Table 1 (Continued)

Table 1. Acute Toxicity of Atrazine to Aquatic Animals

Species	Method[a]	Chemical	Hardness (mg/L as $CaCO_3$)	LC50 or EC50 (µg/L)[b]	Species mean Acute Value (µg/L)	References
			FRESHWATER SPECIES			
Hydra, *Hydra* sp.	R,M	98.5%	48.9	3,000	3,000	Brooke 1990
Annelid, *Lumbriculus variegatus*	F,M	98.5%	67.3	>37,100	>37,100	Brooke 1990
Snail (adult), *Physa* sp.	R,M	98.5%	48.9	>34,100	>34,100	Brooke 1990
Cladoceran (<24 hr), *Ceriodaphnia dubia*	S,M	97%	52	>4,900	-	Jop 1991a
Cladoceran (<12 hr), *Ceriodaphnia dubia*	S,M	>99%	57.1	>30,000	>12,120	Oris et al. 1991
Cladoceran (<24 hr), *Daphnia magna*	S,U	94%	-	6,900	-	Macek et al. 1976
Cladoceran (<24 hr), *Daphnia magna*	S,U	96%	250	>39,000	-	Marchini et al. 1988
Cladoceran, *Daphnia magna*	F,M	79.6%	170	49,000	49,000	Putt 1991
Amphipod, *Hyalella azteca*	F,M	98.5%	67.4	14,700	14,700	Brooke 1990
Stonefly (nymph), *Acroneuria* sp.	F,M	98.5%	67.4	6,700	6,700	Brooke 1990
Midge (4th instar), *Chironomus tentans*	S,U	99%	80-100	>20,000[c]	-	Pape-Lindstrom and Lydy 1997
Midge (1st instar), *Chironomus tentans*	S,U	94%	-	720	720	Macek et al. 1976
Coho salmon (yearling), *Oncorhynchus kisutch*	R,M	80%	101	>18,000	>18,000	Lorz et al. 1979
Rainbow trout (juvenile), *Oncorhynchus mykiss*	S,U	98.8%	43	5,300	5,300	Beliles and Scott 1965
Brown trout, *Salmo trutta*	R,U	-	11	27,000	27,000	Grande et al. 1994

Table 1 (Continued)

Table 1. Acute Toxicity of Atrazine to Aquatic Animals

Species	Method[a]	Chemical	Hardness (mg/L as $CaCO_3$)	LC50 or EC50 (µg/L)[b]	Species mean Acute Value (µg/L)	References
Brook trout (juvenile), *Salvelinus fontinalis*	F,U	94%	-	6,300	6,300	Macek et al. 1976
Goldfish (juvenile), *Carassius auratus*	S,U	98.8%	43	60,000	60,000	Beliles and Scott 1965
Fathead minnow *Pimephales promelas*	R,U	94%	-	15,000	-	Macek et al. 1976
Fathead minnow (juvenile) *Pimephales promelas*	S,M	97%	52	>4,900	-	Jop 1991d
Fathead minnow, *Pimephales promelas*	F,M	97.1%	20-40	20,000	20,000	Dionne 1992
Channel catfish (sac fry), *Ictalurus punctatus*	S,U	80%	78	>10,000	>10,000	Jones 1962
Bluegill (juvenile), *Lepomis macrochirus*	S,U	98.8%	43	24,000	-	Beliles and Scott 1965
Bluegill (juvenile), *Lepomis macrochirus*	F,U	94%	-	>8,000	>8,000	Macek et al. 1976
Largemouth bass (fry), *Micropterus salmoides*	S,U	80%	78	>10,000	>10,000	Jones 1962

Species	Method[a]	Chemical	Salinity (g/kg)	LC50 or EC50 (µg/L)[b]	Species mean Acute Value (µg/L)	References
			SALTWATER SPECIES			
Eastern oyster (embryo/larval), *Crassostrea virginica*	S,U	97.4%	16	>30,000	>30,000	Ward and Ballantine 1985

Table 1 (Continued)

Species	Method[a]	Chemical	Salinity (g/kg)	LC50 or EC50 (µg/L)[b]	Species mean Acute Value (µg/L)	References
Copepod (nauplius), *Eurytemora affinis*	S,M	97.1%	5	500	-	Hall et al. 1994a,b
Copepod (nauplius), *Eurytemora affinis*	S,M	97.1%	15	2,600	-	Hall et al. 1994a,b
Copepod (nauplius), *Eurytemora affinis*	S,M	97.1%	25	13,200	2,579	Hall et al. 1994a,b
Copepod (adult), *Acartia clausii*	R,U	70%	6	7,925	7,925	Thursby et al. 1990
Copepod, *Acartia tonsa*[d]	S,U	97.4%	20	94	-	Ward and Ballantine 1985
Copepod (adult), *Acartia tonsa*	R,M	70%	31-32	210.1	-	Thursby et al. 1990
Copepod (adult), *Acartia tonsa*	R,M	70%	31	91.73	-	Thursby et al. 1990
Copepod (adult), *Acartia tonsa*	F,M	97.1%	30-34	4,300	4,300	McNamara 1991a
Mysid, *Americamysis bahia*	F,M	97.4%	20	1,000	-	Ward and Ballantine 1985
Mysid, *Americamysis bahia*	F,M	97.1%	32	5,400	2,324	Machado 1994
Pink shrimp, *Penaeus duorarum*[d]	S,U	97.4%	26	6,900	6,900	Ward and Ballantine 1985
Grass shrimp, *Palaemonetes pugio*[d]	S,U	97.4%	26	9,000	9,000	Ward and Ballantine 1985
Fiddler crab, *Uca pugilator*[d]	S,U	97.4%	26	>29,000	>29,000	Ward and Ballantine 1985
Sheepshead minnow (larva) *Cyprinodon variegatus*	S,M	97.1%	5	16,200	-	Hall et al. 1994a,b
Sheepshead minnow (larva), *Cyprinodon variegatus*	S,M	97.1%	15	2,300	-	Hall et al. 1994a,b
Sheepshead minnow (larva), *Cyprinodon variegatus*	S,M	97.1%	25	2,000	4,208	Hall et al. 1994a,b

Table 1 (Continued)

Species	Method[a]	Chemical	Salinity (g/kg)	LC50 or EC50 (µg/L)[b]	Species mean Acute Value (µg/L)	References
Sheepshead minnow, *Cyprinodon variegatus*	F,M	97.4%	13	>16,000[c]	-	Ward and Ballantine 1985
Sheepshead minnow, *Cyprinodon variegatus*	F,M	97.1%	32	13,000[c]	-	Machado 1994b
Spot, *Leiostomus xanthurus*[d]	S,U	97.4%	12	8,500	8,500	Ward and Ballantine 1985

[a] S = static; R = renewal; F = flow-through; M = measured; U = unmeasured.
[b] Results are expressed as atrazine, not as the chemical.
[c] Not used in calculations because data are available for a more sensitive life stage.
[d] Test organisms collected from the field.

Table 2a (Continued)

Table 2a. Chronic Toxicity of Atrazine to Aquatic Animals

Species	Test[a]	Chemical	Hardness (mg/L as $CaCO_3$)	Chronic Limits (µg/L)[b]	Chronic Value (µg/L)	References
			FRESHWATER SPECIES			
Cladoceran, *Ceriodaphnia dubia*	LC	>99%	57.1	2,500-5,000	3,536	Oris et al. 1991
Cladoceran, *Ceriodaphnia dubia*	LC	>99%	57.1	2,500-5,000	3,536	Oris et al. 1991
Cladoceran, *Ceriodaphnia dubia*	LC	97%	52	1,200-2,500	1,732	Jop 1991b
Cladoceran, *Daphnia magna*	LC	94%	32.2	140-250	187.1	Macek et al. 1976
Midge, *Chironomus tentans*	LC	94%	43.0	110-230	159.1	Macek et al. 1976
Rainbow trout *Oncorhynchus mykiss*	ELS	Technical	50.0	1,100-3,800	2,045	Whale et al. 1994
Brook trout, *Salvelinus fontinalis*	LC	94%	35.7	65-120	88.32	Macek et al. 1976
Fathead minnow, *Pimephales promelas*	LC	94%	36.2	213-870	430.5	Macek et al. 1976
Fathead minnow, *Pimephales promelas*	LC	97.1%	24-36	250-460	339.1	Dionne 1992
Bluegill, *Lepomis macrochirus*	LC	94%	33.9	95-500	217.9	Macek et al. 1976

