Appendices

Assessment of Environmental Contaminants Associated with the National Defense Reserve Fleet In Suisun Bay, California

February 2009

Prepared by the
National Oceanic and Atmospheric Administration,
Office of Response and Restoration

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Assessment of Environmental Contaminants Associated with the National Defense Reserve Fleet In Suisun Bay, California

Appendix 10.1

MARAD Report 2007 Executive Summary

The following pages are taken from the executive summary of:
National Defense Reserve Fleet (NDRF), Suisun Bay, CA VESSEL ENVIRONMENTAL REVIEW

Prepared for United States Department of Transportation Maritime Administration (MARAD)

Under GSA Contract GS 10F0403R US Maritime Administration Order No. DTMA4F06021

Prepared by
R&M Environmental and Infrastructure, Inc.
February 15, 2007

EXECUTIVE SUMMARY

ES.1 PROJECT OBJECTIVES

Under a contract with the United States Maritime Administration (MARAD), R&M Environmental and Infrastructure Engineering, Inc. (R&M) sampled and analyzed paint chips from 40 vessels of the Suisun Bay Reserve Fleet (SBRF) anchored in Suisan Bay, California. In addition, R&M collected and analyzed sediment samples from locations near the vessels. This sampling program has had the following objectives:

- Document the condition of paints on vessel surfaces.
- Determine the nature and concentrations of hazardous metals in the paint chip.
- Estimate quantities of hazardous paint constituents that (a) may have been lost to the environment to date and (b) still remain and are likely to be released to the environment in the future.
- Characterize the bottom sediments from within and outside the general area where the vessels have been anchored and compare the quality of these sediments with those reported for sediments in other locations in San Francisco Bay.
- Provide a preliminary assessment of the environmental significance of the collected data.

ES.2 PAINT CHIP SAMPLING, SAMPLE ANALYSIS, AND DATA EVALUATION

ES.2.1 Paint Chip Sampling and Field Observations

Paint chip sampling and field observations were performed on August 22-24, 2006. The 40 vessels from which paint chip samples were collected had been chosen at random by MARAD from among the vessels anchored in 7 groups, designated as Rows "E" through "L," at Suisun Bay. For each vessel, three composite samples were obtained representing deck, inboard, and outboard surfaces. A total of 130 composite paint chip samples (including duplicates) were collected. Paint chip samples were obtained from exfoliated/loose paint or directly from the surface using a small scraper. The approximate surface area represented by each sample and the degree of paint exfoliation on the surfaces were estimated during sampling. These estimates were subsequently used, along with the estimates of ships' surface areas provided by MARAD, to develop quantitative estimates of paint constituents lost from and remaining on vessel surfaces.

For the 40 vessels sampled, estimates of the percentages of surface with exfoliated/lost paint averaged 16% for inboard vertical surfaces, 17% for outboard vertical surfaces, and 58% for deck surfaces. There were differences in the type and physical characteristics of the paint, such as color, number of and thickness of overlapping layers, suggesting variation in the type and age of each coating layer.

ES.2.2 Analytical Results for Paint Chip Samples

All paint chip samples were analyzed for the 17 metals (CAM-17) that are classified as toxic substances by virtue of being environmentally persistent and bioaccumulative. Depending on the concentrations of these metals in a waste or substance, such material could be classified as hazardous waste for disposal purposes. Ten of the samples were also analyzed for hexavalent chromium, which is the more toxic form of chromium, for total tin, and for lead and arsenic bioaccessibility via physiologically-based extraction tests (PBET).

CAM-17 analytical results indicated high concentrations of many toxic substances in the paint chip samples, with values as high as 33% for copper, 23% for zinc, 6.6% for lead, and 1.2% for total chromium. Based on regulatory standards, the sampled paints would be classified as hazardous waste with respect to:

- Zinc (110 samples from all 40 vessels).
- Lead (at least 83 samples from 33 vessels).
- Copper (at least 29 samples from 27 vessels).
- Chromium (at least 33 samples from 22 vessels).
- Mercury (at least 2 samples from 2 vessels).
- Cadmium (at least 2 samples from 2 vessels).
- Barium (at least 1 sample from 1 vessel)

The number of samples exceeding hazardous waste criteria may be higher, depending on results from additional tests, which were not conducted in this project.

Hexavalent chromium concentrations ranged from 430 mg/kg to 8,500 mg/kg and accounted for 7% to 71% of the total chromium in the samples examined. Total tin, possibly originating from the use of organotin compounds as biocides in antifouling marine paint formulations, was not detected in 4 of the 10 samples and was at fairly low levels (8.6 to 100 mg/kg) in the remaining 6 samples. PBET results indicated percent bioaccessibility values ranging from less than 0.2% to 82.3% for arsenic and from 7.6% to 31.7% for lead.

ES.2.3 Estimated Quantities of Metals Lost/Remaining

The estimated quantities of CAM-17 metals in paints lost from and remaining on surfaces varied widely among the 40 vessels sampled, with the following highest quantities for chromium, copper, lead, and zinc:

Metals	Ranges of Estimated Quantities, kg/vessel		Estimated Total Quantities, all 40 Vessels, kg	
	Lost	Remaining	Lost	Remaining
Chromium	0.00-60	0.06-133	596	905
Copper	0.01-766	0.43-6,773	2,864	26,045
Lead	0.00-7,86	0.10-700	4,045	4,589
Zinc	1.36-1,679	31-2,972	10,766	25,640

The following data limitations should be considered in evaluating the significance of and any use of the above estimates:

- Not all the missing paints have necessarily been lost at the present locations of the vessels in Suisun Bay.
- Remaining (weathered) paint may be different in composition and not as easily exfoliated as that which has already been lost.
- Visually estimating surface areas represented by a paint chip sample and the fractions of the deck, inboard, and outboard surfaces from which paint has been completely exfoliated is a highly subjective process and would most likely vary with the individual observer.

- Estimates of deck, inboard, and outboard surface area may not be very accurate.
- Paint samples obtained from a few square inches may not be representative of the large surface areas to which the data is extrapolated, particularly in the light of variations noted in the apparent physical characteristics of the paint on such surfaces.
- The 40 Vessels sampled in this project had been selected at random and may not be representative of NDRF vessels at Suisun Bay.

ES.3 SEDIMENT SAMPLING, SAMPLE ANALYSIS, AND DATA EVALUATION

ES.3.1 Sediment Sampling and Field Observations

Sediment sampling, performed on September 12 and 13, 2006, consisted of collecting samples of surface sediments (maximum depth of approximately 5 cm) sediments from 24 locations. Twenty two of the locations were in and around the vessels and two locations were approximately 1,000 yards north and south of the vessels. Visual inspection of the sediment samples as they were brought to the surface indicated variation in sediment sample thickness, appearance, grain size, and support base.

ES.3.2 Analytical Results for Sediment Samples

All sediment samples were analyzed for CAM-17 metals, percent solids, and trace mercury. In addition, the porewater removed from six of the samples were tested for acid-volatile sulfide (AVS), simultaneously extracted metals (SEM), ammonia, and hexavalent chromium. Results indicated that the same metals that were found in high concentrations in the paint chip samples were also present in high concentrations in the sediment samples. The metals with average concentrations (dry-weight basis) above 5 mg/kg were zinc (78 mg/kg), nickel (77 mg/kg), chromium (73 mg/kg), vanadium (73 mg/kg) barium (58 mg/kg), copper (34 mg/kg), cobalt (18 mg/kg), lead (13 mg/kg), and arsenic (7.7 mg/kg). Samples collected approximately 1,000 yards north and 1,000 yard south of the vessels showed metal concentrations that fell within the observed ranges of concentration for the 22 other sediment samples collected in the immediate vicinity of the vessels.

The SEM/AVS molar ratio in sediment porewater is believed to provide an indication of bioavailability and toxicity of certain metals in the porewater. A ratio of one or lower suggests unavailability of metals for biological uptake. For the six samples tested, this ratio ranged from 11 to 38, which are significantly higher than values commonly observed for contaminated sediments. No explanation can be offered for this apparent anomaly, which needs to be further investigated.

Measured ammonia nitrogen and dissolved chromium concentrations in sediment porewater ranged from 1.1 to 4 mg/L and 0.006 to 0.0195, respectively. These ammonia concentrations are generally within the range of observed concentrations in San Francisco Bay. The chromium concentrations were below the 0.05 mg/L 4-day average water quality criteria (WQC) for dissolved chromium in saltwater.

ES.3.3 Sediment Quality Assessment

The National Oceanic and Space Administration (NOAA), has developed numerical sediment quality guidelines (SQG) for interpreting and assessing sediment data. When a substance is present in the sediment at a concentration below the level established by NOAA's SQG as "Effects Range-Low (ERL)", adverse effects are not be anticipated; however, concentrations exceeding what is established as "Effects Range-Median (ERM)" can be indicative of adverse effects.

Comparison of the metal concentrations in the 24 collected sediment samples with the NOAA's ERL and ERM guidelines indicated that, except for nickel, for which all sediment samples concentrations exceeded the ERM value of 51.6 ppm, all metal concentrations were below their respective ERM values, and with only a few exceptions, are also below the ERL levels. In the few cases where ERLs were exceeded, the actual concentrations are much closer to ERLs than to ERMs.

ES.3.4 Comparison of Results with those for Sediment Samples from Other Bay Locations

The fact that sediment samples collected from the bottom of Suisun Bay at locations in and around the SBRF vessels contain the same metals that are found in the paint chip samples from vessel surfaces cannot be interpreted to implicate the paint as the only source or even a partial contributor to the observed sediment contamination. Sediment contamination may result from a variety of sources, including industrial and municipal wastewater discharges, non-point source surface runoff, and atmospheric deposition. The possible contributions from these other sources to the observed contamination of surface sediment in and around SBRF vessels was evaluated in this project in an indirect manner by comparing the metal concentrations in the 24 collected sediment samples with the measured ambient concentration for select sites immediately upstream (Honker Bay and Grizzly Bay) and downstream (San Pablo Bay) of the SBRF in Suisun Bay. This comparison indicated that, with minor exceptions, all metal concentrations were below the range of measured ambient metals concentrations in San Francisco Bay.

ES.4 CONCL USIONS AND RECOMMENDATIONS

Analysis of paint chip samples collected from exposed outside surfaces of 40 SBRF vessels indicate presence of high concentrations of toxic metals in the exfoliating/exfoliated paint. Although the metal concentrations in the surface sediment samples collected within the area where the SBRF vessels are anchored are generally below ERL and/or the range of measured ambient metals concentrations observed in San Francisco Bay, this does not exclude the potential for ecological risk to be present at the site. While the data suggest that the sediment metals concentrations observed at the SBRF site are consistent with the upper reaches of San Francisco Bay, as opposed to being indicative of localized site-specific inputs, the data cannot be interpreted to imply that releases of toxic metals from these vessels have not occurred in the past and/or are not currently taking place. Once released to the aquatic environment, such releases are subject to dispersion and translocation via tidal action and ecosystem processes.

Significant exfoliation of paints has occurred and will continue to occur due to weathering. Exfoliated paint is subject to environmental dispersion with potential impact on ecosystem and site maintenance personnel, visitors, and salvage crews. Corrective actions to arrest further exfoliation and loss of exfoliated paint to the environment are highly warranted and are recommended.

Assessment of Environmental Contaminants Associated with the National Defense Reserve Fleet In Suisun Bay, California

Appendix 10.2

Bathymetric Change Analysis (USGS and NOAA)

Figures

Tables

Maps

1. Bathymetric Change Analysis (USGS 1942-1990)

This section summarizes the bathymetric change analysis for the Reserve Fleet sampling area (2216 acres) based on USGS 1942-1990 bathymetric change grid.

NOAA performed analysis using the USGS bathymetric change data to estimate the net sedimentation rate at the planned sediment sampling stations (Map 1 shows sampled stations in the Suisun Bay Reserve Fleet). The average depth of accretion at planned subsurface sediment stations within the Reserve Fleet, which includes 11 stations in areas of accretion and three stations in areas of erosion, is 154 cm (approx. 5 feet) and the average rate of accretion is 3.2 cm/year. Table 1 summarizes depth change with percent area. NOAA's subsurface sampling plan was designed in part using this bathymetric change analysis to collect subsurface sediments in areas that are likely to have been depositional over the time period that the Reserve Fleet has been moored in Suisun Bay. The average depth of accretion at all stations (surface and subsurface sediment) within the Reserve Fleet sampling area is 52 cm (1.7 feet) and the average rate of deposition for these stations is 1.1 cm/year (see Table 3). The average depth of net accumulated sediment over the entire Reserve Fleet sampling area (2216 acres) as defined by NOAA for this study is 84.4 cm and the average rate of deposition is 1.75 cm/year for the time period 1942-1990. The Reserve Fleet sampling area experiences dynamic sediment transport and this average rate of deposition does not necessarily indicate the age of sediment at a location.

Table 1. Percent are change by accretion (+) and erosion (-) intervals for the Reserve Fleet Sampling Area from 1942-1990 (USGS data).

Depth Change (m)	Area (m^2)	Percent Area
-10-5	16875	0.2%
-5-3	291875	3.3%
-3-2	995625	11.1%
-2-1	1273125	14.2%
-1- -0.10	1315000	14.7%
No Change	207500	2.3%
0.10 – 1.0	748750	8.3%
1.0-2.0	1280000	14.3%
2.0-3.0	936875	10.4%
3.0-4.0	523750	5.8%
4.0-5.0	570625	6.4%
5.0-6.0	671250	7.5%
6.0-7.0	125000	1.4%
7.0-8.0	5000	0.1%
8.0-9.0	3750	0.0%
9.0-10.0	1250	0.0%
10.0-12.0	2500	0.0%

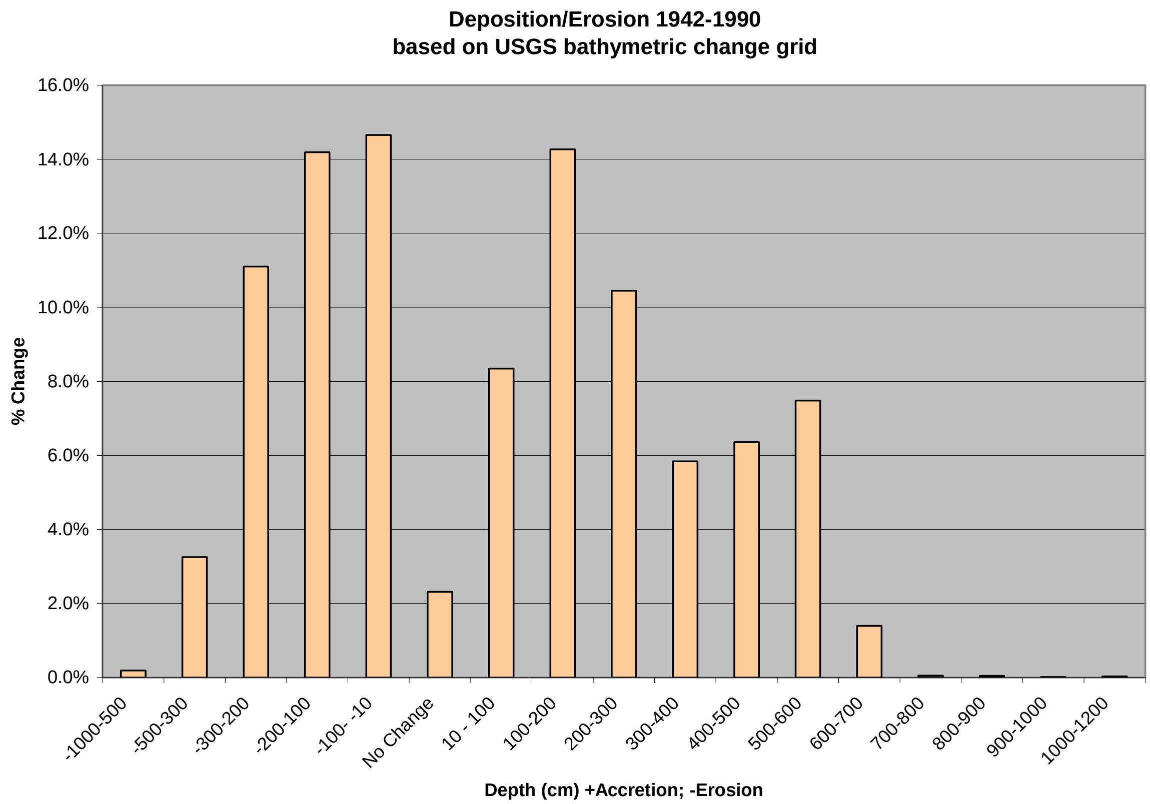


Figure 1. Percent change by accretion (+) and erosion (-) intervals for the Reserve Fleet Sampling Area from 1942-1990.

2. Bathymetric Change Analysis (USGS 2002/NOAA 2007)

To better understand recent erosion and deposition in the Reserve Fleet area, NOAA performed a bathymetric change analysis of multi-beam bathymetric data collected by NOAA's Office of Coast Survey (OCS) in 2007 for the MARAD fleet and USGS 2002 bathymetric data. The NOAA OCS data are provisional and may contain some minor positional errors; however these are the most recent bathymetric data for the Suisun Bay Reserve Fleet area and provide insight into the hydrodynamics of the area. The 2007 bathymetric survey extent of 1295 acres covers the majority of the charted anchorage (Map 2) with less coverage in the Northwest corner of the anchorage beyond where ships have been anchored and where there is shoaling.

The average depth of erosion at the 32 surface and subsurface sediment stations that are within the most recent bathymetric change analysis for the Reserve Fleet is 55.43 cm (approx. 1.8 feet). This is an average rate of erosion of 11.1 cm/year (Map 2 shows sampled stations in the Suisun Bay Reserve Fleet). The average depth of erosion at only the 12 subsurface (core) stations within the Reserve Fleet and the extent of the 2007 bathymetric survey is 46.6 cm (approx. 1.5 feet), with an average rate of erosion of 9.3 cm/year. Table 2 shows the depth change with percent area for the entire Reserve Fleet area with bathymetric change data; Table 3 shows all sediment sampling stations with bathymetric change based on the analyses. Two subsurface stations (RF09 and RF21) were in areas of accretion over the 5 year time period, with 177.4 cm (5.8 feet) and 137.5 cm (4.5 feet) respectively. Three additional surface sediment stations (RF03, RF19T, and RF31) were in areas of accretion with 135.4 cm (4.4 feet), 42.4 cm (1.4 feet), and 25.1 cm (0.8) respectively. Hard metal debris but no paint was noted at station RF31.

Table 2. Percent change by accretion (+) and erosion (-) intervals for the Reserve Fleet Sampling Area from approximately 2002 – 2007 (USGS/NOAA data).

Depth Change (m)	Area (m^2)	Percent Area
-10- -5	1,200.00	0.02%
-5 - -3	19,100.00	0.36%
-3 - -2	100,600.00	1.92%
-2 - -1	1,935,300.00	36.94%
-1 - -0.75	1,009,600.00	19.27%
-0.75 - 0.50	560,200.00	10.69%
-0.5 - -0.25	388,200.00	7.41%
-0.25 - -0.10	180,500.00	3.45%
No Change	191,700.00	3.66%
0.1 - 0.25	117,800.00	2.25%
0.25 - 0.50	158,000.00	3.02%
0.50 - 0.75	118,000.00	2.25%
0.75 - 1.0	95,600.00	1.82%
1.0 - 1.5	216,600.00	4.13%
1.5 - 2.0	111,300.00	2.12%
2.0 - 3.0	6,200.00	0.12%
3.0 - 4.0	29,300.00	0.56%

Figure 2. Bathymetric change analysis (NOAA) Percent change by accretion (+) and erosion (-) intervals for the Reserve Fleet Sampling Area from 2002-2007.

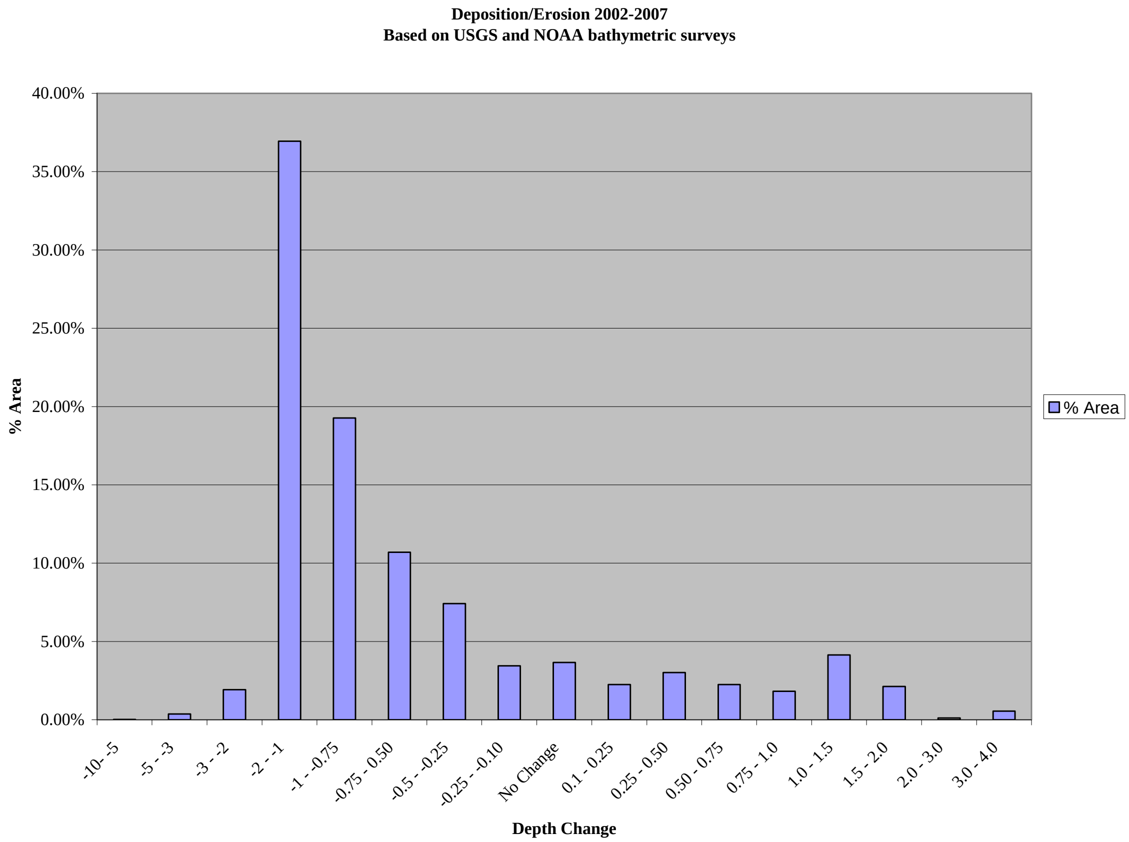


Table 3. Bathymetric change deposition/erosion based on USGS 1942-1990 analysis and NOAA/USGS 2002-2007 analysis

				Erosion (-)/Deposition (+)		
Station ID	Sample Type	Latitude	Longitude	1942-1990 Meters MLLW[a]	2002-2007 Meters MLLW[b]	Water Depth MLLW[c]
CS01A	Surface Sediment	38.0490	-122.1800	**273.000**	No Data	-22.688
CS01B	Surface Sediment	38.0486	-122.1796	**256.000**	No Data	-23.419
CS01C	Surface Sediment	38.0486	-122.1804	**314.000**	No Data	-21.895
CS01T	Surface Sediment	38.0422	-122.1571	**665.000**	No Data	-0.041
CS02	Surface and Subsurface Sediment	38.0446	-122.1288	**308.000**	No Data	-13.483
CS03	Surface and Subsurface Sediment	38.0256	-122.1485	**65.000**	No Data	-2.083
CS03T	Surface Sediment	38.0272	-122.1625	**334.000**	No Data	0.233
GB01	Surface and Subsurface Sediment	38.1150	-122.0157	No Data	No Data	-0.925
GB01A	Surface Sediment	38.1148	-122.0164	No Data	No Data	-0.895
GB01B	Surface Sediment	38.1145	-122.0169	No Data	No Data	-0.834
GB01C	Surface Sediment	38.1152	-122.0166	No Data	No Data	-0.925
GB01T	Surface Sediment	38.1021	-122.0063	No Data	No Data	0.507
GB02	Surface and Subsurface Sediment	38.0987	-122.0255	No Data	No Data	-5.741
GB02A	Surface Sediment	38.0985	-122.0258	No Data	No Data	-6.198
GB02B	Surface Sediment	38.0991	-122.0255	No Data	No Data	-4.339
GB02C	Surface Sediment	38.0985	-122.0252	No Data	No Data	-5.772
GB02T	Surface Sediment	38.0952	-122.0380	No Data	No Data	-0.224
GB03	Surface Sediment	38.1051	-122.0459	No Data	No Data	-2.236
RF01	Surface Sediment	38.0971	-122.0754	No Data	No Data	-0.468
RF02	Surface Sediment	38.0941	-122.0798	**550.000**	No Data	-0.651
RF03	Surface Sediment	38.0940	-122.0747	**516.000**	**135.429**	-4.004
RF04	Surface Sediment	38.0939	-122.0701	**-121.000**	No Data	-8.362
RF05	Surface Sediment	38.0901	-122.0868	**375.000**	No Data	1.513
RF06	Surface Sediment	38.0903	-122.0823	**504.000**	No Data	-2.876
RF07	Surface and Subsurface Sediment	38.0902	-122.0773	**-72.000**	**-65.372**	-8.484
RF08	Surface Sediment	38.0901	-122.0725	**-365.000**	No Data	-7.844
RF09	Surface and Subsurface Sediment	38.0853	-122.0889	**402.000**	**177.423**	-3.699
RF10	Surface Sediment	38.0864	-122.0846	**114.000**	**-85.496**	-6.686
RF11	Surface Sediment	38.0863	-122.0798	**-40.000**	**-84.604**	-8.210
RF12	Surface Sediment	38.0862	-122.0751	**-41.000**	No Data	-6.168
RF13	Surface Sediment	38.0820	-122.0933	**364.000**	**-17.952**	-3.607
RF14	Surface and Subsurface Sediment	38.0826	-122.0871	**48.000**	**-59.140**	-7.235
RF15	Surface Sediment	38.0825	-122.0823	**-86.000**	**-6.540**	-8.759
RF16	Surface Sediment	38.0788	-122.0993	**257.000**	No Data	-2.175
RF17	Surface and Subsurface Sediment	38.0788	-122.0946	**220.000**	**-114.500**	-5.101
RF18	Surface Sediment	38.0788	-122.0895	**110.000**	**-72.476**	-6.381
RF19	Surface Sediment	38.0788	-122.0846	**-237.000**	No Data	-8.210
RF20	Surface Sediment	38.0750	-122.1018	**245.000**	**-28.212**	-3.760
RF21	Surface and Subsurface Sediment	38.0750	-122.0969	**175.000**	**137.480**	-5.406
RF22	Surface Sediment	38.0750	-122.0921	**-146.000**	**-105.976**	-8.545
RF23	Surface Sediment	38.0751	-122.0872	**-83.000**	No Data	-5.406
RF24	Surface Sediment	38.0712	-122.1092	**541.000**	No Data	1.848
RF25	Surface and Subsurface Sediment	38.0712	-122.1044	**279.000**	**-88.644**	-4.248
RF26	Surface Sediment	38.0713	-122.0994	**151.000**	**-29.728**	-5.528
RF27	Surface and Subsurface Sediment	38.0711	-122.0946	**-223.000**	**-119.984**	-8.667
RF28	Surface Sediment	38.0711	-122.0894	**-50.000**	No Data	-4.187
RF29	Surface and Subsurface Sediment	38.0676	-122.1102	**392.000**	No Data	-2.023
RF30	Surface Sediment	38.0674	-122.1068	**159.000**	**-120.100**	-5.101
RF31	Surface Sediment	38.0673	-122.1018	**-86.000**	**25.088**	-7.570
RF32	Surface Sediment	38.0673	-122.0970	**-197.000**	No Data	-8.972

