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CHEMICAL AND BIOLOGICAL MEASURES OF SEDIMENT QUALITY AND TISSUE BIOACCUMULATION IN THE NORTH COAST REGION FINAL REPORT

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California State Water Resources Control Board

California Regional Water Quality Control Board, North Coast Region

California Department of Fish and Game
Marine Pollution Studies Laboratory

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Table 15. Station summary of chemistry, toxicity and benthic community results (** not used in station evaluations due to water quality exceedances, SV= screening values, see text for complete descriptions).

Station Number	Station	Sediment Chemistry	ERL/TEL Exceed.	Tissue Chemistry	Repeat Tox	Single Tox	Benthics	Comments
Stations which exceeded regional chemistry screening levels, toxicity measured one or more times, non-degraded benthic communities								
10028.0	PORTO BODEGA MARINA	ERMQ=0.214	11		X		Transitional	
10006.0	BODEGA BAY-MASON'S MARINA	5 PEL exceedances	9		X		Undegraded	
14001.0	EUREKA WATERFRONT- H STREET	ERMQ=0.243, PELQ=0.528	8	>EPA SV for PCBs & MW value for CU		X	Undegraded	AG in top 95% for the state
14002.0	EUREKA WATERFRONT J STREET	10 PEL exceedances	8	>EPA SV for PAHs & MW values for CU & HG		X	Undegraded	LMW PAHs in top 95% for the state
Stations which exceeded regional chemistry screening levels, non toxic, non-degraded benthic communities								
10019.0	H. BAY-COAL/OIL/GAS PLANT	PELQ= 0.482	6				Undegraded	Lindane in top 90% of the state
Stations with no regional chemistry screening level exceedances, single toxicity, non-degraded benthic communities								
10007.0	BODEGA-SPUD POINT MARINA		3			X	Transitional	Toxic once in both amphipod and SDI tests
10017.0	ARCATA BAY-EUREKA SL.		6			X	Transitional	
10023.0	H. BAY EUREKA STORM 23		6			X	Undegraded	
10040.0	UNCONTAMINATED SITE-33D		4			X	Transitional	
Stations with no regional chemistry screening level exceedances, non toxic, non-degraded benthic communities								
10016.0	ARCATA BAY-JOLLY GIANT SL.		10				Transitional	
10018.0	H. BAY-UNION OIL PLANT		6				Transitional	
10021.0	H. BAY-CHEVRON TERMINAL		5				Transitional	
14004.0	DAVENPORT MARINE		9				Undegraded	
15001.0	H. BAY- HALBERSON SHORELINE		4				Transitional	
Stations with no regional chemistry screening level exceedances, toxicty measured one or more times, benthic community not analyzed								
10004.0	ARCATA BAY-MCDANIEL SL.		5			X		toxic *R. abronius* test; but 90% Fines
10020.0	H. BAY-OLD PAC. LUMBER SITE		7			X		
10032.0	MOUTH OF ESTERO DE SAN ANTONIO					X		
Stations which exceeded regional chemistry screening levels, toxicity not analyzed, benthic community not analyzed								
14003.0	ARCATA BAY- JOLLY GIANT NORTH		4	> EPA SV for PCBs				
Stations with no regional chemistry screening level exceedances, non toxic, benthic community not analyzed								
10025.0	H. BAY HOOKTON SL.		6					
10037.0	H. BAY-MOUTH OF ELK RIVER		4					
Stations with no regional chemistry screening level exceedances, toxicty not analyzed, benthic community not analyzed								
10022.0	HUMBOLDT BAY EUREKA SM.22		5					
15002.0	H. BAY- WASHINGTON STREET		4					
Stations with no chemistry analyzed, toxicity measured one or more times, benthic community not analyzed								
10029.0	ESTERO AMERICANO-VALLEY FORD					X**		toxic *M. edulis* test; but exceeded NH3 by 4.2X
10030.0	ESTERO DE SAN ANTONIO-VALLEY F					X		
10039.0	UNCONTAMINATED SITE-33C					X**		toxic *M. edulis* test; but exceeded NH3 by 4.7X
10041.0	SALMON CREEK-34L					X		
Stations with no chemistry analyzed, non toxic, benthic community not analyzed								
10005.0	RUSSIAN RIVER MOUTH SMW 280.0							
10015.0	ARCATA BAY-MAD RIVER SL.							
10024.0	H. BAY FIELDS LANDING							
10031.0	MOUTH OF ESTERO AMERICANO							
10036.0	SOUTHPORT CHANNEL-33B							

Table 14. Sample summary of toxicity, sediment chemistry exceedances, benthic indices results. Only those bioassay protocols which showed toxicity are listed. Complete results are listed in the appendices (shaded survival indicates samples which were toxic; n/a indicates no chemical analyses)

