L and corresponding BA30 acute translator, 0.53, since this yields a lower adjusted WQO of 170 ug/L vs using the saltwater CCC of 81 ug/L, and the chronic translator, 0.20, that yields an adjusted WQO of 405 ug/L.

2. Background concentrations with reasonable potential shown in bold next to corresponding WQO

3. *WQO option resulting in MEC RP shown in bold italics (I.e. only unadjusted and CF adjusted zinc WQOs)*

4. The CF used (freshwater CMC, freshwater CCC, saltwater CMC, or saltwater CCC) and the translator used was dependent on which criteria was the lowest.

5. Per SIP guidance, median (of all BA30 based) translators used for adjusting CCC based WQOs, 90th percentiles for CMCs.

6. For zinc, alternate translator of 0.58 based on 90th percentile of log transformed winter season BA30 data produces adjusted WQO of 140 ug/L.

7. For simplicity and conservatism, a background hardness of 100 mg/L is assumed (RP conclusions not impacted by this variable).

8. If maximum CTR allowable 400 mg/L hardness is used, the hardness dependent conversion factors for cadmium and lead are less conservative at 0.851 and 0.589, respectively.

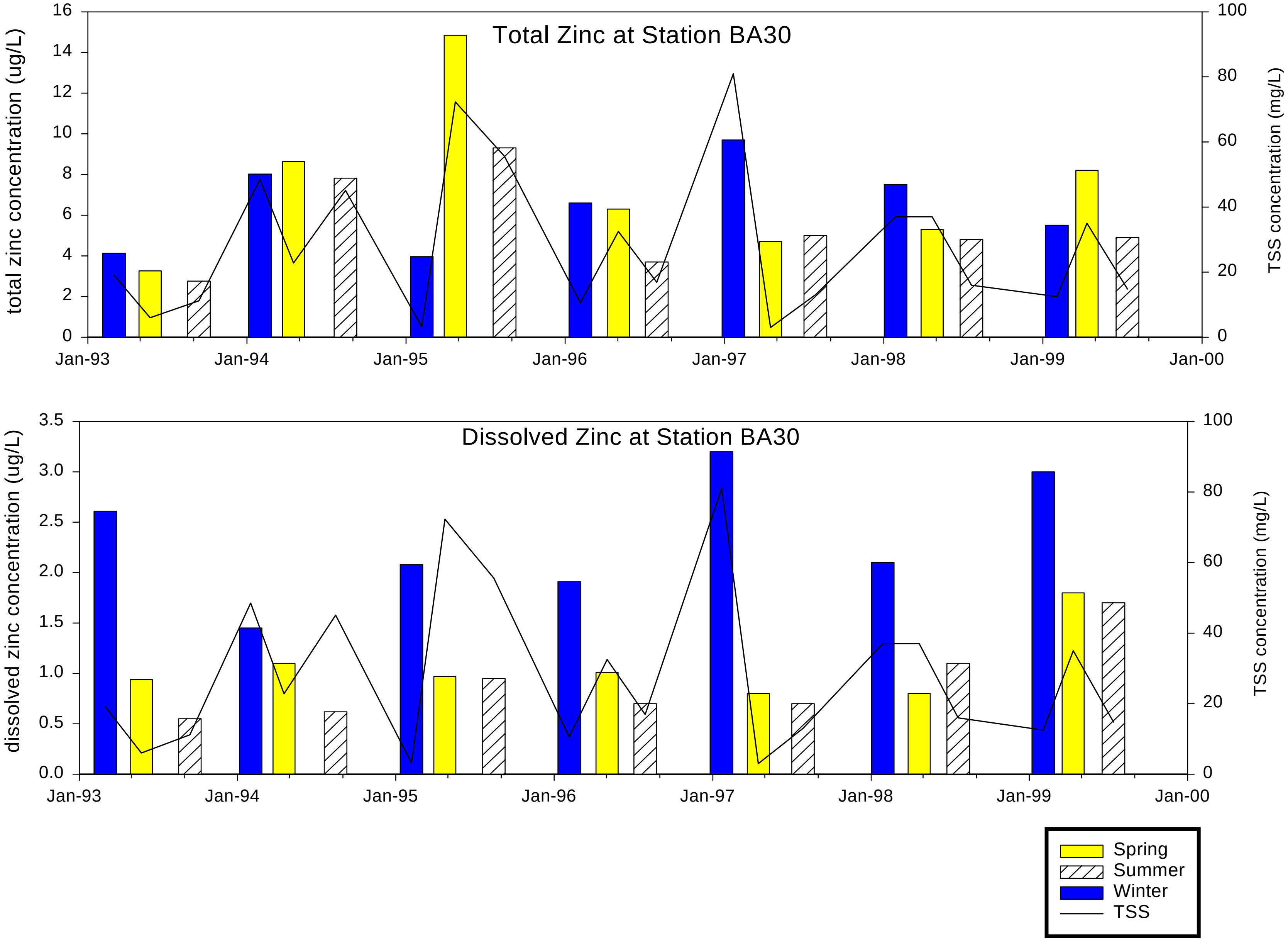
9. RMP maximum total values used for bioaccumaltive mercury and selenium.

F:\SU32\SU32-29\RPA\RMP Translators\[Zn Trans Table A.xls]BA30

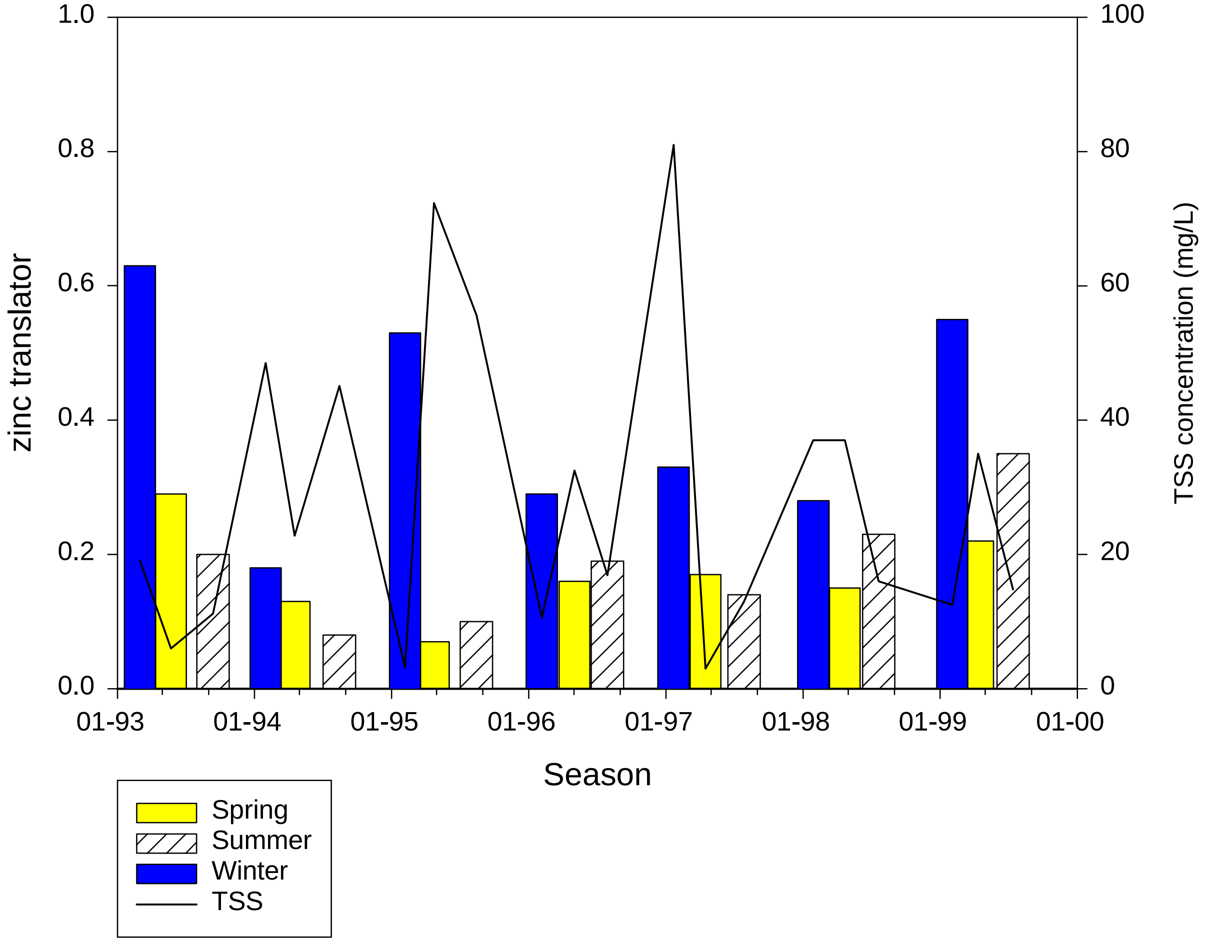
RMP STATION BA30 DUMBARTON BRIDGE DATA

		total	dissolved	translator						Salinity				
Station Code	**Date**	**Zn***	**Zn**	**Zn**	**Chlorophyll-a**	**Conductivity**	**DO**	**DOC**	**pH**	**(by SCT)**	**Silicates**	**Temp**	**TSS**	**Season**
		µg/L	µg/L		mg/m3	µmho	mg/L	mg/L	pH	o/oo	mg/L	°C	mg/L	
BA30	03/02/1993	4.13	2.61	0.63	1.9	NA	9.8	3.41	8.0	13.8	5.1	12.0	19.1	winter
BA30	05/24/1993	3.26	0.94	0.29	2.4	NA	7.2	2.80	7.9	22.2	2.6	21.0	6.0	spring
BA30	09/13/1993	2.76	0.55	0.20	1.6	39000	6.9	2.19	7.9	28.7	5.0	21.0	11.2	summer
BA30	01/31/1994	8.02	1.45	0.18	1.5	30200	8.2	1.53	7.9	27.3	1.3	11.0	48.5	winter
BA30	04/18/1994	8.63	1.10	0.13	4.1	31700	7.9	2.88	8.1	25.7	2.2	20.0	22.8	spring
BA30	08/15/1994	7.82	0.62	0.08	1.6	43600	7.3	2.73	8.0	29.5	0.4	23.0	45.1	summer
BA30	02/06/1995	3.96	2.08	0.53	14.5	20500	9.4	3.32	7.7	16.5	4.2	14.2	3.2	winter
BA30	04/24/1995	14.85	0.97	0.07	44.6	18200	8.5	4.11	8.0	13.4	3.7	16.9	72.3	spring
BA30	08/15/1995	9.31	0.95	0.10	1.9	33300	6.2	3.00	7.8	22.2	4.8	22.9	55.6	summer
BA30	02/05/1996	6.60	1.91	0.29	1.1	26200	9.2	3.15	7.9	22.0	3.7	13.5	10.6	winter
BA30	05/02/1996	6.30	1.01	0.16	4.5	24500	6.6	2.58	7.9	15.5	0.9	22.3	32.5	spring
BA30	07/29/1996	3.70	0.70	0.19	4.5	31000	6.7	2.55	8.0	19.0	4.8	24.4	16.9	summer
BA30	01/21/1997	9.70	3.20	0.33	2.3	12380	8.6	3.97	7.7	7.1	6.0	10.5	81.0	winter
BA30	04/16/1997	4.70	0.80	0.17	22.3	32470	10.5	2.79	8.3	NA	2.0	18.4	3.0	spring
BA30	07/28/1997	5.00	0.70	0.14	4.0	43020	7.2	2.96	7.7	27.8	4.0	23.4	13.0	summer
BA30	01/28/1998	7.50	2.10	0.28	2.9	29830	10.1	2.81	7.5	19.0	2.0	13.4	37.0	winter
BA30	04/22/1998	5.30	0.80	0.15	34.2	23890	9.3	3.02	8.4	14.5	1.0	17.4	37.0	spring
BA30	07/21/1998	4.80	1.10	0.23	2.7	32720	r 7.3	2.91	7.9	20.5	5.0	22.1	16.0	summer
BA30	02/02/1999	5.50	3.00	0.55	3.0	29300	8.5	2.33	7.9	26.1	1.1	9.8	12.5	winter
BA30	04/12/1999	8.20	1.80	0.22	16.5	28300	9.9	2.53	8.2	17.1	1.1	14.0	35.0	spring
BA30	07/14/1999	4.90	1.70	0.35	9.0	42000	6.2	3.20	7.8	25.0	1.1	23.2	14.8	summer
Statistics														
# samples		21	21	21	21	19	20	21	21	20	21	21	21	
minimum		2.76	0.55	0.07	1.1	12380	6.2	1.5	7.5	7.1	0.4	9.8	3.0	
maximum		14.85	3.20	0.63	44.6	43600	10.5	4.1	8.4	29.5	6.0	24.4	81.0	
average		6.43	1.43	0.25	8.6	30111	8.2	2.9	7.9	20.6	3.0	17.8	28.2	
geometric mean		5.92	1.25	0.21	4.5	28883	8.1	2.8	7.9	19.6	2.3	17.1	20.0	
median		5.50	1.10	0.20	3.0	30200	8.4	2.9	7.9	21.3	2.6	18.4	19.1	
standard deviation		2.81	0.80	0.15	11.8	8276	1.4	0.6	0.2	6.1	1.8	4.9	22.1	
90th percentile		9.31	2.61	0.53	22.3	42204	9.9	3.4	8.2	27.9	5.0	23.2	55.6	