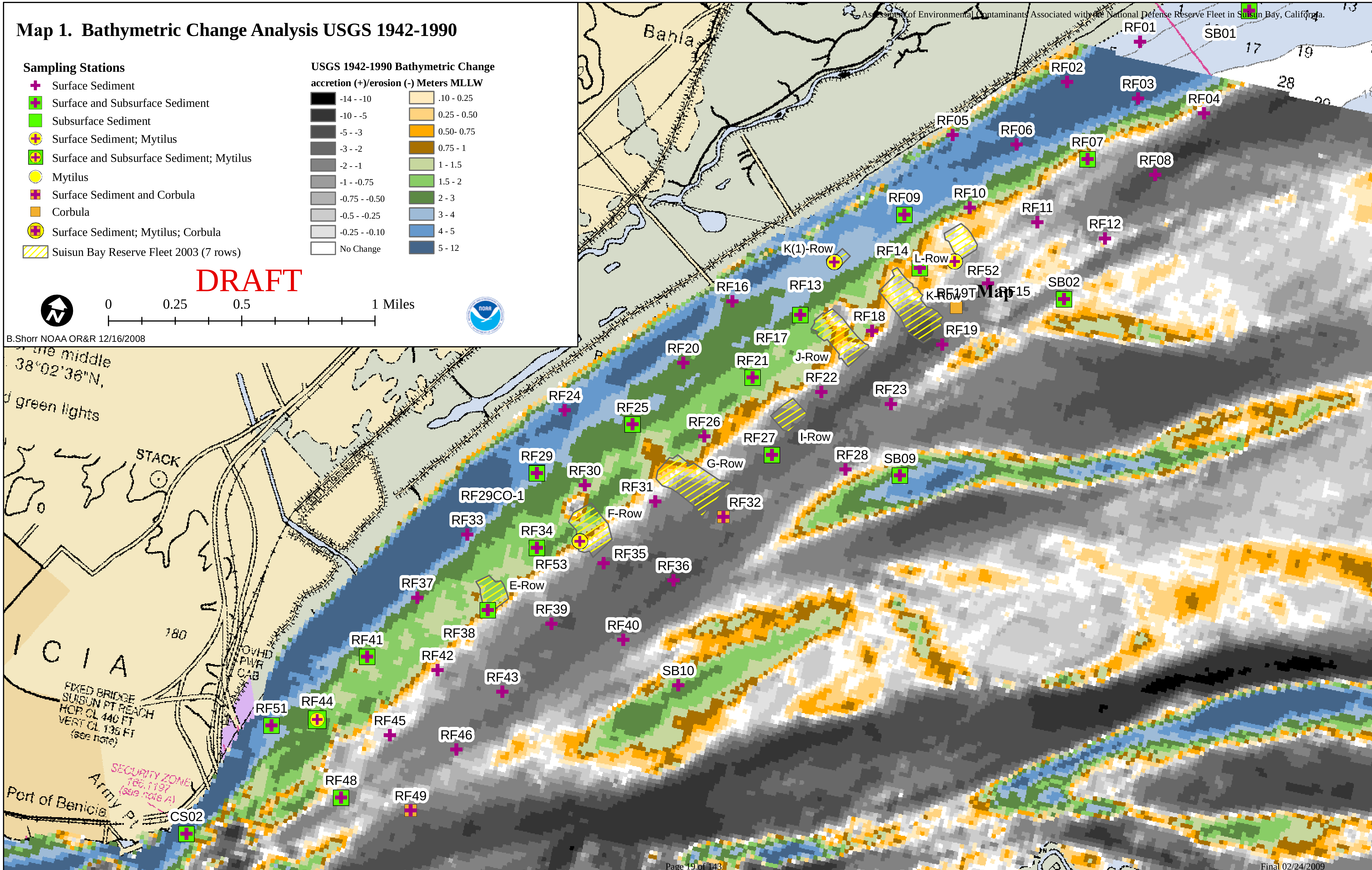
Table 3. Bathymetric change deposition/erosion based on USGS 1942-1990 analysis and NOAA/USGS 2002-2007 analysis

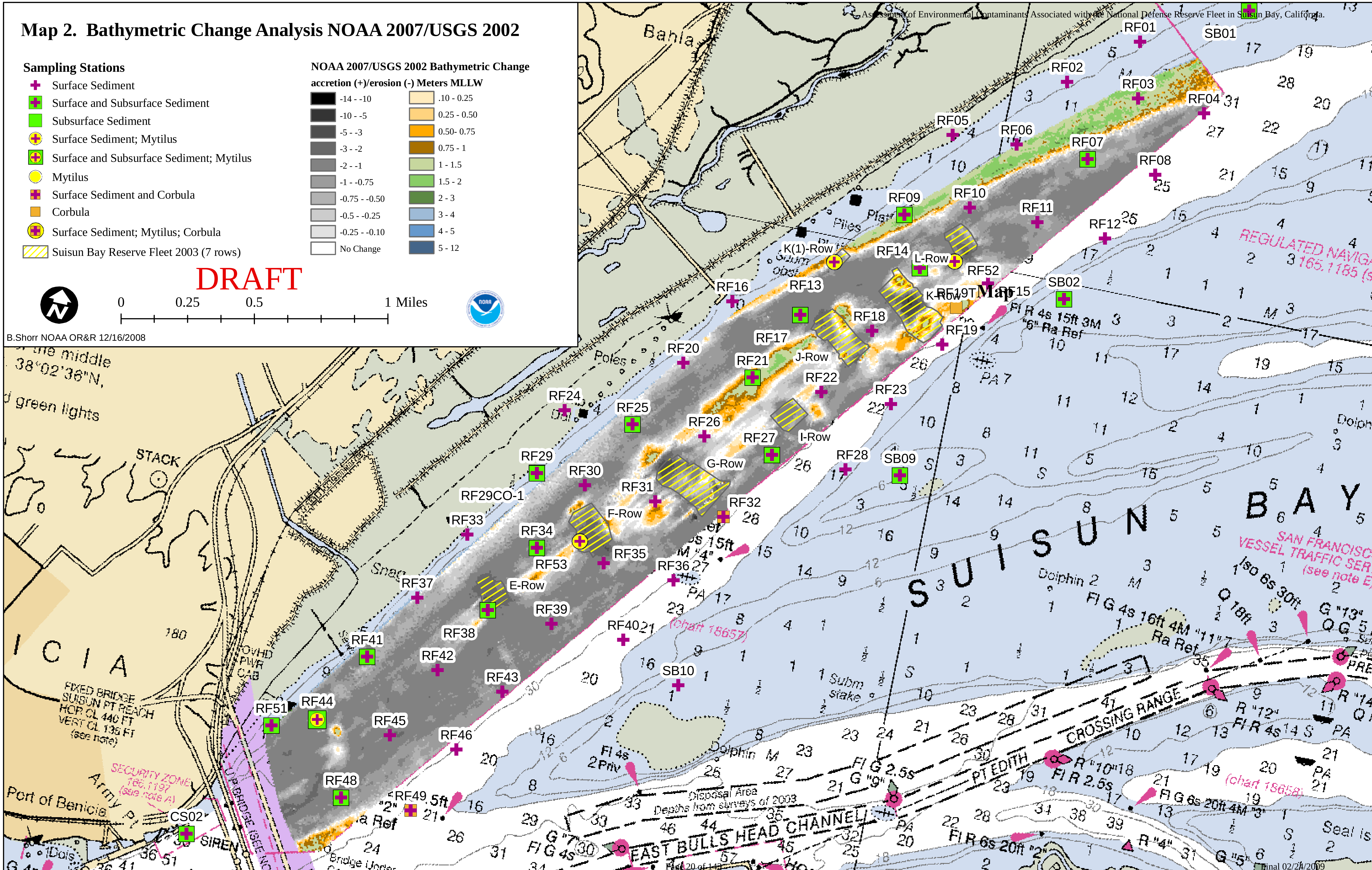
				Erosion (-)/Deposition (+)		
Station ID	Sample Type	Latitude	Longitude	1942-1990 Meters MLLW[a]	2002-2007 Meters MLLW[b]	Water Depth MLLW[c]
RF33	Surface Sediment	38.0635	-122.1140	**463.000**	No Data	-1.382
RF34	Surface and Subsurface Sediment	38.0636	-122.1092	**165.000**	**-74.316**	-5.223
RF35	Surface Sediment	38.0635	-122.1044	**-215.000**	**-89.228**	-9.338
RF36	Surface Sediment	38.0633	-122.0995	**-326.000**	No Data	-8.271
RF37	Surface Sediment	38.0596	-122.1165	**238.000**	**-30.876**	-3.973
RF38	Surface and Subsurface Sediment	38.0597	-122.1116	**114.000**	**-29.616**	-6.046
RF39	Surface Sediment	38.0597	-122.1071	**-232.000**	**-115.744**	-9.582
RF40	Surface Sediment	38.0596	-122.1021	**-185.000**	No Data	-6.991
RF41	Surface and Subsurface Sediment	38.0559	-122.1191	**153.000**	**-103.040**	-4.949
RF42	Surface Sediment	38.0560	-122.1142	**-9.000**	**-141.060**	-7.539
RF43	Surface Sediment	38.0555	-122.1095	**-160.000**	**-106.844**	-9.582
RF44	Surface and Subsurface Sediment	38.0521	-122.1216	**216.000**	**-118.240**	-5.711
RF45	Surface Sediment	38.0520	-122.1165	**-24.000**	**-123.200**	-9.673
RF46	Surface Sediment	38.0520	-122.1118	**-113.000**	No Data	-8.789
RF48	Surface and Subsurface Sediment	38.0482	-122.1191	**-102.000**	**-88.860**	-12.111
RF49	Surface Sediment	38.0482	-122.1141	**-157.000**	No Data	-8.545
RF51	Surface and Subsurface Sediment	38.0513	-122.1246	**355.000**	No Data	-2.266
RF52	Surface Sediment	38.0833	-122.0849	**3.000**	**-138.208**	-7.417
RF53	Surface Sediment	38.0643	-122.1063	**30.000**	**-59.812**	-6.046
SB01	Surface and Subsurface Sediment	38.0999	-122.0684	No Data	No Data	-3.150
SB02	Surface and Subsurface Sediment	38.0825	-122.0770	**-7.000**	No Data	-0.438
SB03	Surface and Subsurface Sediment	38.0421	-122.1059	**-78.000**	No Data	-2.114
SB04	Surface and Subsurface Sediment	38.0871	-122.0403	**211.000**	No Data	-0.834
SB04A	Surface Sediment	38.0870	-122.0406	**163.000**	No Data	-0.864
SB04B	Surface Sediment	38.0869	-122.0400	**179.000**	No Data	-0.834
SB04C	Surface Sediment	38.0874	-122.0405	**147.000**	No Data	-0.742
SB06	Surface Sediment	38.0581	-122.0052	**-174.000**	No Data	-10.892
SB07	Surface and Subsurface Sediment	38.0684	-122.0461	**9.000**	No Data	-0.773
SB07A	Surface Sediment	38.0693	-122.0446	**19.000**	No Data	-1.230
SB07B	Surface Sediment	38.0693	-122.0451	**-17.000**	No Data	-1.352
SB07C	Surface Sediment	38.0689	-122.0444	**143.000**	No Data	-0.590
SB08	Surface and Subsurface Sediment	38.0704	-121.9852	**175.000**	No Data	-5.101
SB08A	Surface Sediment	38.0703	-121.9851	**187.000**	No Data	-5.253
SB08B	Surface Sediment	38.0704	-121.9857	**151.000**	No Data	-5.406
SB08C	Surface Sediment	38.0709	-121.9849	**216.000**	No Data	-4.552
SB09	Surface and Subsurface Sediment	38.0714	-122.0857	**337.000**	No Data	-1.992
SB10	Surface Sediment	38.0578	-122.0977	**196.000**	No Data	-0.285
SB11	Surface Sediment	38.0924	-122.0523	**77.000**	No Data	-1.169
SB12T	Surface Sediment	38.1081	-122.0561	No Data	No Data	-2.023

[a] Erosion/deposition from bathymetric change analysis 1942-1990 (Cappiella et. al USGS 1999).

[b] Erosion/deposition from bathymetric change analysis by NOAA (NOAA 2007/USGS 2002 bathymetry)

[c] Depth in meters referenced to Mean Lower Low Water (MLLW)


Map 1. Bathymetric Change Analysis USGS 1942-1990
Sampling Stations
Surface Sediment
Surface and Subsurface Sediment
Subsurface Sediment
Surface Sediment; Mytilus
Surface and Subsurface Sediment; Mytilus
Mytilus
Surface Sediment and Corbula
Corbula
Surface Sediment; Mytilus; Corbula
Suisun Bay Reserve Fleet 2003 (7 rows)
USGS 1942-1990 Bathymetric Change
accretion (+)/erosion (-) Meters MLLW
-14 - -10
-10 - -5
-5 - -3
-3 - -2
-2 - -1
-1 - -0.75
-0.75 - -0.50
-0.5 - -0.25
-0.25 - -0.10
No Change
.10 - 0.25
0.25 - 0.50
0.50- 0.75
0.75 - 1
1 - 1.5
1.5 - 2
2 - 3
3 - 4
4 - 5
5 - 12
DRAFT
0
0.25
0.5
1 Miles
B.Shorr NOAA OR&R 12/16/2008
Bahia
RF01
SB01
RF02
RF03
RF04
RF05
RF06
RF07
RF08
RF09
RF10
RF11
RF12
K(1)-Row
RF14
L-Row
RF52
RF16
RF13
K-Row
RF15
SB02
RF18
RF19
RF17
J-Row
RF20
RF21
RF22
RF23
RF24
RF25
RF26
I-Row
RF27
G-Row
RF28
SB09
RF29
RF30
RF29CO-1
RF31
F-Row
RF32
RF33
RF34
RF35
RF53
RF36
RF37
E-Row
RF39
RF40
RF38
RF41
RF42
RF43
SB10
RF51
RF44
RF45
RF46
RF48
RF49
CS02
the middle
38°02'36"N,
d green lights
STACK
ICIA
180
OVHD PWR CAB
FIXED BRIDGE
SUISUN PT REACH
HOR CL 440 FT
VERT CL 135 FT
(see note)
SECURITY ZONE
165.1197
(see note A)
Port of Benicia
Army Pt
17
19
28


Map 2. Bathymetric Change Analysis NOAA 2007/USGS 2002
Sampling Stations
Surface Sediment
Surface and Subsurface Sediment
Subsurface Sediment
Surface Sediment; Mytilus
Surface and Subsurface Sediment; Mytilus
Mytilus
Surface Sediment and Corbula
Corbula
Surface Sediment; Mytilus; Corbula
Suisun Bay Reserve Fleet 2003 (7 rows)
NOAA 2007/USGS 2002 Bathymetric Change
accretion (+)/erosion (-) Meters MLLW
-14 - -10
-10 - -5
-5 - -3
-3 - -2
-2 - -1
-1 - -0.75
-0.75 - -0.50
-0.5 - -0.25
-0.25 - -0.10
No Change
.10 - 0.25
0.25 - 0.50
0.50- 0.75
0.75 - 1
1 - 1.5
1.5 - 2
2 - 3
3 - 4
4 - 5
5 - 12
DRAFT
0 0.25 0.5 1 Miles
B.Shorr NOAA OR&R 12/16/2008
SUISUN BAY
EAST BULLS HEAD CHANNEL
CROSSING RANGE
PT EDITH
Port of Benicia
BENICIA
K(1)-Row
L-Row
K-Row
J-Row
I-Row
G-Row
F-Row
E-Row
RF01 RF02 RF03 RF04 RF05 RF06 RF07 RF08 RF09 RF10 RF11 RF12 RF13 RF14 RF15 RF16 RF17 RF18 RF19 RF20 RF21 RF22 RF23 RF24 RF25 RF26 RF27 RF28 RF29 RF29CO-1 RF30 RF31 RF32 RF33 RF34 RF35 RF36 RF37 RF38 RF39 RF40 RF41 RF42 RF43 RF44 RF45 RF46 RF48 RF49 RF51 RF52 RF53
SB01 SB02 SB09 SB10 CS02
REGULATED NAVIGATION
SAN FRANCISCO VESSEL TRAFFIC SERVICE (see note E)
SECURITY ZONE 165.1197 (see note A)
FIXED BRIDGE SUISUN PT REACH HOR CL 440 FT VERT CL 135 FT (see note)
Disposal Area Depths from surveys of 2003
(chart 18657)
(chart 18658)

Assessment of Environmental Contaminants Associated with the National Defense Reserve Fleet In Suisun Bay, California

Appendix 10.3

Query Manager San Francisco Bay Contaminant Data Sets and Maps

Query Manager™ is a database program, developed by NOAA's Office of Response and Restoration, that can be used to access sediment chemistry (surface and subsurface), sediment toxicity, and tissue chemistry data from a relational database for individual watersheds areas. The application enables users to select from a menu of queries that sort and analyze these data in a variety of ways to produce output tables. The selected data can be immediately displayed on maps using MARPLOT® and/or the query output tables can be saved in a variety of formats for use with other mapping software (e.g. ArcGIS®) or other applications (e.g., spreadsheets, statistics packages, word processors).

MARPLOT (Mapping Application for Response, Planning, and Local Operational Tasks) is a general-purpose, desktop mapping program that allows users to create, view, and modify maps quickly and easily and to link objects on maps to data in other programs.

The Query Manager application and the existing San Francisco Bay (which includes Northern California) database may be downloaded at: http://response.restoration.noaa.gov/querymanager

Collected Regional Datasets in Query Manager

Sediment Chemistry (surface) 92 Separate studies
Study Names
Alameda Naval Air - Seaplane Lagoon
Alameda Navy 1991-1998 Sediment Data
Benicia Marina 1996, 1997, 2001
BPTCP San Fran 1991/92 Pilot Project
BPTCP San Fran 1994/95 Reference Sites
BPTCP San Fran 1995 Screen-Legs 38-41
BPTCP San Fran 1996 Screen-Leg 44
BPTCP San Fran 1997 Confirm-Leg 50
BPTCP San Fran 1997 Screen (Stege Marsh)
Bulls Head Channel Dredging 1994
CISNET San Pablo Bay Stress Indicators
Clipper Yacht Harbor 2002
Coyote Point Marina Dredging 202
Ecological Invest Richmond Harbor 1991
Emery Cove Marina Dredging 2000
Humboldt Bay Baseline Baseline Survey 1994-1995
Humboldt Eureka Expansion Channel 1993
Hunters Point EPA Parcel F 2001
Islais Creek SFPUC Sed 1998-2000
John F. Baldwin Ship Channel Phase III
Kappas Marina Dredging Sausalito 1997
Larkspur Landing Ferry Terminal 1999
Local Effects Monitoring Program (BADA)
Loch Lomond Marina San Rafael 2001
MARAD (REMI) 2007

Marina Vista Homeowners Assoc 1998
Mission Creek SFPUC Sed 1998-2000
NOAA/EMAP San Fran Bay 2000 Mag-Extent
NOAA San Fran Bay 2001 Mag and Extent
NOAA NS&T San Fran 1986-1995 Benthic Surv.
NOAA NS&T San Fran 1986-1987 Mussel Watch
NOAA Suisun Bay 2008 Core Sampling
NOAA Suisun Bay 2008 Grab Sampling
Oakland Harbor 38-Foot Phase III 1990
Oakland Harbor 42 Foot Phase IIIA 1990
Oakland Harbor 42 Foot Phase IIIB 1990
Oyster Point Marina 1998
Pinole Shoals Navigation Channel 2003
Pittsburg Power Plant Intake 2000
Point San Pablo Yacht Harbor 2002
Port of Richmond Terminal 1 Retest 1994
Port of San Francisco Pier 35 West 2002
Port of San Francisco Berth 35 E 2003
Port of Oakland 50 Ft Deepening 1998
Richmond Harbor Deepen/Turn Basin 1995
Richmond Harbor Ecotox Changes 1996-98
Richmond Harbor Terminals 1 and 4 1992
Richmond Harbor USACE Dredging Oct 1991
SF Airport Sediment Character 2000
SFEI 1993-2006 Regional Monitoring Program
SFOBB East Span Project 1999
Suisun City Launch Ramp 1999
United Heckathorn Superfund Site 1992
UNOCAL Corporation Terminal 1996
URS Evaluation of US Steel Seds 1999
USCG Baker East Facility 1999
USCG Yerba Buena Island 1999
USGS Trace Metals in Sediment and Clams
Vallejo Ferry Terminal 2003
Yosemite Creek SFPUC Sed 1998-2000

Tissue Chemistry– 47 Separate studies with various analytes
Study Names:
Alameda Naval Air - Seaplane Lagoon
CISNET San Pablo Bay Stress Indicators
Ecological Invest Richmond Harbor 1991
Humboldt Bay Baseline Survey 1993
Hunters Point EPA Parcel F 2001
Islais Creek SFPUC Sed 1998-2000
John F. Baldwin Ship Channel Phase III

Mission Creek SFPUC Sed 1998-2000
NOAA NS&T San Fran 1984-1991 Benthic Surv.
NOAA NS&T San Fran 1986-1995 Mussel Watch
Oakland Harbor 38-Foot Phase III 1990
Oakland Harbor 42 Foot Phase IIIB 1990
Port of Richmond Terminal 1 Retest 1994
Richmond Harbor Ecotox Changes 1996-98
Richmond Harbor USACE Dredging Oct 1991
Richmond Harbor Deepen/Turn Basin 1995
SFEI 1997-2005 Regional Monitoring Program
SFOBB East Span Project 1999
United Heckathorn Superfund Site 1992
USGS Trace Metals in Sediment and Clams
Yosemite Creek SFPUC Sed 1998-2000