Species	Test[a]	Chemical	Salinity (g/kg)	Chronic Limits (µg/L)[b]	Chronic Value (µg/L)	References
			SALTWATER SPECIES			
Copepod, *Eurytemora affinis*	LC	97.1%	5	12,250-17,500	14,640	Hall et al. 1995
Copepod, *Eurytemora affinis*	LC	97.1%	15	17,500-25,000	20,920	Hall et al. 1995

Table 2a (Continued)

Species	Test[a]	Chemical	Salinity (g/kg)	Chronic Limits (µg/L)[b]	Chronic Value (µg/L)	References
Copepod, *Eurytemora affinis*	LC	97.1%	25	4,200-6,000	5,020	Hall et al. 1995
Mysid, *Americamysis bahia*	LC	97.4%	20	80-190	123.3	Ward and Ballantine 1985
Sheepshead minnow, *Cyprinodon variegatus*	ELS	97.4%	13	1,900-3,400	2,542	Ward and Ballantine 1985

[a] LC = Life-cycle or partial life-cycle; ELS = early life-stage.
[b] Results are based on measured concentrations of atrazine.

Table 2b. Acute-Chronic Ratios

Species	Hardness (mg/L as $CaCO_3$)	Acute Value (µg/L)[a]	Chronic Value (µg/L)	Ratio	Reference
Cladoceran, *Ceriodaphnia dubia*	57.1	>30,000	3,536	>8.484	Oris et al. 1991
Cladoceran, *Ceriodaphnia dubia*	52	>4,900	1,732	>2.829	Jop 1991a,b
Cladoceran, *Daphnia magna*	32.2	6,900	187.1	36.88	Macek et al. 1976
Midge, *Chironomus tentans*	43.0	720	159.1	4.525	Macek et al. 1976
Brook trout, *Salvelinus fontinalis*	35.7	6,300	88.32	71.33	Macek et al. 1976
Fathead minnow, *Pimephales promelas*	36.2	15,000	430.5	34.84	Macek et al. 1976
Fathead minnow, *Pimephales promelas*	24-36	20,000	339.1	58.98	Dionne 1992
Bluegill, *Lepomis macrochirus*	33.9	>8,000	217.9	>36.71	Macek et al. 1976
Copepod, *Eurytemora affinis*	5[b]	500	14,640	0.0342	Hall et al. 1994a,b; 1995
Copepod, *Eurytemora affinis*	15[b]	2,600	20,920	0.1243	Hall et al. 1994a,b; 1995
Copepod, *Eurytemora affinis*	25[b]	13,200	5,020	2.629	Hall et al. 1994a,b; 1995
Mysid, *Americamysis bahia*	20[b]	1,000	123.3	8.110	Ward and Ballantine 1985
Sheepshead minnow, *Cyprinodon variegatus*	13[b]	>16,000	2,542	>6.294	Ward and Ballantine 1985

[a] From Table 1.
[b] Salinity expressed as g/kg.

Table 3. Ranked Genus Mean Acute Values with Species Mean Acute-Chronic Ratios

Rank[a]	Genus Mean Acute Value (µg/L)	Species	Species Mean Acute Value (µg/L)[b]	Species Mean Acute-Chronic Ratio[c]
		FRESHWATER SPECIES		
16	60,000	Goldfish, *Carassius auratus*	60,000	-
15	49,000	Cladoceran, *Daphnia magna*	49,000	36.88
14	>37,100	Annelid, *Lumbriculus variegatus*	>37,100	-
13	>34,100	Snail, *Physa* sp.	>34,100	-
12	27,000	Brown trout, *Salmo trutta*	27,000	-
11	20,000	Fathead minnow, *Pimephales promelas*	20,000	45.33
10	14,700	Amphipod, *Hyalella azteca*	14,700	-
9	>12,120	Cladoceran *Ceriodaphnia dubia*	>12,120	>4.899
8	>10,000	Channel catfish, *Ictalurus punctatus*	>10,000	-
7	>10,000	Largemouth bass, *Micropterus salmoides*	>10,000	-
6	9,767	Coho salmon, *Oncorhynchus kisutch*	>18,000	-
	-	Rainbow Trout, *Oncorhynchus mykiss*	5300	-
5	>8,000	Bluegill, *Lepomis macrochirus*	>8,000	>36.71
4	6,700	Stonefly, *Acroneuria* sp.	6,700	-
3	6,300	Brook trout, *Salvelinus fontinalis*	6,300	71.33

Table 3 (continued)

Rank[a]	Genus Mean Acute Value (µg/L)	Species	Species Mean Acute Value (µg/L)[b]	Species Mean Acute-Chronic Ratio[c]
2	3,000	Hydra, *Hydra* sp.	3,000	-
1	720	Midge, *Chironomus tentans*	720	4.525
		SALTWATER SPECIES		
9	>30,000	Eastern oyster, *Crassostrea virginica*	>30,000	-
8	>29,000	Fiddler crab, *Uca pugilator*	>29,000	-
7	9,000	Grass shrimp, *Palaemonetes pugio*	9,000	-
6	8,500	Spot, *Leiostomus xanthurus*	8,500	-
5	6,900	Pink shrimp, *Penaeus duorarum*	6,900	-
4	5,838	Copepod, *Acartia clausii*	7,925	-
		Copepod, *Acartia tonsa*	4,300	-
3	4,208	Sheepshead minnow, *Cyprinodon variegatus*	4,208	>6.294
2	2,579	Copepod, *Eurytemora affinis*	2,579	2.629
1	2,324	Mysid, *Americamysis bahia*	2,324	8.110

[a] Ranked from most resistant to most sensitive based on Genus Mean Acute Value. Inclusion of "greater than" value does not necessarily imply a true ranking, but does allow use of all genera for which data are available so that the Final Acute Value is not unnecessarily lowered.
[b] From Table 1.
[c] From Table 2b.

Table 3 (continued)

Fresh Water

Final Acute Value = 702.4 g/L

Criterion Maximum Concentration = (702.4 g/L)/2 = 351.2 g/L

Final Fish Acute-Chronic Ratio = 56.86

Fish Chronic Value = 12.35 g/L

Final Invertebrate Acute-Chronic Ratio = 7.723

Invertebrate Chronic Value = 90.95 µg/L

Salt Water

Final Acute Value = 1519 µg/L

Criterion Maximum Concentration = (1519 µg/L)/2 = 759.5 µg/L

Final Fish Acute-Chronic Ratio = 56.86

Fish Chronic Value = 26.71 µg/L

Final Invertebrate Acute-Chronic Ratio = 7.723

Invertebrate Chronic Value = 196.7 µg/L

Table 4. Toxicity of Atrazine to Aquatic Plants

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration (days)	Effect	Concentration (µg/L)[a]	Reference
				FRESHWATER SPECIES		
Green alga, *Chlamydomonas reinhardtii*	-	-	4	EC50 (cell number)	51	Schafer et al. 1993
Green alga, *Chlamydomonas reinhardtii*	-	-	7	EC50 (cell number)	21	Schafer et al. 1993
Green alga, *Chlamydomonas reinhardtii*	-	-	10	EC50 (cell number)	10.2	Schafer et al. 1993
Green alga, *Chlamydomonas reinhardtii*	-	-	4	NOEC (growth inhibition)	3.4	Schafer et al. 1994
Green alga, *Chlamydomonas reinhardtii*	-	-	7	NOEC (growth inhibition)	5.1	Schafer et al. 1994
Green alga, *Chlamydomonas reinhardtii*	-	-	10	NOEC (growth inhibition)	3.7	Schafer et al. 1994
Green alga, *Selenastrum capricornutum*	-	-	4	NOEC (cell number, biomass)	0.5	Univ. of Mississippi 1990
Green alga, *Selenastrum capricornutum*	-	-	4	NOEC (chlorophyll a, pheophytin a)	10	Univ. of Mississippi 1990
Green alga, *Selenastrum capricornutum*	-	-	4	LOEC (cell density, biomass)	1.0	Univ. of Mississippi 1990
Green alga, *Selenastrum capricornutum*	-	-	4	LOEC (chlorophylla, pheophytin a)	100	Univ. of Mississippi 1990
Green alga, *Selenastrum capricornutum*	-	-	4	EC50 (cell number)	4	Univ. of Mississippi 1990
Green alga, *Selenastrum capricornutum*	-	-	4	EC50 (pheophytin a)	20	Univ. of Mississippi 1990
Green alga, *Selenastrum capricornutum*	-	-	4	EC50 (chlorophyll a)	150	Univ. of Mississippi 1990
Green alga, *Selenastrum capricornutum*	99.1%	-	4	EC50 (cell number)	128.2	Gala and Giesy 1990