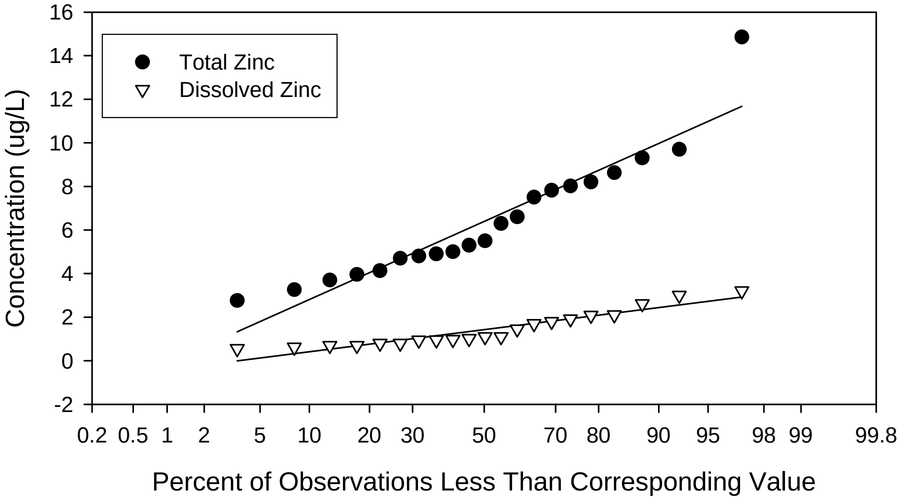
F:\SU32\SU32-29\RPA\RMP Translators\[zn&physicochem data.xls]BA30


Total Zinc at Station BA30
total zinc concentration (ug/L)
TSS concentration (mg/L)
0
2
4
6
8
10
12
14
16
0
20
40
60
80
100
Jan-93
Jan-94
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Dissolved Zinc at Station BA30
dissolved zinc concentration (ug/L)
TSS concentration (mg/L)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
0
20
40
60
80
100
Jan-93
Jan-94
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Spring
Summer
Winter
TSS

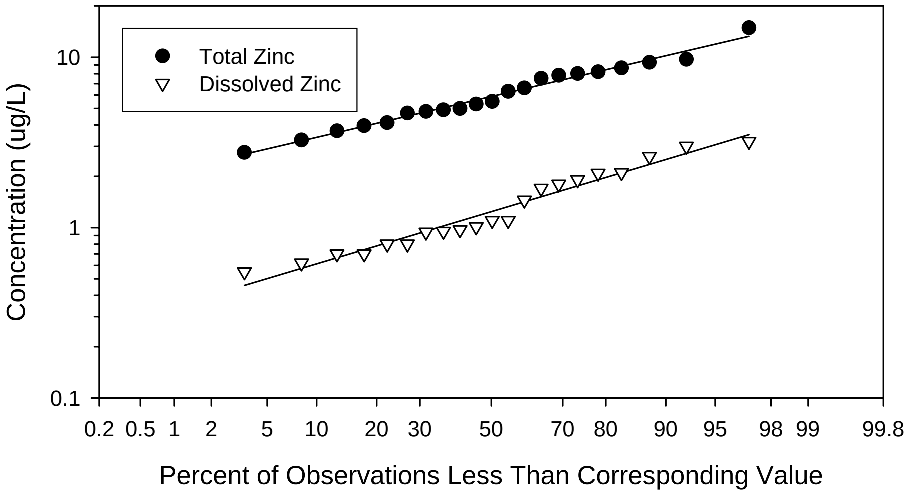
Zinc Translator at Station BA30



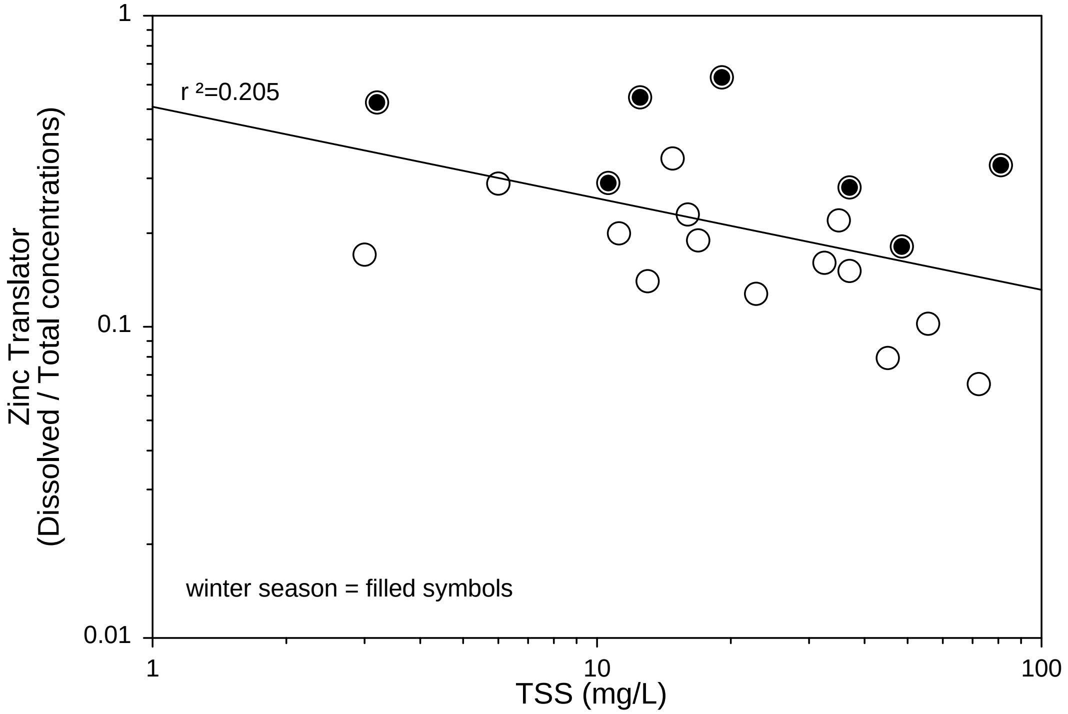
Normal Probability Plot for
Total and Dissolved Zinc at BA30



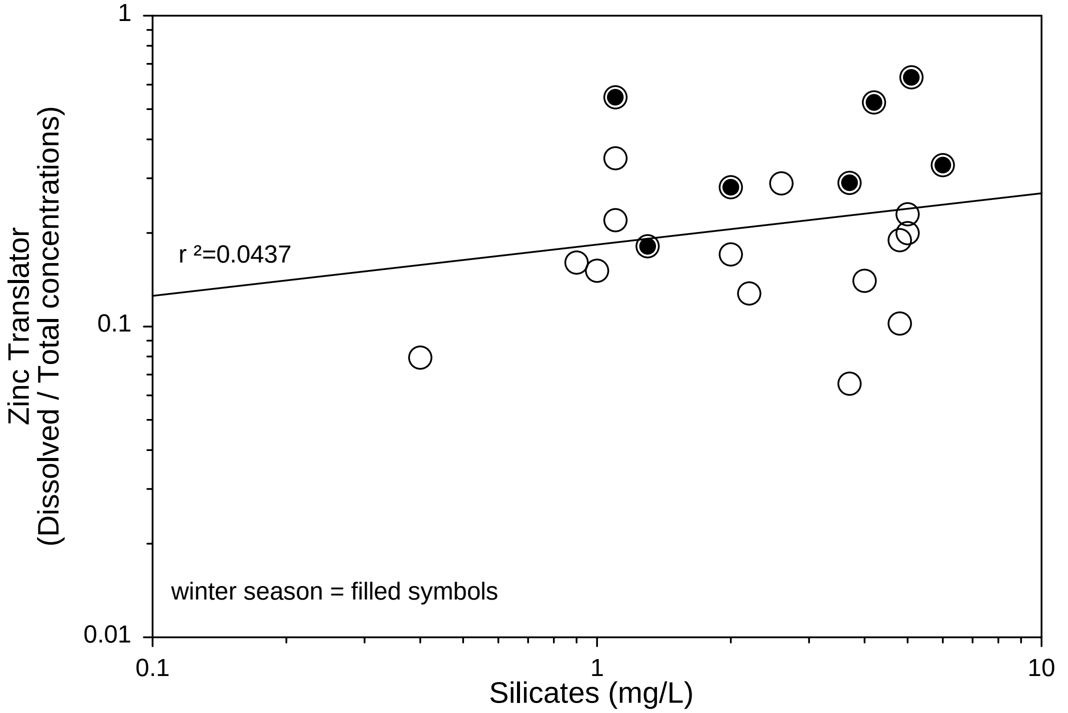
Lognormal Probability Plot for
Total and Dissolved Zinc at BA30



