Appendix I. Results of tests on the acute toxicity of major ion salts, gluconate salts, and mannitol to *Ceriodaphnia dubia* in various tests waters; see text for designations and formulations for test and culture waters; horizontal lines delineate experiments and experimental sets. For LC50s, "Probit" denotes exposure-effects curve calculation by probit method; "Midpoint" denotes geometric mean of confidence limits; parentheses denote confidence limits; see text for methodology. Except where noted, LC50s and component concentrations are nominal, and expected to be within +/-10% based on analysis of subset of test solutions

Set #	Test Chemical	Culture Water	Test Water	LC50 Method	LC50 mg/L (≥95% CL)	LC50 mM (≥95% CL)	Na mM	K mM	Ca mM	Mg mM	Cl mM	SO4 mM	Alk meq/L	pH	LC50 µS/cm	Osmol mOsM
1	NaCl	MHRW	0.33x MHRW	Midpoint	1860 (1740-1990)	31.8 (29.8-34.0)	32.2	0.02	0.116	0.16	31.8	0.28	0.38	7.40	3170	61.4
	NaCl	MHRW	MHRW	Probit	2060 (2020-2490)	35.3 (34.5-42.6)	36.5	0.05	0.348	0.50	35.4	0.84	1.14	7.90	3500	70.1
	Na_2SO_4	MHRW	0.33x MHRW	Midpoint	1860 (1730-2010)	13.1 (12.2-14.2)	26.6	0.02	0.116	0.16	0.02	13.4	0.38	7.60	2480	35.7
	Na_2SO_4	MHRW	MHRW	Probit	3060 (2810-3350)	21.5 (19.8-23.6)	44.2	0.05	0.348	0.50	0.05	22.4	1.14	8.00	3680	58.7
	NaCl	ALSW	ALSW	Midpoint	1680 (1560-1790)	28.7 (26.8-30.7)	28.9	0.04	0.364	0.17	28.9	0.16	0.86	7.95	2980	56.1
	NaCl	ALSW	0.33x ALSW	Probit	1560 (1420-1720)	26.7 (24.4-29.4)	26.8	0.01	0.121	0.06	26.8	0.05	0.29	7.55	2700	51.3
	NaCl	0.33x ALSW	0.33x ALSW	Probit	1770 (1580-1980)	30.2 (27.0-33.9)	30.3	0.01	0.121	0.06	30.3	0.05	0.29	7.55	3030	57.9
	NaCl	0.33x ALSW	ALSW	Probit	1940 (1780-2110)	33.2 (30.5-36.2)	33.5	0.04	0.364	0.17	33.4	0.16	0.86	7.90	3180	64.5
	NaCl	MHRW	MHRW	Probit	1810 (1680-1950)	31.0 (28.8-33.4)	32.1	0.05	0.348	0.50	31.0	0.84	1.14	8.00	3310	62.0
	NaCl	0.33x MHRW	0.33x MHRW	Midpoint	1640 (1530-1760)	28.1 (26.2-30.1)	28.4	0.02	0.116	0.16	28.1	0.28	0.38	7.60	2990	54.4
	NaCl	0.33x MHRW	0.33x MHRW	Probit	1560 (1440-1710)	26.7 (24.6-29.2)	27.1	0.02	0.116	0.16	26.8	0.28	0.38	7.70	2770	51.9
	NaCl	MHRW	0.33x MHRW	Probit	1480 (1340-1640)	25.3 (23.0-28.1)	25.7	0.02	0.116	0.16	25.4	0.28	0.38	7.70	2690	49.3
	$MgCl_2$	0.33x ALSW	0.33x ALSW	Probit	529 (457-612)	5.56 (4.80-6.43)	0.09	0.01	0.121	5.61	11.2	0.05	0.29	7.45	1230	15.9
	$MgCl_2$	ALSW	0.33x ALSW	Probit	667 (556-810)	7.01 (5.84-8.51)	0.09	0.01	0.121	7.06	14.1	0.05	0.29	7.45	1510	19.7
	$MgCl_2$	MHRW	0.33x MHRW	Probit	305 (271-338)	3.20 (2.85-3.55)	0.38	0.02	0.116	3.37	6.42	0.28	0.38	7.55	813	10.2
	$MgCl_2$	0.33x MHRW	0.33x MHRW	Probit	312 (192-417)	3.28 (2.02-4.38)	0.38	0.02	0.116	3.44	6.57	0.28	0.38	7.60	835	10.3
	NaCl	0.125x MHRW	0.125x MHRW	Midpoint	907 (828-993)	15.5 (14.2-17.0)	15.7	0.01	0.044	0.06	15.5	0.11	0.14	7.45	1750	31.0
	NaCl	0.125x MHRW	MHRW	Midpoint	1810 (1640-1990)	30.9 (28.1-34.0)	32.0	0.05	0.348	0.50	31.0	0.84	1.14	8.05	3260	61.9
	NaCl	MHRW	0.125x MHRW	Midpoint	1010 (940-1080)	17.2 (16.1-18.4)	17.3	0.01	0.044	0.06	17.2	0.11	0.14	7.35	1860	34.1
	NaCl	MHRW	MHRW	Probit	1710 (1580-1850)	29.3 (27.1-31.7)	30.4	0.05	0.348	0.50	29.4	0.84	1.14	8.05	3040	58.9