Station number	Station	IDORG	Date	% Fines	TOC	*R. abronius* survival	*E. estuarius* survival	Sed/Water Inter Tox.	*M. edulis** porewater	ERM or PEL Exceedances	ERMQ	PELQ	ERL Exc.	TEL Exc.	Benthic Indices
10004.0	ARCATA BAY-MCDANIEL SL.	304	11/30/92	90.0	0.58	**66**	.	.	.	Cr, Ni	0.112	0.226	5	5	.
10005.0	RUSSIAN RIVER MOUTH SMW 280.0	305	2/25/93	48.0	0.99	.	92	.	NT (0.009)	n/a	n/a	n/a	n/a	n/a	.
10006.0	BODEGA BAY-MASON'S MARINA	306	2/25/93	98.0	2.00	**38**	.	.	.	Ni, ACE, FLA, PHN, PYR	0.175	0.335	8	9	.
10006.0	BODEGA BAY-MASON'S MARINA REP1	1350	6/14/94	96.7	3.44	**61**	.	.	.	n/a	n/a	n/a	n/a	n/a	.
10006.0	BODEGA BAY-MASON'S MARINA REP2	1351	6/14/94	94.1	3.50	**52**	.	.	.	n/a	n/a	n/a	n/a	n/a	.
10006.0	BODEGA BAY-MASON'S MARINA REP3	1352	6/14/94	98.5	3.58	75	.	.	.	n/a	n/a	n/a	n/a	n/a	.
10006.0	BODEGA BAY MASON'S MARINA	1682	12/6/96	98.9	3.34	.	**57**	NT	.	Ni	0.165	0.312	6	9	0.7
10007.0	BODEGA BAY-SPUD POINT MARINA	307	2/25/93	27.0	1.00	80	.	.	.	n/a	n/a	n/a	n/a	n/a	.
10007.0	BODEGA-SPUD POINT MARINA REP1	1353	6/13/94	19.8	0.43	86	.	.	.	n/a	n/a	n/a	n/a	n/a	.
10007.0	BODEGA-SPUD POINT MARINA REP2	1354	6/13/94	17.1	0.48	75	.	.	.	n/a	n/a	n/a	n/a	n/a	.
10007.0	BODEGA-SPUD POINT MARINA REP3	1355	6/13/94	15.2	0.35	91	.	.	.	n/a	n/a	n/a	n/a	n/a	.
10007.0	BODEGA-SPUD POINT MARINA	1683	12/5/96	16.7	0.64	.	**56**	T	.	Cr	0.095	0.187	3	2	0.6
10015.0	ARCATA BAY-MAD RIVER SL.	315	11/30/92	60.0	0.65	81	.	.	.	n/a	n/a	n/a	n/a	n/a	.
10016.0	ARCATA BAY-JOLLY GIANT SL.	316	11/30/92	61.0	0.75	78	.	.	.	Cr, Ni	0.153	0.301	5	10	.
10016.0	ARCATA BAY-JOLLY GIANT SL.	1580	4/18/96	79.5	2.68	.	80	.	.	Cr, Ni	0.188	0.362	6	10	0.5
10017.0	ARCATA BAY-EUREKA SL.	317	11/29/92	88.0	0.77	**67**	.	.	.	Cr, Ni	0.121	0.242	3	6	.
10017.0	ARCATA BAY-EUREKA SL.	1581	4/17/96	82.4	1.47	.	77	.	.	Cr, Ni	0.151	0.305	4	4	0.5
10018.0	H. BAY-UNION OIL PLANT	318	11/29/92	74.0	0.76	94	.	.	.	.	n/a	n/a	n/a	n/a	.
10018.0	H. BAY-UNION OIL PLANT	1584	4/17/96	79.3	1.71	.	81	.	.	Cr, Ni	0.164	0.360	4	6	0.6
10019.0	H. BAY-COAL/OIL/GAS PLANT	319	11/29/92	72.0	0.65	82	.	.	.	.	n/a	n/a	n/a	n/a	.
10019.0	H. BAY- COAL/OIL/GAS PLANT	1442	2/15/95	.	.	.	.	.	.	Cr, Ni, MNP2	n/a	n/a	4	6	.
10019.0	H. BAY-COAL/OIL/GAS PLANT	1583	4/17/96	72.1	1.73	.	94	.	.	Cr, Ni, lindane	0.143	0.482	3	6	0.9
10020.0	H. BAY-OLD PAC. LUMBER SITE	320	11/29/92	83.0	0.70	**70**	.	.	.	Cr, Ni	0.111	0.225	3	5	.
10020.0	H. BAY- OLD PAC. LUMBER SITE	1444	2/15/95	.	.	.	.	.	.	Cr, Ni, MNP2	n/a	n/a	4	7	.
10021.0	H. BAY-CHEVRON TERMINAL	321	11/29/92	50.0	0.56	76	.	.	.	Cr, Ni	0.114	0.237	3	5	.
10021.0	H. BAY-CHEVRON TERMINAL	1582	4/17/96	76.9	1.18	.	86	.	.	Cr, Ni, lindane	0.122	0.312	2	4	0.4
10022.0	HUMBOLDT BAY EUREKA SM.22	1448	2/15/95	.	.	.	.	.	.	Cr, Ni, MNP2	n/a	n/a	4	5	.
10023.0	H. BAY EUREKA STORM 23	323	11/29/92	67.0	1.00	**74**	.	.	.	Cr, Ni	0.137	0.274	5	6	.
10023.0	H. BAY EUREKA STORM 23	1579	4/17/96	36.1	1.82	.	92	.	.	Cr, Ni	0.129	0.268	3	5	0.9
10024.0	H. BAY FIELDS LANDING	324	11/29/92	75.0	0.60	86	.	.	.	n/a	n/a	n/a	n/a	n/a	.
10025.0	H. BAY HOOKTON SL.	325	11/29/92	94.0	0.54	80	.	.	.	Cr, Ni	0.107	0.220	3	6	.