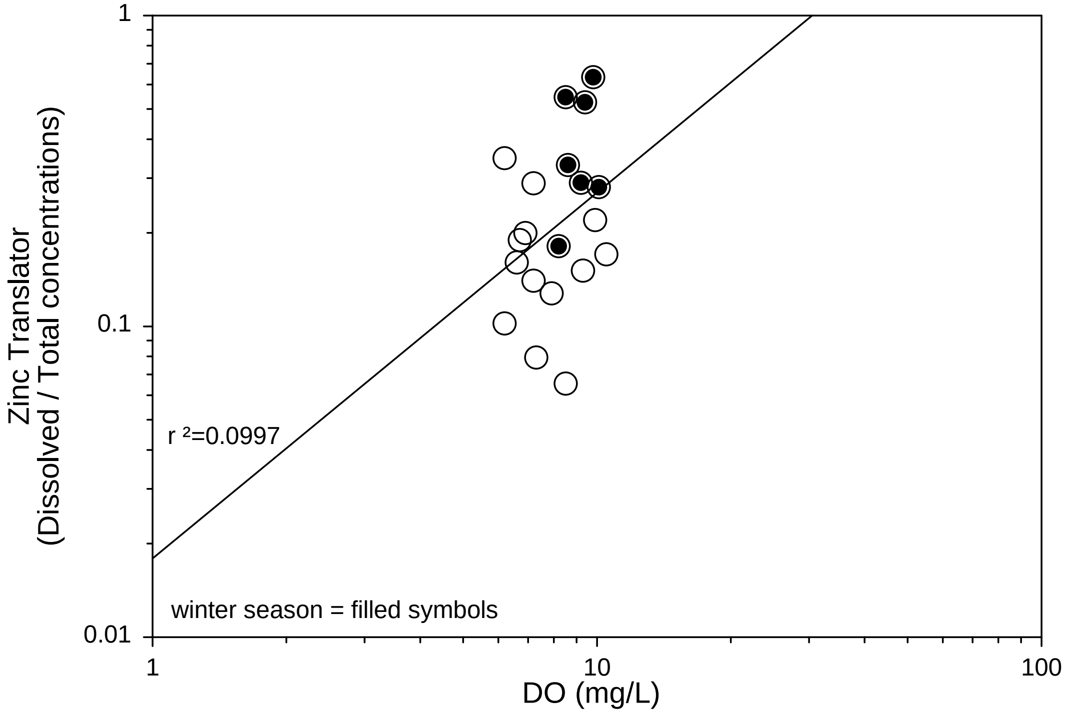
Scatter plot for
TSS vs. Translator for Zinc at BA30



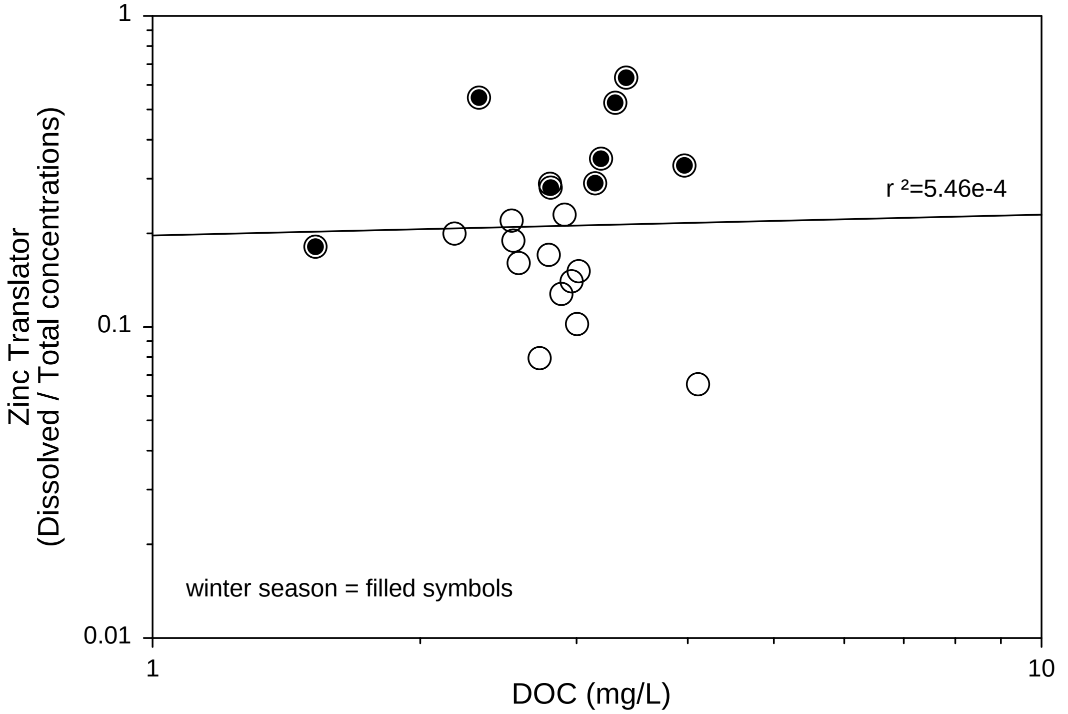
Scatter plot for
Silicates vs. Translator for Zinc at BA30

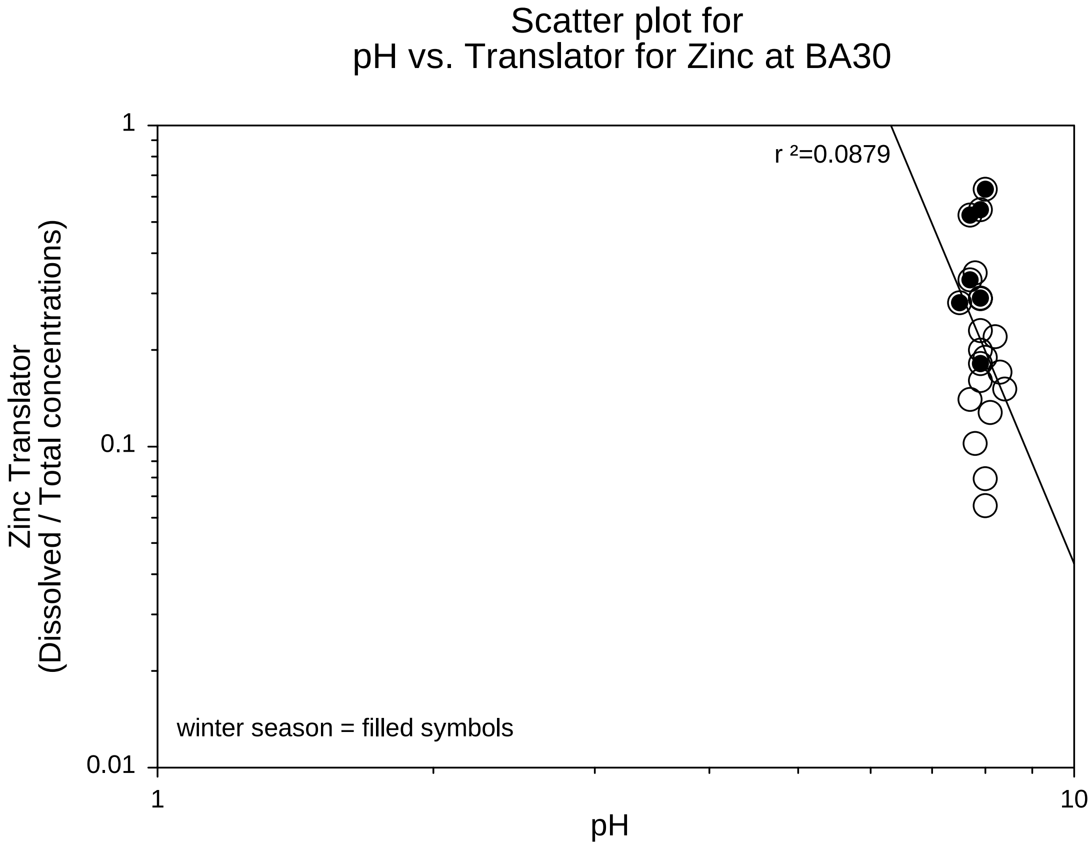


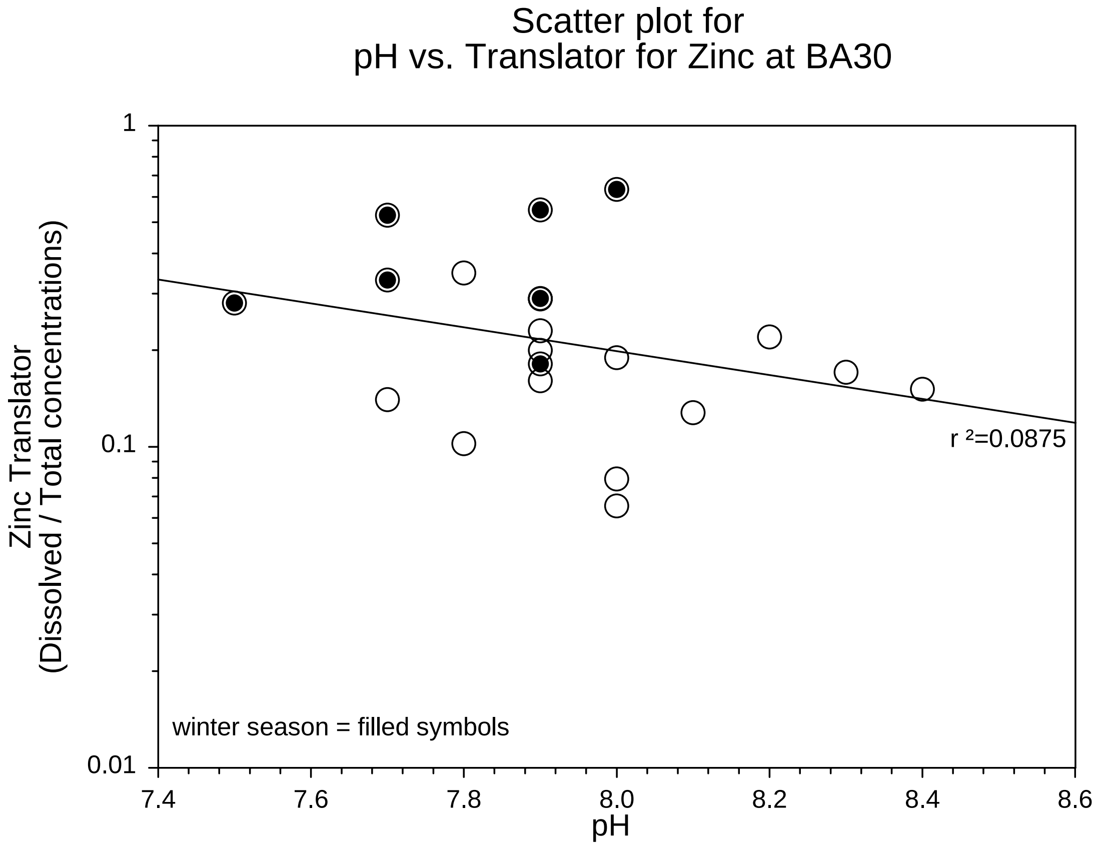
Scatter plot for
DO vs. Translator for Zinc at BA30