2	$MgCl_2$	0.125x MHRW	0.125x MHRW	Probit	69 (53-90)	0.72 (0.56-0.95)	0.14	0.01	0.044	0.79	1.46	0.11	0.14	7.25	229	3.3
	$MgCl_2$	MHRW	0.125x MHRW	Probit	116 (94-202)	1.22 (0.99-2.12)	0.14	0.01	0.044	1.28	2.44	0.11	0.14	7.25	351	8.8
	Na_2SO_4	0.125x MHRW	0.125x MHRW	Midpoint	671 (613-734)	4.72 (4.32-5.17)	9.59	0.01	0.044	0.06	0.01	4.83	0.14	7.40	1070	14.2
	Na_2SO_4	MHRW	0.125x MHRW	Midpoint	916 (829-1012)	6.45 (5.84-7.12)	13.0	0.01	0.044	0.06	0.01	6.55	0.14	7.20	1360	18.8
	$MgSO_4$	0.125x MHRW	0.125x MHRW	Probit	160 (137-184)	1.33 (1.14-1.53)	0.14	0.01	0.044	1.39	0.01	1.43	0.14	7.05	630	3.6
	$MgSO_4$	MHRW	0.125x MHRW	Probit	291 (264-321)	2.42 (2.19-2.67)	0.14	0.01	0.044	2.48	0.01	2.52	0.14	7.20	978	5.2
	KCl	0.125x MHRW	0.125x MHRW	Probit	177 (159-197)	2.37 (2.13-2.64)	0.14	2.38	0.044	0.06	2.38	0.11	0.14	7.40	389	5.9
	KCl	MHRW	0.125x MHRW	Midpoint	224 (204-245)	3.0 (2.74-3.29)	0.14	3.01	0.044	0.06	3.01	0.11	0.14	7.40	474	7.1
	$NaHCO_3$	0.125x MHRW	0.125x MHRW	Midpoint	1070 (1000-1140)	12.7 (11.9-13.6)	12.9	0.01	0.044	0.06	0.01	0.11	12.9	9.20	1110	23.8
	$NaHCO_3$	MHRW	0.125x MHRW	Midpoint	1000 (920-1090)	11.9 (10.9-13.0)	12.0	0.01	0.044	0.06	0.01	0.11	12.0	9.15	1060	22.4
	$CaCl_2$	0.125x MHRW	0.125x MHRW	Midpoint	1670 (1570-1780)	15.1 (14.2-16.1)	0.14	0.01	15.1	0.06	30.2	0.11	0.14	6.90	2930	41.2
	$CaCl_2$	MHRW	0.125x MHRW	Probit	1660 (1620-1940)	15.0 (14.6-17.5)	0.14	0.01	15.0	0.06	30.0	0.11	0.14	6.95	2920	40.9
3	KCl	MHRW	ALSW	Probit	351 (321-384)	4.71 (4.31-5.15)	0.28	4.75	0.364	0.17	4.92	0.16	0.86	7.95	781	11.1
	KCl	MHRW	MHRW	Probit	464 (395-568)	6.22 (5.30-7.62)	1.14	6.28	0.348	0.50	6.28	0.84	1.14	8.10	1140	15.7
	$CaCl_2$	MHRW	ALSW	Probit	1900 (1690-2170)	17.2 (15.2-19.5)	0.28	0.04	17.5	0.17	34.5	0.16	0.86	7.90	3220	46.9
	$CaCl_2$	MHRW	MHRW	Probit	1990 (1760-2260)	18.0 (15.9-20.4)	1.14	0.05	18.3	0.50	36.0	0.84	1.14	7.95	3250	50.3
	$MgCl_2$	MHRW	ALSW	Probit	861 (759-981)	9.04 (7.97-10.3)	0.28	0.04	0.364	9.21	18.3	0.16	0.86	7.85	1900	26.1
	$MgCl_2$	MHRW	MHRW	Probit	733 (615-895)	7.70 (6.46-9.40)	1.14	0.05	0.348	8.19	15.4	0.84	1.14	7.95	1730	24.2
	K_2SO_4	MHRW	ALSW	Midpoint	362 (339-386)	2.08 (1.95-2.22)	0.28	4.19	0.364	0.17	0.22	2.23	0.86	7.90	690	7.7
	K_2SO_4	MHRW	MHRW	Midpoint	606 (557-659)	3.48 (3.20-3.78)	1.14	7.01	0.348	0.50	0.05	4.32	1.14	8.05	1150	13.2
	Na_2SO_4	MHRW	ALSW	Midpoint	3410 (3150-3700)	24.0 (22.2-26.0)	48.3	0.04	0.364	0.17	0.22	24.18	0.86	7.90	4080	63.4
	Na_2SO_4	MHRW	MHRW	Midpoint	3260 (3060-3460)	22.9 (21.5-24.4)	47.0	0.05	0.348	0.50	0.05	23.76	1.14	8.00	3970	62.2
	$MgSO_4$	MHRW	ALSW	Probit	2040 (1880-2230)	16.9 (15.6-18.5)	0.28	0.04	0.364	17.1	0.22	17.10	0.86	7.85	2240	25.2
	$MgSO_4$	MHRW	MHRW	Probit	1990 (1830-2180)	16.6 (15.2-18.1)	1.14	0.05	0.348	17.1	0.05	17.4	1.14	8.00	2280	26.3
	$KHCO_3$	MHRW	ALSW	Probit	322 (306-340)	3.22 (3.06-3.40)	0.28	3.25	0.364	0.17	0.22	0.16	4.08	8.70	487	8.0