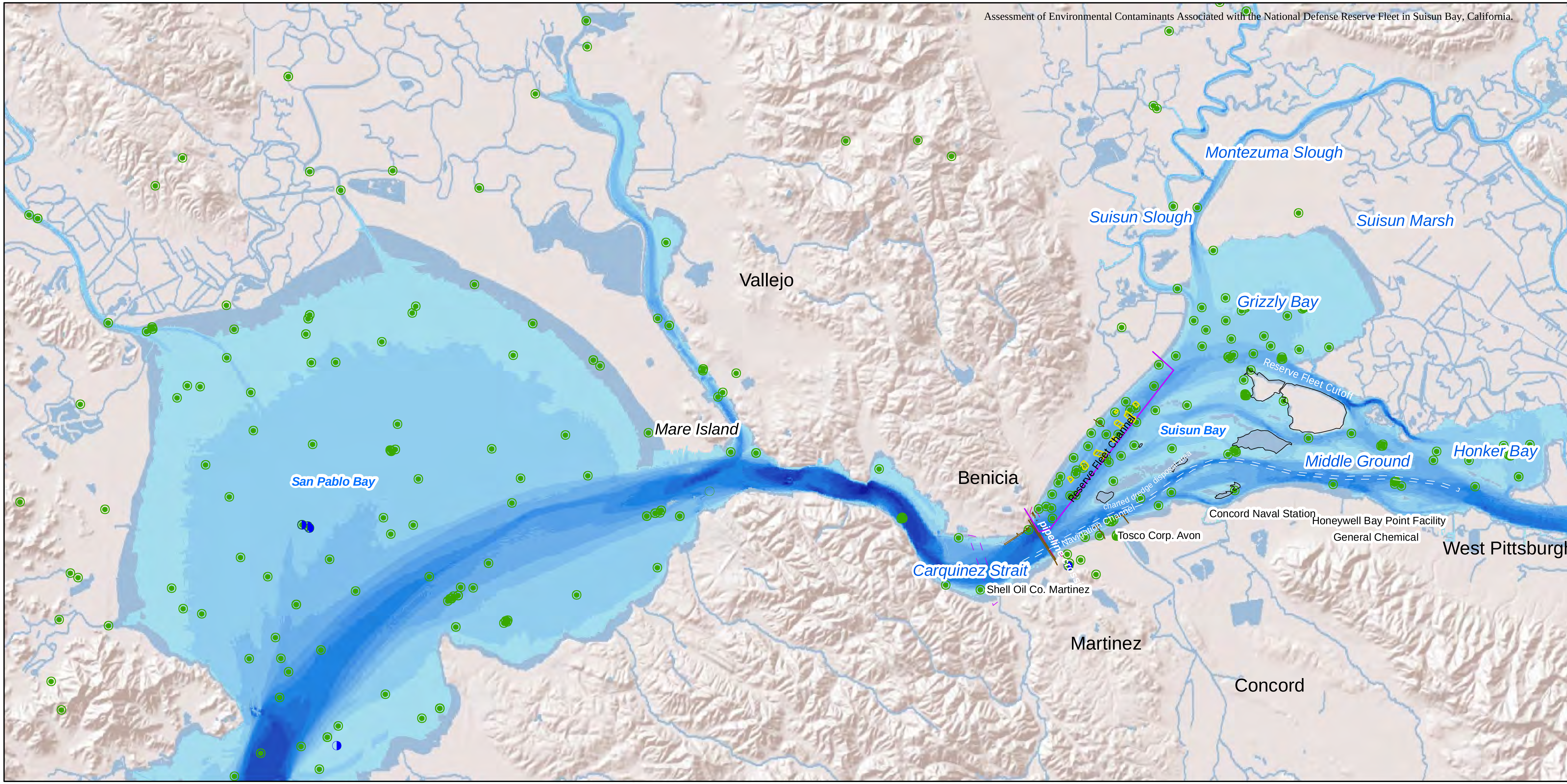
Sediment Bioassays – 72 Separate studies with various toxicity endpoints
Study Names:
Alameda Naval Air - Seaplane Lagoon
Arques Shipyard and Marina 1998
Benicia Marina 1996, 1997, 2001
BPTCP San Fran 1994/95 Reference Sites
BPTCP San Fran 1995 Screen-Legs 38-41
BPTCP San Fran 1996 Screen-Leg 44
BPTCP San Fran 1997 Confirm-Leg 50
BPTCP San Fran 1997 Screen (Stege Marsh)
Bulls Head Channel Dredging 1994
CISNET San Pablo Bay Stress Indicators
Clipper Yacht Harbor 2002
Coyote Point Marina Dredging 202
Ecological Invest Richmond Harbor 1991
Emery Cove Marina Dredging 2000
Humboldt Bay Baseline Baseline Survey 1994-1995
Humboldt Eureka Expansion Channel 1003
Hunters Point EPA Parcel F 2001
Islais Creek SFPUC Sed 1998-2000
John F. Baldwin Ship Channel Phase III
Kappas Marina Dredging Sausalito 1997
Larkspur Landing Ferry Terminal 1999
Loch Lomond Marina San Rafael 2001
Marina Vista Homeowners Assoc 1998
Martinez Marina Dredging 2000
Mission Creek SFPUC Sed 1998-2000
Moss Landing Harbor Dredging 2002
NOAA/EMAP San Fran Bay 2000 Mag-Extent
NOAA San Fran Bay 2001 Mag and Extent

Oakland Harbor 38-Foot Phase III 1990
Oakland Harbor 42 Foot Phase IIIA 1990
Oakland Harbor 42 Foot Phase IIIB 1990
Oyster Point Marina 1998
Pinole Shoals Navigation Channel 2003
Pittsburg Power Plant Intake 2000
Point San Pablo Yacht Harbor 2002
Port of Oakland 50 Ft Deepening 1998
Port of Oakland Berths 26 and 30, 1994
Port of Richmond Terminal 1 Retest 1994
Port of San Francisco Berth 35 E 2003
Port of San Francisco Pier 35 West 2002
Richmond Harbor Deepen/Turn Basin 1995
Richmond Harbor Ecotox Changes 1996-98
Richmond Harbor Terminals 1 and 4 1992
Richmond Harbor USACE Dredging Oct 1991
RMC Lonestar Redwood City 1999
SF Airport Sediment Character 2000
SFEI 1993-2006 Regional Monitoring Program
SFOBB East Span Project 1999
Suisun City Launch Ramp 1999
United Heckathorn Superfund Site 1992
UNOCAL Corporation Terminal 1996
URS Evaluation of US Steel Seds 1999
USCG Baker East Facility 1999
USCG Yerba Buena Island 1999
Vallejo Ferry Terminal 2003
Yosemite Creek SFPUC Sed 1998-2000

The relevant regional datasets listed above were used to examine contaminant levels within Suisun Bay. The following maps were generated using Query Manager data for studies located within or near to Suisun Bay and are intended to aid in the understanding of the results of the NOAA 2008 Suisun Fleet investigation.

The contaminant data from San Francisco Bay regional datasets (Query Manager database) include surface sediment studies from 0 - 30 cm. The NOAA 2008 Sampling data shown in this appendix are the grab samples, which are 0 - 5 cm.

Map 1. Total PAHs (PPB) in surface sediment compared to ERL/ERM
Map 2. Total PCBs (PPB) in surface sediment compared to ERL/ERM



Map 1. Total PAHs (PPB) in surface sediment compared to ERL/ERM

0 0.5 1 2 3 4 5 Miles

0 0.5 1 2 3 4 5 6 7 8 Kilometers

Total PAHs PPB ERL-ERM

- Non-Detect (DL<ERL)
- Non-Detect (ERL<DL<ERM)
- Non-Detect (DL>ERM)
- < ERL (4022)
- ERL - ERM
- > ERM (44792)

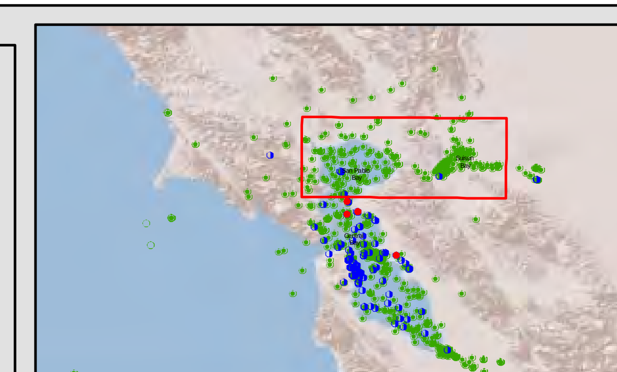
- Suisun Bay Reserve Fleet (2003)
- Navigation Channel (NOAA Chart 18656)
- Regulated Navigation Area (NOAA Chart 18652)
- Pipeline Area (NOAA Chart 18656)
- islands (NOAA Chart 18656)
- disposal area (NOAA Chart 18656)
- Docks and Bridges

Data sources include NOAA, ESRI
USGS, SFEI, CA State, MARAD
Contaminant data from NOAA Query Manager
SF Bay including NOAA Suisun Bay 2008 (update 12/22/2008)
ERL/ERM = Effects Range-Low, Effects Range-Medium

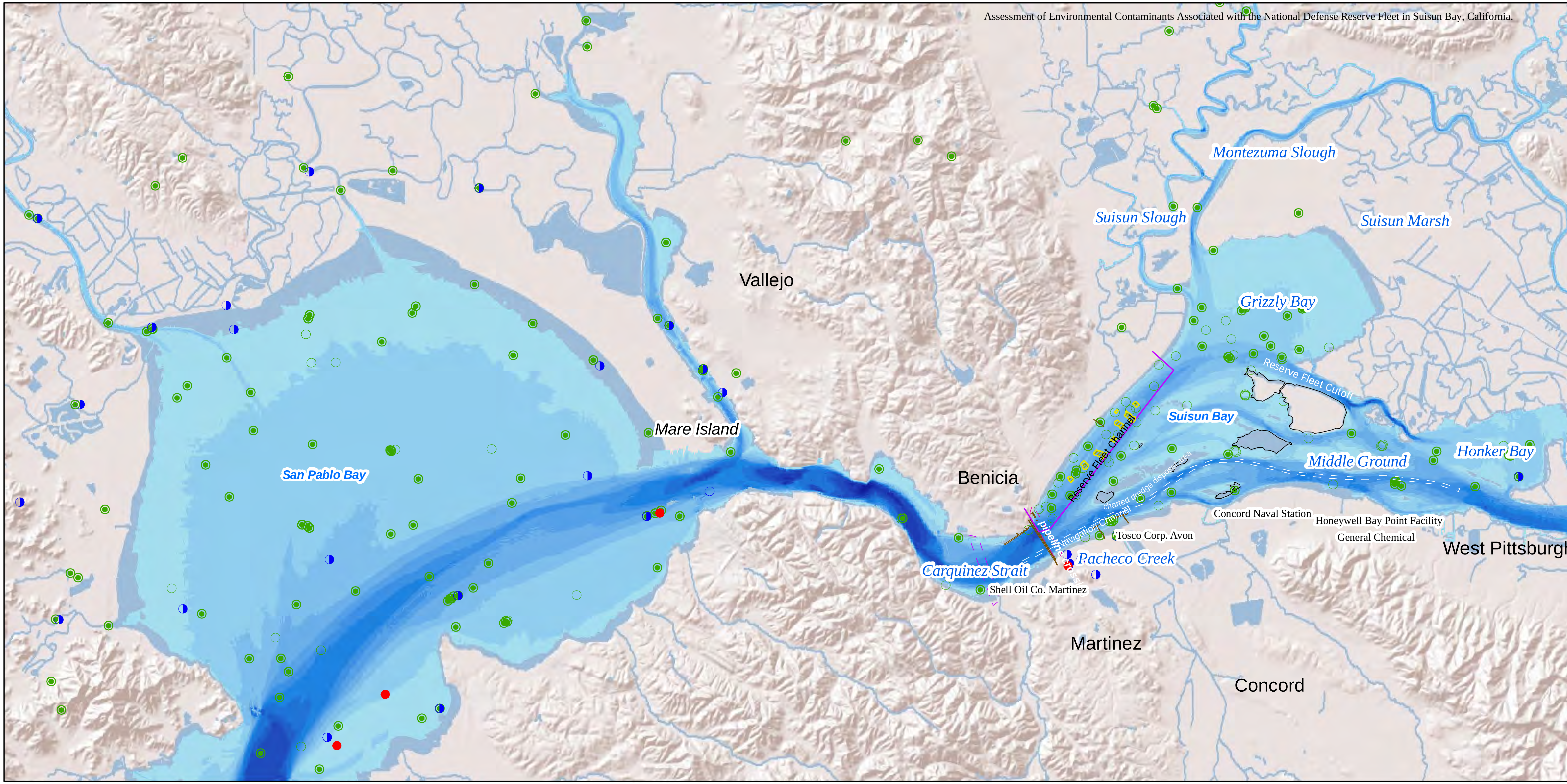
NOAA OR&R | ARD Ben Shorr 2/3/2009
c:\gis\projects\SuisunBay\Suisun_Bay_2009_contaminant.mxd

Bathymetry: Suisun Bay USGS compilation 2002
San Pablo Bay NOAA SPO Estuarine Bathymetry 1971-1993
Meters MLLW

-41.4	-19.9 - -18	-7.9 - -5
-41.3 - -35	-17.9 - -15	-4.9 - -3
-34.9 - -30	-14.9 - -12	-2.9 - -1
-29.9 - -25	-11.9 - -10	-0.9 - 0
-24.9 - -20	-9.9 - -8	



Final 02/24/2009



Map 2. Total PCBs (PPB) in surface sediment compared to ERL/ERM

0 0.5 1 2 3 4 5 Miles

0 0.5 1 2 3 4 5 6 7 8 Kilometers

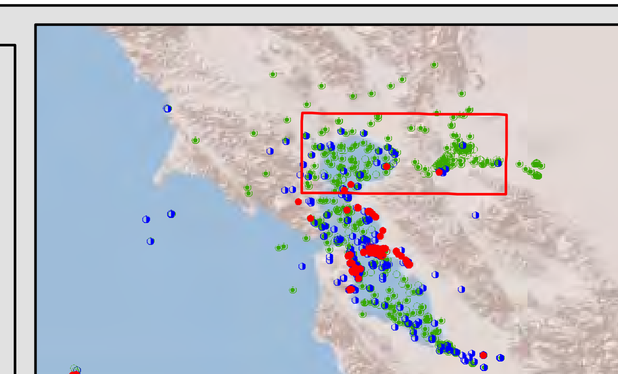
Total PCBs PPB ERL-ERM

- Non-Detect (DL<ERL)
- Non-Detect (ERL<DL<ERM)
- Non-Detect (DL>ERM)
- < ERL (22.7)
- ERL - ERM
- > ERM (180)

- Suisun Bay Reserve Fleet (2003)
- Navigation Channel (NOAA Chart 18656)
- Regulated Navigation Area (NOAA Chart 18652)
- Pipeline Area (NOAA Chart 18656)
- islands (NOAA Chart 18656)
- disposal area (NOAA Chart 18656)
- Docks and Bridges

Bathymetry: Suisun Bay USGS compilation 2002
San Pablo Bay NOAA SPO Estuarine Bathymetry 1971-1993
Meters MLLW

-41.4	-19.9 - -18	-7.9 - -5
-41.3 - -35	-17.9 - -15	-4.9 - -3
-34.9 - -30	-14.9 - -12	-2.9 - -1
-29.9 - -25	-11.9 - -10	-0.9 - 0
-24.9 - -20	-9.9 - -8	



Data sources include NOAA, ESRI
USGS, SFEI, CA State, MARAD
Contaminant data from NOAA Query Manager
SF Bay including NOAA Suisun Bay 2008 (update 12/22/2008)
ERL/ERM = Effects Range-Low, Effects Range-Medium

NOAA OR&R | ARD Ben Shorr 2/3/2009
c:\gis\projects\SuisunBay\Suisun_Bay_2009_contaminant.mxd

Final 02/24/2009

Assessment of Environmental Contaminants Associated with the National Defense Reserve Fleet In Suisun Bay, California

Appendix 10.4

NOAA Suisun Bay Project Field Datasheet

Station Occupation Data Sheet: Suisun Bay **NOAA | NOS | OR&R**

Station ID: ______________ **Date:** ___ / ___ / 2008

Sample ID: ______________

Arrival Time: ______________ **Field Crew:** ______________

Sample Time: ______________

Departure Time: ______________

Water Depth (m): ______________ **Recorder:** ______________

Salinity (ppt): ______________

Navigation Type (circle one): DGPS GPS **Accuracy (ft):** ______________

Latitude Decimal Degrees (xx.xxxxx) [ ]

Longitude Decimal Degrees (-xxx.xxxxx) [ ]

Field Pictures Numbers and Description:

[ ]

Habitat Type (circle one):

Open Water
Tidal flat: mud
Tidal flat: sand
Other : ______________

Samples Collected:

- Surface Sediment ☐
- Subsurface Sediment ☐
- Paint Chip Sample ☐
- Corbula ☐
- Mytilus (deployed/collected) ☐

Collection Method:

Surface Sediment

Van Veen (# grabs) ________

Subsurface Core (cm):			**Sample ID:**
0-15	☐	chemistry	______________
15-30	☐	chemistry	______________
30-45	☐	chemistry	______________
45-60	☐	chemistry	______________
60-90	☐	chemistry	______________
90-120	☐		
120-240	☐	archive	

Sample Observations: (circle)

Paint Chips Visible?: Yes No
Sed Odor (circle one): None, Sulfides, Sewage, Petroleum, Mixed, Other ______________
Sed Color (circle one): Brown, Colorless, Green, Yellow
Oily Sheen?: Yes No
Debris in Sample: ______________

Station Comments:

[ ]

Suisun Bay Sampling Field Data Sheet Version 1.2 June 24, 2008

Assessment of Environmental Contaminants Associated with the National Defense Reserve Fleet In Suisun Bay, California

Appendix 10.5

Paint chip Sample Photo Documentation

Field photos of surface sediment grab samples taken July 7-16, 2008. Samples were photographed on board the sampling vessels at time of retrieval. The surface of grab samples was visually inspected by field staff before either sediment chemistry sample or paint chip core was taken and any comments of interest were noted on the field sheet.