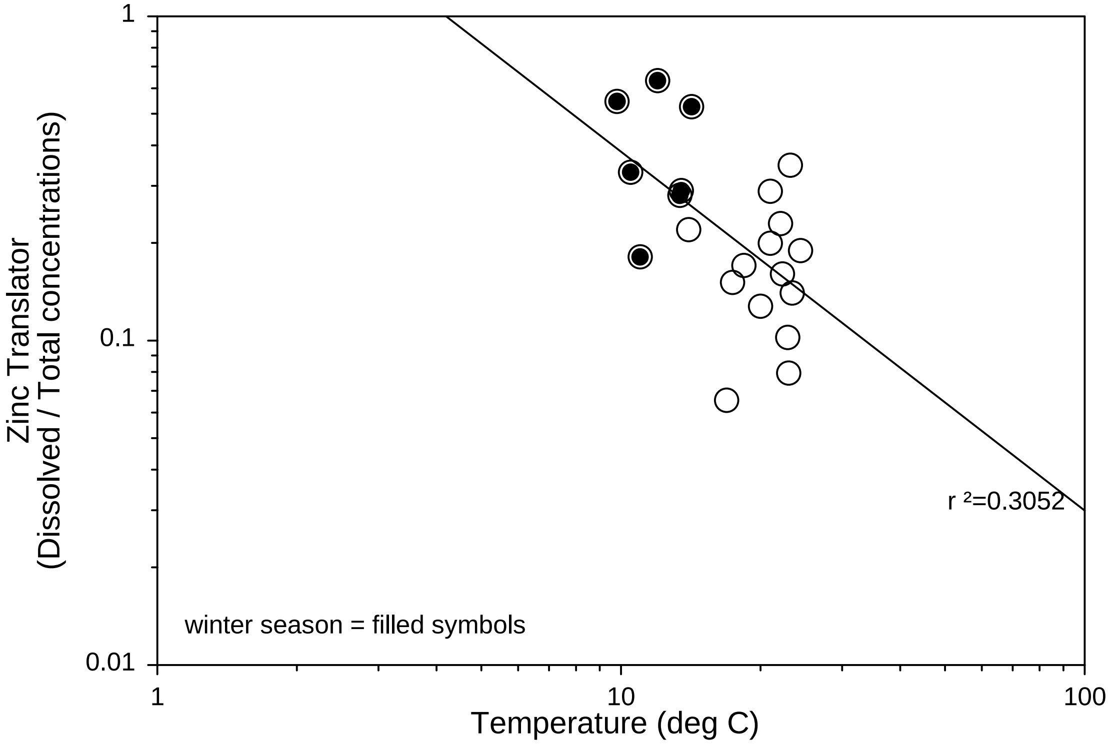
Scatter plot for
DOC vs. Translator for Zinc at BA30



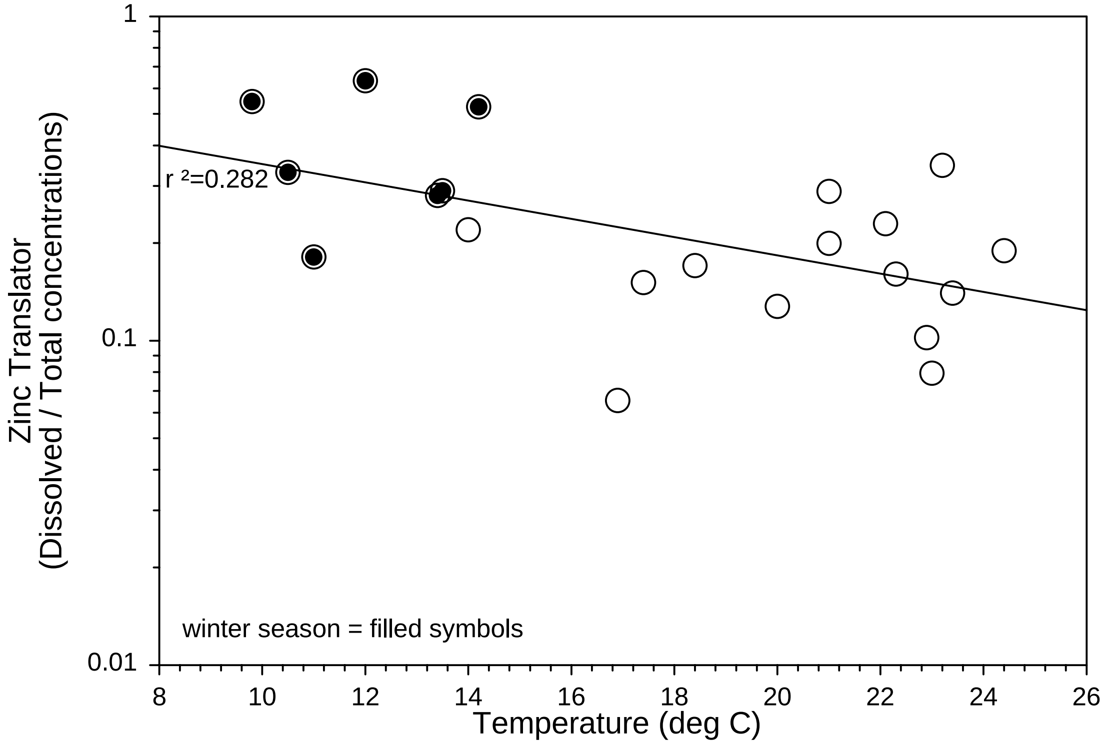

Scatter plot for
pH vs. Translator for Zinc at BA30


Scatter plot for
pH vs. Translator for Zinc at BA30

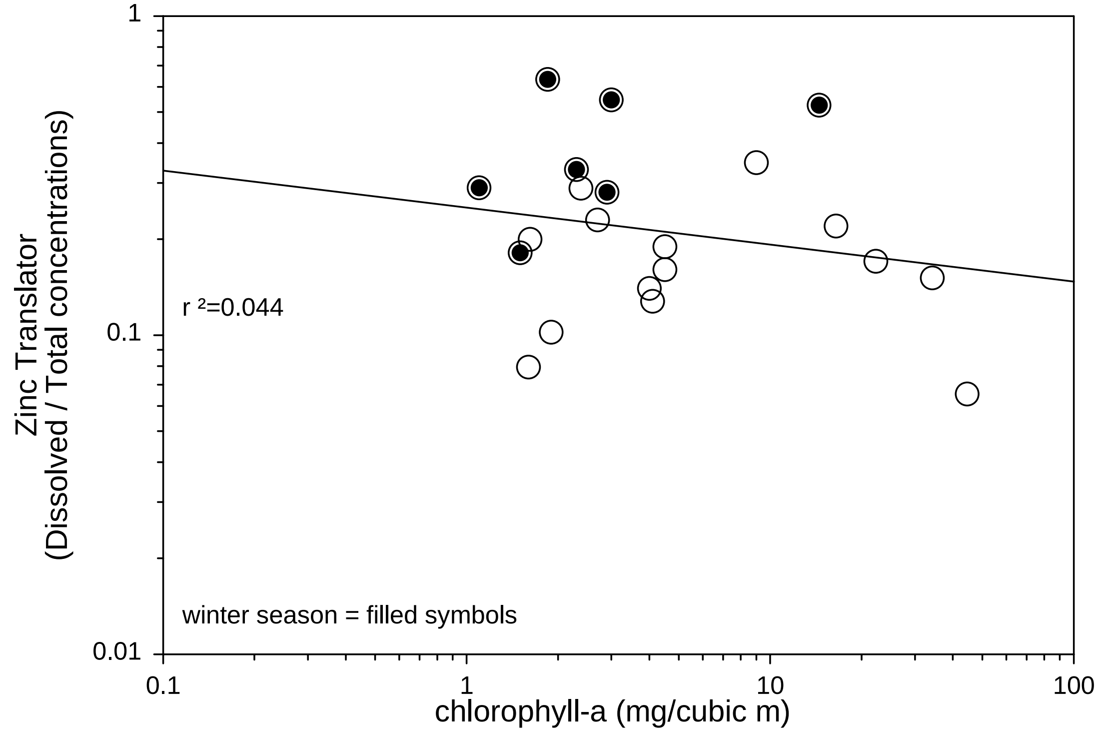
Scatter plot for
Temperature vs. Translator for Zinc at BA30



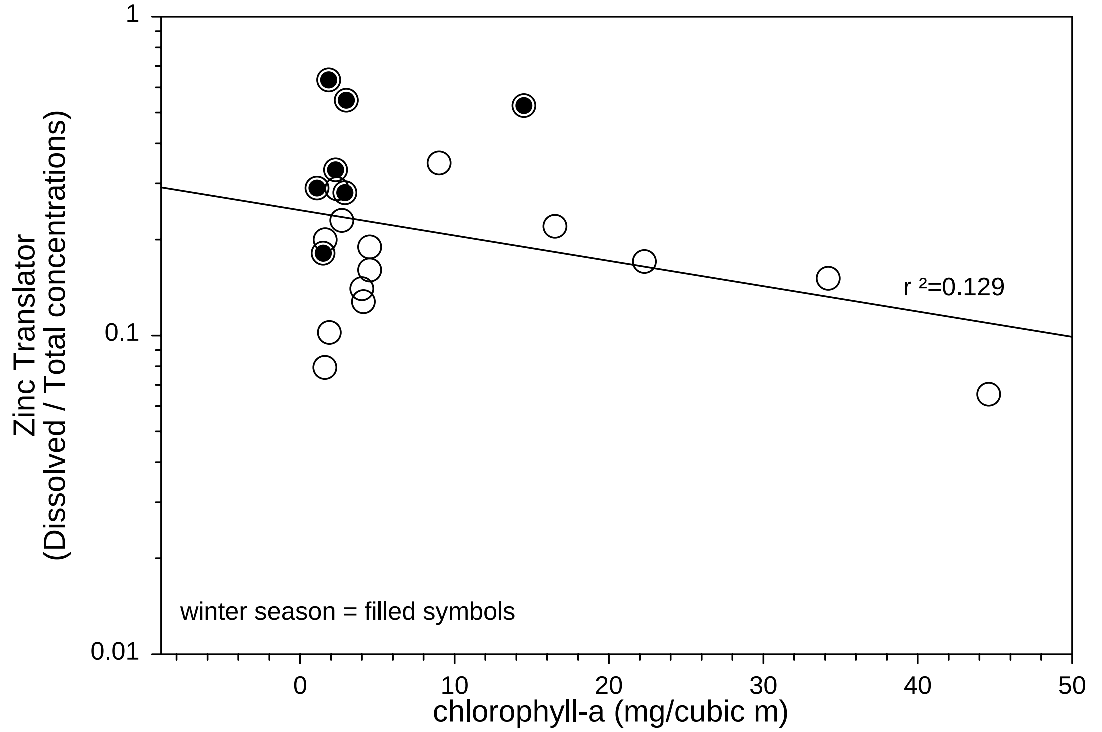
Scatter plot for
Temperature vs. Translator for Zinc at BA30



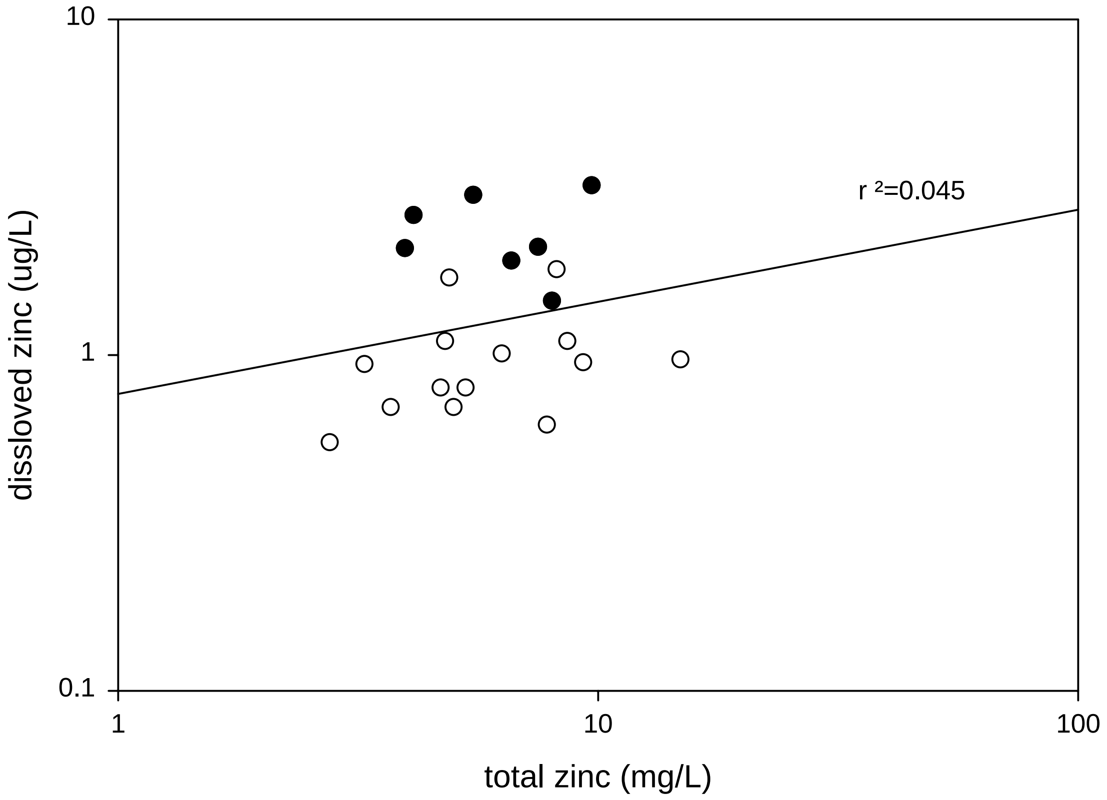
Scatter plot for
Chlorophyll a vs. Translator for Zinc at BA30