	$KHCO_3$	MHRW	MHRW	Probit	454 (407-507)	4.53 (4.07-5.06)	1.14	4.59	0.348	0.50	0.05	0.84	5.68	8.85	844	13.3
	$NaHCO_3$	MHRW	ALSW	Midpoint	1980 (1880-2090)	23.6 (22.3-24.9)	23.8	0.04	**0.187**[a]	0.17	0.22	0.16	24.4	9.35	1940	41.7
	$NaHCO_3$	MHRW	MHRW	Probit	1610 (1440-1700)	19.1 (17.2-20.3)	20.3	0.05	**0.141**[a]	0.50	0.05	0.84	20.3	9.25	1680	36.6
	NaCl	MHRW	ALSW	Probit	1910 (1730-2110)	32.7 (29.6-36.1)	33.0	0.04	0.364	0.17	32.9	0.16	0.86	8.00	3110	63.6
	NaCl	MHRW	MHRW	Midpoint	2000 (1830-2190)	34.3 (31.4-37.5)	35.4	0.05	0.348	0.50	34.4	0.84	1.14	8.10	3470	68.1
	$MgCO_3$	MHRW	ALSW	Midpoint	906 (859-956)	10.8 (10.2-11.3)	0.28	0.04	0.443	10.9	0.22	0.16	22.4	9.25	1160	23.2
	$MgCO_3$	MHRW	MHRW	Midpoint	892 (848-938)	10.6 (10.1-11.1)	1.14	0.05	0.426	11.1	0.05	0.84	22.3	9.25	1230	25.2
	$NaHCO_3$	MHRW	0.33x ALSW	Midpoint	1950 (1780-2130)	23.2 (21.2-25.4)	23.3	0.01	0.121	0.06	0.07	0.05	23.5	9.30	1800	40.3
	$NaHCO_3$	MHRW	3.0x ALSW	Probit	1710 (1560-1890)	20.4 (18.6-22.5)	21.2	0.12	**0.231**[a]	0.50	0.65	0.47	23.0	9.35	1800	39.1
	NaCl	MHRW	0.33x ALSW	Midpoint	1640 (1530-1760)	28.1 (26.2-30.0)	28.2	0.01	0.121	0.06	28.1	0.05	0.29	7.40	2700	53.9
	NaCl	MHRW	3.0x ALSW	Probit	1980 (1770-2160)	33.8 (30.2-36.9)	34.7	0.12	1.093	0.50	34.5	0.47	2.58	8.30	3490	69.1
	Na_2SO_4	MHRW	0.33x ALSW	Probit	1940 (1770-2100)	13.6 (12.5-14.8)	27.3	0.01	0.121	0.06	0.07	13.7	0.29	7.55	2480	36.5
	Na_2SO_4	MHRW	3.0x ALSW	Midpoint	3350 (3140-3570)	23.6 (22.1-25.2)	23.8	0.12	1.093	0.50	0.65	0.47	2.58	8.45	4090	65.4
	KCl	MHRW	0.33x ALSW	Midpoint	192 (180-205)	2.58 (2.41-2.75)	0.09	2.59	0.121	0.06	2.65	0.05	0.29	7.65	430	5.7
	KCl	MHRW	3.0x ALSW	Probit	481 (432-534)	6.45 (5.79-7.16)	0.85	6.57	1.093	0.50	7.10	0.47	2.58	8.45	1220	18.1
	$MgSO_4$	MHRW	0.33x ALSW	Midpoint	1590 (1440-1770)	13.2 (11.9-14.7)	0.09	0.01	0.121	13.3	0.07	13.3	0.29	7.45	1780	19.4
	$MgSO_4$	MHRW	3.0x ALSW	Midpoint	2860 (2620-3130)	23.8 (21.7-26.0)	0.85	0.12	1.093	24.3	0.65	24.2	2.58	8.35	2910	36.9
	$MgCl_2$	MHRW	0.33x ALSW	Probit	374 (344-409)	3.93 (3.61-4.30)	0.09	0.01	0.121	3.98	7.93	0.05	0.29	7.25	910	11.6
4	$MgCl_2$	MHRW	3.0x ALSW	Probit	1290 (1160-1490)	13.6 (12.2-15.7)	0.85	0.12	1.093	14.0	27.8	0.47	2.58	8.35	2760	40.8
	$CaCl_2$	ALSW	0.3x ALSW	Midpoint	1600 (1490-1710)	14.4 (13.4-15.4)	0.09	0.01	14.5	0.06	28.8	0.05	0.29	7.35	2870	38.7
	$CaCl_2$	ALSW	3.0x ALSW	Midpoint	2000 (1870-2130)	18.0 (16.9-19.2)	0.85	0.12	19.1	0.50	36.7	0.47	2.58	7.95	3510	52.4
	K_2SO_4	ALSW	0.3x ALSW	Probit	234 (215-254)	1.34 (1.23-1.46)	0.09	2.70	0.121	0.06	0.07	1.39	0.29	7.40	426	4.5
	K_2SO_4	ALSW	3.0x ALSW	Midpoint	518 (449-598)	2.97 (2.58-3.43)	0.85	6.06	1.093	0.50	0.65	3.44	2.58	8.50	1120	13.7
	$MgCO_3$	ALSW	0.3x ALSW	Midpoint	390 (365-417)	4.63 (4.33-4.95)	0.09	0.01	0.155	4.68	0.07	0.05	9.54	8.95	619	11.8
	$MgCO_3$	ALSW	3.0x ALSW	Midpoint	977 (916-1041)	11.6 (10.9-12.4)	0.85	0.12	**0.318**[a]	12.1	0.65	0.47	25.8	9.15	1280	28.9