Station CS01 Grab

Station CS01T Grab

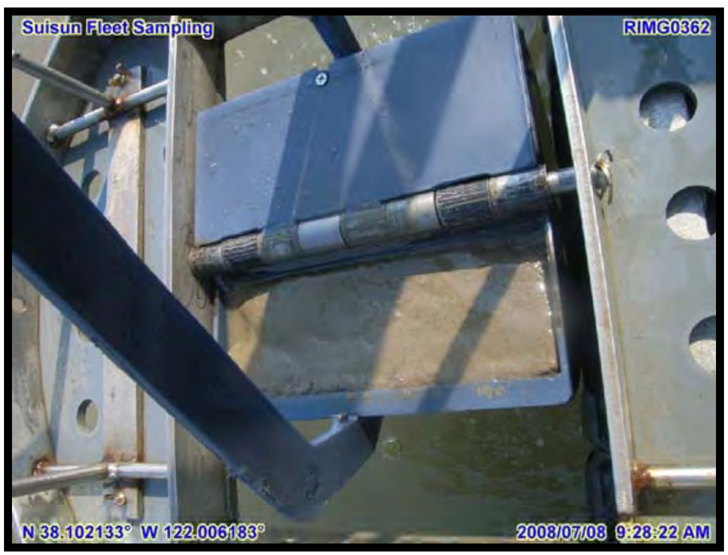
Station CS02 Grab

Station CS03 Grab

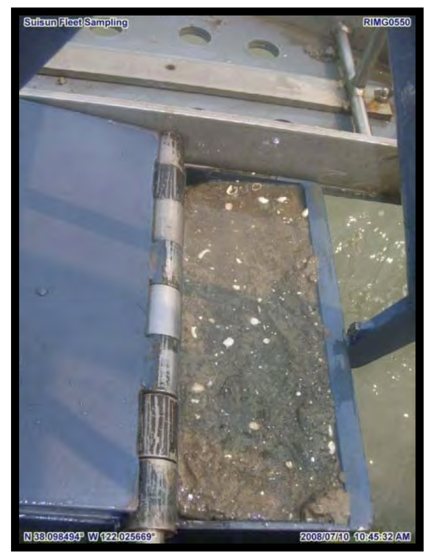
1

Station CS03T Grab

Station GB01 Grab



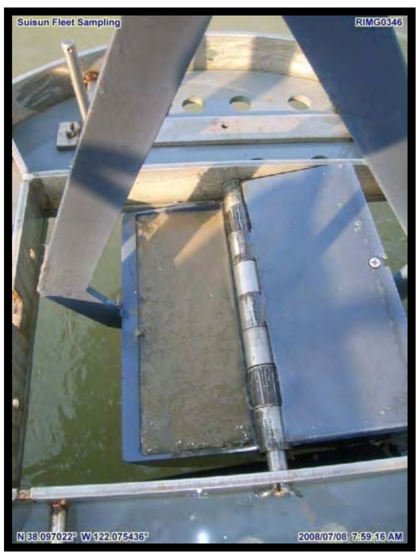
Station GB01T Grab



Station GB02 Grab

Station GB02T Grab

Station GB03 Grab



Station RF01 Grab

Station RF02 Grab

Station RF03 Grab

Station RF04 Grab

Station RF05 Grab

Station RF06 Grab

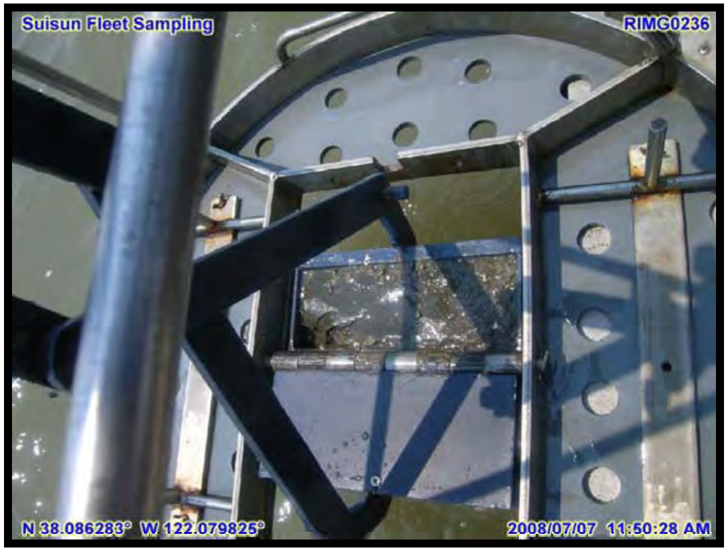
4

Station RF07 Grab

Station RF08 Grab

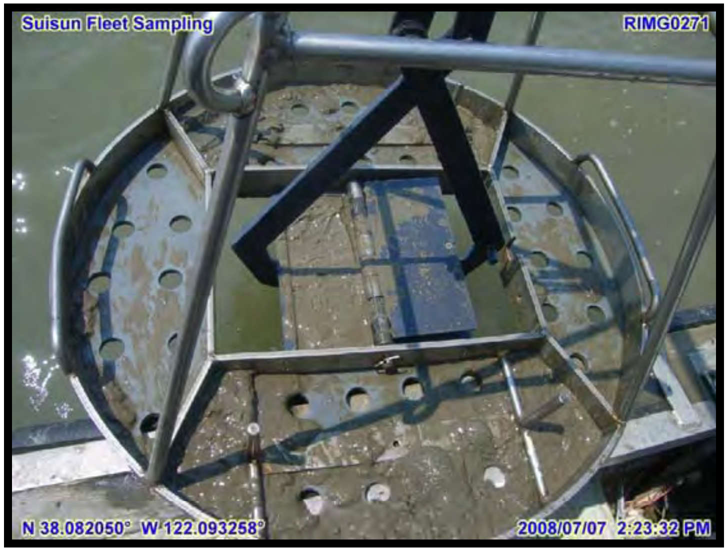
Station RF09 Grab

Station RF10 Grab



Station RF11 Grab

Station RF12 Grab



Station RF13 Grab

Station RF15 Grab

6

Station RF16 Grab

Station RF17 Grab

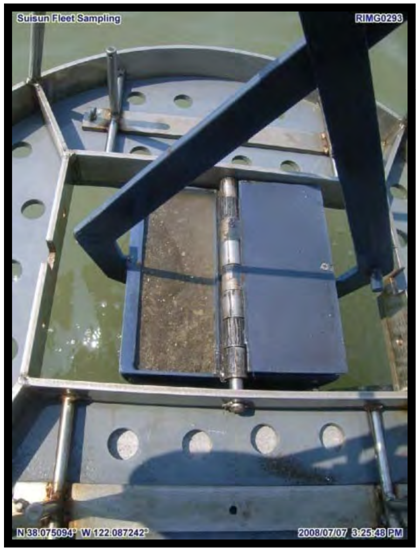
Station RF18 Grab

Station RF19 Grab

7

Station RF20 Grab

Station RF22 Grab

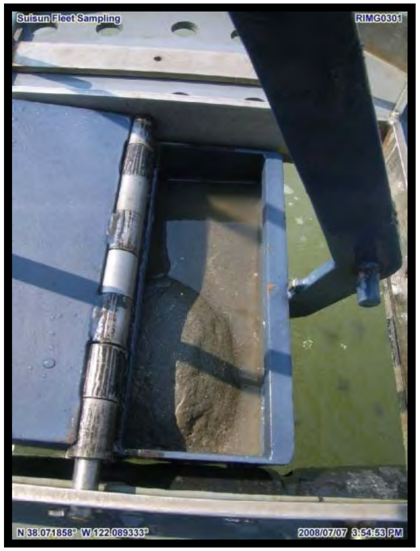


Station RF23 Grab

Station RF24 Grab

Station RF26 Grab

Station RF27 Grab



Station RF28 Grab

Station RF29 Grab

Station RF30 Grab

Station RF31 Grab

Station RF32 Grab

Station RF33 Grab

10

Station RF34 Grab

Station RF35 Grab

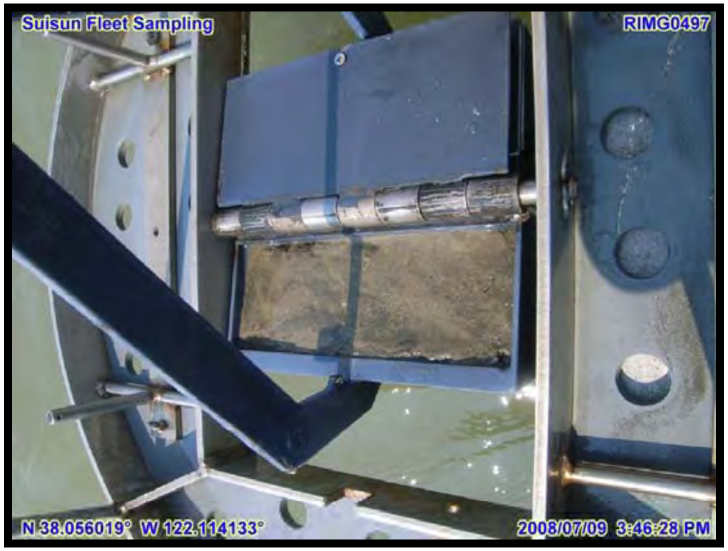
Station RF36 Grab

Station RF37 Grab

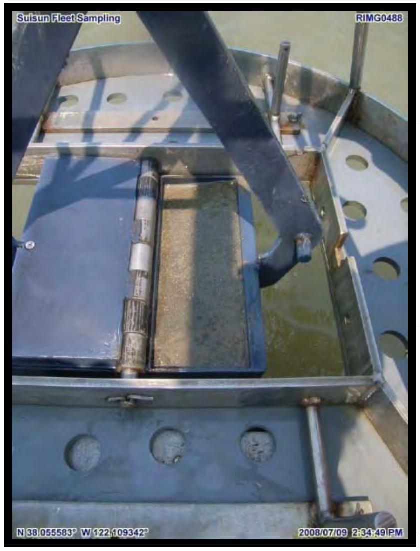
Station RF38 Grab

Station RF39 Grab

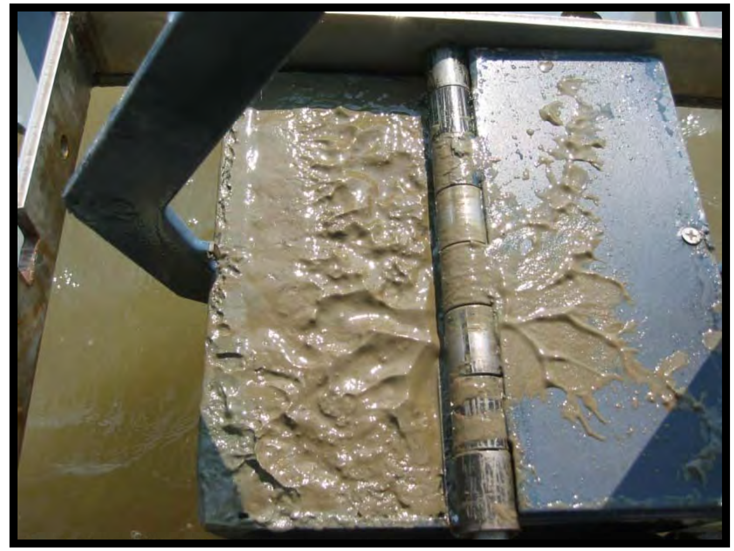
Station RF40 Grab



Station RF42 Grab



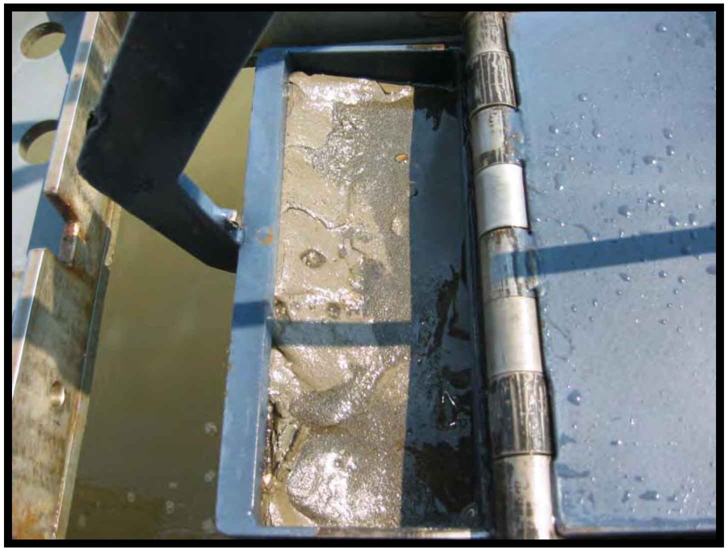
Station RF43 Grab



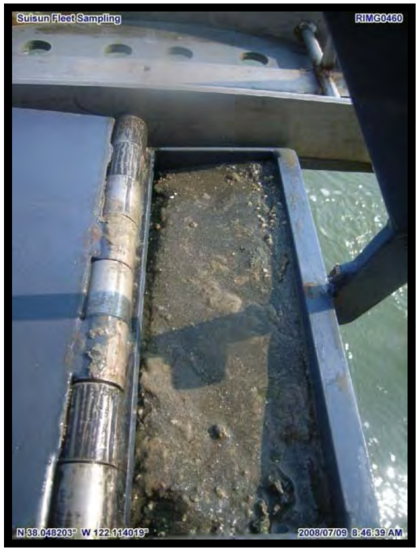
Station RF44 Grab

Station RF45 Grab

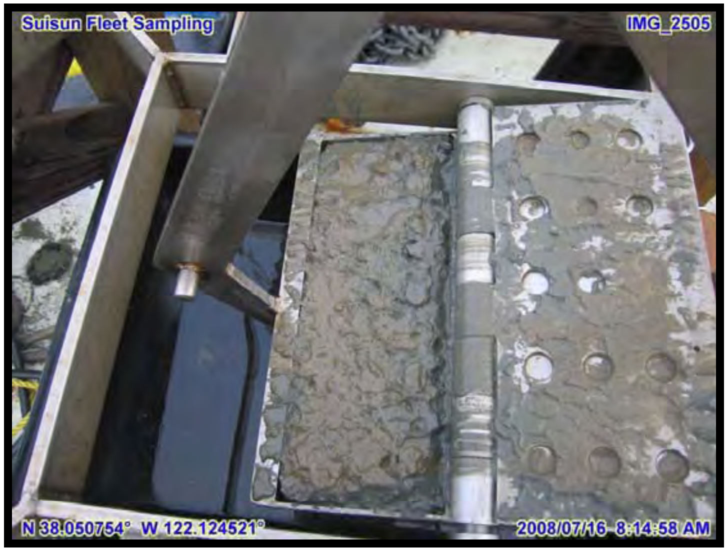
Station RF46 Grab



Station RF48 Grab

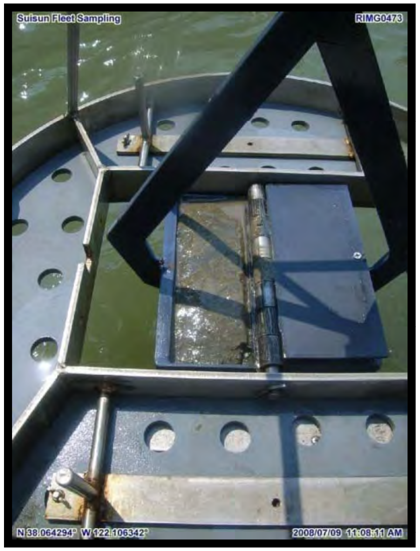


Station RF49TTC Grab



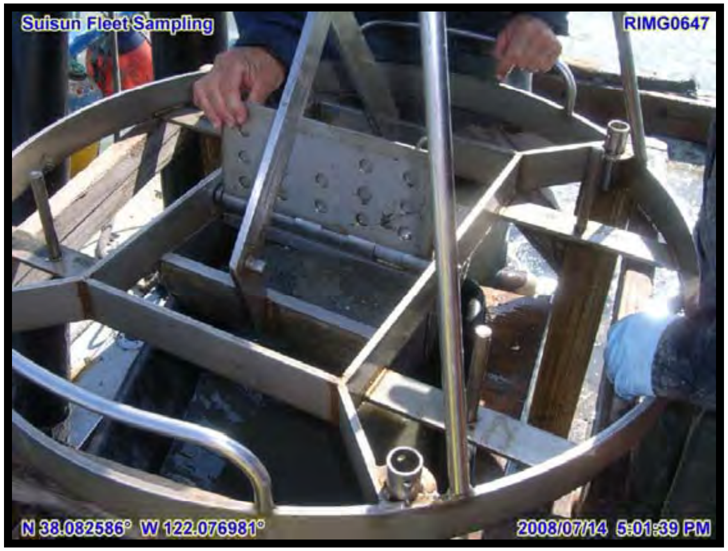
Station RF51 Grab

Station RF52 Grab



Station RF53 Grab

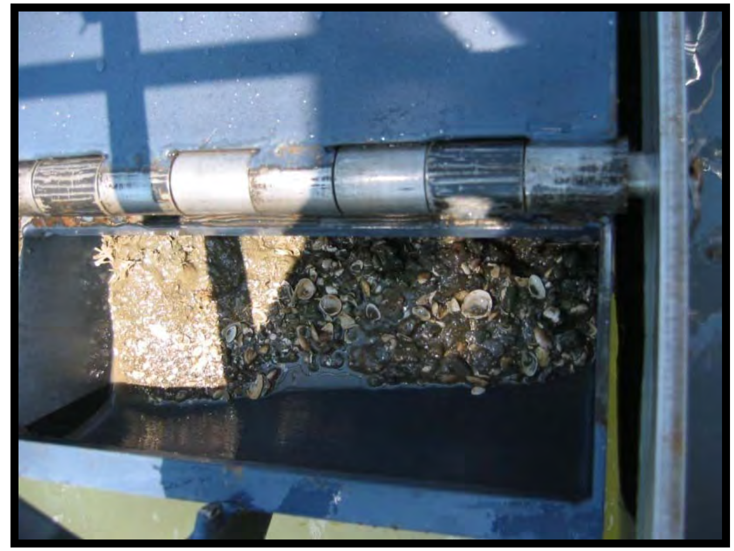
Station SB01 Grab



Station SB02 Grab

Station SB03 Grab

Station SB04 Grab



Station SB06 Grab

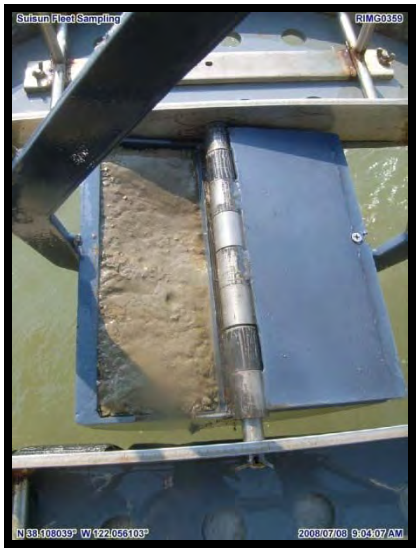
Station SB07 Grab

Station SB08 Grab

Station SB09 Grab

Station SB10 Grab

Station SB11 Grab



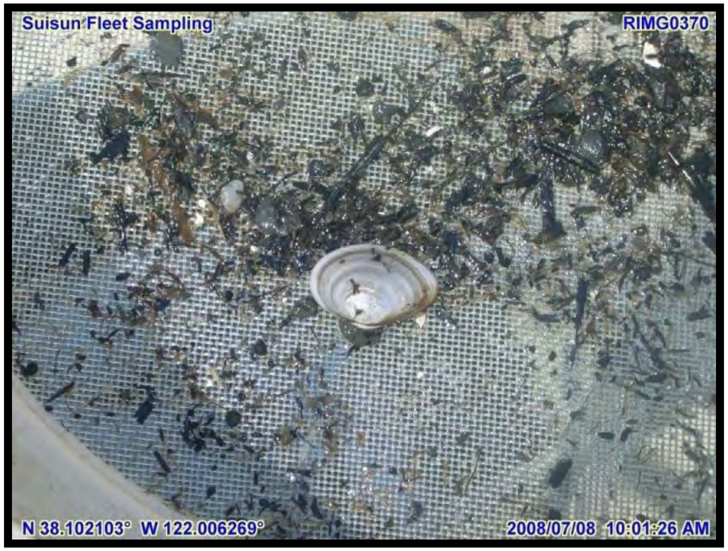
Station SB12 Grab

The following photos include samples that were sieved on board the sampling vessels after sediment core had been taken from sediment grab. On occasion, field photos were not logistically feasible for all paint chip samples during processing; however, all paint chip samples were sieved by 1mm mesh sieve and processed as according to the SAP (NOAA 2008b).

Station CS01 Sieve

Station CS01T Sieve

Station GB01 Sieve



Station GB01T Sieve

18

Station GB02 Sieve

Station GB02T Sieve

Station GB03 Sieve

R19F Sieve

Station RF01 Sieve

Station RF02 Sieve

Station RF03 Sieve

Station RF04 Sieve

Station RF06 Sieve

Station RF08 Sieve

Station RF10 Sieve

Station RF12 Sieve

Station RF13 Sieve

Station RF15 Sieve

Station RF16 Sieve

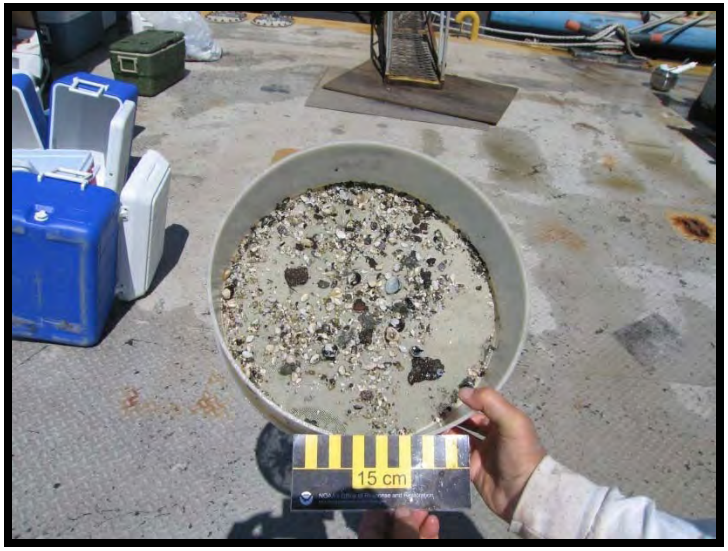
Station RF18 Sieve

Station RF20 Sieve


Station RF22SS Sieve

Station RF23 Sieve

Station RF24 Sieve



Station RF25 Sieve

Station RF26 Sieve

Station RF28 Sieve

Station RF30 Sieve

Station RF31 Sieve

Station RF32 Sieve

Station RF32 Sieve

Station RF33 Sieve

Station RF35 Sieve

Station RF36 Sieve

Station RF37 Sieve

26

Station RF39 Sieve

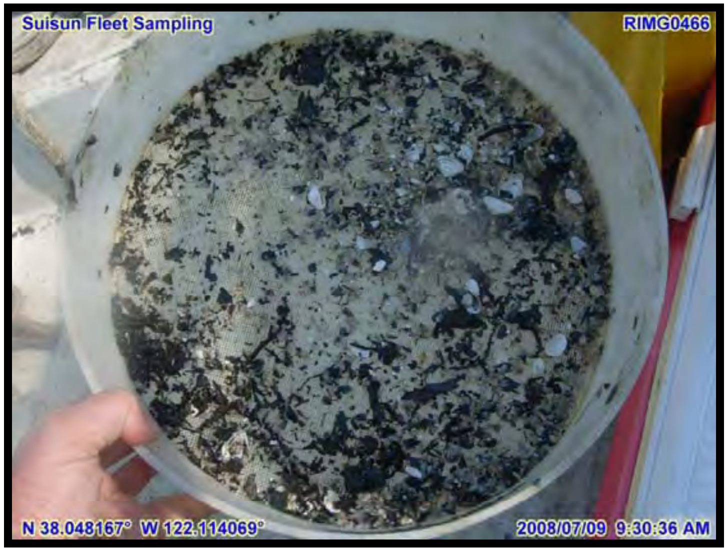
Station RF40 Sieve

Station RF42 Sieve

Station RF43 Sieve

Station RF45 Sieve

Station RF46 Sieve



Station RF49TTC Sieve

Station RF52 Sieve

Station RF53 Sieve

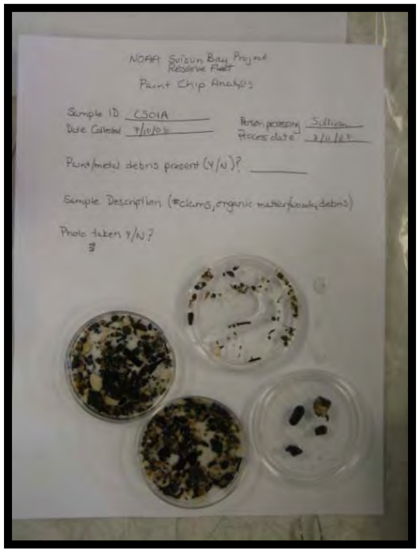
Station SB06 Sieve

Station SB07 Sieve

Station SB10 Sieve

Station SB11 Sieve

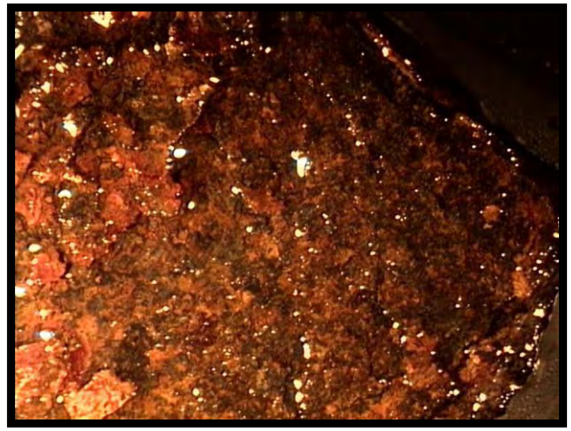
The following pages are lab photos of sieved surface sediment grab samples, which were archived during field sampling for being of note for containing either visible paint chips, metal debris, or unknown material. Samples were photographed in 5cm petri dishes, provided this magnification level offered any visible detail. Several samples were only photographed under the microscope because fragments were too small to be visible without greater magnification. For details on classification of these samples, refer to Table 11 or Map 26.