Table 4 (Continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration (days)	Effect	Concentration (µg/L)[a]	Reference
Green alga, *Selenastrum capricornutum*	97.0%	-	4	NOEC (cell number)	76	Hoberg 1991a
Green alga, *Selenastrum capricornutum*	97.0%	-	4	LOEC (cell number)	130	Hoberg 1991a
Green alga, *Selenastrum capricornutum*	97.0%	-	4	EC10 (cell number)	90	Hoberg 1991a
Green alga, *Selenastrum capricornutum*	97.0%	-	4	EC50 (cell number)	130	Hoberg 1991a
Green alga, *Selenastrum capricornutum*	97.0%	-	4	EC90 (cell number)	190	Hoberg 1991a
Green alga, *Selenastrum capricornutum*	97.1%	-	5	NOEC (cell number)	16	Hoberg 1993a
Green alga, *Selenastrum capricornutum*	97.1%	-	5	EC10 (cell number)	26	Hoberg 1993a
Green alga, *Selenastrum capricornutum*	97.1%	-	5	LOEC (cell number)	31	Hoberg 1993a
Green alga, *Selenastrum capricornutum*	97.1%	-	5	EC50 (cell number)	55	Hoberg 1993a
Green alga, *Selenastrum capricornutum*	97.1%	-	5	EC90 (cell number)	120	Hoberg 1993a
Duckweed, *Lemna gibba*	97%	-	7	EC50 (frond production)	180	Hoberg 1991b
Duckweed, *Lemna gibba*	97.1%	-	14	NOEC (frond number)	<3.4	Hoberg 1993b
Duckweed, *Lemna gibba*	97.1%	-	14	LOEC (frond number)	3.4	Hoberg 1993b
Duckweed, *Lemna gibba*	97.1%	-	14	EC10 (frond number)	6.2	Hoberg 1993b
Duckweed, *Lemna gibba*	97.1%	-	14	NOEC (frond biomass)	7.7	Hoberg 1993b

Table 4 (Continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration (days)	Effect	Concentration (µg/L)[a]	Reference
Duckweed, *Lemna gibba*	97.1%	-	14	EC10 (frond biomass)	12	Hoberg 1993b
Duckweed, *Lemna gibba*	97.1%	-	14	LOEC (frond biomass)	17	Hoberg 1993b
Duckweed, *Lemna gibba*	97.1%	-	14	EC50 (frond number)	37	Hoberg 1993b
Duckweed, *Lemna gibba*	97.1%	-	14	EC50 (frond biomass)	45	Hoberg 1993b
Duckweed, *Lemna gibba*	97.1%	-	14	EC90 (frond biomass)	170	Hoberg 1993b
Duckweed, *Lemna gibba*	97.1%	-	14	EC90 (frond number)	220	Hoberg 1993b
Duckweed, *Lemna gibba*	97.4%	-	14	EC10 (frond number)	2.2[b]	Hoberg 1993c
Duckweed, *Lemna gibba*	97.4%	-	14	EC10 (frond biomass)	4.2[b]	Hoberg 1993c
Duckweed, *Lemna gibba*	97.4%	-	14	NOEC (frond number & biomass)	8.3[b]	Hoberg 1993c
Duckweed, *Lemna gibba*	97.4%	-	14	LOEC (frond number & biomass)	18[b]	Hoberg 1993c
Duckweed, *Lemna gibba*	97.4%	-	14	LOEC (frond biomass)	22[b]	Hoberg 1993c
Duckweed, *Lemna gibba*	97.4%	-	14	EC50 (frond number)	50[b]	Hoberg 1993c
Duckweed, *Lemna gibba*	97.4%	-	14	EC90 (frond number)	98[b]	Hoberg 1993c
Duckweed, *Lemna gibba*	97.4%	-	14	EC90 (frond biomass)	110[b]	Hoberg 1993c
Duckweed, *Lemna minor*	-	-	14	NOEC (biomass)	10	Univ. of Mississippi 1990

Table 4 (Continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration (days)	Effect	Concentration (µg/L)[a]	Reference
Duckweed, *Lemna minor*	-	-	14	LOEC (mature frond production)	10	Univ. of Mississippi 1990
Duckweed, *Lemna minor*	-	-	14	LOEC (biomass)	100	Univ. of Mississippi 1990
Duckweed, *Lemna minor*	-	-	14	EC50 (biomass)	8,700	Univ. of Mississippi 1990
Duckweed, *Lemna minor*	98%	-	10	EC50 (frond number)	56	Kirby and Sheahan 1994
Duckweed, *Lemna minor*	98%	-	10	EC50 (fresh weight)	60	Kirby and Sheahan 1994
Duckweed, *Lemna minor*	98%	-	10	EC50 (chlorophyll)	62	Kirby and Sheahan 1994
Elodea, *Elodea canadensis*	-	-	10	NOEC (biomass)	10[c]	Univ. of Mississippi 1990
Elodea, *Elodea canadensis*	-	-	10	LOEC (biomass)	100[c]	Univ. of Mississippi 1990
Elodea, *Elodea canadensis*	-	-	10	LOEC (mature frond production)	10[c]	Univ. of Mississippi 1990
Elodea, *Elodea canadensis*	-	-	10	EC50 (biomass)	1,200[c]	Univ. of Mississippi 1990
Elodea, *Elodea canadensis*	-	-	10	LOEC (biomass)	100[d]	Univ. of Mississippi 1990
Elodea, *Elodea canadensis*	-	-	10	EC50 (biomass)	25,400[d]	Univ. of Mississippi 1990

Species	Chemical	Salinity g/kg	Duration (days)	Effect	Concentration (µg/L)[a]	Reference
SALTWATER SPECIES						
Diatom, *Skeletonema costatum*	-	30	2	EC50 (growth)	265	Walsh 1983
Green alga, *Chlorella* sp.	99.7%	30	3	EC50 (growth)	140	Mayer 1987

Table 4 (Continued)

Species	Chemical	Salinity g/kg	Duration (days)	Effect	Concentration (µg/L)[a]	Reference
Green alga, *Neochloris* sp.	99.7%	30	3	EC50 (growth)	82	Mayer 1987
Green alga, *Platymonas* sp.	99.7%	30	3	EC50 (growth)	100	Mayer 1987
Red alga, *Porphyridium cruentum*	99.7%	30	3	EC50 (growth)	79	Mayer 1987
Redheadgrass pondweed, *Potamogeton perfoliatus*	96.4%	9	28	IC50 (photosynthesis)	55	Kemp et al. 1982b, 1983; Kemp et al. 1985
Redheadgrass pondweed, *Potamogeton perfoliatus*	96.4%	9	35	IC50 (final biomass)	30	Kemp et al. 1982b, 1983; Kemp et al. 1985
Sago pondweed, *Potamogeton pectinatus*	97.1%	1	28	NOEC (Dry weight)	15	Hall et al. 1997
Sago pondweed, *Potamogeton pectinatus*	97.1%	1	28	NOEC (Wet weight)	15	Hall et al. 1997
Sago pondweed, *Potamogeton pectinatus*	97.1%	1	28	NOEC (Rhizome tip Mass)	30	Hall et al. 1997
Sago pondweed, *Potamogeton pectinatus*	97.1%	1	28	LOEC (Dry weight)	30	Hall et al. 1997
Sago pondweed, *Potamogeton pectinatus*	97.1%	1	28	LOEC (Wet weight)	30	Hall et al. 1997
Sago pondweed, *Potamogeton pectinatus*	97.1%	1	28	LOEC (Rhizome tip Mass)	300	Hall et al. 1997
Sago pondweed, *Potamogeton pectinatus*	97.1%	1	28	Chronic value (Dry weight)	21.2	Hall et al. 1997
Sago pondweed, *Potamogeton pectinatus*	97.1%	1	28	Chronic value (Wet weight)	21.1	Hall et al. 1997
Sago pondweed, *Potamogeton pectinatus*	97.1%	1	28	Chronic value (Rhizome tip mass)	94.9	Hall et al. 1997
Sago pondweed, *Potamogeton pectinatus*	97.1%	6	28	NOEC (Dry weight)	15	Hall et al. 1997