	NaCl	ALSW	0.33x ALSW	Midpoint	1700 (1600-1800)	29.1 (27.4-30.9)	29.2	0.01	0.121	0.06	29.1	0.05	0.29	7.50	2960	55.7
	NaCl	ALSW	ALSW	Probit	1910 (1760-2070)	32.6 (30.1-35.4)	32.9	0.04	0.364	0.17	32.8	0.16	0.86	7.90	3320	63.5
	NaCl	ALSW	3.0x ALSW	Midpoint	2420 (2210-2660)	41.5 (37.8-45.5)	42.3	0.12	1.093	0.50	42.1	0.47	2.58	8.40	4110	83.1
	Na_2SO_4	ALSW	0.33x ALSW	Midpoint	1890 (1760-2020)	13.3 (12.4-14.2)	26.7	0.01	0.121	0.06	0.07	13.4	0.29	7.55	2480	35.7
	Na_2SO_4	ALSW	ALSW	Midpoint	3440 (3220-3670)	24.2 (22.6-25.8)	48.7	0.04	0.364	0.17	0.22	24.4	0.86	7.95	4000	63.8
	Na_2SO_4	ALSW	3.0x ALSW	Probit	3520 (3200-3880)	24.8 (22.5-27.3)	50.4	0.12	1.093	0.50	0.65	25.3	2.58	8.50	4280	68.5
	NaCl	MHRW	Low Ca:Mg	Midpoint	1580 (1420-1740)	27.0 (24.3-29.8)	27.2	0.04	0.075	0.46	27.2	0.15	0.86	7.90	2790	53.0
	NaCl	MHRW	HighCa:Mg	Midpoint	1920 (1790-2050)	32.8 (30.7-35.0)	33.1	0.04	0.475	0.06	33.0	0.15	0.86	7.90	3218	63.8
	$NaHCO_3$	MHRW	Low Ca:Mg	Midpoint	1540 (1440-1640)	18.3 (17.2-19.5)	18.6	0.04	0.075	0.46	0.22	0.15	19.2	9.25	1611	33.8
	$NaHCO_3$	MHRW	HighCa:Mg	Midpoint	2000 (1870-2140)	23.8 (22.2-25.5)	24.1	0.04	**0.200**[a]	0.06	0.22	0.15	24.6	9.30	1970	41.2
	Na_2SO_4	MHRW	Low Ca:Mg	Probit	1430 (1340-1560)	10.1 (9.41-11.0)	20.4	0.04	0.075	0.46	0.22	10.2	0.86	7.95	2027	28.6
5	Na_2SO_4	MHRW	HighCa:Mg	Midpoint	3140 (2940-3360)	22.1 (20.7-23.6)	44.5	0.04	0.475	0.06	0.22	22.3	0.86	8.00	3822	58.7
	KCl	MHRW	Low Ca:Mg	Midpoint	245 (229-263)	3.29 (3.07-3.53)	0.28	3.32	0.075	0.46	3.50	0.15	0.86	7.95	626	8.4
	KCl	MHRW	HighCa:Mg	Midpoint	281 (258-306)	3.77 (3.46-4.10)	0.28	3.81	0.475	0.06	3.99	0.15	0.86	7.95	663	9.3
	$MgSO_4$	MHRW	Low Ca:Mg	Probit	935 (857-1020)	7.77 (7.12-8.52)	0.28	0.04	0.075	8.23	0.22	7.92	0.86	7.90	1292	13.3
	$MgSO_4$	MHRW	HighCa:Mg	Midpoint	2060 (1920-2200)	17.1 (15.9-18.3)	0.28	0.04	0.475	17.1	0.22	17.2	0.86	7.95	2232	25.4
	$MgCl_2$	MHRW	Low Ca:Mg	Probit	223 (203-245)	2.34 (2.13-2.57)	0.28	0.04	0.075	2.80	4.90	0.15	0.86	7.90	654	8.5
	$MgCl_2$	MHRW	HighCa:Mg	Probit	935 (865-1015)	9.82 (9.09-10.7)	0.28	0.04	0.475	9.88	19.9	0.15	0.86	7.90	2041	28.1
	Na_2SO_4	MHRW	Low Cl:SO4	Midpoint	3430 (3200-3670)	24.1 (22.5-25.8)	48.5	0.04	0.365	0.17	0.04	24.3	0.86	8.00	4001	63.5
	Na_2SO_4	MHRW	HighCl:SO4	Probit	2990 (2770-3250)	21.1 (19.5-22.9)	42.4	0.04	0.365	0.17	0.40	21.1	0.86	7.95	3632	56.2
	K_2SO_4	MHRW	Low Cl:SO4	Midpoint	377 (355-401)	2.16 (2.04-2.30)	0.28	4.37	0.365	0.17	0.04	2.38	0.86	8.00	710	7.8
	K_2SO_4	MHRW	HighCl:SO4	Midpoint	349 (322-379)	2.00 (1.85-2.17)	0.28	4.04	0.365	0.17	0.40	2.04	0.86	8.00	669	7.6
	$MgSO_4$	MHRW	Low Cl:SO4	Midpoint	1980 (1800-2170)	16.4 (15.0-18.0)	0.28	0.04	0.365	16.6	0.04	16.6	0.86	7.90	2172	24.4
6	$MgSO_4$	MHRW	HighCl:SO4	Probit	1860 (1670-2080)	15.5 (13.9-17.3)	0.28	0.04	0.365	15.6	0.40	15.5	0.86	7.90	2097	23.4
	$NaHCO_3$	MHRW	Low Cl:SO4	Probit	1990 (1830-2180)	23.7 (21.8-26.0)	24.0	0.04	**0.190**[a]	0.17	0.04	0.22	24.6	9.35	1927	41.9