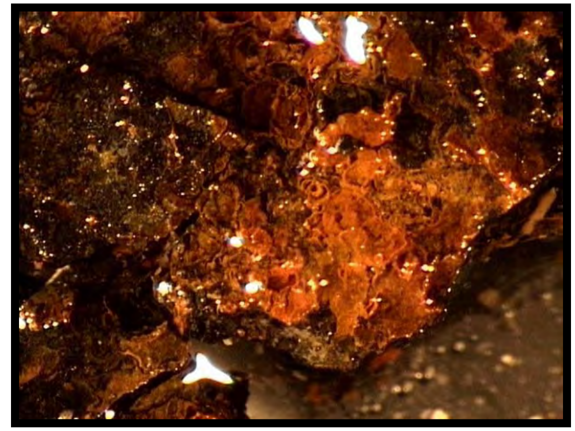


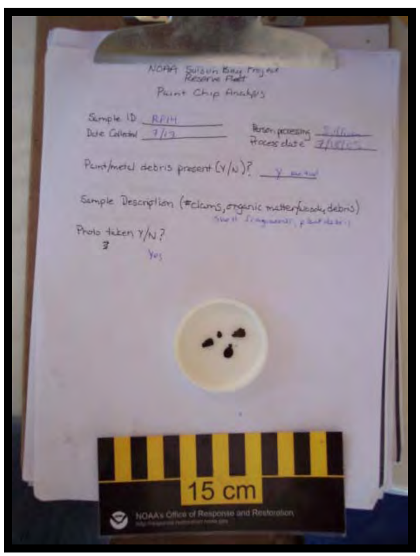
Station CS01 PC sample

Sample CS01 PC

Sample RF10 PC


RF10 PC at 10x magnification


RF10 PC at 25X magnification



Station RF14 sample

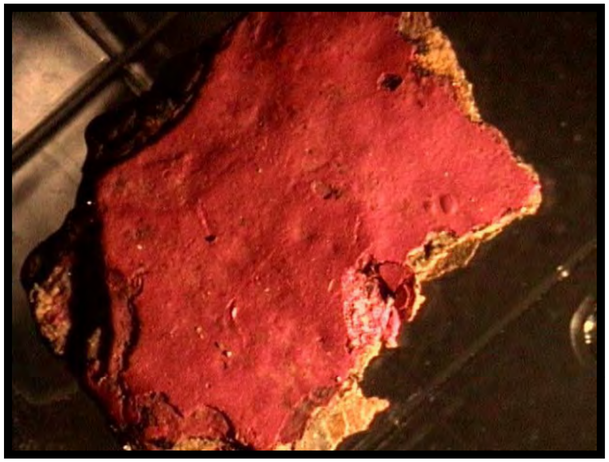
Sample RF14 PC

Station RF25 sample

Sample RF25 sample

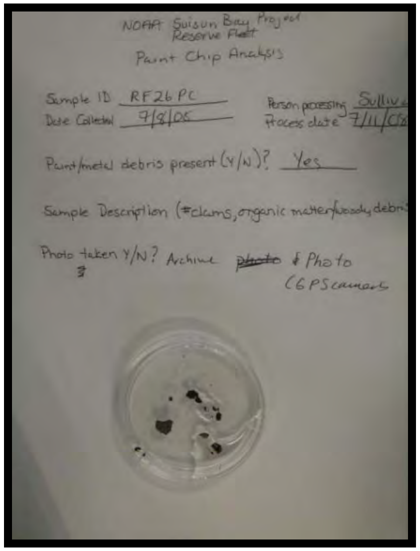
Sample RF25 PC

RF25 PC at 10x magnification

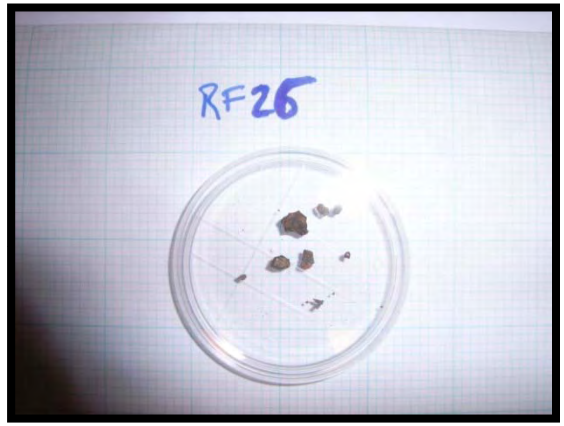


RF25 PC at 25x magnification

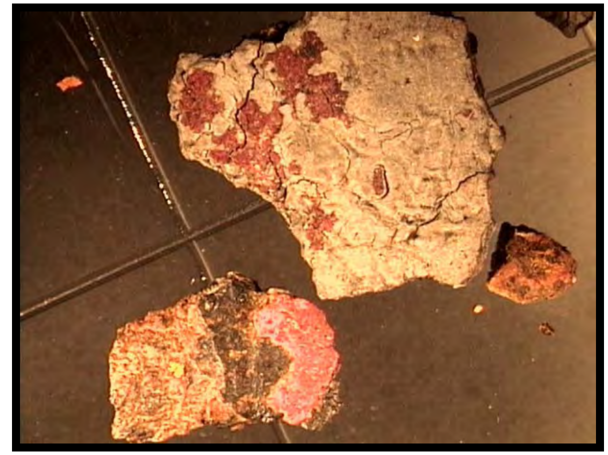
33



Station RF26PC sample



Sample RF26 PC

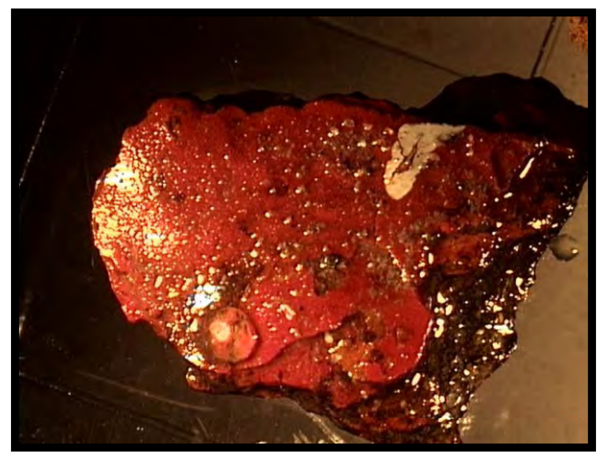


RF26 PC at 10x magnification

Station RF27 sample

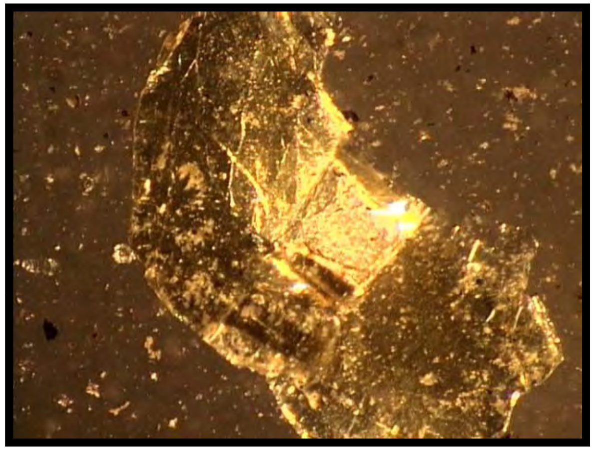
Station RF27 sample

Sample RF27 PC

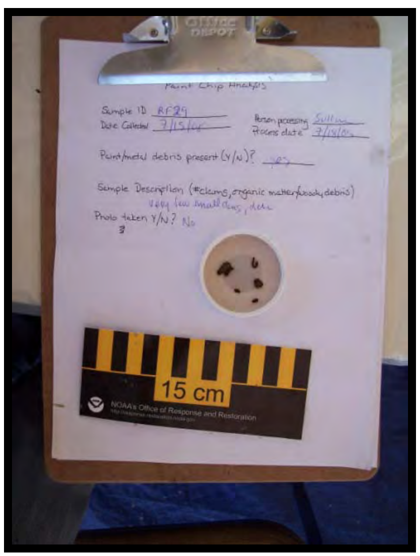


RF27 PC at 25x magnification

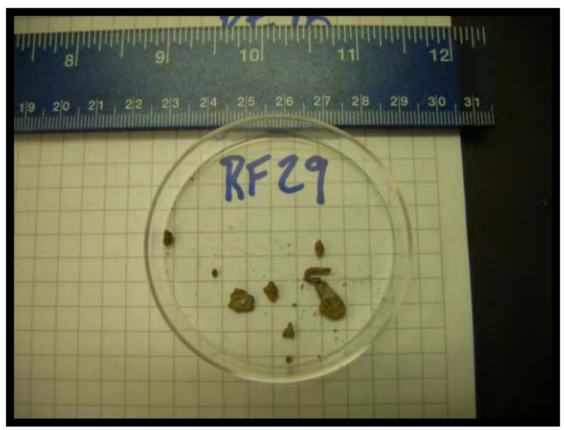
35



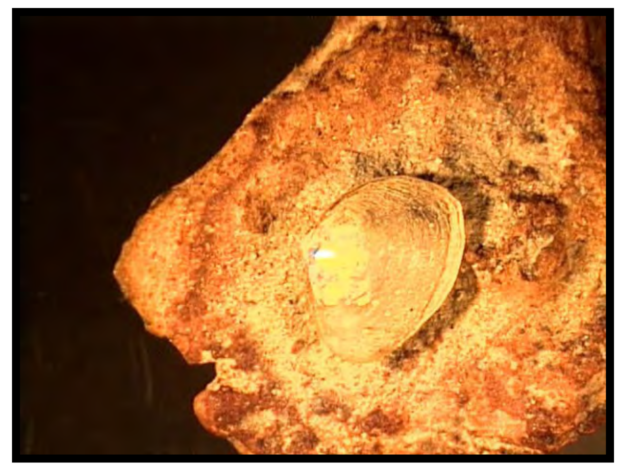
RF28 PC at 25x magnification



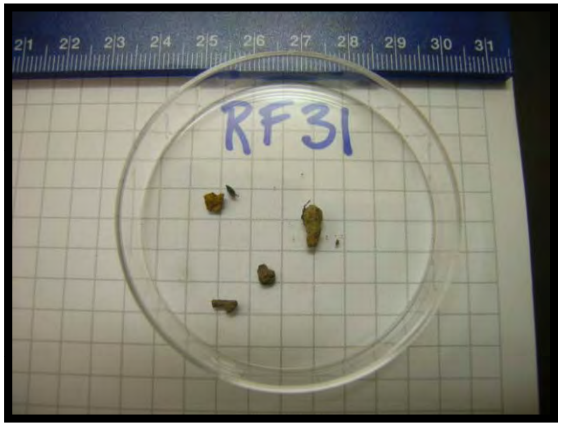
Station RF29 sample



Sample RF29 PC



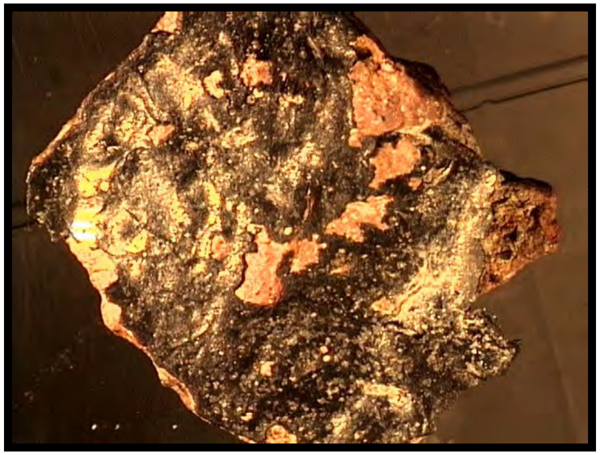
RF29 PC at 10x magnification



Sample RF31 PC

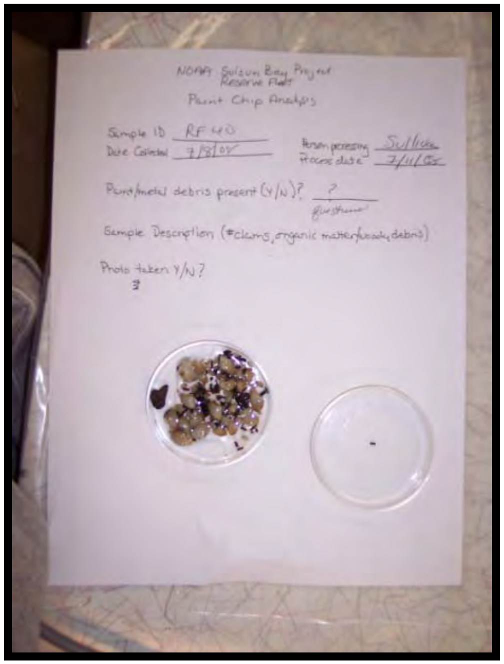
Station RF39 sample

Sample RF39 PC



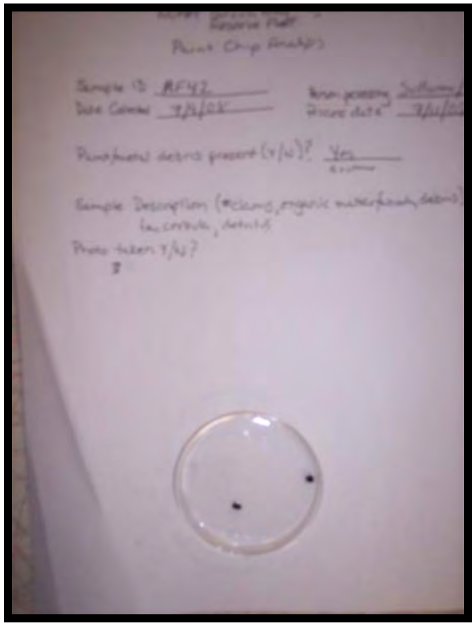
RF39 PC at 10x magnification

37



Station RF40 sample

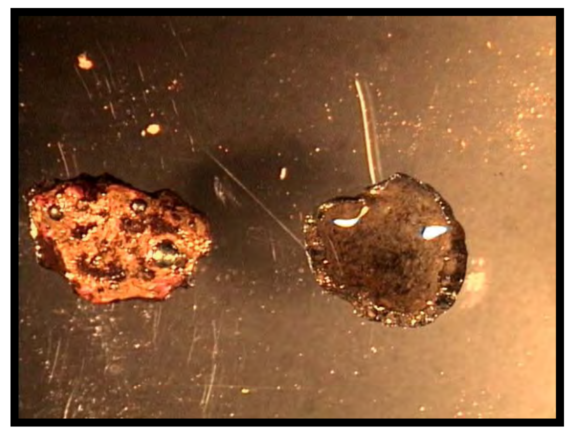
RF40 PC at 10x magnification



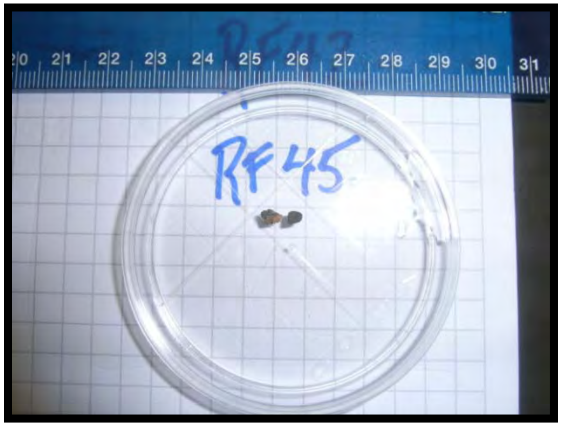
Station RF42 sample

Sample RF42 PC

RF42 PC 25x

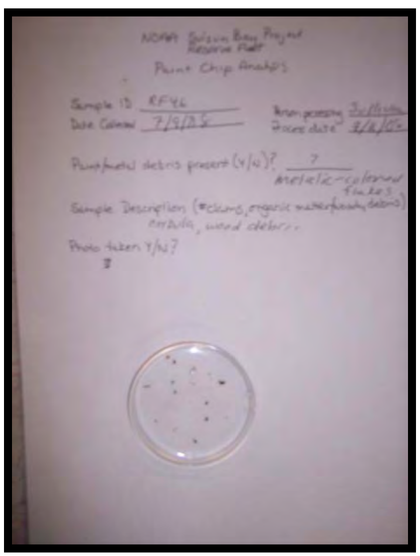


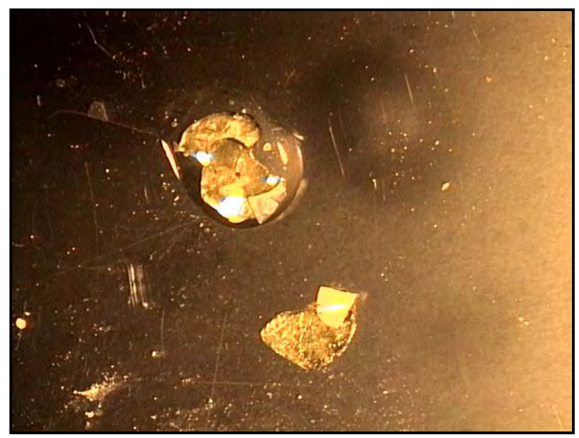
RF42 PC 10x



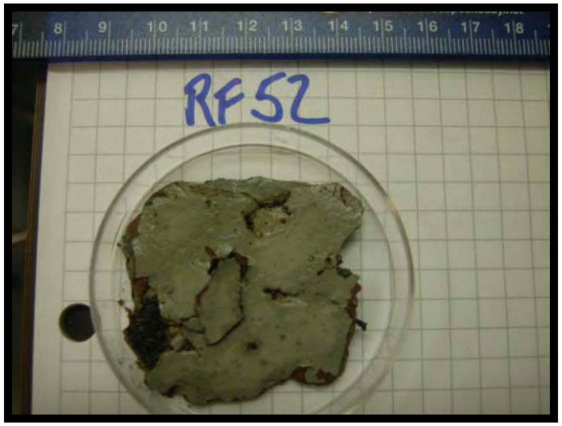
Sample RF45 PC


RF45 PC 10x


Station RF46 sample


RF46 PC

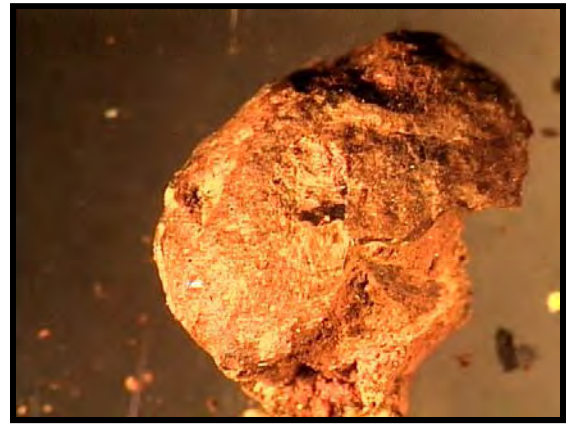
40



Sample RF52 PC

RF 52 at 25x with multiple views

Sample RF49 PC



RF49 PC

Station SB06 sample

Sample SB06 PC

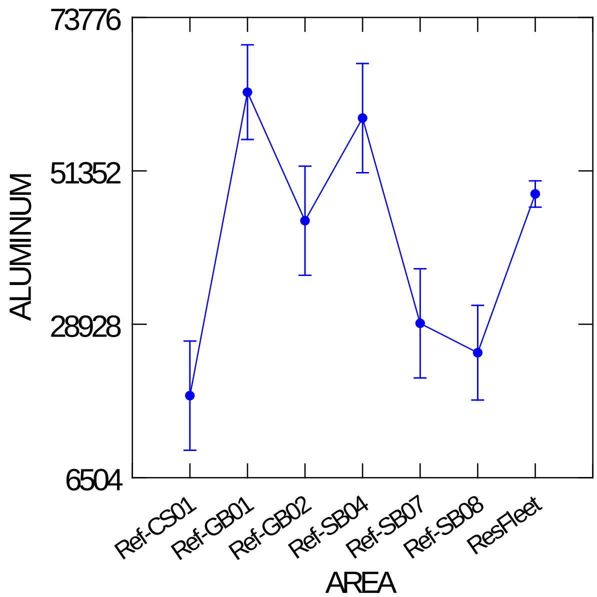
Assessment of Environmental Contaminants Associated with the National Defense Reserve Fleet In Suisun Bay, California

Appendix 10.6

Statistical Analyses

Surface grab sample statistical analyses

Aluminum



Kruskal-Wallis One-Way Analysis of Variance for 69 cases

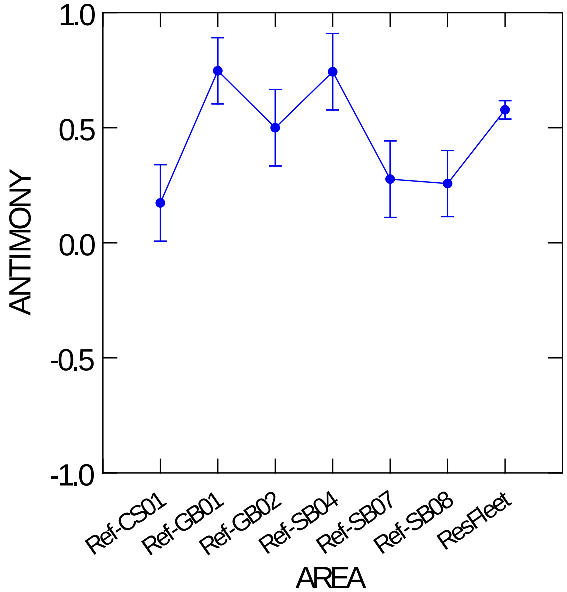
Group	Count	Rank Sum
CS01	3	13
GB01	3	117.5
GB02	3	95.
ResFleet	51	1971.5
SB04	3	150
SB07	3	47
SB08	3	21

Kruskal-Wallis H Test Statistic = 22.6414
Probability is 0.0009 assuming Chi-square distribution with 6 df

Multiple Contrasts: ResFleet vs. Refs

Contrast	SE	S	Critical Chi	Conclusion
10.4477	12.3697	0.844623	3.548	ns

Antimony



Kruskal-Wallis One-Way Analysis of Variance for 69 cases

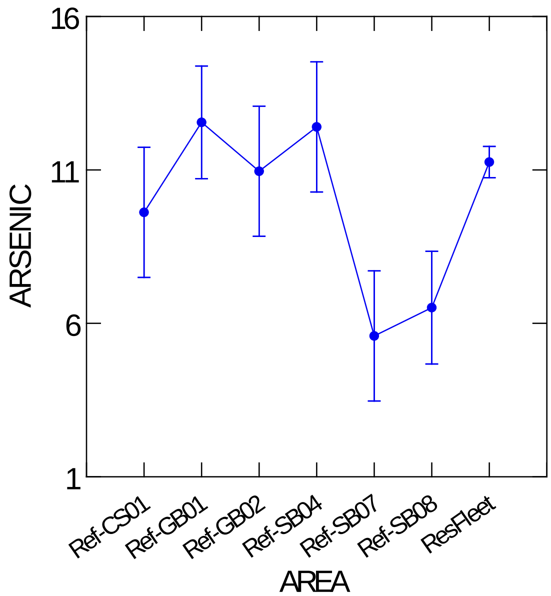
Group	Count	Rank Sum
CS01	3	12
GB01	3	108
GB02	3	108.5
ResFleet	51	1961.5
SB04	3	161
SB07	3	39.5
SB08	3	24.5

Kruskal-Wallis Test Statistic = 24.538
Probability is 0.00 assuming Chi-square distribution with 6 df

Multiple Contrasts: ResFleet vs. Refs

Contrast	SE	S	Critical Chi	Conclusion
9.80882	12.3654	0.793249	3.54846	ns

Arsenic



Kruskal-Wallis One-Way Analysis of Variance for 69 cases

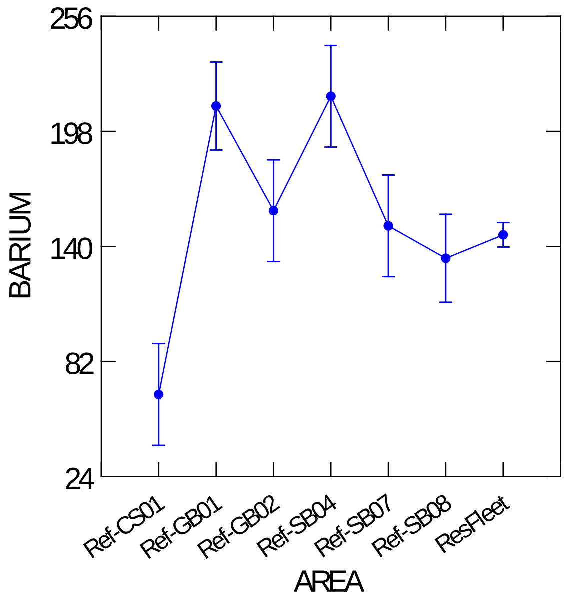
Group	Count	Rank Sum
CS01	3	90.5
GB01	3	97
GB02	3	113
ResFleet	51	1947
SB04	3	132.5
SB07	3	15
SB08	3	20

Kruskal-Wallis Test Statistic = 15.6754
Probability is 0.016 assuming Chi-square distribution with 6 df

Multiple Contrasts: ResFleet vs. Refs

Contrast	SE	S	Critical Chi	Conclusion
9.39542	5.49979	1.70832	3.54846	ns

Barium



Kruskal-Wallis One-Way Analysis of Variance for 69 cases

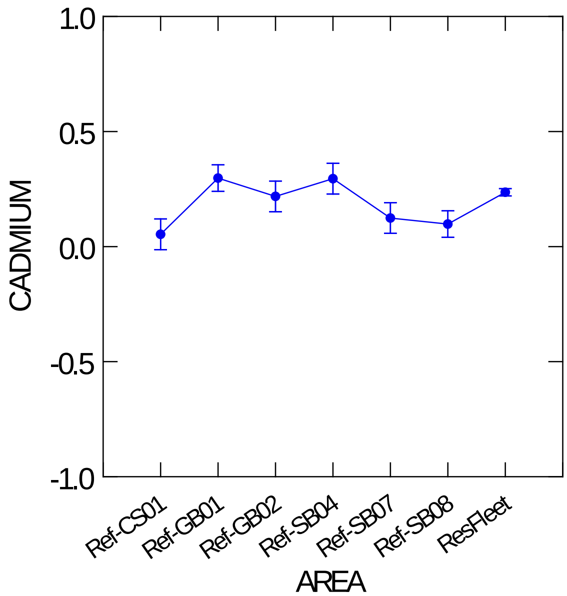
Group	Count	Rank Sum
CS01	3	12
GB01	3	114
GB02	3	129.5
ResFleet	51	1802
SB04	3	184
SB07	3	116.5
SB08	3	57

Kruskal-Wallis Test Statistic = 17.9892
Probability is 0.006 assuming Chi-square distribution with 6 df

Multiple Contrasts: ResFleet vs. Refs

Contrast	SE	S	Critical Chi	Conclusion
-4.05882	12.369	0.328145	3.54846	ns

Cadmium



Kruskal-Wallis One-Way Analysis of Variance for 69 cases

Group	Count	Rank Sum
CS01	3	12
GB01	3	117
GB02	3	108.5
ResFleet	51	1931
SB04	3	176
SB07	3	48.5
SB08	3	22

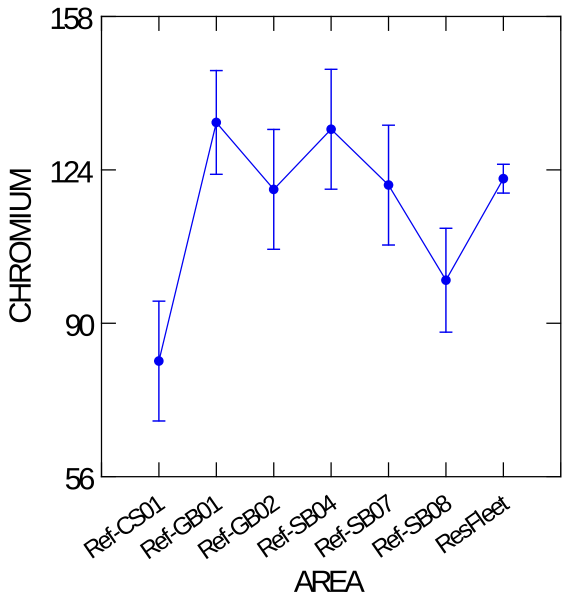
Kruskal-Wallis Test Statistic = 24.0827
Probability is 0.0005 assuming Chi-square distribution with 6 df

SB08_vs_CS01	7.33333	16.38	0.447701

Multiple Contrasts: ResFleet vs. Refs

Contrast	SE	S	Critical Chi	Conclusion
6.83987	12.3695	0.552965	3.54846	ns

Chromium



Kruskal-Wallis One-Way Analysis of Variance for 69 cases

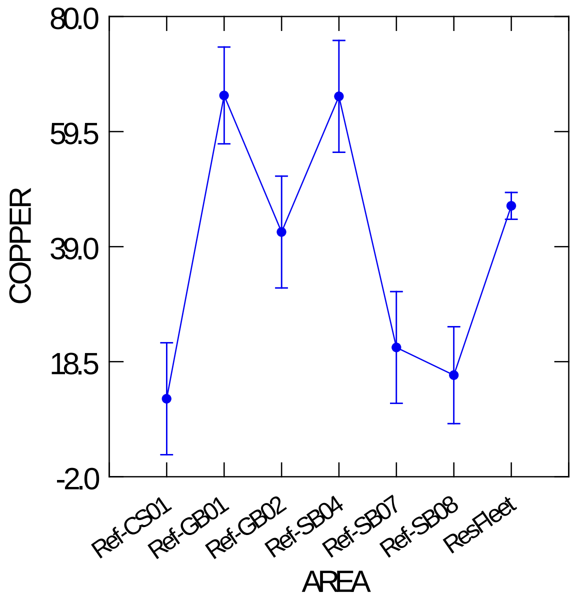
Group	Count	Rank Sum
CS01	3	15
GB01	3	105.5
GB02	3	98
ResFleet	51	1923
SB04	3	149
SB07	3	88.5
SB08	3	36.

Kruskal-Wallis Test Statistic = 14.3431
Probability is 0.026 assuming Chi-square distribution with 6 df

Multiple Contrasts: ResFleet vs. Refs

Contrast	SE	S	Critical Chi	Conclusion
6.38889	12.3666	0.516623	3.54846	ns

Copper



Kruskal-Wallis One-Way Analysis of Variance for 69 cases

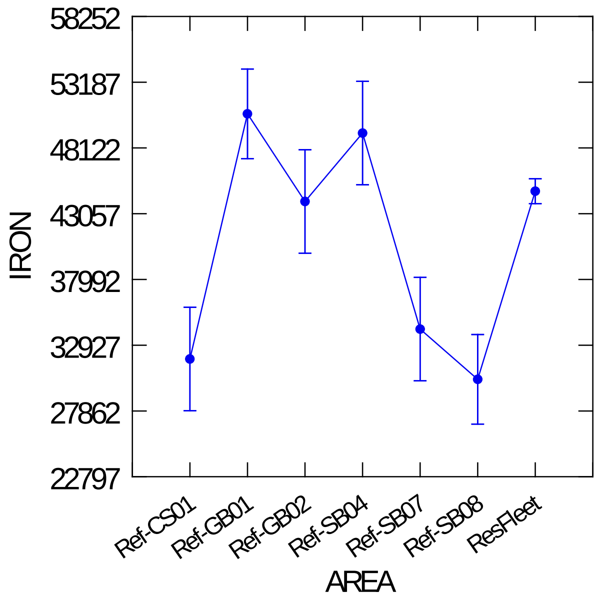
Group	Count	Rank Sum
CS01	3	13
GB01	3	114
GB02	3	103
ResFleet	51	1962
SB04	3	166.5
SB07	3	38
SB08	3	18.5

Kruskal-Wallis Test Statistic = 24.9474
Probability is 0.0003 assuming Chi-square distribution with 6 df

Multiple Contrasts: ResFleet vs. Refs

Contrast	SE	S	Critical Chi	Conclusion
10.0719	12.3697	0.814241	3.54846	ns

Iron



Kruskal-Wallis One-Way Analysis of Variance for 69 cases

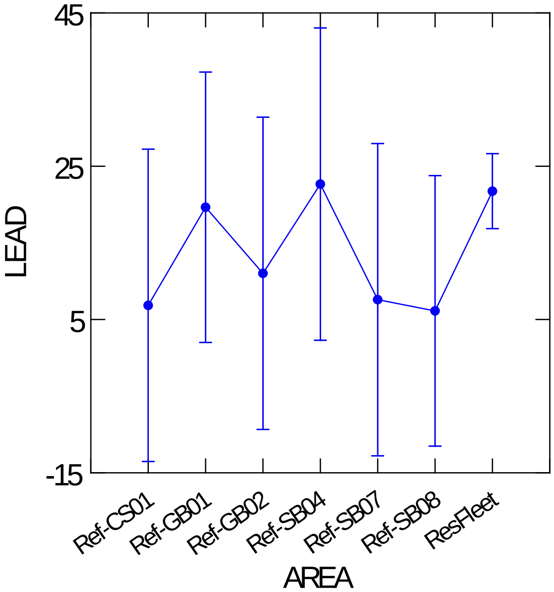
Group	Count	Rank Sum
CS01	3	28
GB01	3	117
GB02	3	90
ResFleet	51	1973.5
SB04	3	152.5
SB07	3	37
SB08	3	17

Kruskal-Wallis Test Statistic = 21.6441
Probability is 0.001 assuming Chi-square distribution with 6 df

Multiple Contrasts: ResFleet vs. Refs

Contrast	SE	S	Critical Chi	Conclusion
10.4853	12.3689	0.847715	3.54846	ns

Lead



Kruskal-Wallis One-Way Analysis of Variance for 69 cases

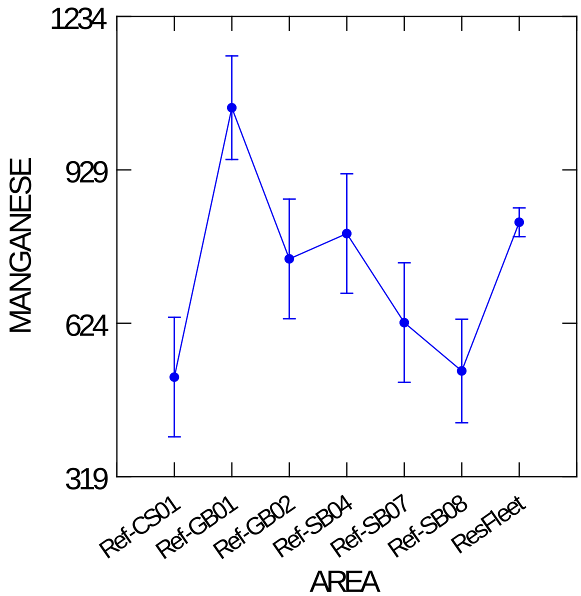
Group	Count	Rank Sum
CS01	3	32.5
GB01	3	102
GB02	3	98
ResFleet	51	1942.5
SB04	3	178
SB07	3	51
SB08	3	11

Kruskal-Wallis Test Statistic = 21.2821
Probability is 0.001 assuming Chi-square distribution with 6 df