Table 4 (Continued)

Species	Chemical	Salinity g/kg	Duration (days)	Effect	Concentration (µg/L)[a]	Reference
Sago pondweed, *Potamogeton pectinatus*	97.1%	6	28	NOEC (Wet weight)	15	Hall et al. 1997
Sago pondweed, *Potamogeton pectinatus*	97.1%	6	28	NOEC (Rhizome tip mass)	30	Hall et al. 1997
Sago pondweed, *Potamogeton pectinatus*	97.1%	6	28	LOEC (Dry weight)	30	Hall et al. 1997
Sago pondweed, *Potamogeton pectinatus*	97.1%	6	28	LOEC (Wet weight)	30	Hall et al. 1997
Sago pondweed, *Potamogeton pectinatus*	97.1%	6	28	LOEC (Rhizome tip mass)	300	Hall et al. 1997
Sago pondweed, *Potamogeton pectinatus*	97.1%	6	28	Chronic value (Dry weight)	21.2	Hall et al. 1997
Sago pondweed, *Potamogeton pectinatus*	97.1%	6	28	Chronic value (Wet weight)	21.2	Hall et al. 1997
Sago pondweed, *Potamogeton pectinatus*	97.1%	6	28	Chronic value (Rhizome tip mass)	94.9	Hall et al. 1997
Sago pondweed, *Potamogeton pectinatus*	97.1%	12	28	NOEC (Dry weight)	7.5	Hall et al. 1997
Sago pondweed, *Potamogeton pectinatus*	97.1%	12	28	NOEC (Wet weight)	15	Hall et al. 1997
Sago pondweed, *Potamogeton pectinatus*	97.1%	12	28	NOEC (Rhizome tip mass)	30	Hall et al. 1997
Sago pondweed, *Potamogeton pectinatus*	97.1%	12	28	LOEC (Dry weight)	15	Hall et al. 1997
Sago pondweed, *Potamogeton pectinatus*	97.1%	12	28	LOEC (Wet weight)	30	Hall et al. 1997
Sago pondweed, *Potamogeton pectinatus*	97.1%	12	28	LOEC (Rhizome tip mass)	300	Hall et al. 1997

Table 4 (Continued)

Species	Chemical	Salinity g/kg	Duration (days)	Effect	Concentration (µg/L)[a]	Reference
Sago pondweed, *Potamogeton pectinatus*	97.1%	12	28	Chronic value (Dry weight)	10.6	Hall et al. 1997
Sago pondweed, *Potamogeton pectinatus*	97.1%	12	28	Chronic value (Wet weight)	21.2	Hall et al. 1997
Sago pondweed, *Potamogeton pectinatus*	97.1%	12	28	Chronic value (Rhizome tip mass)	94.9	Hall et al. 1997
Sago pondweed, *Potamogeton pectinatus*	97.1%	1-12	28	Chronic value (Dry weight)	5.3	Hall et al. 1997
Eurasian water milfoil, *Myriophyllum spicatum*	96.4%	9	28	IC50 (photosynthesis)	117	Kemp et al. 1982b, 1983; Kemp et al. 1985
Eurasian water milfoil, *Myriophyllum spicatum*	96.4%	9	35	IC50 (final biomass)	25	Kemp et al. 1982b, 1983; Kemp et al. 1985
Eelgrass, *Zostera marina*	-	22	21	LC50	540	Delistraty and Hershner 1984
Eelgrass, *Zostera marina*	-	20	21	LC50	100	Delistraty and Hershner, 1984
Eelgrass, *Zostera marina*	-	20	21	LC50	365	Delistraty and Hershner, 1984
Eelgrass, *Zostera marina*	-	19	21	LC50	367	Delistraty and Hershner, 1984

[a] Effect concentrations are based upon measured concentrations of atrazine during the exposure period.
[b] Effect concentration is based upon measured concentration of atrazine on the last day of exposure only.
[c] No sediment present.
[d] Sediment present.

Table 5. Bioaccumulation of Atrazine by Aquatic Organisms

Species	Chemical	Hardness (mg/L as $CaCo_3$)	Concentration in Water (µg/L)	Duration (days)	Tissue	BCF or BAF	Reference
			FRESHWATER SPECIES				
Brook trout, *Salvelinus fontinalis*	94%	35.7	740	308	Muscle	<0.27	Macek et al. 1976
Bluegill, *Lepomis macrochirus*	94%	33.9	94	546	Muscle	<2.1	Macek et al. 1976
Fathead minnow, *Pimephales promelas*	94%	36.2	210	301	Eviscerated carcass	<8.1	Macek et al. 1976
Fathead minnow (F_o larvae), *Pimphales promelas*	97.1%	24-36	2,000	60	Whole body	6.5[a]	Dionne 1992
Fathead minnow (adult males), *Pimephales promelas*	97.1%	24-36	2,000	274	Whole body	8.5[a]	Dionne 1992
Fathead minnow (adult females), *Pimephales promelas*	97.1%	24-36	2,000	274	Whole body	8.5[a]	Dionne 1992
Fathead minnow (F_1 embryos), *Pimephales promelas*	97.1%	24-36	2,000	3	Whole body composite sample	4.6[a]	Dionne 1992
Fathead minnow (14-day old larvae), *Pimephales promelas*	97.1%	24-36	2,000	14	Whole body	3.3[a]	Dionne 1992
Fathead minnow (30-day old larvae), *Pimephales promelas*	97.1%	24-36	2,000	30	Whole body	6.0[a]	Dionne 1992

[a] Based on ^{14}C measurements, and therefore, represents a maximum possible bioconcentration factor.

Table 6. Other Data on Effects of Atrazine on Aquatic Organisms

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
			FRESHWATER SPECIES			
Mixed nitrifying bacteria	-	-	28 days	Increased nitrite oxidation; ammonium oxidation unaffected	1,000	Gadkari 1988
Mixed nitrifying bacteria	-	-	28 days	Ammonium oxidation unaffected	2,000	Gadkari 1988
Bacterium, *Pseudomonas putida*	-	214	16 hr	Incipient inhibition	>10,000	Bringmann and Kuhn 1976, 1977
Cyanobacterium, *Anabaena cylindrica*	-	-	14 days	LOEC (growth)	2,160	Rohwer and Fluckiger 1979
Cyanobacterium, *Anabaena cylindrica*	-	-	19 hr	LOEC (nitrogenase activity)	2,160	Rohwer and Fluckiger 1979
Cyanobacterium, *Anabaena cylindrica*	-	-	1 hr	LOEC (O_2 production)	21,600	Rohwer and Fluckiger 1979
Cyanobacterium, *Anabaena cylindrica*	>95%	-	12-14 days	EC50 (cell number)	1,200	Stratton 1984
Cyanobacterium, *Anabaena cylindrica*	-	-	24 hr	EC50 (^{14}C uptake)	253[a]	Larsen et al. 1986
Cyanobacterium, *Anabaena cylindrica*	-	-	24 hr	EC50 (^{14}C uptake)	178[a]	Larsen et al. 1986
Cyanobacterium, *Anabaena cylindrica*	-	-	24 hr	EC50 (^{14}C uptake)	182[b]	Larsen et al. 1986
Cyanobacterium, *Anabaena flos-aquae*	97%	-	5 days	EC50 (cell number)	230	Hughes 1986; Hughes et al. 1986, 1988
Cyanobacterium, *Anabaena flos-aquae*	97%	-	5 day exposure, 9 day recovery	NOEC (cell number)	<100	Hughes 1986; Hughes et al. 1986, 1988