	$NaHCO_3$	MHRW	HighCl:SO4	Midpoint	2050 (1910-2200)	24.4 (22.8-26.1)	24.7	0.04	**0.166**[a]	0.17	0.40	0.04	25.2	9.35	2003	42.2
	NaCl	MHRW	Low Cl:SO4	Probit	1660 (1500-1840)	28.4 (25.7-31.5)	28.7	0.04	0.365	0.17	28.4	0.22	0.86	7.95	2816	55.5
	NaCl	MHRW	HighCl:SO4	Midpoint	1700 (1600-1800)	29.1 (27.4-30.9)	29.4	0.04	0.365	0.17	29.5	0.04	0.86	7.90	2921	57.0
	$MgCO_3$	MHRW	Low Cl:SO4	Probit	948 (874-1030)	11.2 (10.4-12.2)	0.28	0.04	0.447	11.4	0.04	0.22	23.4	9.20	1149	24.7
	$MgCO_3$	MHRW	HighCl:SO4	Midpoint	894 (836-957)	10.6 (9.92-11.4)	0.28	0.04	0.442	10.8	0.40	0.04	22.1	9.20	1131	23.8
	NaCl	ALSW	Low K ALSW	Midpoint	1920 (1800-2040)	32.8 (30.9-35.0)	33.2	0.01	0.364	0.17	33.`	0.16	0.86	7.85	3110	63.9
	NaCl	ALSW	High K ALSW	Probit	1980 (1830-2160)	34.0 (31.3-37.0)	34.0	0.26	0.364	0.17	34.1	0.16	0.86	7.85	3216	66.0
	Na_2SO_4	ALSW	Low K ALSW	Probit	2920 (2650-3230)	20.6 (18.7-22.8)	41.5	0.01	0.364	0.17	0.22	20.8	0.86	7.90	3351	54.9
	Na_2SO_4	ALSW	High K ALSW	Probit	3420 (3140-3730)	24.0 (22.1-26.3)	48.2	0.26	0.364	0.17	0.22	24.2	0.86	7.85	3858	63.5
	$NaHCO_3$	ALSW	Low K ALSW	Midpoint	2090 (1960-2220)	24.8 (23.3-26.5)	25.2	0.01	**0.139**[a]	0.17	0.22	0.16	25.7	9.35	1867	43.8
7	$NaHCO_3$	ALSW	High K ALSW	Midpoint	2220 (2010-2450)	26.4 (23.9-29.1)	26.5	0.26	**0.192**[a]	0.17	0.22	0.16	27.2	9.35	2007	46.2
	$CaCl_2$	ALSW	Low K ALSW	Probit	1870 (1690-2050)	16.9 (15.2-18.5)	0.33	0.01	17.2	0.17	34.0	0.16	0.86	7.90	3168	46.2
	$CaCl_2$	ALSW	High K ALSW	Probit	1710 (1550-1880)	15.4 (14.0-17.0)	0.08	0.26	15.8	0.17	31.1	0.16	0.86	7.85	2942	42.5
	$MgCl_2$	ALSW	Low K ALSW	Probit	970 (853-1103)	10.2 (8.96-11.6)	0.33	0.01	0.364	10.4	20.6	0.16	0.86	7.85	2022	29.1
	$MgCl_2$	ALSW	High K ALSW	Probit	912 (794-1050)	9.58 (8.34-11.0)	0.08	0.26	0.364	9.75	19.4	0.16	0.86	7.90	1968	27.5
	$MgSO_4$	ALSW	Low K ALSW	Probit	2030 (1790-2300)	16.8 (14.9-19.1)	0.33	0.01	0.364	17.0	0.22	17.0	0.86	7.95	2232	25.1
	$MgSO_4$	ALSW	High K ALSW	Probit	2240 (1980-2470)	18.6 (16.5-20.5)	0.08	0.26	0.364	18.8	0.22	18.8	0.86	8.00	2329	27.3
	KCl	MHRW	Low Alk ALSW	Midpoint	673 (632-718)	9.03 (8.48-9.63)	1.23	9.07	0.364	0.17	9.24	0.95	0.20	7.45	1433	20.2
	KCl	MHRW	High Alk ALSW	Probit	533 (487-584)	7.15 (6.53-7.83)	1.23	7.19	0.364	0.17	7.37	0.16	1.80	8.30	1188	17.6
	NaCl	MHRW	Low Alk ALSW	Probit	1860 (1690-2050)	31.8 (28.9-35.1)	33.1	0.04	0.364	0.17	32.1	0.95	0.20	7.40	3316	62.9
	NaCl	MHRW	High Alk ALSW	Probit	1970 (1790-2120)	33.8 (30.6-36.3)	35.0	0.04	0.364	0.17	34.0	0.16	1.80	8.25	3474	67.3
	$MgCl_2$	MHRW	Low Alk ALSW	Probit	899 (784-1008)	9.44 (8.23-10.6)	1.23	0.04	0.364	9.61	19.1	0.95	0.20	7.30	2076	27.9
8	$MgCl_2$	MHRW	High Alk ALSW	Midpoint	611 (571-654)	6.42 (6.00-6.87)	1.23	0.04	0.364	6.59	13.0	0.16	1.80	8.25	1542	21.0
	Na_2SO_4	MHRW	Low Alk ALSW	Probit	2960 (2700-3240)	20.8 (19.0-22.8)	42.9	0.04	0.364	0.17	0.22	21.8	0.20	7.45	3736	56.3
	Na_2SO_4	MHRW	High Alk ALSW	Probit	2830 (2560-3130)	19.9 (18.0-22.0)	41.0	0.04	0.364	0.17	0.22	20.1	1.80	8.25	3481	54.9