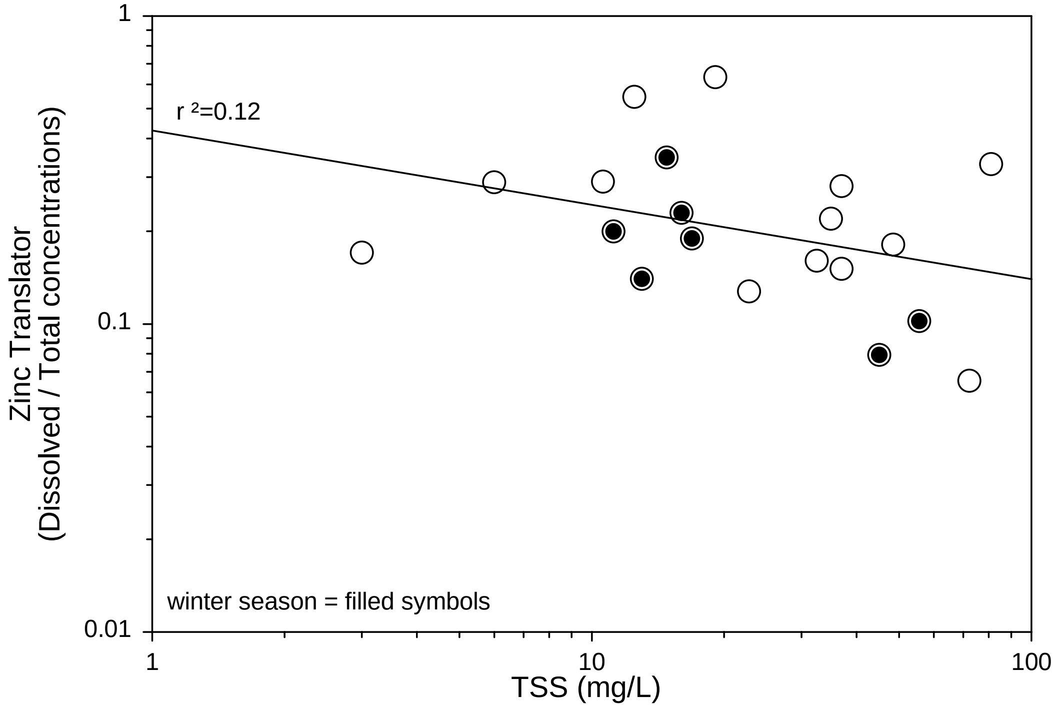
Scatter plot for
Chlorophyll a vs. Translator for Zinc at BA30



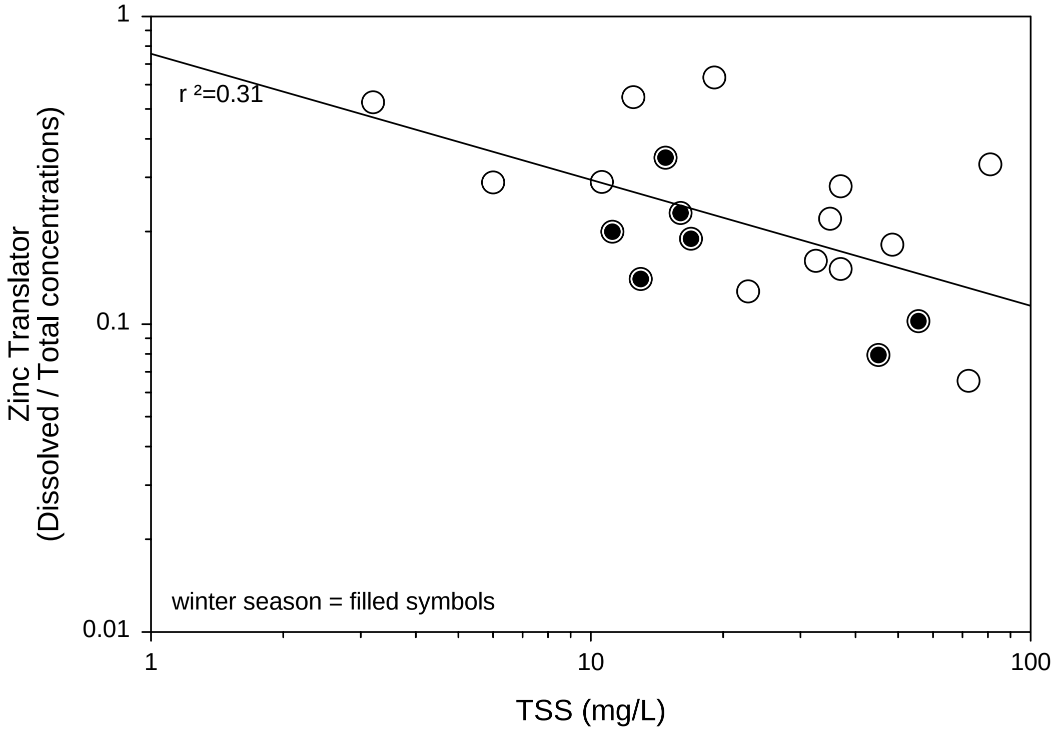
Total Zinc vs Dissolved Zinc at BA30



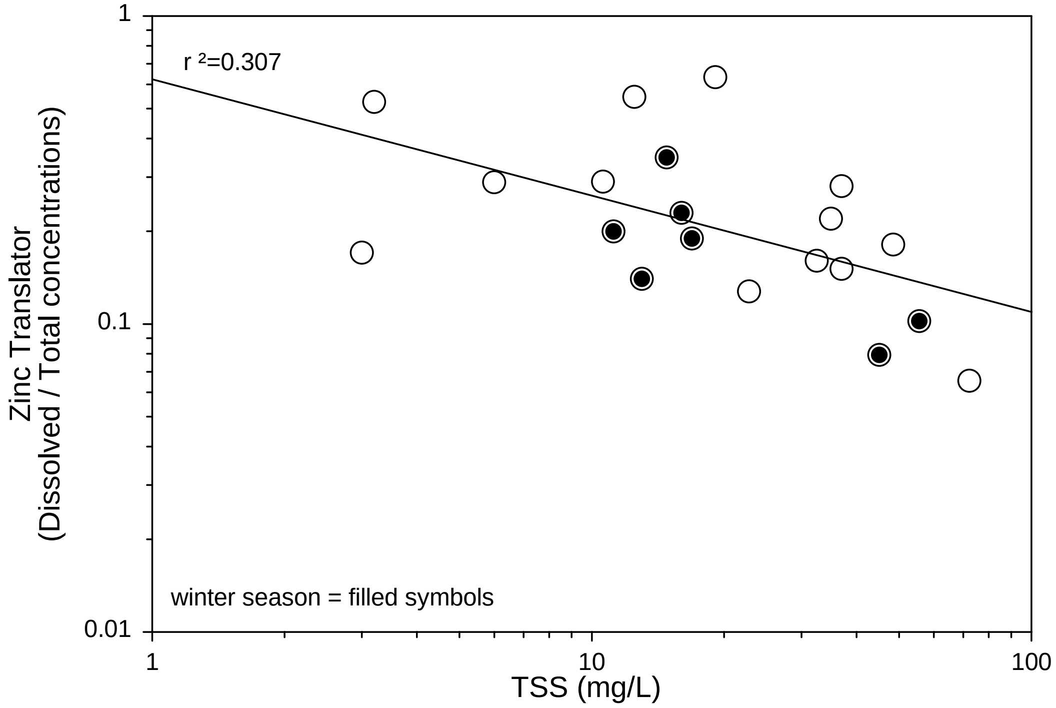
Scatter plot for
TSS vs. Translator for Zinc at BA30
(1 data point removed, 2/6/95)



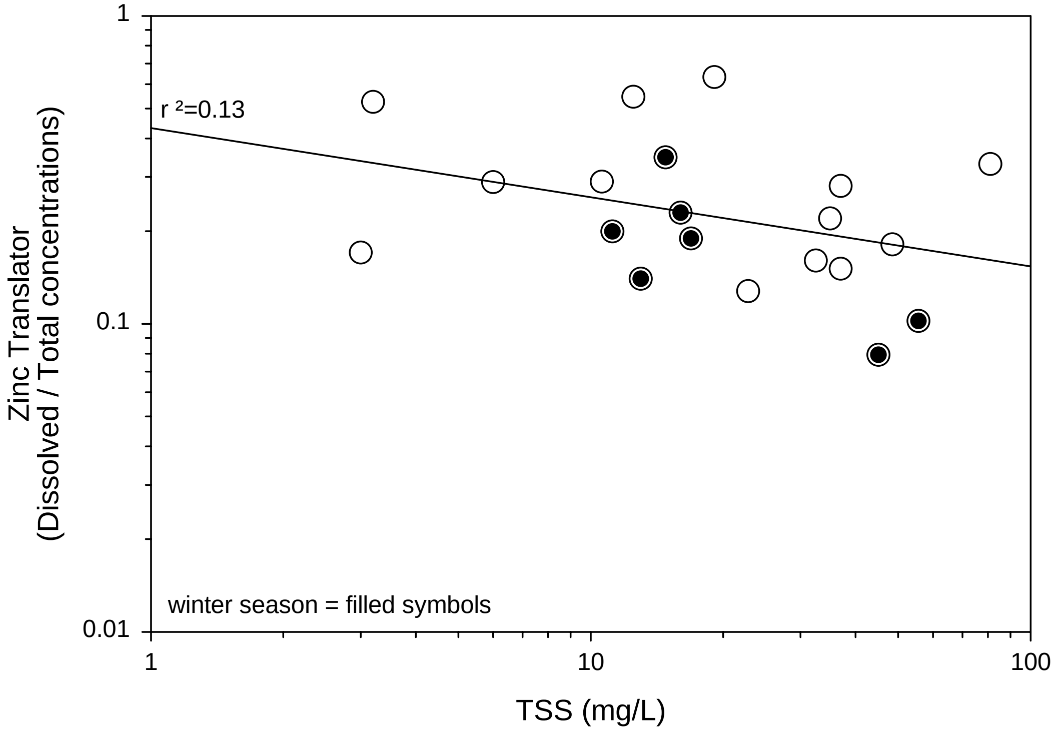
Scatter plot for
TSS vs. Translator for Zinc at BA30
(1 data point removed, 4/16/97)