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Cyanobacterium, *Anabaena flos-aquae*	97%	-	5 day exposure, 9 day recovery	Algistatic concentration	4,970	Hughes 1986; Hughes et al. 1986, 1988
Cyanobacterium, *Anabaena flos-aquae*	97%	-	5 day exposure, 9 day recovery	Algicidal concentration	>3,200	Hughes 1986; Hughes et al. 1986, 1988
Cyanobacterium, *Anabaena flos-aquae*	99.9%	-	1 day	56.2% reduction in ^{14}C uptake	40	Abou-Waly et al. 1991a
Cyanobacterium, *Anabaena flos-aquae*	99.9%	-	3 days	50.0% reduction in ^{14}C uptake	40	Abou-Waly et al. 1991a
Cyanobacterium, *Anabaena flos-aquae*	99.9%	-	5 days	9.5% reduction in ^{14}C uptake	40	Abou-Waly et al. 1991a
Cyanobacterium, *Anabaena flos-aquae*	99.9%	-	1 day	49.0% reduction in chlorophyll	100	Abou-Waly et al. 1991a
Cyanobacterium, *Anabaena flos-aquae*	99.9%	-	3 days	2.0% reduction in chlorophyll	100	Abou-Waly et al. 1991a
Cyanobacterium, *Anabaena flos-aquae*	99.9%	-	5 days	21.8% reduction in chlorophyll	100	Abou-Waly et al. 1991a
Cyanobacterium, *Anabaena flos-aquae*	99.9%	-	7 days	29.9% reduction in chlorophyll	100	Abou-Waly et al. 1991a
Cyanobacterium, *Anabaena flos-aquae*	99.9%	-	3 days	EC50 (chlorophyll a)	58	Abou-Waly et al. 1991b
Cyanobacterium, *Anabaena flos-aquae*	99.9%	-	5 days	EC50 (chlorophyll a)	469	Abou-Waly et al. 1991b
Cyanobacterium, *Anabaena flos-aquae*	99.9%	-	7 days	EC50 (chlorophyll a)	766	Abou-Waly et al. 1991b
Cyanobacterium, *Anabaena flos-aquae*	92.2%	-	4 days	EC50 (chlorophyll a)	>3,000	Fairchild et al. 1998
Cyanobacterium, *Anabaena inaequalis*	>95%	-	12-14 days	EC50 (cell number)	30	Stratton 1984

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Cyanobacterium, *Anabaena inaequalis*	Technical or analytical	-	22 hr	65% inhibition of photosynthesis (^{14}C uptake)	2,667	Peterson et al. 1994
Cyanobacterium, *Anabaena variabilis*	>95%	-	12-14 days	EC50 (cell number)	4,000	Stratton 1984
Cyanobacterium, *Aphanizomenon flos-aquae*	Technical or analytical	-	22 hr	97% inhibition of photosynthesis (^{14}C uptake)	2,667	Peterson et al. 1994
Cyanobacterium, *Microcystis aeruginosa*	-	214	8 days	Incipient inhibition	3	Bringmann and Kuhn 1976, 1978a,b
Cyanobacterium, *Microcystis aeruginosa*	97.4%	-	5 days	Reduced cell numbers	108	Parrish 1978
Cyanobacterium, *Microcystis aeruginosa*	97.4%	-	5 days	Minimum algistatic concentration	440	Parrish 1978
Cyanobacterium, *Microcystis aeruginosa*	-	-	6 days	EC50 (growth)	630	Kallqvist and Romstad 1994
Cyanobacterium, *Microcystis aeruginosa*	-	-	6 days	EC50 (microplate method)	630	Kallqvist and Romstad 1994
Cyanobacterium, *Microcystic aeruginosa*	Technical or analytical	-	22 hr	96% inhibition of photosynthesis (^{14}C uptake)	2,667	Peterson et al. 1994
Cyanobacterium, *Microcystic aeruginosa*	Technical or analytical	-	22 hr	84% inhibition of photosynthesis (^{14} C uptake)	2,667	Peterson et al. 1994
Cyanobacterium, *Microcystis* sp.	Technical or analytical	-	4 days	EC50 (biomass)	90	Fairchild et al. 1998
Cyanobacterium, *Oscillatoria* cf. *chalybea*	99.7%	-	6 days	Lowest complete inhibition conc.	2160	Schrader et al. 1997
Cyanobacterium, *Oscillatoria* cf. *chalybea*	99.7%	-	5 days	LOEC (growth)	220	Schrader at al 1998

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Cyanobacterium, *Oscillatoria* sp.	Technical or analytical	-	22 hr	87% inhibition of photosynthesis (^{14}C uptake)	2,667	Peterson et al. 1994
Cyanobacterium, *Plectonema boryanum*	-	-	31 days	69% decrease in cell number	10,000	Mallison and Cannon 1984
Cyanobacterium, *Pseudoanabaena* sp.	Technical or analytical	-	22 hr	91% inhibition of photosynthesis (^{14}C uptake)	2,667	Peterson et al. 1994
Cyanobacterium, *Synechococcus leopolensis*	-	-	5 days	EC50 (growth)	130	Kallqvist and Romstad 1994
Cyanobacterium, *Synechococcus leopolensis*	-	-	5 days	EC50 (microplate method)	130	Kallqvist and Romstad 1994
Green alga, *Ankistrodesmus braunii*	99.9%	-	11 days	EC50 (cell number)	60	Burrell et al. 1985
Green alga, *Ankistrodesmus* sp.	-	-	24 hr	EC50 (^{14}C uptake)	72[a]	Larsen et al. 1986
Green alga, *Ankistrodesmus* sp.	-	-	24 hr	EC50 (^{14}C uptake)	61[a]	Larsen et al. 1986
Green alga, *Chlamydomonas geitleri* Ettl	96.4%	-	1 hr	EC50 (CO_2 fixation)	311	Francois and Robinson 1990
Green alga, *Chlamydomonas geitleri* Ettl	96.4%	-	1 hr	EC50 (CO_2 fixation)	194[c]	Francois and Robinson 1990
Green alga, *Chlamydomonas moewssi*	95%	-	14 days	EC50 (growth inhibition)	1384 (exponential growth phase)	Kotrikla et al. 1997
Green alga, *Chlamydomonas moewssi*	95%	-	14 days	EC50 (growth inhibition)	1181 (stationary growth phase)	Kotrikla et al. 1997
Green alga, *Chlamydomonas noctigama*	-	-	72 hr	EC50 (growth)	330	Kallqvist and Romstad 1994
Green alga, *Chlamydomonas reinhardtii*	-	-	8 hr	~32% inhibition of photosynthesis	10	Valentine and Bingham 1976

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Green alga, *Chlamydomonas reinhardtii*	-	-	8 hr	~74% inhibition of photosynthesis	100	Valentine and Bingham 1976
Green alga, *Chlamydomonas reinhardtii*	-	-	8 hr	~97% inhibition of photosynthesis	1,000	Valentine and Bingham 1976
Green alga, *Chlamydomonas reinhardtii*	-	-	24 hr	EC50 (^{14}C uptake)	48[a]	Larsen et al. 1986
Green alga, *Chlamydomonas reinhardtii*	-	-	24 hr	EC50 (^{14}C uptake)	19[a]	Larsen et al. 1986
Green alga, *Chlamydomonas reinhardtii*	-	-	24 hr	EC50 (^{14}C uptake)	44[a]	Larsen et al. 1986
Green alga, *Chlamydomonas reinhardtii*[d]	-	-	1-2 days	Growth rate reduced by 100%	216	Hersh and Crumpton 1987
Green alga, *Chlamydomonas reinhardtii*[e]	-	-	1-2 days	Growth rate reduced by 13%	21.6	Hersh and Crumpton 1987
Green alga, *Chlamydononas reinhardtii*[d]	94%	-	2 min	EC50 (photosynthetic oxygen evolution)	45	Hersh and Crumpton 1989
Green alga, *Chlamydomonas reinhardtii*[e]	94%	-	2 min	EC50 (photosynthetic oxygen evolution)	484	Hersh and Crumpton 1989
Green alga, *Chlamydomonas reinhardtii*	-	-	65 hr	13% reduction in chlorophyll	49.6	Hiranpradit and Foy 1992
Green alga, *Chlamydomonas reinhardtii*	92.2%	-	96 hr	EC50 (chlorophyll)	176	Fairchild et al. 1998
Green alga, *Chlamydomonas* sp.	-	-	72-96 hr	36.2%[f] and 84.9%[g] growth inhibition; 12.8% reduction in chlorophyll	50-52	Foy and Hiranpradit 1977