	$MgSO_4$	MHRW	Low Alk ALSW	Midpoint	2250 (2010-2510)	18.7 (16.7-20.8)	1.23	0.04	0.364	18.8	0.22	19.6	0.20	7.30	2475	28.2
	$MgSO_4$	MHRW	High Alk ALSW	Probit	2060 (1850-2450)	17.2 (15.4-20.3)	1.23	0.04	0.364	17.3	0.22	17.3	1.80	8.20	2263	27.1
	$MgCl_2$	MHRW	Low Alk ALSW	Probit	865 (754-985)	9.09 (7.92-10.4)	1.23	0.04	0.364	9.25	18.4	0.95	0.20	7.25	1986	27.0
	$MgCl_2$	MHRW	High Alk ALSW	Probit	623 (559-692)	6.54 (5.87-7.27)	1.23	0.04	0.364	6.71	13.3	0.16	1.80	8.10	1546	21.4
9	NaCl	ALSW	ALSW	Probit	2080 (1890-2280)	35.5 (32.3-39.1)	35.8	0.04	0.364	0.17	35.8	0.16	0.86	7.85	3342	68.9
	NaCl	ALSW	Low pH ALSW	Midpoint	2160 (1980-2370)	37.0 (33.9-40.5)	37.3	0.04	0.364	0.17	37.2	0.16	0.86	6.75	3459	71.9
	NaCl	ALSW	High pH ALSW	Probit	1880 (1730-2050)	32.2 (29.7-35.0)	32.5	0.04	0.364	0.17	32.4	0.16	0.86	8.20	3116	62.7
	$MgCl_2$	ALSW	ALSW	Probit	938 (841-1090)	9.85 (8.83-11.4)	0.28	0.04	0.364	10.0	19.9	0.16	0.86	7.85	2045	28.2
	$MgCl_2$	ALSW	Low pH ALSW	Probit	1040 (894-1230)	10.9 (9.39-13.0)	0.28	0.04	0.364	11.0	22.0	0.16	0.86	6.75	2057	31.0
	$MgCl_2$	ALSW	High pH ALSW	Probit	1130 (1040-1280)	11.9 (10.9-13.4)	0.28	0.04	0.364	12.0	23.9	0.16	0.86	8.50	2257	33.2
10	KCl	MHRW	1.6 Na ALSW	Probit	153 (141-167)	2.05 (1.89-2.24)	0.07	2.09	0.364	0.17	2.09	0.16	0.86	7.95	422	5.6
	KCl	MHRW	3 Na ALSW	Probit	241 (206-268)	3.23 (2.76-3.59)	0.13	3.27	0.364	0.17	3.34	0.16	0.86	8.00	599	8.0
	KCl	MHRW	10 Na ALSW	Midpoint	393 (360-429)	5.27 (4.83-5.75)	0.43	5.31	0.364	0.17	5.68	0.16	0.86	7.95	872	12.5
	KCl	MHRW	30 Na ALSW	Midpoint	513 (469-560)	6.88 (6.29-7.51)	1.30	6.92	0.364	0.17	8.16	0.16	0.86	7.95	1193	17.3
	KCl	MHRW	100 Na ALSW	Midpoint	644 (602-690)	8.64 (8.08-9.26)	4.35	8.68	0.364	0.17	13.0	0.16	0.86	7.95	1656	26.4
	KCl	MHRW	300 Na ALSW	Probit	752 (641-1360)	10.1 (8.60-18.2)	13.0	10.13	0.364	0.17	23.1	0.16	0.86	7.90	2616	45.3
11	$NaHCO_3$	ALSW	ALSW Aged	Midpoint	1660 (1531-1790)	19.7 (18.2-21.3)	20.0	0.04	**0.134**[b]	0.17	0.22	0.16	20.6	9.35	1670	35.5
	$NaHCO_3$	ALSW	3.0x ALSW Aged	Midpoint	1670 (1530-1810)	19.8 (18.3-21.5)	20.7	0.12	**0.126**[b]	0.50	0.65	0.47	22.4	9.35	1793	38.2
	$NaHCO_3$	ALSW	ALSW Fresh	Probit	2150 (1990-2320)	25.6 (23.7-27.6)	25.9	0.04	**0.207**[b]	0.17	0.22	0.16	26.4	9.15	2087	47.2
	$NaHCO_3$	ALSW	3.0x ALSW Fresh	Midpoint	2240 (2080-2420)	26.7 (24.8-28.8)	27.5	0.12	**0.139**[b]	0.50	0.65	0.47	29.3	9.10	2284	51.7
	$MgCO_3$	ALSW	ALSW Aged	Probit	767 (699-843)	9.10 (8.29-10.0)	0.28	0.04	0.431	9.27	0.22	0.16	19.0	9.30	1043	20.9
	$MgCO_3$	ALSW	3.0x ALSW Aged	Probit	507 (467-551)	6.01 (5.54-6.54)	0.85	0.12	**0.147**[b]	6.52	0.65	0.47	14.6	9.30	879	18.0
	$MgCO_3$	ALSW	ALSW Fresh	Midpoint	792 (736-853)	9.39 (8.73-10.1)	0.28	0.04	0.433	9.56	0.22	0.16	19.6	9.15	1054	23.8
	$MgCO_3$	ALSW	3.0x ALSW Fresh	Probit	635 (529-752)	7.53 (6.27-8.92)	0.85	0.12	**0.152**[b]	8.04	0.65	0.47	17.6	9.00	941	18.4
	NaCl	ALSW	ALSW	Midpoint	1950 (1840-2070)	33.4 (31.5-35.5)	33.7	0.04	0.364	0.17	33.6	0.16	0.86	7.85	3296	65.0