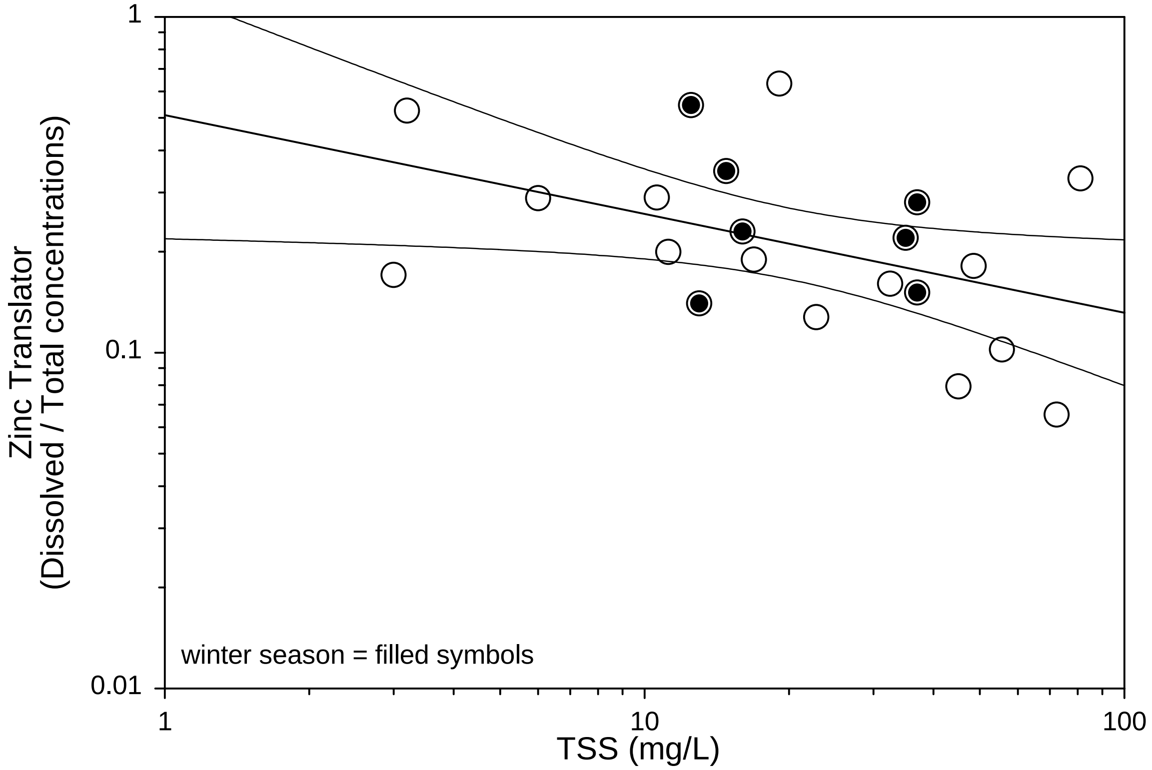
Scatter plot for
TSS vs. Translator for Zinc at BA30
(1 data point removed, 1/21/97)



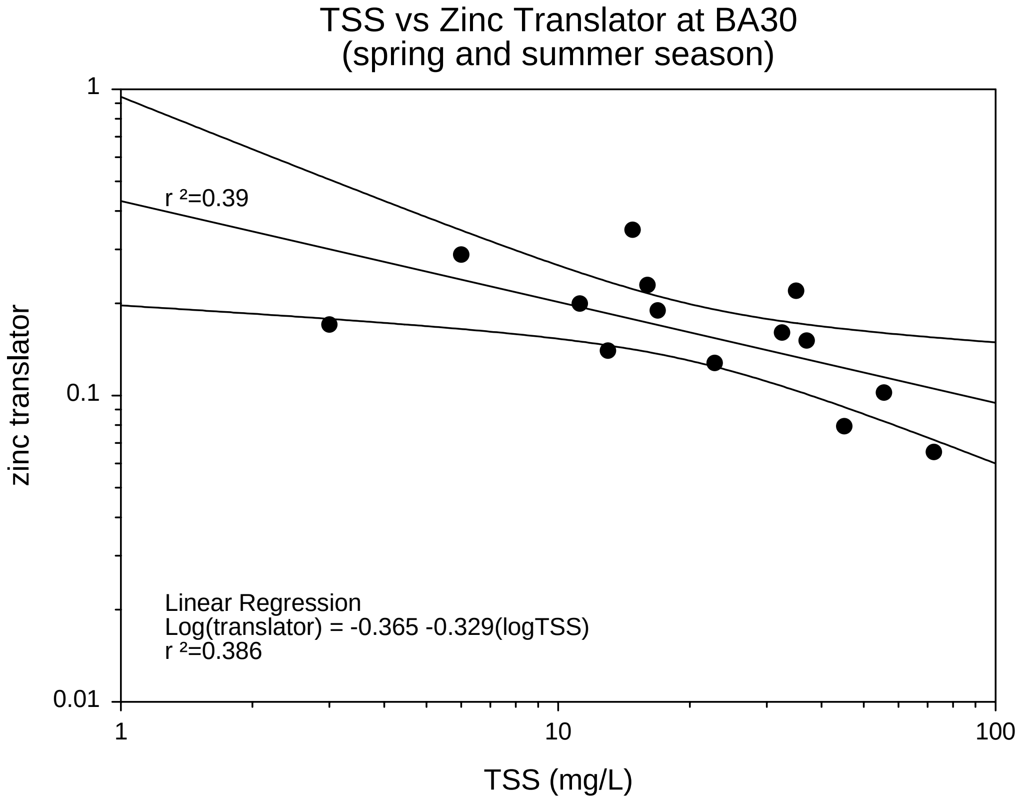
Scatter plot for
TSS vs. Translator for Zinc at BA30
(1 data point removed, 4/24/95)

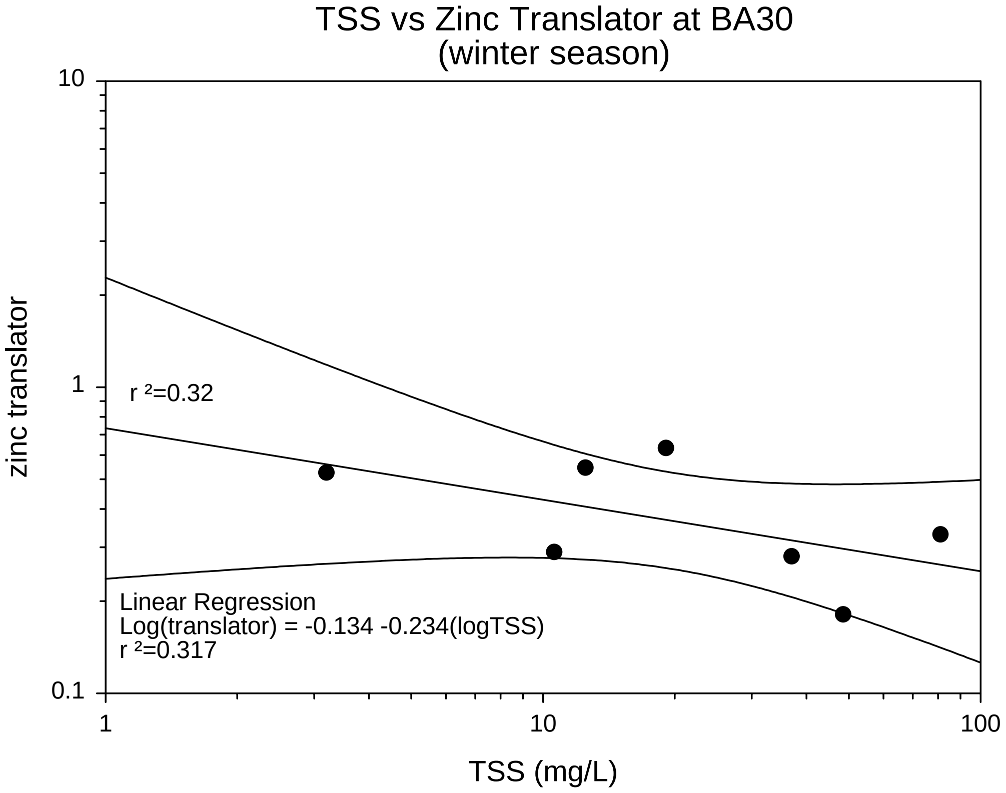


Scatter plot for
TSS vs. Translator for Zinc at BA30
Linear Regression with 95% Confidence Interval