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Green alga, *Chlamydomonas* sp.	-	-	72-96 hr	64.1%[f] and 93.3%[g] growth inhibition; 32.4% reduction in chlorophyll	100-104	Foy and Hiranpradit 1977
Green alga, *Chlamydomonas* sp.	-	-	72-96 hr	77.5%[f] and 96.6%[g] growth inhibition; 49.9% reduction in chlorophyll	200-208	Foy and Hiranpradit 1977
Green alga, *Chlamydomonas* sp.	-	-	72-96 hr	76.6%[f] and 100%[g] growth inhibition; 84.2% reduction in chlorophyll	400-416	Foy and Hiranpradit 1977
Green alga, *Chlamydomonas* sp.	-	-	72-96 hr	78.6% growth inhibition[f]; 90.5% reduction in chlorophyll	832	Foy and Hiranpradit 1977
Green alga, *Chlamydomonas* sp.	-	-	4 days	EC50 (biomass)	176	Fairchild et al. 1994a
Green alga, *Chlorella fusca*	99%	-	15 min	EC50 (photosynthesis)	141	Altenburger et al. 1990
Green alga, *Chlorella fusca*	99%	-	14 hr	EC50 (cell volume growth)	36	Altenburger et al. 1990
Green alga, *Chlorella fusca*	99%	-	24 hr	EC50 (cell reproduction)	26	Altenburger et al. 1990
Green alga, *Chlorella fusca*	98%	-	24 hr	EC50 (cell number)	15	Faust et al. 1993
Green alga, *Chlorella fusca*	95%	-	14 days	EC50 (growth inhibition)	53.91 (exponential growth phase)	Kotrikla et al. 1997

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Green alga, *Chlorella fusca*	95%	-	14 days	EC50 (growth inhibition)	75.73 (stationary growth phase)	Kotrikla et al. 1997
Green alga, *Chlorella kessleri*	-	-	72 hr	30% growth inhibition and photosynthetic O_2 evolution; 6.7% reduction in protein synthesis; effects upon lipids	1,078	El-Sheekh et al. 1994
Green alga, *Chlorella pyrenoidosa*	-	-	2 wk	70% reduced growth	500	Virmani et al. 1975
Green alga, *Chlorella pyrenoidosa*	-	-	2 wk	95% reduced growth	2,500	Virmani et al. 1975
Green alga, *Chlorella pyrenoidosa*	-	-	2 wk	92% reduced growth	10,000	Virmani et al. 1975
Green alga, *Chlorella pyrenoidosa*	-	-	8 hr	~64% inhibition of photosynthesis	100	Valentine and Bingham 1976
Green alga, *Chlorella pyrenoidosa*	-	-	8 hr	~96% inhibition of photosynthesis	1,000	Valentine and Bingham 1976
Green alga, *Chlorella pyrenoidosa*	>95%	-	12-14	EC50 (cell number)	300	Stratton 1984
Green alga, *Chlorella pyrenoidosa*	-	-	10 days	30% growth inhibition; 40% reduction in chlorophyll a	53.9	Gonzalez-Murua et al. 1985
Green alga, *Chlorella pyrenoidosa*	-	-	10 days	65% growth inhibition; 70% reduction in chlorophyll a	107.8	Gonzalez-Murua et al. 1985
Green alga, *Chlorella pyrenoidosa*	-	-	110 hr	39% reduction in chlorophyll	49.6	Hiranpradit and Foy 1992

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Green alga, *Chlorella pyrenoidosa*	Analytical	-	<50 min	>80% inhibition of photosynthetic CO_2 uptake	125	Hannan 1995
Green alga, *Chlorella pyrenoidosa*	Analytical	-	<50 min	100% inhibition of photosynthetic CO_2 uptake	1,250	Hannan 1995
Green alga, *Chlorella vulgaris*	-	-	7 days	31.0% reduction in dry wt.	250[h]	Veber et al. 1981
Green alga, *Chlorella vulgaris*	-	-	7 days	43.6% reduction in dry wt.	500[h]	Veber et al. 1981
Green alga, *Chlorella vulgaris*	-	-	7 days	56.4% reduction in dry wt.	2,500[h]	Veber et al. 1981
Green alga, *Chlorella vulgaris*	-	-	7 days	61.8% reduction in dry wt.	5,000[h]	Veber et al. 1981
Green alga, *Chlorella vulgaris*	-	-	24 hr	EC50 (^{14}C uptake)	325[a]	Larsen et al. 1986
Green alga, *Chlorella vulgaris*	-	-	24 hr	EC50 (^{14}C uptake)	305[a]	Larsen et al. 1986
Green alga, *Chlorella vulgaris*	-	-	24 hr	EC50 (^{14}C uptake)	293[b]	Larsen et al. 1986
Green alga, *Chlorella vulgaris*	-	-	30 min	EC50 (Decrease in oxygen evolution)	305	Van der Heever and Grobbelaar 1997
Green alga, *Chlorella vulgaris*	92.2%	-	96 hr	EC50 (chlorophyll)	94	Fairchild et al. 1998
Green alga, *Chlorella vulgaris*	98%	-	12 days	Reduced growth, but showed signs of recovery	10	Berard et al 1999

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Green alga, *Chlorella* sp.	-	-	72-96 hr	31.0% growth inhibition[f]; 38.8% reduction in chlorophyll	52	Foy and Hiranpradit 1977
Green alga, *Chlorella* sp.	-	-	72-96 hr	45.3% growth inhibition[f]; 30.3% reduction in chlorophyll	104	Foy and Hiranpradit 1977
Green alga, *Chlorella* sp.	-	-	72-96 hr	52.3% growth inhibition[f]; 83.7% reduction in chlorophyll	208	Foy and Hiranpradit 1977
Green alga, *Chlorella* sp.	-	-	72-96 hr	59.2% growth inhibition[f]; 93.5% reduction in chlorophyll	416	Foy and Hiranpradit 1977
Green alga, *Chlorella* sp.	-	-	72-96 hr	53.7% growth inhibition[f]; 95.4% reduction in chlorophyll	832	Foy and Hiranpradit 1977
Green alga, *Chlorella* sp.	-	-	1-2 days	Growth rate reduced by 86%	216	Hersh and Crumpton 1987
Green alga, *Chlorella* sp.	-	-	2-3 days	Growth rate reduced by 55%	21.6	Hersh and Crumpton 1987
Green alga, *Chlorella* sp.	94%	-	2 min	EC50 (photosynthetic oxygen evolution)	36	Hersh and Crumpton 1989
Green alga, *Chlorella* sp.[e]	94%	-	2 min	EC50 (photosynthetic oxygen evolution)	41	Hersh and Crumpton 1989
Green alga, *Clorella* sp.[e]	94%	-	2 min	EC50 (photosynthetic oxygen evolution)	35	Hersh and Crumpton 1989
Green alga, *Chlorella* sp.	-	-	4 days	EC50 (biomass)	92	Fairchild et al. 1994a

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Green alga, *Chlorococcum hypnosporum*	-	-	2 wk	75% reduced growth	5,000	Virmani et al. 1975
Green alga, *Chlorococcum hypnosporum*	-	-	2 wk	92% reduced growth	10,000	Vermani et al. 1975
Green alga, *Franceia* sp.[f]	94%	-	2 min	EC50 (photosynthetic oxygen evolution)	466	Hersh and Crumpton 1989
Green alga, *Franceia* sp.	94%	-	2 min	EC50 (photosynthetic oxygen evolution)	774	Hersh and Crumpton 1989
Green alga, *Franceia* sp.	94%	-	2 min	EC50 (photosynthetic oxygen evolution)	710	Hersh and Crumpton 1989
Green alga, *Franceia* sp.	94%	-	2 min	EC50 (photosynthetic oxygen evolution)	430	Hersh and Crumpton 1989
Green alga, *Franceia* sp.	94%	-	2 min	EC50 (photosynthetic oxygen evolution)	720	Hersh and Crumpton 1989
Green alga, *Gloetaenium loitlesbergarianum*	-	-	96 hr	inhibition of calcification	2,157	Prasad and Chowdary 1981
Green alga, *Scenedesmus obliquus*	-	-	24 hr	EC50 (^{14}C uptake)	38	Larsen et al. 1986
Green alga, *Scenedesmus obliquus*	-	-	24 hr	EC50 (^{14}C uptake)	57	Larsen et al. 1986
Green alga, *Scenedesmus obliquus*	-	-	24 hr	EC50 (^{14}C uptake)	49	Larsen et al. 1986
Green alga, *Scenedesmus quadricauda*	-	-	8 hr	42% inhibition of photosynthesis	10	Valentine and Bingham 1976