Multiple Contrasts: ResFleet vs. Refs

Contrast	SE	S	Critical Chi	Conclusion
8.45588	12.3698	0.683591	3.54846	ns

Manganese



Kruskal-Wallis One-Way Analysis of Variance for 69 cases

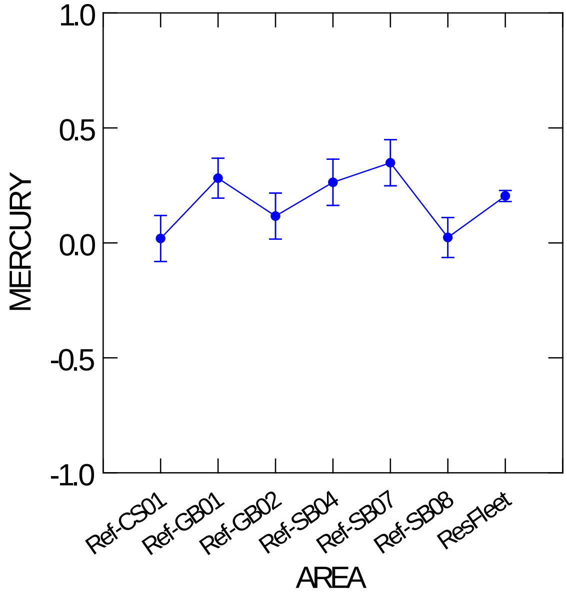
Group	Count	Rank Sum
CS01	3	26
GB01	3	120.5
GB02	3	97.5
ResFleet	51	1975
SB04	3	117
SB07	3	61
SB08	3	18

Kruskal-Wallis Test Statistic = 18.6649
Probability is 0.005 assuming Chi-square distribution with 6 df

Multiple Contrasts: ResFleet vs. Refs

Contrast	SE	S	Critical Chi	Conclusion
10.4853	12.3693	0.847684	3.54846	ns

Mercury



Kruskal-Wallis One-Way Analysis of Variance for 69 cases

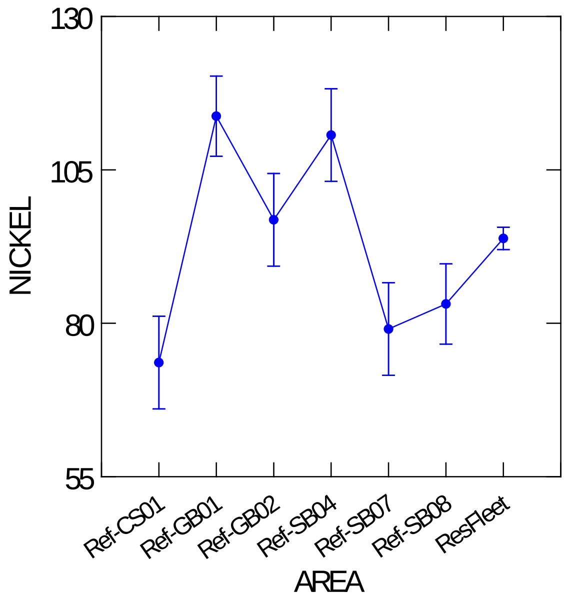
Group	Count	Rank Sum
CS01	3	26
GB01	3	120.5
GB02	3	97.5
ResFleet	51	1975
SB04	3	117
SB07	3	61
SB08	3	18

Kruskal-Wallis Test Statistic = 20.2884
Probability is 0.002 assuming Chi-square distribution with 6 df

Multiple Contrasts: ResFleet vs. Refs

Contrast	SE	S	Critical Chi	Conclusion
8.94444	12.3696	0.723101	3.54846	ns

Nickel



Kruskal-Wallis One-Way Analysis of Variance for 69 cases

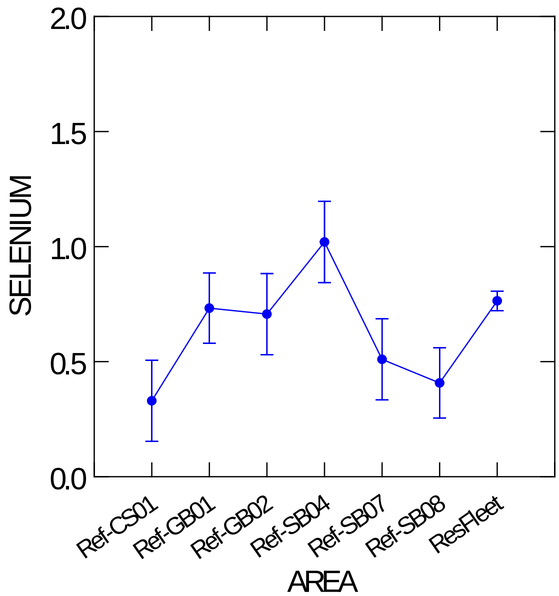
Group	Count	Rank Sum
CS01	3	31
GB01	3	133.5
GB02	3	121
ResFleet	51	1869
SB04	3	172.5
SB07	3	47
SB08	3	41

Kruskal-Wallis Test Statistic = 19.7181
Probability is 0.003 assuming Chi-square distribution with 6 df

Multiple Contrasts: ResFleet vs. Refs

Contrast	SE	S	Critical Chi	Conclusion
1.27778	5.49879	0.232374	3.54846	ns

Selenium



Kruskal-Wallis One-Way Analysis of Variance for 69 cases

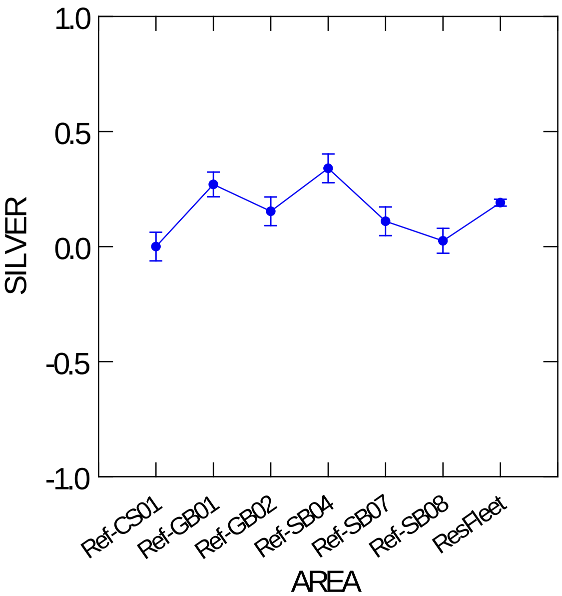
Group	Count	Rank Sum
CS01	3	43.5
GB01	3	92.5
GB02	3	97.5
ResFleet	51	1953.5
SB04	3	156
SB07	3	56.5
SB08	3	15.5

Kruskal-Wallis Test Statistic = 12.8749
Probability is 0.045 assuming Chi-square distribution with 6 df

Multiple Contrasts: ResFleet vs. Refs

Contrast	SE	S	Critical Chi	Conclusion
9.88399	12.367	0.799225	3.54846	ns

Silver



Kruskal-Wallis One-Way Analysis of Variance for 69 cases

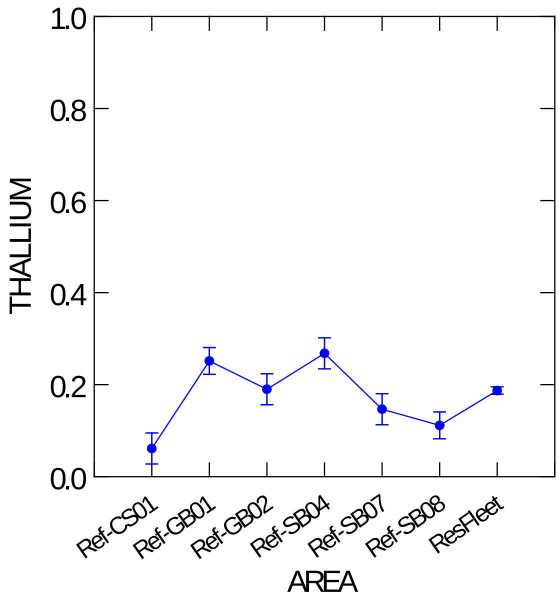
Group	Count	Rank Sum
CS01	3	13.5
GB01	3	111.5
GB02	3	101
ResFleet	51	1913
SB04	3	189.5
SB07	3	64
SB08	3	22.5

Kruskal-Wallis Test Statistic = 23.6523
Probability is 0.0006 assuming Chi-square distribution with 6 df

Multiple Contrasts: ResFleet vs. Refs

Contrast	SE	S	Critical Chi	Conclusion
6.53922	12.3576	0.529166	3.54846	ns

Thallium



Kruskal-Wallis One-Way Analysis of Variance for 69 cases

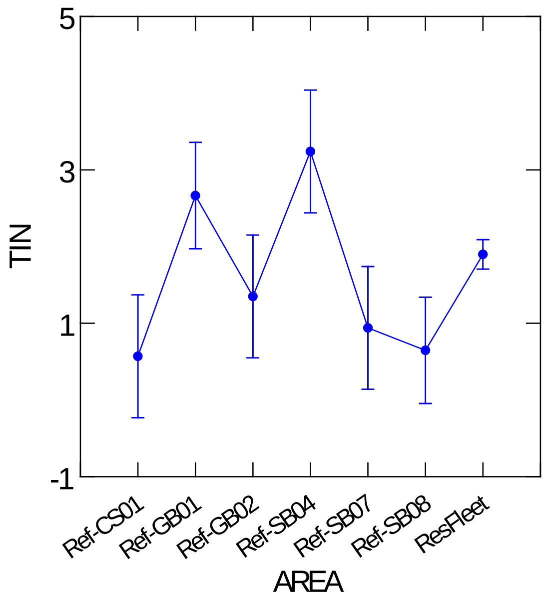
Group	Count	Rank Sum
CS01	3	13
GB01	3	110.5
GB02	3	114
ResFleet	51	1895
SB04	3	179.5
SB07	3	71
SB08	3	32.

Kruskal-Wallis Test Statistic = 19.8901
Probability is 0.003 assuming Chi-square distribution with 6 df

Multiple Contrasts: ResFleet vs. Refs

Contrast	SE	S	Critical Chi	Conclusion
4.05882	5.49969	0.738009	3.54846	ns

Tin



Kruskal-Wallis One-Way Analysis of Variance for 69 cases

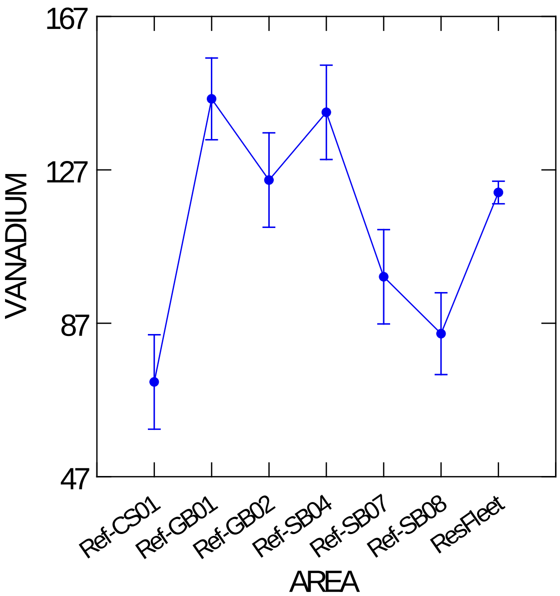
Group	Count	Rank Sum
CS01	3	21
GB01	3	118
GB02	3	105
ResFleet	51	1896.5
SB04	3	190
SB07	3	64.5
SB08	3	20

Kruskal-Wallis Test Statistic = 23.4638
Probability is 0.0007 assuming Chi-square distribution with 6 df

Multiple Contrasts: ResFleet vs. Refs

Contrast	SE	S	Critical Chi	Conclusion
4.13399	12.3695	0.334209	3.54846	ns

Vanadium



Kruskal-Wallis One-Way Analysis of Variance for 69 cases

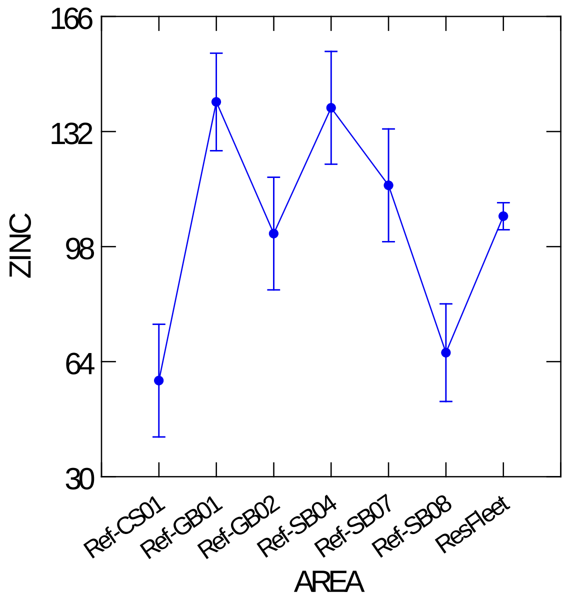
Group	Count	Rank Sum
CS01	3	16
GB01	3	122
GB02	3	108
ResFleet	51	1919
SB04	3	164.5
SB07	3	59.5
SB08	3	26

Kruskal-Wallis Test Statistic = 21.3727
Probability is 0.002 assuming Chi-square distribution with 6 df

Multiple Contrasts: ResFleet vs. Refs

Contrast	SE	S	Critical Chi	Conclusion
6.08824	12.3665	0.492316	3.54846	ns

Zinc



Kruskal-Wallis One-Way Analysis of Variance for 69 cases

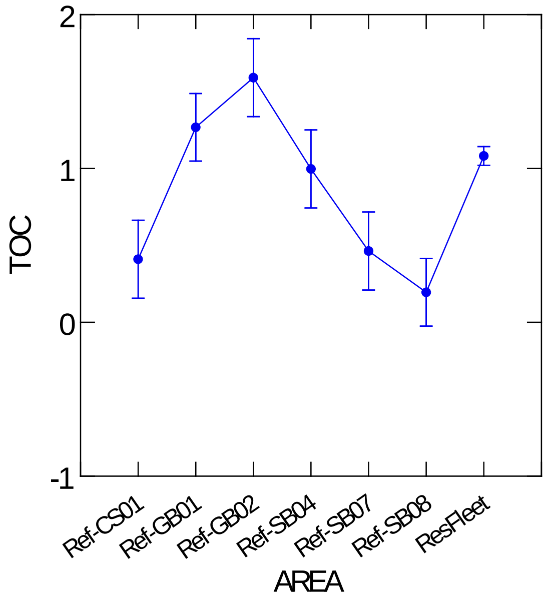
Group	Count	Rank Sum
CS01	3	15
GB01	3	118
GB02	3	107
ResFleet	51	1886
SB04	3	165
SB07	3	104
SB08	3	20

Kruskal-Wallis Test Statistic = 19.6433
Probability is 0.003 assuming Chi-square distribution with 6 df

Multiple Contrasts: ResFleet vs. Refs

Contrast	SE	S	Critical Chi	Conclusion
3.94608	12.3683	0.319047	3.54846	ns

TOC



Kruskal-Wallis One-Way Analysis of Variance for 69 cases

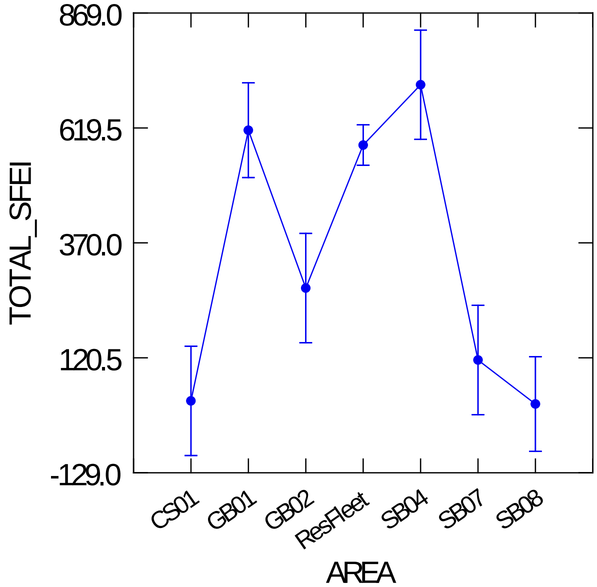
Group	Count	Rank Sum
GB01	3	111.5
GB02	3	121
ResFleet	51	1998
SB04	3	101.5
SB07	3	37
SB08	3	15.5

Kruskal-Wallis Test Statistic = 19.4597
Probability is 0.003 assuming Chi-square distribution with 6 df

Multiple Contrasts: ResFleet vs. Refs

Contrast	SE	S	Critical Chi	Conclusion
13.8301	12.3685	1.11816	3.54846	ns

Total PAHs (SFEI)



Kruskal-Wallis One-Way Analysis of Variance for 42 cases

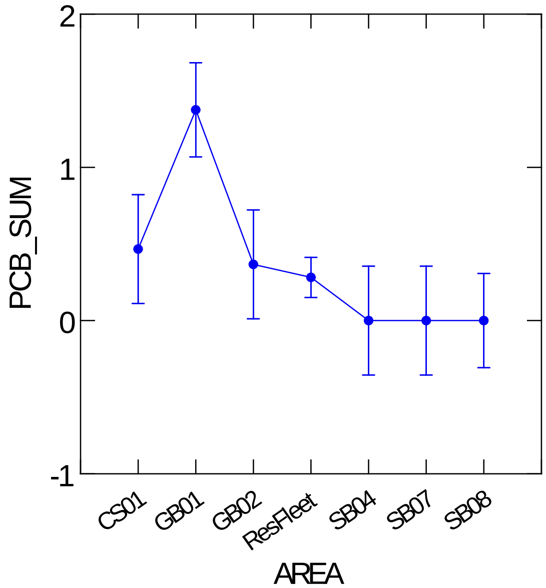
Group	Count	Rank Sum
CS01	3	12
GB01	5	107
GB02	3	46
ResFleet	24	595
SB04	3	97
SB07	3	30
SB08	4	16

Kruskal-Wallis Test Statistic = 25.206
Probability is 0.0003 assuming Chi-square distribution with 6 df

Multiple Contrasts: ResFleet vs. Refs

Contrast	SE	S	Critical Chi	Conclusion
11.6427	7.52513	1.54717	3.54846	ns

PCBs



Kruskal-Wallis One-Way Analysis of Variance for 42 cases
Dependent variable is PCB_SUM
Grouping variable is AREA$

Group	Count	Rank Sum
CS01	3	71.000
GB01	4	136.000
GB02	3	68.500
ResFleet	22	457.500
SB04	3	51.000
SB07	3	51.000
SB08	4	68.000

Kruskal-Wallis Test Statistic = 11.067
Probability is 0.086 assuming Chi-square distribution with 6 df

Kruskal-Wallis Test Statistic = 12.59
Probability is 0.46 assuming Chi-square distribution with 6 df

Multiple Contrasts: ResFleet vs. Refs

Contrast	SE	S	Critical Chi	Conclusion
-1.12121	3.80842	0.294403	3.54846	ns

Core surface (0 – 15 cm) Statistical Analyses

Kruskal-Wallis One-Way Analysis of Variance for 29 cases
Dependent variable is ALUMINUM

Group	Count	Rank Sum
Other	6	86.000
Ref	8	117.000
ResFleet	15	232.000

Kruskal-Wallis Test Statistic = 0.097
Probability is 0.952 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 29 cases
Dependent variable is ANTIMONY

Group	Count	Rank Sum
Other	6	76.500
Ref	8	98.000
ResFleet	15	260.500

Kruskal-Wallis Test Statistic = 2.415
Probability is 0.299 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 29 cases
Dependent variable is ARSENIC

Group	Count	Rank Sum
Other	6	58.000
Ref	8	118.500
ResFleet	15	258.500

Kruskal-Wallis Test Statistic = 3.391
Probability is 0.184 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 29 cases
Dependent variable is BARIUM

Group	Count	Rank Sum
Other	6	81.000
Ref	8	137.000
ResFleet	15	217.000

Kruskal-Wallis Test Statistic = 0.743
Probability is 0.690 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 29 cases
Dependent variable is CADMIUM

Group	Count	Rank Sum
Other	6	70.000
Ref	8	105.500
ResFleet	15	259.500

Kruskal-Wallis Test Statistic = 2.377
Probability is 0.305 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 29 cases
Dependent variable is CHROMIUM

Group	Count	Rank Sum
Other	6	76.000
Ref	8	132.000
ResFleet	15	227.000

Kruskal-Wallis Test Statistic = 0.704
Probability is 0.703 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 29 cases
Dependent variable is COPPER

Group	Count	Rank Sum
Other	6	81.000
Ref	8	100.000
ResFleet	15	254.000

Kruskal-Wallis Test Statistic = 1.649
Probability is 0.438 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 29 cases
Dependent variable is IRON

Group	Count	Rank Sum
Other	6	91.000
Ref	8	94.000
ResFleet	15	250.000

Kruskal-Wallis Test Statistic = 1.743
Probability is 0.418 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 29 cases
Dependent variable is LEAD

Group	Count	Rank Sum
Other	6	89.000
Ref	8	94.000
ResFleet	15	252.000

Kruskal-Wallis Test Statistic = 1.839
Probability is 0.399 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 29 cases
Dependent variable is MANGANESE

Group	Count	Rank Sum
Other	6	86.000
Ref	8	63.500
ResFleet	15	285.500

Kruskal-Wallis Test Statistic = 8.913
Probability is 0.012 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 31 cases
Dependent variable is MERCURY

Group	Count	Rank Sum
Other	6	91.000
Ref	7	78.000
ResFleet	18	327.000

Kruskal-Wallis Test Statistic = 3.070
Probability is 0.215 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 29 cases
Dependent variable is NICKEL

Group	Count	Rank Sum
Other	6	92.000
Ref	8	93.500
ResFleet	15	249.500

Kruskal-Wallis Test Statistic = 1.773
Probability is 0.412 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 29 cases
Dependent variable is SELENIUM

Group	Count	Rank Sum
Other	6	95.000
Ref	8	111.000
ResFleet	15	229.000

Kruskal-Wallis Test Statistic = 0.212
Probability is 0.899 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 29 cases
Dependent variable is SILVER

Group	Count	Rank Sum
Other	6	92.000
Ref	8	87.500
ResFleet	15	255.500

Kruskal-Wallis Test Statistic = 2.692
Probability is 0.260 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 29 cases
Dependent variable is THALLIUM

Group	Count	Rank Sum
Other	6	78.000
Ref	8	120.500
ResFleet	15	236.500

Kruskal-Wallis Test Statistic = 0.453
Probability is 0.797 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 29 cases
Dependent variable is TIN

Group	Count	Rank Sum
Other	6	85.000
Ref	8	104.000
ResFleet	15	246.000

Kruskal-Wallis Test Statistic = 0.904
Probability is 0.636 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 29 cases
Dependent variable is VANADIUM

Group	Count	Rank Sum
Other	6	87.000
Ref	8	120.500
ResFleet	15	227.500

Kruskal-Wallis Test Statistic = 0.027
Probability is 0.987 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 29 cases
Dependent variable is ZINC

Group	Count	Rank Sum
Other	6	85.500
Ref	8	93.500
ResFleet	15	256.000

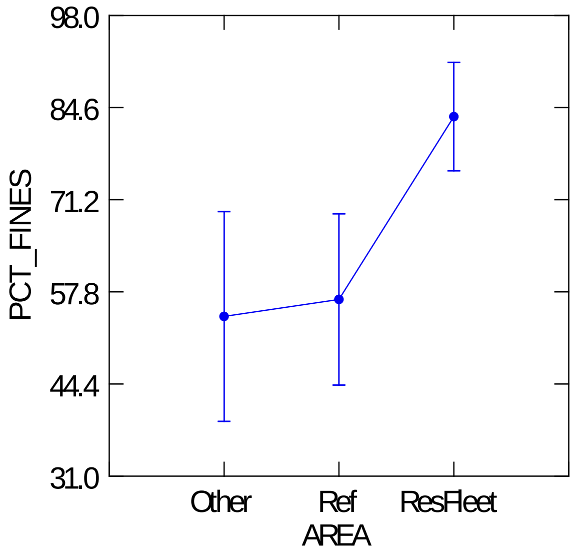
Kruskal-Wallis Test Statistic = 2.142
Probability is 0.343 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 33 cases
Dependent variable is TOC

Group	Count	Rank Sum
Other	6	68.000
Ref	9	154.000
ResFleet	18	339.000

Kruskal-Wallis Test Statistic = 2.716
Probability is 0.257 assuming Chi-square distribution with 2 df

Conventionals and Organics



Kruskal-Wallis One-Way Analysis of Variance for 25 cases
Dependent variable is PCT_FINES

Group	Count	Rank Sum	Mean Rank
Other	4	37.000	9.25
Ref	6	50.500	8.3
ResFleet	15	237.500	15.8

Kruskal-Wallis Test Statistic = 5.591
Probability is 0.061 assuming Chi-square distribution with 2 df

Multiple Contrasts: ResFleet vs. Refs

Contrast	SE	S	Critical Chi	Conclusion
6.125	3.629	1.68779	2.44775	ns

Kruskal-Wallis One-Way Analysis of Variance for 29 cases
Dependent variable is TOC
Grouping variable is AREA$

Group	Count	Rank Sum
Other	6	65.000
Ref	6	85.000
ResFleet	17	285.000

Kruskal-Wallis Test Statistic = 2.231
Probability is 0.328 assuming Chi-square distribution with 2 df

Sum Organo-tins

Top of Cores

Kruskal-Wallis One-Way Analysis of Variance for 27 cases – only one detection
Dependent variable is TOTALTIN
Grouping variable is AREA$

Group	Count	Rank Sum
Other	6	94.500
Ref	6	81.000
ResFleet	15	202.500

Kruskal-Wallis Test Statistic = 3.500
Probability is 0.174 assuming Chi-square distribution with 2 df

Sum PCBs

Top of Cores

Kruskal-Wallis One-Way Analysis of Variance for 18 cases – only one detection
Dependent variable is PCBS
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	45.000
Ref	3	27.000
ResFleet	10	99.000

Kruskal-Wallis Test Statistic = 0.800
Probability is 0.670 assuming Chi-square distribution with 2 df