12	Mannitol	ALSW	ALSW	Probit	73.7 (66.2-82.1)	0.28	0.04	0.364	0.17	0.22	0.16	0.86	7.75		75.7
	NaGluconate	ALSW	ALSW	Midpoint	39.2 (36.8-42.0)	39.5	0.04	0.364	0.17	0.22	0.16	0.86	7.85	2188	76.1
	CaGluconate	ALSW	ALSW	Probit	32.9 (29.9-36.2)	0.28	0.04	33.3	0.17	0.22	0.16	0.86	7.80	2074	84.6
	MgGluconate	ALSW	ALSW	Probit	17.1 (14.3-18.7)	0.28	0.04	0.364	17.3	0.22	0.16	0.86	7.80	1638	50.6

[a] Ca concentrations are an extrapolation of Ca measurements to LC50 based on model for time dependence of Ca as a function of alkalinity; see Supplemental Material for more information

[b] Ca concentrations are a weighted average of measurements and 24 and 48 hours that bracket the LC50

SUPPLEMENTAL DATA

(ETCJ-Feb-16-00107**;** Mount DM, Erickson RJ, Highland TL, Hoff DJ, Jenson CT, Norberg-King TJ, Peterson KN, Polaske A, Wisniewski S. The Acute Toxicity Of Major Ion Salts To *Ceriodaphnia Dubia*: I. Influence Of Background Water Chemistry)

The concentration- and time- dependence of calcium concentrations in tests of the acute toxicity of $NaHCO_3$ and $MgCO_3$ to Ceriodaphnia dubia

For tests of the acute toxicity of $NaHCO_3$, $KHCO_3$, and $MgCO_3$, the solubility of calcite was exceeded at the LC50 for the Ca concentrations of all dilution waters used. However, significant precipitation of Ca did not always occur, and when it did occur calcite solubility was still exceeded at the end of the test. For $NaHCO_3$, measurements of [Ca] at the end of tests showed substantial reductions in [Ca] for any dilution water with [Ca] at or above 0.35 mM, which includes 1x ALSW, 3x ALSW, MHRW, and ALSW modified to have a higher Ca:Mg ratio, but not 1/8x, 1/3x ALSW, or ALSW modified to have a lower Ca:Mg ratio. For $MgCO_3$, reductions in [Ca] occurred only for the 3X ALSW dilution water ([Ca]≈1.1mM). For $KHCO_3$, no reductions in [Ca] occurred (tests were only in ALSW and MHRW and added CO_3 was less than for $NaHCO_3$ due to high K toxicity).

For [Ca] to remain above the level dictated by calcite solubility is not unexpected, given various constraints on precipitation, especially for anhydrous, crystalline phases. Nonetheless, to properly evaluate the effects of Ca on salt toxicity requires associating each measured LC50 with an appropriate [Ca], and thus requires addressing the time- and concentration-dependence of Ca for those tests in which substantial losses of Ca did occur.

Under our standard testing protocol, [Ca] was measured only in (a) the dilution water at the start of the test, (b) the lowest treatment with 100% mortality at 24 h, and (c) the treatment nearest the LC50 at 48 h. Such sampling is not sufficient to characterize the [Ca] at the measured LC50 when [Ca] varies markedly across time and treatments. Consequently, as noted in Methods and Materials section of the main paper, an additional 2x2x2 factorial experiment (Table 2, Experimental Set 11) was conducted, which addressed (a) the toxicity of both $NaHCO_3$ and $MgCO_3$, (b) in both 1x ALSW and 3x ALSW, and (c) with/without a 2-d aging period before adding test organisms.

In this experiment, additional replicate test chambers for some treatments allowed more intensive monitoring of [Ca] to characterize its dependence on salt concentration and time. Figure S1 shows the dependence of [Ca] on alkalinity and time in these tests. The times indicated on this figure are from test solution preparation, so range from 0 to 2 d for the unaged treatment and 2 to 4 d for the aged treatment.

For the $NaHCO_3$ tests in 1x ALSW (Figure S1A), loss of Ca increased markedly with both alkalinity and time. Concentrations in the unaged treatment were initially near nominal levels (0.36 mM). During the 1st day, significant precipitation did not occur at and below 23 meq/L alkalinity, but [Ca] was reduced 50% and 60% at 36 mM and 45 mM alkalinity, respectively. By the end of the 2nd day, precipitation also had occurred at 23 meq/L alkalinity and had increased at the higher alkalinities, with results being very similar for both the unaged and aged treatments. In the aged treatment, substantial precipitation at 11 meq/L alkalinity started on the 3rd day and continued during the 4th day; for higher alkalinities, some further precipitation occurred during the 3rd day, but had essentially stopped by the 4th.