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Green alga, *Scenedesmus quadricauda*	-	-	8 hr	84% inhibition of photosyn-thesis	100	Valentine and Bingham 1976
Green alga, *Scenedesmus quadricauda*	-	-	8 hr	98% inhibition of photosynthesis	1,000	Valentine and Bingham 1976
Green alga, *Scenedesmus quadricauda*	-	214	8 days	Incipient inhibition	30	Bringmann and Kuhn 1977, 1978a,b
Green alga, *Scenedesmus quadricauda*	>95%	-	12-14 days	EC50 (cell number)	100	Stratton 1984
Green alga, *Scenedesmus quadricauda*	-	-	8 days	4.5% reduction in photosynthesis	4	Bogacka et al. 1990
Green alga, *Scenedesmus quadricauda*	-	-	8 days	9.9% reduction in photosynthesis	9	Bogacka et al. 1990
Green alga, *Scenedesmus quadricauda*	-	-	8 days	18.5% reduction in photosynthesis	30	Bogacka et al. 1990
Green alga, *Scenedesmus quadricauda*	-	-	8 days	68.1% reduction in photosynthesis	100	Bogacka et al. 1990
Green alga, *Scenedesmus quadricauda*	-	-	8 days	99.3% reduction in photosynthesis	337	Bogacka et al. 1990
Green alga, *Scenedesmus quadricauda*	Technical or analytical	-	22 hr	96% inhibition of photosynthesis (^{14}C uptake)	2,667	Peterson et al. 1994
Green alga, *Scenedesmus quadricauda*	92.2%	-	96 hr	EC50 (chlorophyll)	169	Fairchild et al. 1998
Green alga, *Scenedesmus subspicatus*	99.0%	-	4 days	EC50 (cell number)	110	Geyer et al. 1985
Green alga, *Scenedesmus subspicatus*	-	-	24 hr	24.8% inhibition of effective photosynthesis rate	12.3	Schafer et al. 1994

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Green alga, *Scenedesmus subspicatus*	-	-	24 hr	57.4% inhibition of effective photosynthesis rate	37	Schafer et al. 1994
Green alga, *Scenedesmus subspicatus*	-	-	24 hr	93.4% inhibition of effective photosynthesis rate	111.1	Schafer et al. 1994
Green alga, *Scenedesmus subspicatus*	-	-	24 hr	100.0% inhibition of effective photosynthesis rate	333.3	Schafer et al. 1994
Green alga, *Scenedesmus subspicatus*	98%	-	2 days	EC50 (cell numbers)	21	Kirby and Sheahan 1994
Green alga, *Scenedesmus subspicatus*	-	-	24 hr	50% reduction in dry mass	~21.5	Reinold et al. 1994
Green alga, *Scenedesmus subspicatus*	-	-	24 hr	EC50 (net assimilation inhibition)	25	Zagorc-Koncan 1996
Green alga, *Scenedesmus subspicatus*	-	-	72 hr	EC50 (growth inhibition)	200	Zagorc-Koncan 1996
Green alga, *Scenedesmus subspicatus*	99%	-	60 days	NOEC (growth and photosynthetic oxygen evolution)	20	Behra et al. 1999
Green alga, *Scenedesmus* sp.	-	-	72-96 hr	60.2% growth inhibition[g]	50	Foy and Hiranpradit 1977
Green alga, *Scenedesmus* sp.	-	-	72-96 hr	72.4% growth inhibition[g]	100	Foy and Hiranpradit 1977
Green alga, *Scenedesmus* sp.	-	-	72-96 hr	81.6% growth inhibition[g]	200	Foy and Hiranpradit 1977

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Green alga, *Scenedesmus* sp.	-	-	72-96 hr	84.7% growth inhibition[g]	400	Foy and Hiranpradit 1977
Green alga, *Scenedesmus* sp.	-	-	72-96 hr	83.7% growth inhibition[g]	800	Foy and Hiranpradit 1977
Green alga, *Scenedesmus* sp.	-	-	4 days	EC50 (biomass)	169	Fairchild et al. 1994a
Green alga, *Selenastrum capricornutum*	97.4%	-	5 days	Significantly reduced cell numbers	54	Parrish 1978
Green alga, *Selenastrum capricornutum*	97.4%	-	5 days	Minimum algistatic concentration	200	Parrish 1978
Green alga, *Selenastrum capricornutum*	97.4%	-	5 days	12% chlorophyll a reduction	32	Parrish 1978
Green alga, *Selenastrum capricornutum*	97.4%	-	5 days	42% chlorophyll a reduction	54	Parrish 1978
Green alga, *Selenastrum capricornutum*	97.4%	-	5 days	76% chlorophyll a reduction	90	Parrish 1978
Green alga, *Selenastrum capricornutum*	97.4%	-	5 days	92% chlorophyll a reduction	150	Parrish 1978
Green alga, *Selenastrum capricornutum*	97.4%	-	5 days	96% chlorophyll a reduction	200	Parrish 1978
Green alga, *Selenastrum capricornutum*	85.5%	47	7 days	13.8% increased biomass	100[i]	Johnson 1986
Green alga, *Selenastrum capricornutum*	85.5%	47	7 days	36.2% decreased biomass	1,000[i]	Johnson 1986
Green alga, *Selenastrum capricornutum*	85.5%	47	7 days	75.9% decreased biomass	1,000[j]	Johnson 1986
Green alga, *Selenastrum capricornutum*	-	-	24 hr	EC50 (^{14}C uptake)	53[a]	Larsen et al. 1986
Green alga, *Selenastrum capricornutum*	-	-	24 hr	EC50 (^{14}C uptake)	34[a]	Larsen et al. 1986

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Green alga, *Selenastrum capricornutum*	-	-	24 hr	EC50 (^{14}C uptake)	42[b]	Larsen et al. 1986
Green alga, *Selenastrum capricornutum*	80%	-	21 days	EC50 (biomass)	58.7[a]	Turbak et al. 1986
Green alga, *Selenastrum capricornutum*	80%	-	21 days	EC50 (biomass)	410[b]	Turbak et al. 1986
Green alga, *Selenastrum capricornutum*	80%	-	24 hr	EC50 (0_2 evolution)	69.7[k]	Turbak et al. 1986
Green alga, *Selenastrum capricornutum*	80%	-	24 hr	EC50 (0_2 evolution)	854[l]	Turbak et al. 1986
Green alga, *Selenastrum capricornutum*	-	-	5 days	EC50 (cell number)	100	Roberts et al. 1990
Green alga, *Selenastrum capricornutum*	-	-	5 days	EC50 (cell number)	95	Roberts et al. 1990
Green alga, *Selenastrum capricornutum*	reagent grade	171	30 min	EC50 (CO_2 fixation)	100	Versteeg 1990
Green alga, *Selenastrum capricornutum*	reagent grade	171	30 min	EC50 (O_2 generation)	380	Versteeg 1990
Green alga, *Selenastrum capricornutum*	reagent grade	171	4 days	EC50 (cell number)	50	Versteeg 1990
Green alga, *Selenastrum capricornutum*	99.9%	-	1 day	22.0% reduction in chlorophyll; 69.3% reduction in ^{14}C uptake	130	Abou-Waly et al. 1991a
Green alga, *Selenastrum capricornutum*	99.9%	-	3 days	53.2% reduction in chlorophyll; 42.4% reduction in ^{14}C uptake	130	Abou-Waly et al. 1991a
Green alga, *Selenastrum capricornutum*	99.9%	-	5 days	24.5% reduction in chlorophyll; 60.6% reduction in ^{14}C uptake	130	Abou-Waly et al. 1991a
Green alga, *Selenastrum capricornutum*	99.9%	-	7 days	11.6% reduction in chlorophyll; 31.5% reduction in ^{14}C uptake	130	Abou-Waly et al. 1991a