SFEI PAHs

Top of Cores

Kruskal-Wallis One-Way Analysis of Variance for 18 cases
Dependent variable is SFEI_PAHS
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	52.000
Ref	3	25.000
ResFleet	10	94.000

Kruskal-Wallis Test Statistic = 0.289
Probability is 0.866 assuming Chi-square distribution with 2 df

Core Subsurface Statistical Analyses

SFEI PAHs

Cores: 30-45 cm

Kruskal-Wallis One-Way Analysis of Variance for 16 cases
Dependent variable is SFEI_PAH
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	42
Ref	3	17
ResFleet	8	77

Kruskal-Wallis Test Statistic = 1.511
Probability is 0.47 assuming Chi-square distribution with 2 df

Cores: 90-120 cm

Kruskal-Wallis One-Way Analysis of Variance for 14 cases
Dependent variable is SFEI_PAH
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	39
Ref	2	15
ResFleet	7	51

Kruskal-Wallis Test Statistic = 0.044
Probability is 0.978 assuming Chi-square distribution with 2 df

Cores: 30-45 cm TOC normalized

Kruskal-Wallis One-Way Analysis of Variance for 16 cases
Dependent variable is PAHS_NORM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	49
Ref	3	23
ResFleet	8	64

Kruskal-Wallis Test Statistic = 0.553
Probability is 0.758 assuming Chi-square distribution with 2 df

Cores: 90-120 cm TOC normalized

Kruskal-Wallis One-Way Analysis of Variance for 15 cases
Dependent variable is PAHS_NORM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	39
Ref	3	30
ResFleet	7	51

Kruskal-Wallis Test Statistic = 0.789
Probability is 0.674 assuming Chi-square distribution with 2 df

Sum PCBs

Cores: 30-45 cm

Kruskal-Wallis One-Way Analysis of Variance for 16 cases
Dependent variable is PCBS
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	39.000
Ref	3	29.000
ResFleet	8	68.000

Kruskal-Wallis Test Statistic = 0.497
Probability is 0.780 assuming Chi-square distribution with 2 df

Cores: 90-120 cm

Kruskal-Wallis One-Way Analysis of Variance for 16 cases
Dependent variable is PCBS
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	40.500
Ref	2	11.000
ResFleet	7	53.500

Kruskal-Wallis Test Statistic = 0.891
Probability is 0.640 assuming Chi-square distribution with 2 df

Cores: 30-45 cm TOC normalized

Kruskal-Wallis One-Way Analysis of Variance for 16 cases
Dependent variable is PCBS/TOC
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	35.000
Ref	3	30.000
ResFleet	8	71.000

Kruskal-Wallis Test Statistic = 1.816
Probability is 0.403 assuming Chi-square distribution with 2 df

Cores: 90-120 cm TOC normalized

Kruskal-Wallis One-Way Analysis of Variance for 16 cases
Dependent variable is PCBS/TOC
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	47.500
Ref	2	13.000
ResFleet	9	75.500

Kruskal-Wallis Test Statistic = 0.998
Probability is 0.607 assuming Chi-square distribution with 2 df

Sum Organo-tins

Cores: 15-30 cm

Kruskal-Wallis One-Way Analysis of Variance for 25 cases
Dependent variable is TOTAL_OT
Grouping variable is AREA$

Group	Count	Rank Sum
Other	6	87.5
Ref	5	62.5
ResFleet	14	175

Kruskal-Wallis Test Statistic = 3.167
Probability is 0.205 assuming Chi-square distribution with 2 df

Cores: 30-45 cm

Kruskal-Wallis One-Way Analysis of Variance for 24 cases
Dependent variable is TOTAL_OT
Grouping variable is AREA$

Group	Count	Rank Sum
Other	6	84
Ref	5	60
ResFleet	13	156

Kruskal-Wallis Test Statistic = 3
Probability is 0.223 assuming Chi-square distribution with 2 df

Cores: 45-60 cm

Kruskal-Wallis One-Way Analysis of Variance for 20 cases
Dependent variable is TOTAL_OT
Grouping variable is AREA$

Group	Count	Rank Sum
Other	4	50
Ref	4	40
ResFleet	12	120

Kruskal-Wallis Test Statistic = 4
Probability is 0.135 assuming Chi-square distribution with 2 df

Cores: 60-90 cm

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is TOTAL_OT
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	63
Ref	4	42
ResFleet	12	126

Kruskal-Wallis Test Statistic = 3.200
Probability is 0.202 assuming Chi-square distribution with 2 df

Cores: 90-120 cm

Kruskal-Wallis One-Way Analysis of Variance for 20 cases
Dependent variable is TOTAL_OT
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	60
Ref	4	40
ResFleet	11	110

Kruskal-Wallis Test Statistic = 3
Probability is 0.223 assuming Chi-square distribution with 2 df

TOC

Cores: 30-45 cm

Kruskal-Wallis One-Way Analysis of Variance for 24 cases
Dependent variable is TOC
Grouping variable is AREA$

Group	Count	Rank Sum
Other	6	52
Ref	5	58
ResFleet	13	190

Kruskal-Wallis Test Statistic = 3.009
Probability is 0.222 assuming Chi-square distribution with 2 df

Fines

Cores: 15-30 cm

Kruskal-Wallis One-Way Analysis of Variance for 25 cases
Dependent variable is FINES
Grouping variable is AREA$

Group	Count	Rank Sum
Other	6	63.5
Ref	5	49
ResFleet	14	212.5

Kruskal-Wallis Test Statistic = 2.821
Probability is 0.244 assuming Chi-square distribution with 2 df

Cores: 30-45 cm

Kruskal-Wallis One-Way Analysis of Variance for 24 cases
Dependent variable is FINES
Grouping variable is AREA$

Group	Count	Rank Sum
Other	6	53
Ref	5	46.5
ResFleet	13	200.5

Kruskal-Wallis Test Statistic = 4.861
Probability is 0.088 assuming Chi-square distribution with 2 df

Comparison	Difference	SE	Q	Q_c	Conclusion
ResFleet_vs_Other	6.58974	3.48915	1.88864	2.39398	
ResFleet_vs_Ref	6.12308	3.72023	1.64589	2.39398	
Ref_vs_Other	0.466667	4.28081	0.109014	2.39398	

Cores: 45-60 cm

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is FINES
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	40
Ref	4	32
ResFleet	12	159

Kruskal-Wallis Test Statistic = 3.682
Probability is 0.159 assuming Chi-square distribution with 2 df

Cores: 60-90 cm

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is FINES
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	36
Ref	4	35
ResFleet	12	160

Kruskal-Wallis Test Statistic = 4.098
Probability is 0.129 assuming Chi-square distribution with 2 df

Cores: 90-120 cm

Kruskal-Wallis One-Way Analysis of Variance for 20 cases
Dependent variable is FINES
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	37
Ref	4	35
ResFleet	11	138

Kruskal-Wallis Test Statistic = 3.038
Probability is 0.219 assuming Chi-square distribution with 2 df

Trace Elements

Cores: 15-30 cm

Kruskal-Wallis One-Way Analysis of Variance for 25 cases
Dependent variable is ALUMINUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	6	56
Ref	5	84
ResFleet	14	185

Kruskal-Wallis Test Statistic = 2.834
Probability is 0.242 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 25 cases
Dependent variable is ANTIMONY
Grouping variable is AREA$

Group	Count	Rank Sum
Other	6	55.5
Ref	5	62
ResFleet	14	207.5

Kruskal-Wallis Test Statistic = 2.454
Probability is 0.293 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 25 cases
Dependent variable is ARSENIC
Grouping variable is AREA$

Group	Count	Rank Sum
Other	6	52
Ref	5	65
ResFleet	14	208

Kruskal-Wallis Test Statistic = 2.973
Probability is 0.226 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 25 cases
Dependent variable is BARIUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	6	63
Ref	5	77
ResFleet	14	185

Kruskal-Wallis Test Statistic = 1.236
Probability is 0.539 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 25 cases
Dependent variable is CADMIUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	6	62
Ref	5	49
ResFleet	14	214

Kruskal-Wallis Test Statistic = 3.088
Probability is 0.214 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 25 cases
Dependent variable is CHROMIUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	6	52
Ref	5	77
ResFleet	14	196

Kruskal-Wallis Test Statistic = 2.880
Probability is 0.237 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 25 cases
Dependent variable is COPPER
Grouping variable is AREA$

Group	Count	Rank Sum
Other	6	62
Ref	5	55
ResFleet	14	208

Kruskal-Wallis Test Statistic = 2.048
Probability is 0.359 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 25 cases
Dependent variable is IRON
Grouping variable is AREA$

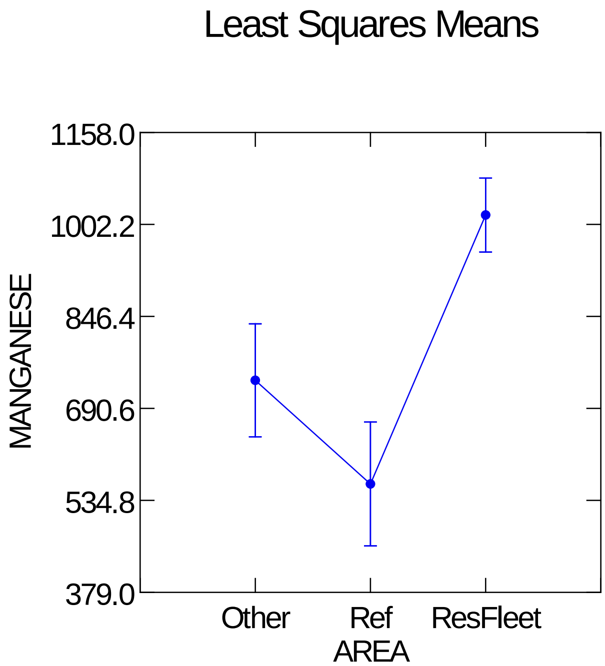
Group	Count	Rank Sum
Other	6	51
Ref	5	56.5
ResFleet	14	217.5

Kruskal-Wallis Test Statistic = 4.175
Probability is 0.124 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 25 cases
Dependent variable is LEAD
Grouping variable is AREA$

Group	Count	Rank Sum
Other	6	66
Ref	5	41
ResFleet	14	218

Kruskal-Wallis Test Statistic = 4.279
Probability is 0.118 assuming Chi-square distribution with 2 df



Kruskal-Wallis One-Way Analysis of Variance for 25 cases
Dependent variable is MANGANESE
Grouping variable is AREA$

Group	Count	Rank Sum	Mean Rank
Other	6	61.5	10.25
Ref	5	30	6
ResFleet	14	233.5	16.67

Kruskal-Wallis Test Statistic = 8.862
Probability is 0.012 assuming Chi-square distribution with 2 df

Comparison	Difference	SE	Q	Q_c	Conclusion
ResFleet_vs_Ref	10.6786	3.83363	2.7855	2.39398	*
ResFleet_vs_Other	6.42857	3.59052	1.79043	2.39398	
Other_vs_Ref	4.25	4.45572	0.953829	2.39398	

Kruskal-Wallis One-Way Analysis of Variance for 25 cases
Dependent variable is MERCURY
Grouping variable is AREA$

Group	Count	Rank Sum
Other	6	66
Ref	5	56
ResFleet	14	203

Kruskal-Wallis Test Statistic = 1.324
Probability is 0.516 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 25 cases
Dependent variable is NICKEL
Grouping variable is AREA$

Group	Count	Rank Sum
Other	6	63.5
Ref	5	51
ResFleet	14	210.5

Kruskal-Wallis Test Statistic = 2.443
Probability is 0.295 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 25 cases
Dependent variable is SELENIUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	6	63.5
Ref	5	52
ResFleet	14	209.5

Kruskal-Wallis Test Statistic = 2.272
Probability is 0.321 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 25 cases
Dependent variable is SILVER
Grouping variable is AREA$

Group	Count	Rank Sum
Other	6	78.5
Ref	5	36
ResFleet	14	210.5

Kruskal-Wallis Test Statistic = 4.190
Probability is 0.123 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 25 cases
Dependent variable is THALLIUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	6	57.5
Ref	5	67
ResFleet	14	200.5

Kruskal-Wallis Test Statistic = 1.760
Probability is 0.415 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 25 cases
Dependent variable is TIN
Grouping variable is AREA$

Group	Count	Rank Sum
Other	6	68
Ref	5	43
ResFleet	14	214

Kruskal-Wallis Test Statistic = 3.445
Probability is 0.179 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 25 cases
Dependent variable is VANADIUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	6	49.5
Ref	5	86
ResFleet	14	189.5

Kruskal-Wallis Test Statistic = 4.205
Probability is 0.122 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 25 cases
Dependent variable is ZINC
Grouping variable is AREA$

Group	Count	Rank Sum
Other	6	65
Ref	5	42
ResFleet	14	218

Kruskal-Wallis Test Statistic = 4.184
Probability is 0.123 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 25 cases
Dependent variable is TOC
Grouping variable is AREA$

Group	Count	Rank Sum
Other	6	73
Ref	5	58
ResFleet	14	194

Kruskal-Wallis Test Statistic = 0.448
Probability is 0.799 assuming Chi-square distribution with 2 df

Cores: 30-45 cm

Kruskal-Wallis One-Way Analysis of Variance for 24 cases
Dependent variable is ALUMINUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	6	50
Ref	5	58
ResFleet	13	192

Kruskal-Wallis Test Statistic = 3.506
Probability is 0.173 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 24 cases
Dependent variable is ANTIMONY
Grouping variable is AREA$

Group	Count	Rank Sum	Mean Rank
Other	6	57	9.5
Ref	5	41.5	8.3
ResFleet	13	201.5	15.5

Kruskal-Wallis Test Statistic = 5.189
Probability is 0.075 assuming Chi-square distribution with 2 df

ResFleet_vs_Ref 6.96923 3.71942 1.87374 2.39398 1 Comparison Difference

Comparison	Difference	SE	Q	Q_c	Conclusion
ResFleet_vs_Ref	6.96923	3.71942	1.87374	2.39398	
ResFleet_vs_Other	5.26923	3.48839	1.5105	2.39398	
Other_vs_Ref	1.7	4.27988	0.397207	2.39398	

Kruskal-Wallis One-Way Analysis of Variance for 24 cases
Dependent variable is ARSENIC
Grouping variable is AREA$

Group	Count	Rank Sum	Mean Rank
Other	6	47.5	7.9
Ref	5	49	9.8
ResFleet	13	203.5	15.6

Kruskal-Wallis Test Statistic = 5.839
Probability is 0.054 assuming Chi-square distribution with 2 df

Comparison	Difference	SE	Q	Q_c	Conclusion
ResFleet_vs_Other	7.73718	3.48915	2.21749	2.39398	
ResFleet_vs_Ref	5.85385	3.72023	1.57352	2.39398	
Ref_vs_Other	1.88333	4.28081	0.439948	2.39398	

Kruskal-Wallis One-Way Analysis of Variance for 24 cases
Dependent variable is BARIUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	6	61
Ref	5	57
ResFleet	13	182

Kruskal-Wallis Test Statistic = 1.359
Probability is 0.507 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 24 cases
Dependent variable is CADMIUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	6	61
Ref	5	49
ResFleet	13	190

Kruskal-Wallis Test Statistic = 2.546
Probability is 0.280 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 24 cases
Dependent variable is CHROMIUM
Grouping variable is AREA$

Group	Count	Rank Sum	Mean Rank
Other	6	45	7.5
Ref	5	58	11.6
ResFleet	13	197	15.2

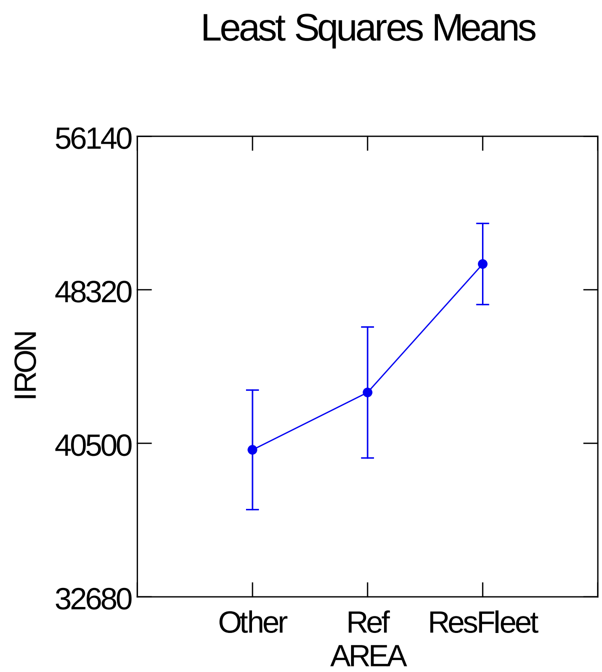
Kruskal-Wallis Test Statistic = 4.914
Probability is 0.086 assuming Chi-square distribution with 2 df

Comparison	Difference	SE	Q	Q_c	Conclusion
ResFleet_vs_Other	7.65385	3.48915	2.19361	2.39398	
ResFleet_vs_Ref	3.55385	3.72023	0.955275	2.39398	
Ref_vs_Other	4.1	4.28081	0.957762	2.39398	

Kruskal-Wallis One-Way Analysis of Variance for 24 cases
Dependent variable is COPPER
Grouping variable is AREA$

Group	Count	Rank Sum
Other	6	55
Ref	5	48
ResFleet	13	197

Kruskal-Wallis Test Statistic = 4.005
Probability is 0.135 assuming Chi-square distribution with 2 df



Kruskal-Wallis One-Way Analysis of Variance for 24 cases
Dependent variable is IRON
Grouping variable is AREA$

Group	Count	Rank Sum	Mean Rank
Other	6	45	7.5
Ref	5	51	10.2
ResFleet	13	204	15.7

Kruskal-Wallis Test Statistic = 6.179
Probability is 0.046 assuming Chi-square distribution with 2 df

Comparison	Difference	SE	Q	Q_c	Conclusion
ResFleet_vs_Other	8.19231	3.48991	2.34743	2.39398	
ResFleet_vs_Ref	5.49231	3.72104	1.47601	2.39398	
Ref_vs_Other	2.7	4.28174	0.630584	2.39398	

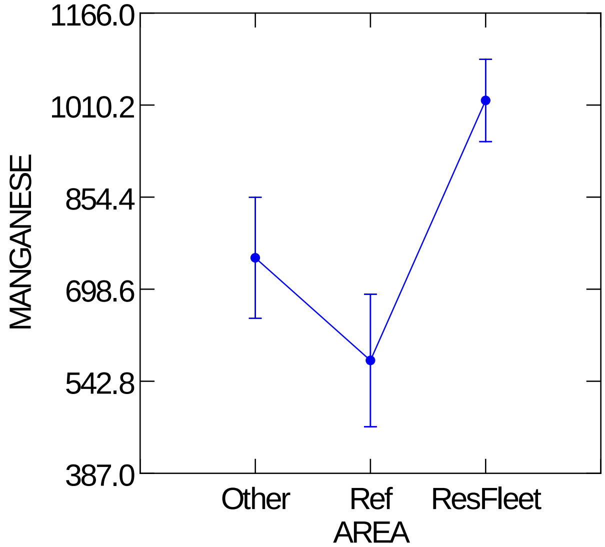
Kruskal-Wallis One-Way Analysis of Variance for 24 cases
Dependent variable is LEAD
Grouping variable is AREA$

Group	Count	Rank Sum	Mean Rank
Other	6	61	10.2
Ref	5	39	7.8
ResFleet	13	200	15.4

Kruskal-Wallis Test Statistic = 5.028
Probability is 0.081 assuming Chi-square distribution with 2 df

Comparison	Difference	SE	Q	Q_c	Conclusion
ResFleet_vs_Ref	7.66154	3.72023	2.05942	2.39398	1
ResFleet_vs_Other	5.46154	3.48915	1.56529	2.39398	1
Other_vs_Ref	2.2	4.28081	0.513921	2.39398	1

Least Squares Means



Kruskal-Wallis One-Way Analysis of Variance for 24 cases
Dependent variable is MANGANESE
Grouping variable is AREA$

Group	Count	Rank Sum	Mean Rank
Other	6	62.5	10.4
Ref	5	30.5	6.1
ResFleet	13	207	15.9

Kruskal-Wallis Test Statistic = 7.670
Probability is 0.022 assuming Chi-square distribution with 2 df

Comparison	Difference	SE	Q	Q_c	Conclusion
ResFleet_vs_Ref	9.82308	3.71942	2.64102	2.39398	*
ResFleet_vs_Other	5.50641	3.48839	1.57849	2.39398	
Other_vs_Ref	4.31667	4.27988	1.00859	2.39398	

Kruskal-Wallis One-Way Analysis of Variance for 24 cases
Dependent variable is MERCURY
Grouping variable is AREA$

Group	Count	Rank Sum
Other	6	57.5
Ref	5	58
ResFleet	13	184.5

Kruskal-Wallis Test Statistic = 1.847
Probability is 0.397 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 24 cases
Dependent variable is NICKEL
Grouping variable is AREA$

Group	Count	Rank Sum
Other	6	51
Ref	5	52
ResFleet	13	197

Kruskal-Wallis Test Statistic = 4.196
Probability is 0.123 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 24 cases
Dependent variable is SELENIUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	6	71.5
Ref	5	64
ResFleet	13	164.5

Kruskal-Wallis Test Statistic = 0.056
Probability is 0.972 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 24 cases
Dependent variable is SILVER
Grouping variable is AREA$

Group	Count	Rank Sum
Other	6	69.5
Ref	5	40
ResFleet	13	190.5

Kruskal-Wallis Test Statistic = 3.344
Probability is 0.188 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 24 cases
Dependent variable is THALLIUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	6	59.5
Ref	5	56.5
ResFleet	13	184

Kruskal-Wallis Test Statistic = 1.657
Probability is 0.437 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 24 cases
Dependent variable is TIN
Grouping variable is AREA$

Group	Count	Rank Sum	Mean Rank
Other	6	56	9.3
Ref	5	41	8.2
ResFleet	13	203	15.6

Kruskal-Wallis Test Statistic = 5.576
Probability is 0.062 assuming Chi-square distribution with 2 df

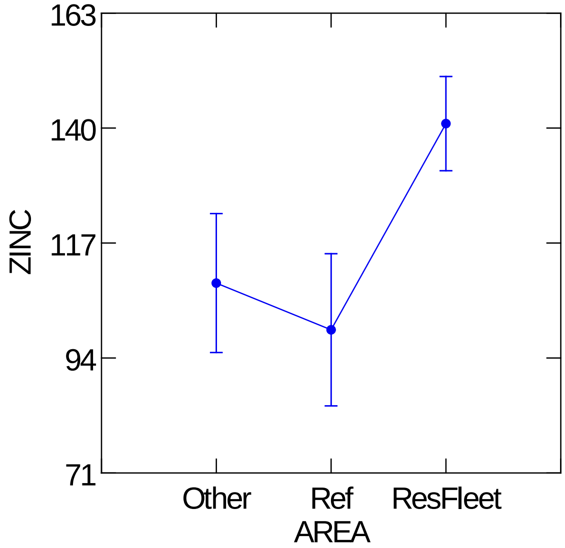
Comparison	Difference	SE	Q	Q_c	Conclusion
ResFleet_vs_Ref	7.26154	3.72104	1.95148	2.39398	
ResFleet_vs_Other	5.79487	3.48991	1.66046	2.39398	
Other_vs_Ref	1.46667	4.28174	0.34254	2.39398	

Kruskal-Wallis One-Way Analysis of Variance for 24 cases
Dependent variable is VANADIUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	6	49
Ref	5	57.5
ResFleet	13	193.5

Kruskal-Wallis Test Statistic = 3.837
Probability is 0.147 assuming Chi-square distribution with 2 df

Least Squares Means



Kruskal-Wallis One-Way Analysis of Variance for 24 cases
Dependent variable is ZINC
Grouping variable is AREA$

Group	Count	Rank Sum	Mean Rank
Other	6	55	9.2
Ref	5	40	8
ResFleet	13	205	15.8

Kruskal-Wallis Test Statistic = 6.140
Probability is 0.046 assuming Chi-square distribution with 2 df

Comparison	Difference	SE	Q	Q_c	Conclusion
ResFleet_vs_Ref	7.76923	3.72023	2.08837	2.39398	
ResFleet_vs_Other	6.60256	3.48915	1.89231	2.39398	
Other_vs_Ref	1.16667	4.28081	0.272534	2.39398	

Kruskal-Wallis One-Way Analysis of Variance for 24 cases
Dependent variable is TOC
Grouping variable is AREA$

Group	Count	Rank Sum
Other	6	53
Ref	5	59
ResFleet	13	188

Kruskal-Wallis Test Statistic = 2.664
Probability is 0.264 assuming Chi-square distribution with 2 df

Cores: 45-60 cm

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is ALUMINUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	50.5
Ref	4	43.5
ResFleet	12	137

Kruskal-Wallis Test Statistic = 0.161
Probability is 0.923 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is ANTIMONY
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	48
Ref	4	43
ResFleet	12	140

Kruskal-Wallis Test Statistic = 0.400
Probability is 0.819 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is ARSENIC
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	38
Ref	4	52
ResFleet	12	141

Kruskal-Wallis Test Statistic = 2.092
Probability is 0.351 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is BARIUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	57
Ref	4	39.5
ResFleet	12	134.5

Kruskal-Wallis Test Statistic = 0.166
Probability is 0.920 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is CADMIUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	46
Ref	4	32
ResFleet	12	153

Kruskal-Wallis Test Statistic = 2.310
Probability is 0.315 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is CHROMIUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	48
Ref	4	37.5
ResFleet	12	145.5

Kruskal-Wallis Test Statistic = 0.926
Probability is 0.629 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is COPPER
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	50
Ref	4	29
ResFleet	12	152

Kruskal-Wallis Test Statistic = 2.458
Probability is 0.293 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is IRON
Grouping variable is AREA$