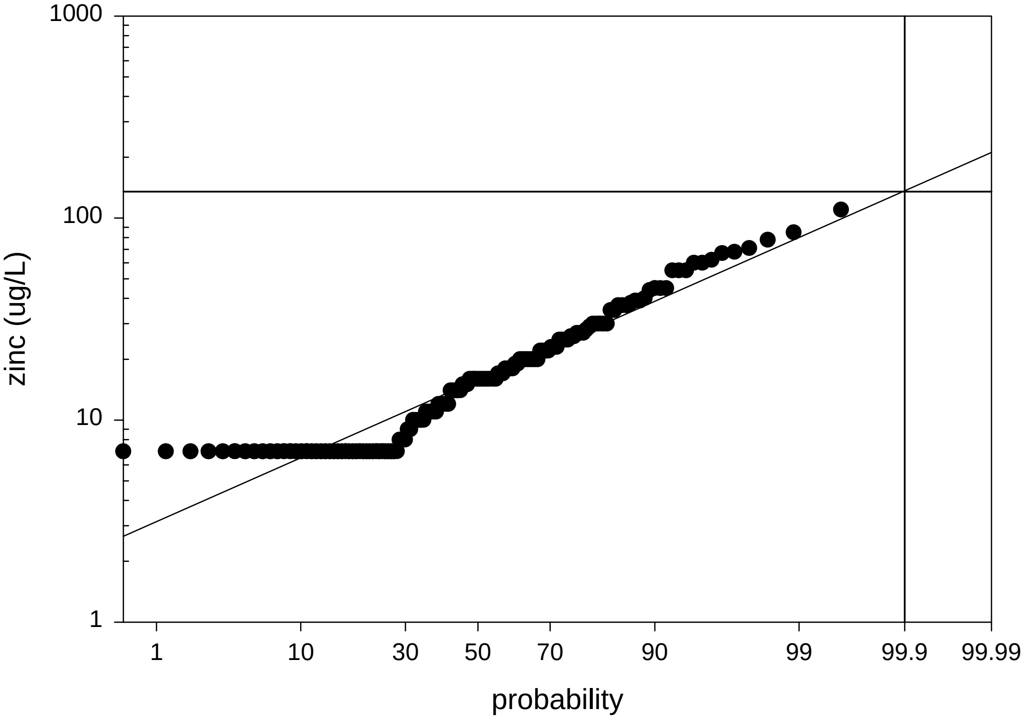


Linear Regression
Log(translator) = -0.293 -0.294(logTSS)
r^2=0.205

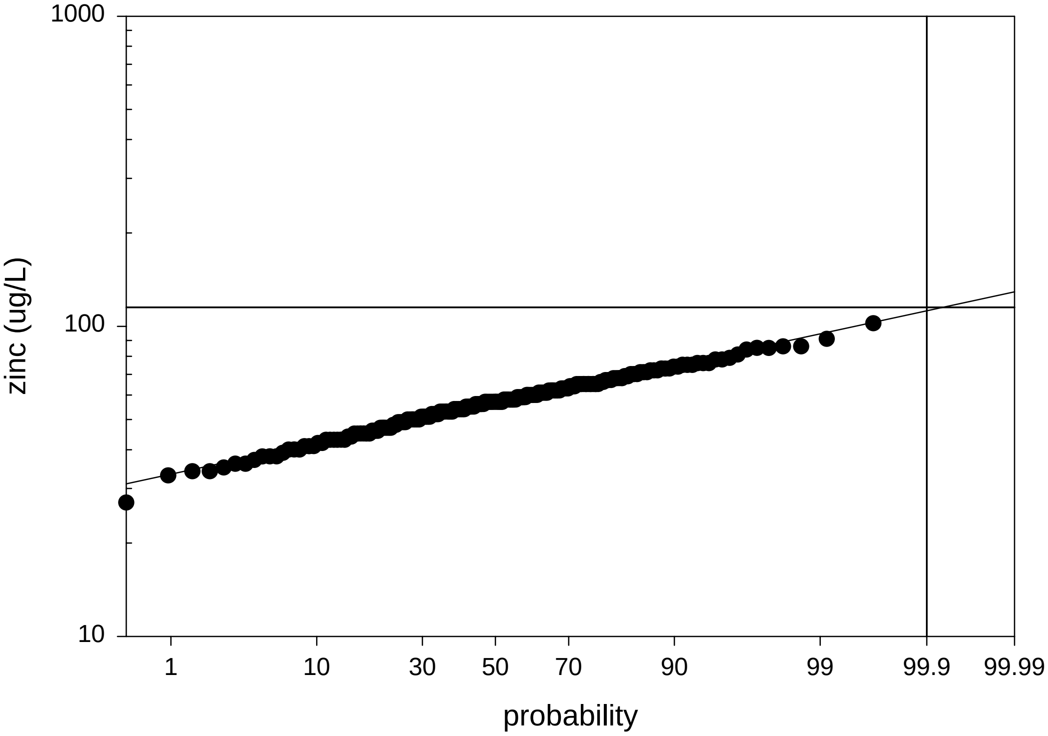

TSS vs Zinc Translator at BA30
(spring and summer season)


TSS vs Zinc Translator at BA30
(winter season)

Sunnyvale Zinc Effluent Concentration
(11/99-10/02)



San Jose Zinc Effluent Concentration
(11/99-10/02)



San Jose Plant Effluent Zinc Concentrations

Date	Zinc Effluent ug/L	Data Sorted by Concentration	
		Date	Zn Effluent (ug/L)
04/06/99	49	05/29/01	27
05/04/99	47	01/02/02	33
06/01/99	36	05/20/01	34
07/06/99	40	07/24/01	34
08/05/99	42	08/01/01	35
09/01/99	52	06/01/99	36
10/07/99	51	07/10/01	36
11/02/99	57	12/26/00	37
12/02/99	56	09/04/00	38
01/04/00	62	04/08/01	38
02/01/00	78	04/15/01	38
03/08/00	73	09/11/01	39
04/04/00	63	07/06/99	40
05/02/00	56	11/26/00	40
06/06/00	61	06/26/01	40
07/04/00	41	07/04/00	41
08/01/00	59	03/25/01	41
08/17/00	69	05/24/01	41
08/20/00	65	08/05/99	42
08/22/00	65	01/08/02	42
08/24/00	59	04/10/01	43
08/27/00	56	04/12/01	43
08/29/00	65	04/29/01	43
08/31/00	60	05/06/01	43
09/04/00	38	08/14/01	43
09/05/00	60	12/25/01	43
09/06/00	73	10/02/01	44
09/10/00	85	12/04/01	44
09/12/00	102	04/01/01	45
09/14/00	73	04/17/01	45
09/17/00	59	05/13/01	45
09/19/00	61	06/05/01	45
09/21/00	52	07/17/01	45
09/24/00	65	11/20/01	45
09/26/00	67	05/15/01	46
09/28/00	76	05/27/01	46
10/01/00	62	03/19/02	46
10/03/00	78	05/04/99	47
10/05/00	65	05/08/01	47
10/09/00	54	08/07/01	47
10/10/00	76	08/28/01	47
10/12/00	68	10/30/01	47
10/15/00	59	01/02/01	48
10/17/00	74	03/04/01	48
10/19/00	72	04/06/99	49
10/22/00	55	06/19/01	49
10/24/00	71	07/02/01	49
10/26/00	75	09/25/01	49
10/29/00	58	11/05/00	50

San Jose Plant Effluent Zinc Concentrations

	Zinc Effluent	Data Sorted by Concentration	
Date	**ug/L**	**Date**	**Zn Effluent (ug/L)**
10/31/00	60	01/15/01	50
11/02/00	59	02/19/01	50
11/05/00	50	03/11/01	50
11/07/00	55	10/23/01	50
11/08/00	63	03/26/02	50
11/12/00	53	10/07/99	51
11/14/00	65	03/13/01	51
11/16/00	66	10/09/01	51
11/19/00	72	12/18/01	51
11/20/00	55	02/05/02	51
11/21/00	67	09/01/99	52
11/26/00	40	09/21/00	52
11/28/00	75	03/22/01	52
11/30/00	69	03/27/01	52
12/03/00	63	11/12/00	53
12/05/00	70	01/21/01	53
12/07/00	70	02/25/01	53
12/10/00	62	05/01/01	53
12/12/00	71	05/10/01	53
12/14/00	61	06/12/01	53
12/17/00	58	10/16/01	53
12/19/00	91	10/09/00	54
12/20/00	64	03/18/01	54
12/21/00	79	03/20/01	54
12/26/00	37	09/18/01	54
12/27/00	64	11/27/01	54
12/28/00	65	02/26/02	54
01/02/01	48	10/22/00	55
01/03/01	84	11/07/00	55
01/04/01	68	11/20/00	55
01/07/01	66	04/24/01	55
01/09/01	86	01/15/02	55
01/11/01	56	12/02/99	56
01/15/01	50	05/02/00	56
01/16/01	86	08/27/00	56
01/18/01	85	01/11/01	56
01/21/01	53	11/06/01	56
01/23/01	72	11/02/99	57
01/25/01	67	02/11/01	57
01/28/01	60	03/08/01	57
01/30/01	65	04/05/01	57
02/01/01	74	04/19/01	57
02/04/01	61	08/21/01	57
02/06/01	75	11/13/01	57
02/08/01	71	01/22/02	57
02/11/01	57	03/05/02	57
02/13/01	70	03/12/02	57
02/15/01	58	10/29/00	58
02/19/01	50	12/17/00	58

San Jose Plant Effluent Zinc Concentrations

	Zinc Effluent	Data Sorted by Concentration	
Date	ug/L	Date	Zn Effluent (ug/L)
02/20/01	64	02/15/01	58
02/22/01	63	04/03/01	58
02/25/01	53	09/05/01	58
02/27/01	65	12/11/01	58
03/01/01	68	02/12/02	58
03/04/01	48	08/01/00	59
03/06/01	65	08/24/00	59
03/08/01	57	09/17/00	59
03/11/01	50	10/15/00	59
03/13/01	51	11/02/00	59
03/15/01	60	08/31/00	60
03/18/01	54	09/05/00	60
03/20/01	54	10/31/00	60
03/22/01	52	01/28/01	60
03/25/01	41	03/15/01	60
03/27/01	52	02/19/02	60
03/29/01	62	06/06/00	61
04/01/01	45	09/19/00	61
04/03/01	58	12/14/00	61
04/05/01	57	02/04/01	61
04/08/01	38	05/03/01	61
04/10/01	43	01/04/00	62
04/12/01	43	10/01/00	62
04/15/01	38	12/10/00	62
04/17/01	45	03/29/01	62
04/19/01	57	04/26/01	62
04/22/01	76	05/17/01	62
04/24/01	55	04/04/00	63
04/26/01	62	11/08/00	63
04/29/01	43	12/03/00	63
05/01/01	53	02/22/01	63
05/03/01	61	12/20/00	64
05/06/01	43	12/27/00	64
05/08/01	47	02/20/01	64
05/10/01	53	08/20/00	65
05/13/01	45	08/22/00	65
05/15/01	46	08/29/00	65
05/17/01	62	09/24/00	65
05/20/01	34	10/05/00	65
05/22/01	68	11/14/00	65
05/24/01	41	12/28/00	65
05/27/01	46	01/30/01	65
05/29/01	27	02/27/01	65
06/05/01	45	03/06/01	65
06/12/01	53	11/16/00	66
06/19/01	49	01/07/01	66
06/26/01	40	09/26/00	67
07/02/01	49	11/21/00	67
07/10/01	36	01/25/01	67

San Jose Plant Effluent Zinc Concentrations

Date	Zinc Effluent ug/L	Data Sorted by Concentration Date	Zn Effluent (ug/L)
07/17/01	45	10/12/00	68
07/24/01	34	01/04/01	68
08/01/01	35	03/01/01	68
08/07/01	47	05/22/01	68
08/14/01	43	08/17/00	69
08/21/01	57	11/30/00	69
08/28/01	47	12/05/00	70
09/05/01	58	12/07/00	70
09/11/01	39	02/13/01	70
09/18/01	54	10/24/00	71
09/25/01	49	12/12/00	71
10/02/01	44	02/08/01	71
10/09/01	51	10/19/00	72
10/16/01	53	11/19/00	72
10/23/01	50	01/23/01	72
10/30/01	47	03/08/00	73
11/06/01	56	09/06/00	73
11/13/01	57	09/14/00	73
11/20/01	45	10/17/00	74
11/27/01	54	02/01/01	74
12/04/01	44	10/26/00	75
12/11/01	58	11/28/00	75
12/18/01	51	02/06/01	75
12/25/01	43	09/28/00	76
01/02/02	33	10/10/00	76
01/08/02	42	04/22/01	76
01/15/02	55	02/01/00	78
01/22/02	57	10/03/00	78
01/29/02	81	12/21/00	79
02/05/02	51	01/29/02	81
02/12/02	58	01/03/01	84
02/19/02	60	09/10/00	85
02/26/02	54	01/18/01	85
03/05/02	57	01/09/01	86
03/12/02	57	01/16/01	86
03/19/02	46	12/19/00	91
03/26/02	50	09/12/00	102

# samples	184
# NDs	0
average	57.5
st dev	12.6
avg+3*stdev	95.2
geomean	56.2
geo stdev	1.2
geo avg*geostdev^3	110
max	102
probit	115