For the $NaHCO_3$ tests in 3x ALSW (Figure S1B), precipitation was even more intense, so that even the "time zero" samples in the unaged treatment showed [Ca] below the nominal value of 1.09 mM. At the end of the 1st day, Ca losses ranged from 90% at 45 meq/L alkalinity to 60% at 11 meq/L. At the end of the 2nd day, Ca losses were again similar in the aged and unaged treatments, on average ranging from 93% at 45 meq/L alkalinity to 81% at 11 meq/L. The aged treatments showed little additional precipitation during the 3rd and 4th days at any of the tested alkalinities.

For these $NaHCO_3$ tests, a 3-parameter exponential relationship was fitted to [Ca] vs alkalinity for both 1 d and 2 d data (solid black lines) using least-squares nonlinear regression, resulting in the following equations:

1 d, 1X ALSW $$[\mathrm{Ca}] = 0.134 + 3.33 \cdot e^{-0.120 \cdot \mathrm{Alkalinity}}$$

2 d, 1X ALSW $$[\mathrm{Ca}] = 0.087 + 1.29 \cdot e^{-0.137 \cdot \mathrm{Alkalinity}}$$

1 d, 3X ALSW $$[\mathrm{Ca}] = 0.085 + 1.08 \cdot e^{-0.101 \cdot \mathrm{Alkalinity}}$$

2 d, 3X ALSW $[Ca] = 0.045 + 0.28 \cdot e^{-0.050 \cdot Alkalinity}$

The [Ca] to associate with the LC50s in these tests was calculated as the average of these 1 d and 2d relationships at the alkalinity for the LC50. This approximates the average [Ca] at the LC50 during the 2nd day of the test. This 2nd day average was used rather than an average over the whole test because ion toxicity was observed to be very rapid and thus should more reflect the higher toxicity associated with lower [Ca] near the end of the test rather than the lower toxicity that would be associated with the initial [Ca].

Using these regression relationships to directly estimate [Ca] in other $NaHCO_3$ tests is not appropriate because it would assume that precipitation was invariant across tests and would ignore the actual [Ca] measurements made in these tests. Rather, a more limited assumption was made that these relationships could inform the ***relative*** difference of [Ca] at one alkalinity to that at another alkalinity. This allowed the actual [Ca] measurements in these earlier tests (i.e., at the treatment nearest the LC50 at 2 d and the lowest treatment with 100% mortality at 1 d) to be adjusted to the alkalinity of the LC50, and then averaged to estimate a [Ca] to associate with the LC50. The relationships for 1X ALSW (Figure S1A) were also used for MHRW and the high Ca:Mg ratio tests, because the [Ca] for these waters were close to that for ALSW. Although this procedure entails some uncertainty, the adjustments from the measured [Ca] values were not great; for example, relative to the [Ca] measured at test termination in the treatment closest to the LC50, the estimated [Ca] associated with the LC50 was, on average, only 50% higher.

For the $MgCO_3$ tests in 1x ALSW (Figure S1C), precipitation was negligible across all alkalinities and times, and measured concentrations were always near nominal (0.39-0.46 mM). For durations up to 48 h, this was expected based on previous results, and these data extend this finding to 96 h. This apparent inhibitory effect of Mg on Ca precipitation (relative to the $NaHCO_3$ tests) likely reflects the higher solubility of Mg and mixed Ca/Mg carbonate minerals, and the effect of [Mg]>>[Ca] would thus have on the precipitation of $CaCO_3$. Regardless of the specific reason, these tests indicated that the nominal [Ca] can be associated with the LC50 for these tests, and confirmed the same conclusion for earlier $MgCO_3$ tests with similar or lower [Ca] in the dilution water.

For the $MgCO_3$ tests in 3x ALSW (Figure S1D), initial Ca concentrations were near nominal (1.12-1.19 mM) but did show substantial losses over the first 2 days of the test. However, this precipitation was anomalous in being greatest at the lowest alkalinity and virtually absent at the highest alkalinity. This again suggests an inhibitory effect of Mg that greatly complicates the precipitation of $CaCO_3$. Uncertainty and

variability regarding this precipitation are also indicated in Figure S1D by the two-fold disagreement in the measured [Ca] at 2 d for the unaged and aged treatments at the lower alkalinities. This precludes any meaningful modeling of these relationships. Within these tests, the [Ca] associated with the LC50 was calculated as a weighted average of the 1 d and 2 d [Ca] measurements at concentrations bracketing the LC50. For the one earlier test with $MgCO_3$ in 3x ALSW, the LC50 corresponded to an alkalinity of about 25 meq/L and the final [Ca] was 0.18 mM at the treatment nearest this LC50. Because Figure S1D indicates about a two-fold loss of Ca at this alkalinity from 1 d to 2 d, this measurement was increased by 50% to 0.27 mM as an approximate estimate of the [Ca] over the 2^{nd} day of the test, and the value to associate with the LC50.

1108 Figure S1. Relationship of Ca concentration to alkalinity in tests of the acute toxicity of $NaHCO_3$ and $MgCO_3$ to Ceriodaphnia dubia, in both 1X
1109 ALSW and 3X ALSW dilution waters and with/without 2-d aging of the test waters. For $NaHCO_3$, solid black lines denote 3-parameter
1110 exponential relationship fitted by least-squares regression.
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