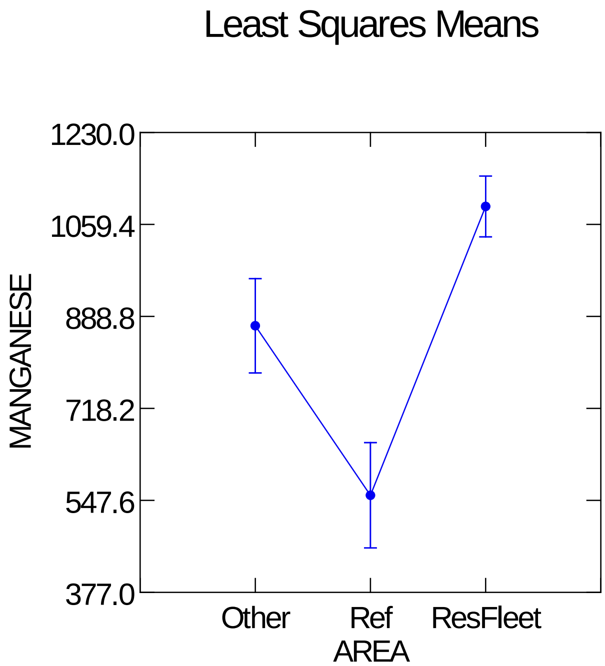
Group	Count	Rank Sum
Other	5	44
Ref	4	34.5
ResFleet	12	152.5

Kruskal-Wallis Test Statistic = 2.128
Probability is 0.345 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is LEAD
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	52
Ref	4	27
ResFleet	12	152

Kruskal-Wallis Test Statistic = 2.789
Probability is 0.248 assuming Chi-square distribution with 2 df



Kruskal-Wallis Test Statistic = 2.789
Probability is 0.248 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is MANGANESE
Grouping variable is AREA$

Group	Count	Rank Sum	Mean Rank
Other	5	48	9.6
Ref	4	12	3
ResFleet	12	171	14.2

Kruskal-Wallis Test Statistic = 10.196
Probability is 0.006 assuming Chi-square distribution with 2 df

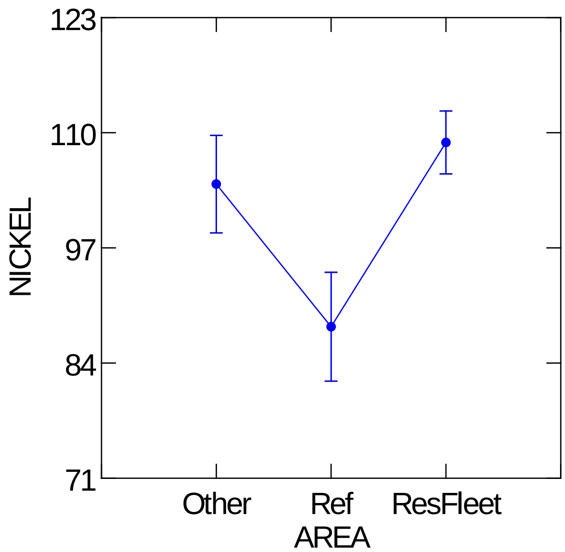
Comparison	Difference	SE	Q	Q_c	Conclusion
ResFleet_vs_Ref	11.25	3.58236	3.14038	2.39398	*
ResFleet_vs_Other	4.65	3.30278	1.40791	2.39398	
Other_vs_Ref	6.6	4.16233	1.58565	2.39398	

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is MERCURY
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	40
Ref	4	37
ResFleet	12	154

Kruskal-Wallis Test Statistic = 2.536
Probability is 0.281 assuming Chi-square distribution with 2 df

Least Squares Means



Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is NICKEL
Grouping variable is AREA$

Group	Count	Rank Sum	Mean Rank
Other	5	61	12.2
Ref	4	19	4.8
ResFleet	12	151	12.6

Kruskal-Wallis Test Statistic = 5.033
Probability is 0.081 assuming Chi-square distribution with 2 df

Comparison	Difference	SE	Q	Q_c	Conclusion
ResFleet_vs_Ref	7.83333	3.58004	2.18806	2.39398	
ResFleet_vs_Other	0.383333	3.30063	0.116139	2.39398	
Other_vs_Ref	7.45	4.15963	1.79103	2.39398	

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is SELENIUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	54
Ref	4	47
ResFleet	12	130

Kruskal-Wallis Test Statistic = 0.072
Probability is 0.964 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is SILVER
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	57
Ref	4	24.5
ResFleet	12	149.5

Kruskal-Wallis Test Statistic = 3.165
Probability is 0.205 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is THALLIUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	49.5
Ref	4	40
ResFleet	12	141.5

Kruskal-Wallis Test Statistic = 0.457
Probability is 0.796 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is TIN
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	57
Ref	4	25
ResFleet	12	149

Kruskal-Wallis Test Statistic = 2.990
Probability is 0.224 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is VANADIUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	52.5
Ref	4	43.5
ResFleet	12	135

Kruskal-Wallis Test Statistic = 0.054
Probability is 0.974 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is ZINC
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	50
Ref	4	25
ResFleet	12	156

Kruskal-Wallis Test Statistic = 3.721
Probability is 0.156 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is TOC
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	35.5
Ref	4	43.5
ResFleet	12	152

Kruskal-Wallis Test Statistic = 2.845
Probability is 0.241 assuming Chi-square distribution with 2 df

Cores: 60-90 cm

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is ALUMINUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	43
Ref	4	50
ResFleet	12	138

Kruskal-Wallis Test Statistic = 1.060
Probability is 0.589 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is ANTIMONY
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	49
Ref	4	38
ResFleet	12	144

Kruskal-Wallis Test Statistic = 0.733
Probability is 0.693 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is ARSENIC
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	41
Ref	4	51
ResFleet	12	139

Kruskal-Wallis Test Statistic = 1.442
Probability is 0.486 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is BARIUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	47
Ref	4	48
ResFleet	12	136

Kruskal-Wallis Test Statistic = 0.471
Probability is 0.790 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is CADMIUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	49.5
Ref	4	35
ResFleet	12	146.5

Kruskal-Wallis Test Statistic = 1.139
Probability is 0.566 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is CHROMIUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	42
Ref	4	46
ResFleet	12	143

Kruskal-Wallis Test Statistic = 1.168
Probability is 0.558 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is COPPER
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	49
Ref	4	34
ResFleet	12	148

Kruskal-Wallis Test Statistic = 1.390
Probability is 0.499 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is IRON
Grouping variable is AREA$

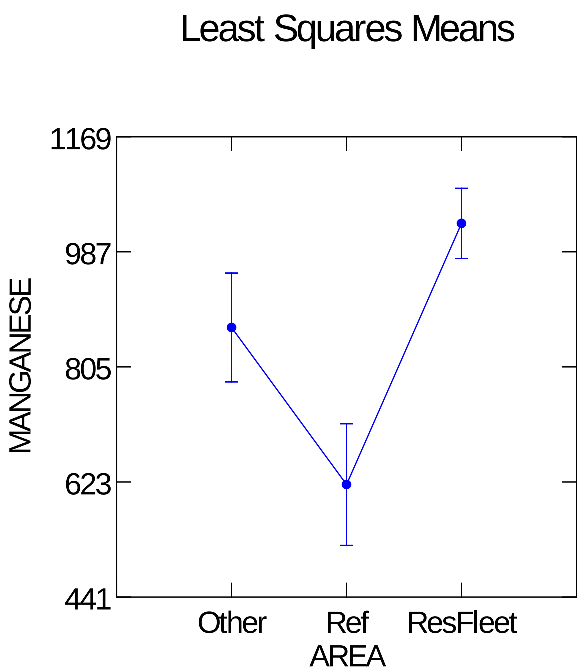
Group	Count	Rank Sum
Other	5	43
Ref	4	45
ResFleet	12	143

Kruskal-Wallis Test Statistic = 1.016
Probability is 0.602 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is LEAD
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	57
Ref	4	29.5
ResFleet	12	144.5

Kruskal-Wallis Test Statistic = 1.725
Probability is 0.422 assuming Chi-square distribution with 2 df



Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is MANGANESE
Grouping variable is AREA$

Group	Count	Rank Sum	Mean Rank
Other	5	47.5	9.5
Ref	4	17	4.2
ResFleet	12	166.5	13.9

Kruskal-Wallis Test Statistic = 7.607
Probability is 0.022 assuming Chi-square distribution with 2 df

Comparison	Difference	SE	Q	Q_c	Conclusion
ResFleet_vs_Ref	9.625	3.5812	2.68765	2.39398	*
ResFleet_vs_Other	4.375	3.3017	1.32507	2.39398	
Other_vs_Ref	5.25	4.16098	1.26172	2.39398	

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is MERCURY
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	45
Ref	4	36
ResFleet	12	150

Kruskal-Wallis Test Statistic = 1.637
Probability is 0.441 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is NICKEL
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	60.5
Ref	4	25
ResFleet	12	145.5

Kruskal-Wallis Test Statistic = 2.901
Probability is 0.234 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is SELENIUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	57
Ref	4	36
ResFleet	12	138

Kruskal-Wallis Test Statistic = 0.515
Probability is 0.773 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is SILVER
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	57
Ref	4	23
ResFleet	12	151

Kruskal-Wallis Test Statistic = 3.675
Probability is 0.159 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is THALLIUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	47
Ref	4	45
ResFleet	12	139

Kruskal-Wallis Test Statistic = 0.445
Probability is 0.800 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is TIN
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	63
Ref	4	25
ResFleet	12	143

Kruskal-Wallis Test Statistic = 2.939
Probability is 0.230 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is VANADIUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	42
Ref	4	51
ResFleet	12	138

Kruskal-Wallis Test Statistic = 1.275
Probability is 0.529 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is ZINC
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	51.5
Ref	4	26
ResFleet	12	153.5

Kruskal-Wallis Test Statistic = 3.170
Probability is 0.205 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 21 cases
Dependent variable is TOC
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	41
Ref	4	35
ResFleet	12	155

Kruskal-Wallis Test Statistic = 2.689
Probability is 0.261 assuming Chi-square distribution with 2 df

Cores: 90-120 cm

Kruskal-Wallis One-Way Analysis of Variance for 20 cases
Dependent variable is ALUMINUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	35
Ref	4	41
ResFleet	11	134

Kruskal-Wallis Test Statistic = 2.646
Probability is 0.266 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 20 cases
Dependent variable is ANTIMONY
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	47.5
Ref	4	38
ResFleet	11	124.5

Kruskal-Wallis Test Statistic = 0.468
Probability is 0.791 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 20 cases
Dependent variable is ARSENIC
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	38.5
Ref	4	46
ResFleet	11	125.5

Kruskal-Wallis Test Statistic = 1.495
Probability is 0.474 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 20 cases
Dependent variable is BARIUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	37
Ref	4	46
ResFleet	11	127

Kruskal-Wallis Test Statistic = 1.831
Probability is 0.400 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 20 cases
Dependent variable is CADMIUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	53
Ref	4	29
ResFleet	11	128

Kruskal-Wallis Test Statistic = 1.614
Probability is 0.446 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 20 cases
Dependent variable is CHROMIUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	43.5
Ref	4	42
ResFleet	11	124.5

Kruskal-Wallis Test Statistic = 0.674
Probability is 0.714 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 20 cases
Dependent variable is COPPER
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	43
Ref	4	27
ResFleet	11	140

Kruskal-Wallis Test Statistic = 3.682
Probability is 0.159 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 20 cases
Dependent variable is IRON
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	39
Ref	4	40
ResFleet	11	131

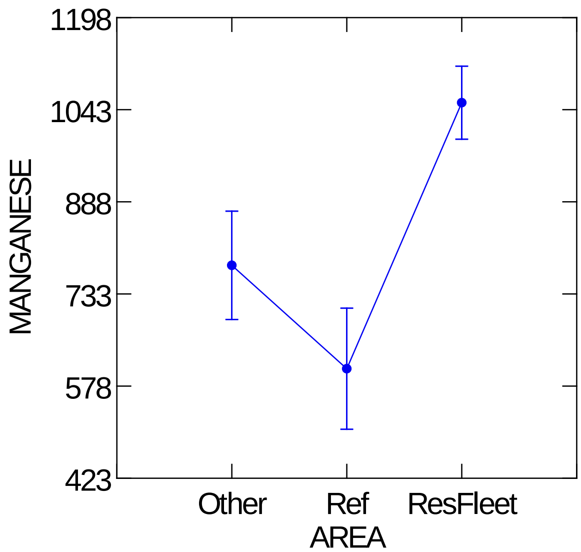
Kruskal-Wallis Test Statistic = 1.694
Probability is 0.429 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 20 cases
Dependent variable is LEAD
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	51.5
Ref	4	27
ResFleet	11	131.5

Kruskal-Wallis Test Statistic = 2.280
Probability is 0.320 assuming Chi-square distribution with 2 df

Least Squares Means



Kruskal-Wallis One-Way Analysis of Variance for 20 cases
Dependent variable is MANGANESE
Grouping variable is AREA$

Group	Count	Rank Sum	Mean Rank
Other	5	41	8.2
Ref	4	17	4.2
ResFleet	11	152	13.8

Kruskal-Wallis Test Statistic = 8.680
Probability is 0.013 assuming Chi-square distribution with 2 df

Comparison	Difference	SE	Q	Q_c	Conclusion
ResFleet_vs_Ref	9.56818	3.45425	2.76998	2.39398	*
ResFleet_vs_Other	5.61818	3.1909	1.76069	2.39398	
Other_vs_Ref	3.95	3.96863	0.995306	2.39398	

Kruskal-Wallis One-Way Analysis of Variance for 20 cases
Dependent variable is MERCURY
Grouping variable is AREA$

Group	Count	Rank Sum	Mean Rank
Other	5	46	9.2
Ref	4	22	5.5
ResFleet	11	142	12.9

Kruskal-Wallis Test Statistic = 4.923
Probability is 0.085 assuming Chi-square distribution with 2 df

Comparison	Difference	SE	Q	Q_c	Conclusion
Other_vs_Ref	8.85	3.96713	2.23083	2.39398	
Other_vs_ResFleet	0.6	3.1897	0.188106	2.39398	
ResFleet_vs_Ref	8.25	3.45295	2.38926	2.39398	

Kruskal-Wallis One-Way Analysis of Variance for 20 cases
Dependent variable is NICKEL
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	44
Ref	4	26
ResFleet	11	140

Kruskal-Wallis Test Statistic = 3.803
Probability is 0.149 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 20 cases
Dependent variable is SELENIUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	55
Ref	4	39
ResFleet	11	116

Kruskal-Wallis Test Statistic = 0.101
Probability is 0.951 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 20 cases
Dependent variable is SILVER
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	60.5
Ref	4	20.5
ResFleet	11	129

Kruskal-Wallis Test Statistic = 4.147
Probability is 0.126 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 20 cases
Dependent variable is THALLIUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	39
Ref	4	41.5
ResFleet	11	129.5

Kruskal-Wallis Test Statistic = 1.553
Probability is 0.460 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 20 cases
Dependent variable is TIN
Grouping variable is AREA$

Group	Count	Rank Sum	Mean Rank
Other	5	63	
Ref	4	15	
ResFleet	11	132	

Kruskal-Wallis Test Statistic = 6.549
Probability is 0.038 assuming Chi-square distribution with 2 df

Comparison	Difference	SE	Q	Q_c	Conclusion
Other_vs_Ref	8.85	3.96713	2.23083	2.39398	
Other_vs_ResFleet	0.6	3.1897	0.188106	2.39398	
ResFleet_vs_Ref	8.25	3.45295	2.38926	2.39398	

Kruskal-Wallis One-Way Analysis of Variance for 20 cases
Dependent variable is VANADIUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	38.5
Ref	4	48.5
ResFleet	11	123

Kruskal-Wallis Test Statistic = 1.570
Probability is 0.456 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 20 cases
Dependent variable is ZINC
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	46.5
Ref	4	26
ResFleet	11	137.5

Kruskal-Wallis Test Statistic = 3.304
Probability is 0.192 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 20 cases
Dependent variable is TOC
Grouping variable is AREA$

Group	Count	Rank Sum
Other	5	59
Ref	4	39
ResFleet	11	112

Kruskal-Wallis Test Statistic = 0.338
Probability is 0.844 assuming Chi-square distribution with 2 df

Tissue (Mytilus) Statistical Analyses

Tissue Residues

Organo-tins

Kruskal-Wallis One-Way Analysis of Variance for 8 cases
Dependent variable is Organo-Tins
Grouping variable is AREA$

Group	Count	Rank Sum
Other	2	10.5
Ref	2	12
ResFleet	4	13.5

Kruskal-Wallis Test Statistic = 2.022
Probability is 0.364 assuming Chi-square distribution with 2 df

Same exact results when normalized to lipid.

PCBs

Kruskal-Wallis One-Way Analysis of Variance for 8 cases
Dependent variable is PCB
Grouping variable is AREA$

Group	Count	Rank Sum
Other	2	7
Ref	2	7
ResFleet	4	22

Kruskal-Wallis Test Statistic = 2.286
Probability is 0.319 assuming Chi-square distribution with 2 df

Same exact results when normalized to lipid.

SFEI PAHs

Kruskal-Wallis One-Way Analysis of Variance for 8 cases
Dependent variable is PAHs
Grouping variable is AREA$

Group	Count	Rank Sum
Other	2	9
Ref	2	8
ResFleet	4	19

Kruskal-Wallis Test Statistic = 0.125
Probability is 0.939 assuming Chi-square distribution with 2 df

Normalized to Lipdis

Kruskal-Wallis One-Way Analysis of Variance for 8 cases
Dependent variable is PAHs./LIPID
Grouping variable is AREA$

Group	Count	Rank Sum
Other	2	9
Ref	2	9
ResFleet	4	18

Kruskal-Wallis Test Statistic = 0
Probability is 1.000 assuming Chi-square distribution with 2 df

Trace Elements

Kruskal-Wallis One-Way Analysis of Variance for 8 cases
Dependent variable is ALUMINUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	2	9
Ref	2	8
ResFleet	4	19

Kruskal-Wallis Test Statistic = 0.125
Probability is 0.939 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 8 cases
Dependent variable is ARSENIC
Grouping variable is AREA$

Group	Count	Rank Sum
Other	2	10
Ref	2	8
ResFleet	4	18

Kruskal-Wallis Test Statistic = 0.167
Probability is 0.920 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 8 cases
Dependent variable is BARIUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	2	9
Ref	2	7
ResFleet	4	20

Kruskal-Wallis Test Statistic = 0.5
Probability is 0.779 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 8 cases
Dependent variable is CADMIUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	2	13
Ref	2	7
ResFleet	4	16

Kruskal-Wallis Test Statistic = 1.833
Probability is 0.400 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 8 cases
Dependent variable is CHROMIUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	2	8
Ref	2	9
ResFleet	4	19

Kruskal-Wallis Test Statistic = 0.125
Probability is 0.939 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 8 cases
Dependent variable is COPPER
Grouping variable is AREA$

Group	Count	Rank Sum
Other	2	9
Ref	2	8
ResFleet	4	19

Kruskal-Wallis Test Statistic = 0.125
Probability is 0.939 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 8 cases
Dependent variable is IRON
Grouping variable is AREA$

Group	Count	Rank Sum
Other	2	9
Ref	2	7
ResFleet	4	20

Kruskal-Wallis Test Statistic = 0.5
Probability is 0.779 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 8 cases
Dependent variable is LEAD
Grouping variable is AREA$

Group	Count	Rank Sum
Other	2	8
Ref	2	6.5
ResFleet	4	21.5

Kruskal-Wallis Test Statistic = 1.128
Probability is 0.569 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 8 cases
Dependent variable is MANGANESE
Grouping variable is AREA$

Group	Count	Rank Sum
Other	2	9
Ref	2	8
ResFleet	4	19

Kruskal-Wallis Test Statistic = 0.125
Probability is 0.939 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 8 cases
Dependent variable is MERCURY
Grouping variable is AREA$

Group	Count	Rank Sum
Other	2	8
Ref	2	12
ResFleet	4	16

Kruskal-Wallis Test Statistic = 1
Probability is 0.607 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 8 cases
Dependent variable is NICKEL
Grouping variable is AREA$

Group	Count	Rank Sum
Other	2	9
Ref	2	8
ResFleet	4	19

Kruskal-Wallis Test Statistic = 0.125
Probability is 0.939 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 8 cases
Dependent variable is SELENIUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	2	8
Ref	2	9
ResFleet	4	19

Kruskal-Wallis Test Statistic = 0.125
Probability is 0.939 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 8 cases
Dependent variable is VANADIUM
Grouping variable is AREA$

Group	Count	Rank Sum
Other	2	9
Ref	2	7.5
ResFleet	4	19.5

Kruskal-Wallis Test Statistic = 0.285
Probability is 0.867 assuming Chi-square distribution with 2 df

Kruskal-Wallis One-Way Analysis of Variance for 8 cases
Dependent variable is ZINC
Grouping variable is AREA$

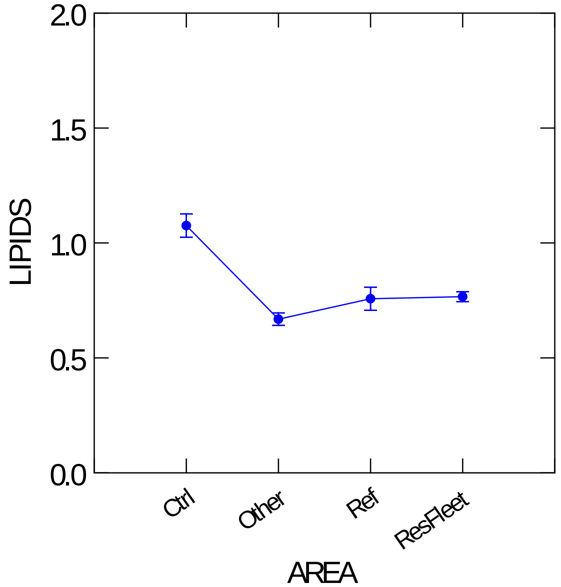
Group	Count	Rank Sum	Mean Rank
Other	2	13	6.5
Ref	2	3	1.5
ResFleet	4	20	5

Kruskal-Wallis Test Statistic = 4.5
Probability is 0.1054 assuming Chi-square distribution with 2 df

Comparison	Difference	SE	Q	Q_c	Conclusion
ResFleet_vs_Other	1.5	2.12	0.707107	2.39398	ns
ResFleet_vs_Ref	3.5	2.12	1.64992	2.39398	ns
Ref_vs_Other	5	2.5	2.04124	2.39398	ns

LIPIIDS

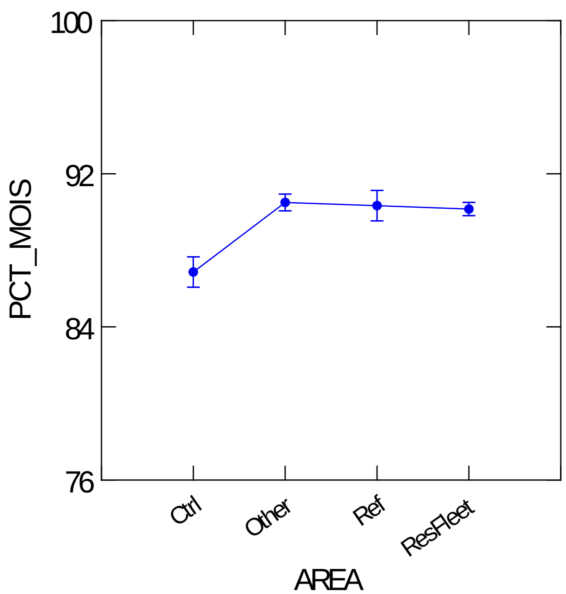
Here are the K-W results for mussel characteristics, along with graphical presentation:



Kruskal-Wallis One-Way Analysis of Variance for 66 cases
Dependent variable is LIPIDS
Grouping variable is AREA$

Group	Count
Ctrl	1
Other	3
Ref	4
ResFleet	1

Kruskal-Wallis Test Statistic = 6.4
Probability is 0.09 assuming Chi-square distribution with 3 df

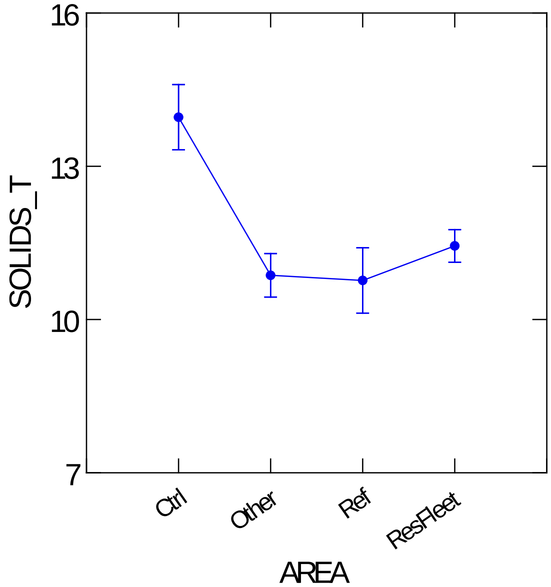


Kruskal-Wallis One-Way Analysis of Variance for 32 cases

Dependent variable is PCT_MOISTURE
Grouping variable is AREA$

Group	Count
Ctrl	1
Other	3
Ref	4
ResFleet	1

Kruskal-Wallis Test Statistic = 3.2777
Probability is 0.35 assuming Chi-square distribution with 3 df



Kruskal-Wallis One-Way Analysis of Variance for 33 cases
Dependent variable is SOLIDS_T
Grouping variable is AREA$

Group	Count
Ctrl	1
Other	3
Ref	1
ResFleet	4

Kruskal-Wallis Test Statistic = 4.344
Probability is 0.2265 assuming Chi-square distribution with 3 df

These tests fail to indicate significant differences, except for lipids. Graphically however, what can be easily discerned is that the initial set of mussels collected, the control, is behaving differently from all deployed mussels. For lipids, the K-W indicated significant differences, however the multiple comparison test was unable to distinguish between areas. This incapacity may well be due to the lack of replication and extremely low sample sizes