F:\SU32\SU32-29\RPA\RMP Translators\[SU&SJ zn effluent.xls]SJ eff tbl

City of Sunnyvale Plant Effluent Zinc Concentrations

		Zn Effluent	Data Sorted by Concentration		
Date		ug/L	Date		Zn Effluent (ug/L)
04/06/99		16	05/12/99	<	7
04/14/99		39	05/17/99	<	7
04/19/99		62	06/01/99	<	7
04/25/99		67	07/13/99	<	7
05/04/99		9	07/21/99	<	7
05/12/99	<	7	08/04/99	<	7
05/17/99	<	7	09/01/99	<	7
05/23/99		12	09/07/99	<	7
06/01/99	<	7	09/13/99	<	7
06/06/99		20	10/12/99		7
06/16/99		10	05/02/00	<	7
06/22/99		11	08/09/00	<	7
06/27/99		16	08/14/00	<	7
07/08/99		40	08/22/00	<	7
07/13/99	<	7	08/27/00	<	7
07/21/99	<	7	09/06/00	<	7
07/25/99		14	09/13/00	<	7
08/04/99	<	7	09/18/00	<	7
08/10/99		8	09/24/00	<	7
08/15/99		14	10/03/00	<	7
08/23/99		10	10/09/00	<	7
09/01/99	<	7	10/15/00	<	7
09/07/99	<	7	10/25/00	<	7
09/13/99	<	7	10/31/00	<	7
09/19/99		10	11/05/00	<	7
09/28/99		14	01/23/01	<	7
10/06/99		9	04/16/01	<	7
10/12/99		7	05/29/01	<	7
10/17/99		18	06/13/01	<	7
10/25/99		11	06/18/01	<	7
11/03/99		16	06/24/01	<	7
11/09/99		30	07/23/01	<	7
11/15/99		25	08/01/01	<	7
11/21/99		23	08/07/01	<	7
12/01/99		25	08/13/01	<	7
12/06/99		16	08/20/01	<	7
12/14/99		27	08/26/01	<	7
12/19/99		23	09/23/01	<	7
12/27/99		11	11/13/01	<	7
01/05/00		18	03/06/02	<	7
01/11/00		27	03/18/02	<	7
01/17/00		27	08/10/99		8
01/23/00		44	04/04/01		8
02/01/00		28	05/01/01		8
02/09/00		25	05/04/99		9
02/13/00		17	10/06/99		9
02/23/00		26	06/16/99		10
02/29/00		29	08/23/99		10
03/05/00		18	09/19/99		10

City of Sunnyvale Plant Effluent Zinc Concentrations

		Zn Effluent	Data Sorted by Concentration	
Date		ug/L	Date	Zn Effluent (ug/L)
03/15/00		35	06/25/00	10
03/20/00		22	07/23/00	10
03/26/00		78	06/22/99	11
04/04/00		17	10/25/99	11
04/09/00		15	12/27/99	11
04/19/00		12	05/09/01	11
04/24/00		23	09/12/01	11
05/02/00	<	7	05/23/99	12
05/10/00		39	04/19/00	12
05/15/00		16	03/04/01	12
05/21/00		30	07/01/01	12
05/29/00		68	07/19/01	12
06/06/00		22	07/25/99	14
06/14/00		37	08/15/99	14
06/19/00		16	09/28/99	14
06/25/00		10	02/26/01	14
07/05/00		110	09/04/01	14
07/10/00		45	04/09/00	15
07/18/00		25	11/14/00	15
07/23/00		10	12/10/00	15
08/01/00		20	04/06/99	16
08/09/00	<	7	06/27/99	16
08/14/00	<	7	11/03/99	16
08/22/00	<	7	12/06/99	16
08/27/00	<	7	05/15/00	16
09/06/00	<	7	06/19/00	16
09/13/00	<	7	04/22/01	16
09/18/00	<	7	05/13/01	16
09/24/00	<	7	07/09/01	16
10/03/00	<	7	12/26/01	16
10/09/00	<	7	01/02/02	16
10/15/00	<	7	01/13/02	16
10/25/00	<	7	02/13/00	17
10/31/00	<	7	04/04/00	17
11/05/00	<	7	10/03/01	17
11/14/00		15	10/17/99	18
11/19/00		20	01/05/00	18
11/27/00		20	03/05/00	18
12/05/00		30	04/10/01	18
12/10/00		15	06/05/01	19
12/18/00		20	11/08/01	19
12/25/00		20	06/06/99	20
01/03/01		30	08/01/00	20
01/09/01		45	11/19/00	20
01/15/01		20	11/27/00	20
01/23/01	<	7	12/18/00	20
02/05/01		85	12/25/00	20
02/14/01		45	01/15/01	20
02/20/01		35	09/19/01	20

City of Sunnyvale Plant Effluent Zinc Concentrations

		Zn Effluent	Data Sorted by Concentration	
Date		**ug/L**	**Date**	**Zn Effluent (ug/L)**
02/26/01		14	03/20/00	22
03/04/01		12	06/06/00	22
03/12/01		60	03/28/01	22
03/20/01		60	12/17/01	22
03/28/01		22	11/21/99	23
04/04/01		8	12/19/99	23
04/10/01		18	04/24/00	23
04/16/01	<	7	11/15/99	25
04/22/01		16	12/01/99	25
05/01/01		8	02/09/00	25
05/09/01		11	07/18/00	25
05/13/01		16	02/23/00	26
05/21/01		30	12/09/01	26
05/29/01	<	7	12/14/99	27
06/05/01		19	01/11/00	27
06/13/01	<	7	01/17/00	27
06/18/01	<	7	02/01/00	28
06/24/01	<	7	02/29/00	29
07/01/01		12	11/09/99	30
07/09/01		16	05/21/00	30
07/19/01		12	12/05/00	30
07/23/01	<	7	01/03/01	30
08/01/01	<	7	05/21/01	30
08/07/01	<	7	03/15/00	35
08/13/01	<	7	02/20/01	35
08/20/01	<	7	06/14/00	37
08/26/01	<	7	10/10/01	37
09/04/01		14	11/26/01	37
09/12/01		11	12/04/01	38
09/19/01		20	04/14/99	39
09/23/01	<	7	05/10/00	39
10/03/01		17	07/08/99	40
10/10/01		37	01/23/00	44
10/17/01		55	07/10/00	45
10/22/01		55	01/09/01	45
10/28/01		55	02/14/01	45
11/08/01		19	10/17/01	55
11/13/01	<	7	10/22/01	55
11/18/01		71	10/28/01	55
11/26/01		37	03/12/01	60
12/04/01		38	03/20/01	60
12/09/01		26	04/19/99	62
12/17/01		22	04/25/99	67
12/26/01		16	05/29/00	68
01/02/02		16	11/18/01	71
01/13/02		16	03/26/00	78
03/06/02	<	7	02/05/01	85
03/18/02	<	7	07/05/00	110

City of Sunnyvale Plant Effluent Zinc Concentrations

Date	Zn Effluent ug/L	Data Sorted by Concentration Date	Zn Effluent (ug/L)
# samples	146		
# NDs	40		
average	21.0		
st dev	18.0		
avg+3*stdev	74.9		
geomean	15.9		
geo stdev	2.0		
geo avg*geostdev^3	137		
max	110		
probit	135		

F:\SU32\SU32-29\RPA\RMP Translators\[SU&SJ zn effluent.xls]Su eff tbl

City of Sunnyvale Water Supply Sampling at Wright Plant Turnout

Date Year 2001	Zn (ug/L) MDL=4.6	Date Year 2000	Zn (ug/L) MDL=4.6	Date Year 1999	Zn (ug/L) MDL=7
01/02/01	250	01/04/00	521	01/04/99	357
01/16/01	260	01/18/00	639	01/15/99	273
02/06/01	250	02/07/00	532	01/19/99	246
02/20/01	240	02/22/00	550	01/26/99	286
03/06/01	284	03/06/00	566	02/01/99	380
03/20/01	207	03/20/00	583	02/08/99	280
04/03/01	282	04/03/00	604	02/19/99	362
04/17/01	250	04/17/00	579	02/23/99	421
05/01/01	226	05/01/00	560	03/01/99	316
05/15/01	263	05/15/00	572	03/08/99	489
06/05/01	230	06/05/00	427	03/16/99	301
06/10/01		06/19/00	600	03/22/99	365
06/19/01	255	07/03/00	600	03/29/99	437
07/03/01	306	07/17/00	430	04/06/99	571
07/10/01	270	07/31/00	490	04/20/99	534
07/17/01	305	08/15/00	530	05/04/99	532
07/25/01	206	09/06/00	320	05/17/99	350
08/01/01	260	09/19/00	510	06/02/99	434
08/15/01		10/04/00	220	06/15/99	443
08/21/01	276	10/18/00	380	07/06/99	440
09/05/01	384	11/01/00	310	07/20/99	
09/19/01	61	11/14/00	240	08/03/99	495
10/03/01	229	12/06/00	250	08/17/99	455
10/17/01	254	12/19/00	250	09/07/99	507
11/13/01	232			09/21/99	486
11/27/01	173			10/05/99	482
12/04/01	235			10/18/99	564
12/18/01	208			11/01/99	542
				11/15/99	560
				12/06/99	525
				12/20/99	512

average all years= 383

F:\SU32\SU32-29\RPA\RMP Translators\[SU&SJ zn effluent.xls]SU water supply

RATIONALE FOR USE OF EXISTING RMP DATA FOR LOWER SOUTH BAY METALS TRANSLATOR CALCULATIONS

10/08/02

The Regional Board adopted Resolution 92-043 on April 15, 1992 that endorsed in concept the development and implementation of the Regional Monitoring Program for Trace Substances (RMP). The initial sampling design was based on the Bay Protection and Toxic Cleanup Program (BPTCP) pilot studies conducted during 1991 and 1992. Stations were primarily located in the deeper shipping channels along the "spine" of the Estuary and were selected to collect baseline data on trace substances in the Estuary and to determine seasonal and long-term trends in contaminant concentrations. Additional stations were added over the years to fill in spatial gaps and to monitor near major tributaries and at the estuary interface.

Each year the monitoring plan has been reviewed and adjusted as deemed appropriate by the RMP's advisory committees. External review of the RMP's technical and administrative structure is conducted every five years to ensure that the RMP adapts to scientific and technological advances and continues to be useful to the regulatory and scientific communities. Trace metals sampling was conducted three times per year from 1993 – 1999, typically in February, April, and July to capture the range of Delta outflows (from high to low flows).

Sampling during the period of declining Delta outflows during April was discontinued during 2000 since the dry season was determined to be more indicative of ambient contaminant concentrations in the Estuary. In 2000 chromium was removed from the list of analytes measured in water, sediment, and tissue samples. Additional revisions were made in 2001 and the "redesigned" RMP began to be fully implemented in 2002. Modifications included shifting sampling frequency from seasonal to annual dry season sampling to reduce interannual variation. Only three fixed stations will continue to be sampled (Sacramento and San Joaquin Rivers and Golden Gate Bridge), with the other stations based on an annual randomized sample design.

The RMP produces high quality, nationally recognized data. Sampling is conducted in accordance with the "Field Sampling Manual for the Regional Monitoring Program for Trace Substances" (February 2001). This manual outlines the sampling methods and standard operating procedures for water, sediment, and bioaccumulation sampling. The "2001 Quality Assurance Project Plan for the Regional Monitoring Program for Trace Substances" (September 2000) includes the San Francisco Estuary Institute's (SFEI) quality assurance and quality control (QA/QC) protocols and requirements for contract laboratories associated with the RMP. It addresses QA/QC measures both in the field and in the laboratory.

All available RMP total and dissolved metals data from March 1993 through July 1999 (generally 21 datapoints) were used to directly calculate metals translators (i.e. ratio of dissolved to total metal) in accordance with the EPA translator guidance document ("The Metals Translator: Guidance for Calculating A Total Recoverable Permit Limit From A Dissolved Criterion" (June 1996)). The 21 pairs of datapoints are over double the minimum (of 10) recommended in the USEPA guidance document.

Translator values calculated for both the BC10 (Yerba Buena) and BA30 (Dumbarton Bridge) RMP stations were quite consistent, showing there to be relatively little spatial variability. In the 1993-1999 timeframe samples were collected three times per year and thus captured the full range of seasonal variability (that is primarily a function of Delta outflow).

ATTACHMENT B

SUNNYVALE TRANSLATOR CASE STUDY MEMO

(EOA August/December 1997)

(hard copy only, available upon request)