* (interstitial unionized ammonia values for M. edulis (mg/L))

IV. CONCLUSIONS

Sediment quality guideline values were used for comparison with chemical concentrations found within the North Coast Region. Chromium, nickel, PAHs, and lindane were found most often to exceed ERM or PEL guideline values. Due to relatively low chemical concentrations within the region, ERL and TEL guideline values also were used to provide a more relevant comparison to the chemical composition of the North Coast Region. Copper, mercury, and zinc were found most often to exceed ERL and TEL guideline values. Although ERL and TEL values are considerably lower than ERM and PEL guidelines, multiple exceedances of ERL and TEL guidelines may indicate possible impacts on the relatively pristine environment of the North Coast Region.

The upper 90th percentiles, for sediment quotient ranges, for the North Coast Region were ERMQ>0.201 and PELQ>0.422. These values are significantly lower than other summary quotient values calculated for the state (i.e., San Diego 90th percentile ERMQ>0.85 and PELQ>1.29). Nevertheless, this is to be expected because the North Coast is not as heavily populated or industrialized as much of California. It should be noted that lower summary quotient values should not be used to infer that chemical pollution does not exist at discrete stations within the region. It should be noted that in contrast to the mitigation approach employed in more urban/industrial coastal regions, prevention and prohibition are the primary approaches employed in the protection of the relatively unpolluted coastal resources of California's North Coast. Therefore, any anthropogenic pollution is of great concern.

Tissue samples were collected from 10 stations and were analyzed for a variety of chemicals. Samples included both resident and transplanted mussels, oysters, crabs and polychaete worms. When applicable, relevant SMWP data were reviewed for chemical contamination and provided supplemental information about stations. In general, measured tissue concentrations of organic contaminants, such as pesticides, BTEX and TPH, were below detection limits, indicating relatively low levels of tissue contamination in the North Coast Region. However, some trace metals were detected in patterns similar to those found in sediments. Metals that were detected in both sediments and tissues included chromium, nickel, copper, and mercury.

Toxicity within the region was examined using a variety of bioassays. Twenty-nine of 31 stations sampled were tested using solid phase amphipod survival tests. Of these stations, 9 were toxic at least once using either *Eohaustorius* or *Rhepoxynius*; amphipod survival ranged from 38-99%. Stations shown to be toxic were scattered along the northern section of the Eureka waterfront, at the northern most station in Arcata Bay, and at the three marinas in Bodega Bay. All samples that were toxic, and had synoptic chemical analysis performed on them, had at least one ERM or PEL exceedance and at least 3 ERL or TEL exceedances. However, multiple regression analysis of data from throughout the region showed no significant relationships between amphipod toxicity and chemical concentrations.

Benthic community structure within the North Coast Region was analyzed using a Relative Benthic Index. The low and high ranges of the index indicate the relative "health" of a station compared to other stations within the data set and was used to classify stations as degraded, transitional and undegraded. The RBI for the North Coast ranged between 0.4 and 0.9 and none were classified as degraded. Nine stations were classified as having transitional benthic communities. These stations were scattered throughout the study area, particularly in Bodega Bay. The three undegraded stations were located on the central portion of the Eureka Waterfront. Due to the relatively low pollution levels in this region, and the small benthic community sample, size specific patterns or relationship between sediment chemistry and RBI values were not found.

Five stations, Porto Bodega Marina, Mason's Marina, H Street, J Street, and Humboldt Bay Coal, Gas and Oil Plant were distinguished as stations of concern or interest for the region. These stations exhibited greater level impacts of toxicity, greater chemical concentrations, or biological impacts compared to the remaining 31 stations analyzed in the region, and correspond with issues of regional concern.