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Green alga, *Selenastrum capricornutum*	99.9%	-	3 days	EC50 (chlorophyll a)	283	Abou-Waly et al. 1991b
Green alga, *Selenastrum capricornutum*	99.9%	-	5 days	EC50 (chlorophyll a)	218	Abou-Waly et al. 1991b
Green alga, *Selenastrum capricornutum*	99.9%	-	7 days	EC50 (chlorophyll a)	214	Abou-Waly et al. 1991b
Green alga, *Selenastrum capricornutum*	92.2%	-	4 days	EC50 (chlorophyll)	117	Fairchild et al. 1994a, 1998
Green alga, *Selenastrum capricornutum*	-	-	72 hr	EC50 (growth)	200	Kallqvist and Romstad 1994
Green alga, *Selenastrum capricornutum*	-	-	72 hr	EC50 (growth)	110	Kallqvist and Romstad 1994
Green alga, *Selenastrum capricornutum*	Technical or analytical	-	22 hr	99% inhibition of photosynthesis (^{14}C uptake)	2,667	Peterson et al. 1994
Green alga, *Selenastrum capricornutum*	-	100	96 hr	EC50 (chlorophyll a)	147	Gaggi et al. 1995
Green alga, *Selenastrum capricornutum*	-	-	72 hr	EC50	118.2	Radetski et al. 1995
Green alga, *Selenastrum capricornutum*	-	-	72 hr	EC50 (cell numbers)	359	Van der Heever and Grobbelaar 1996
Green alga, *Selenastrum capricornutum*	-	-	72 hr	EC50 (chlorophyll a - spectrophotometric measurement)	902	Van der Heever and Grobbelaar 1996
Green alga, *Selenastrum capricornutum*	-	-	72 hr	EC50 (chlorophyll a - fluorometric measurement)	960	Van der Heever and Grobbelaar 1996

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Green alga, *Selenastrum capricornutum*	-	-	96 hr	EC50 (cell number; free culture)	200	Abdel-Hamid 1996
Green alga, *Selenastrum capricornutum*	-	-	96 hr	EC50 (cell number; immobilized culture)	220	Abdel-Hamid 1996
Green alga, *Selenastrum capricornutum*	-	-	96 hr	LC50	26	Caux et al. 1996
Green alga, *Selenastrum capricornutum*	-	-	96 hr	EC50 (cell numbers)	26	Caux et al. 1996
Green alga, *Selenastrum capricornutum*	-	-	30 min	EC50 (decrease in oxygen evolution)	222	Van der Heever and Grobbelaar 1997
Green alga, *Selenastrum capricornutum*	-	-	72 hr	EC50 (growth inhibition)	164.3	Benhra et al. 1997
Green alga, *Selenastrum capricornutum*	-	-	72 hr	EC50 (growth inhibition)	92.9 (Cryoalgotox)	Benhra et al. 1997
Green alga, *Selenastrum capricornutum*	-	-	4 days	I50 (chlorophyll a)	80	El Jay et al. 1997
Green alga, *Selenastrum capricornutum*	Technical grade	-	96 hr	NOEC (biomass)	75	Fairchild et al. 1997
Green alga, *Selenastrum capricornutum*	Technical grade	-	96 hr	LOEC (biomass)	150	Fairchild et al. 1997
Green alga, *Selenastrum capricornutum*	Technical grade	-	96 hr	EC50 (biomass)	235	Fairchild et al. 1997
Green alga, *Selenastrum capricornutum*	99.7%	-	6 days	Lowest Complete Inhibition Concentration (growth)	2160	Schrader et al. 1997

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Green alga, *Selenastrum capricornutum*	-	-	4 hr	EC50 (chlorophyll a fluorescence)	232	Van der Heever and Grobbelaar 1998
Green alga, *Selenastrum capricornutum*	ACS	-	3 days	EC50 (growth)	164	Mayer et al. 1998
Green alga, *Selenastrum capricornutum*	99.7%	-	5 days	LOEC (growth)	220	Schrader et al 1998
Green alga, *Stigeoclonium tenue*	-	-	24 hr	EC50 (^{14}C uptake)	127[a]	Larsen et al. 1986
Green alga, *Stigeoclonium tenue*	-	-	24 hr	EC50 (^{14}C uptake)	224[a]	Larsen et al. 1986
Green alga, *Ulothrix subconstricta*	-	-	24 hr	EC50 (^{14}C uptake)	88[a]	Larsen et al. 1986
Benthic diatom, *Craticula cuspidata*	98%	-	67 days chronic, 12 days acute	LOEC (chlorophyll a)	83	Nelson et al. 1999
Diatom, *Cyclotella meneghiniana* (Arizona race)	-	-	7 min	EC50 (photosynthesis)	99	Millie and Hersh 1987
Diatom, *Cyclotella meneghiniana* (Iowa race)	-	-	7 min	EC50 (photosynthesis)	105	Millie and Hersh 1987
Diatom, *Cyclotella meneghiniana* (Minnesota race)	-	-	7 min	EC50 (photosynthesis)	243	Millie and Hersh 1987
Diatom, *Cyclotella meneghiniana*	Technical or analytical	-	22 hr	97% inhibition of photosynthesis (^{14}C uptake)	2,667	Peterson et al. 1994
Diatom, *Cyclotella* sp.	-	-	6 days	EC50 (growth)	430	Kallqvist and Romstad 1994
Diatom, *Navicula pelliculosa*	97%	-	5 days	EC50 (cell number)	60	Hughes 1986; Hughes et al. 1986, 1988

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Diatom, *Navicula pelliculosa*	97%	-	5 day exposure, 9 day recovery	NOEC	<100	Hughes 1986; Hughes et al. 1986, 1988
Diatom, *Navicula pelliculosa*	97%	-	5 day exposure, 9 day recovery	Algistatic concentration	1,710	Hughes 1986; Hughes et al. 1986, 1988
Diatom, *Navicula pelliculosa*	97%	-	5 day exposure, 9 day recovery	Algicidal concentration	>3,200	Hughes 1986; Hughes et al. 1986, 1988
Diatom, *Nitzschia* sp.	Technical or analytical	-	22 hr	99% inhibition of photosynthesis (^{14}C uptake)	2,667	Peterson et al. 1994
Cryptomonad, *Cryptomonas pyrinoidifera*	-	-	6 days	EC50 (growth)	500	Kallqvist and Romstad 1994
Duckweed, *Lemna gibba*	97%	-	5 days	EC50 (frond production)	170	Hughes 1986; Hughes et al. 1986, 1988
Duckweed, *Lemna gibba*	97%	-	5 day exposure 9 day recovery	NOEC (frond production)	<100	Hughes 1986; Hughes et al. 1986, 1988
Duckweed, *Lemna gibba*	97%	-	5 day exposure 9 day recovery	Phytostatic concentration	1,720	Hughes 1986; Hughes et al. 1986, 1988
Duckweed, *Lemna gibba*	97%	-	5 day exposure 9 day recovery	Phytocidal concentration	>3,200	Hughes 1986; Hughes et al. 1986, 1988
Duckweed, *Lemna minor*	-	-	20 days	No effect upon growth; increased soluble protein content; increased photosynthesis and respiration	20	Beaumont et al. 1976a,b

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Duckweed, *Lemna minor*	-	-	20 days	~12% reduced growth; increased water and soluble protein content; increased photosynthesis and respiration	50	Beaumont et al. 1976a,b, 1978
Duckweed, *Lemna minor*	-	-	20 days	~23% reduced growth; increased water and soluble protein content; increased photosynthesis and respiration	100	Beaumont et al. 1976a,b, 1978
Duckweed, *Lemna minor*	-	-	20 days	~74% reduced growth; increased water, chlorophyll, and soluble protein content; increased photosynthesis and respiration	250	Beaumont et al. 1976a,b
Duckweed, *Lemna minor*	-	-	15 days	Increased total fatty acid and -linolenic acid content; increased monogalatosyldi a-cyl-glycerol percentage	100	Grenier et al. 1979
Duckweed, *Lemna minor*	-	-	15 days	Increased total fatty acid and -linolenic acid content; decreased linoleic acid content; increased monoga-lactosyldiacyl-glycerol percentage	1,000	Grenier et al. 1979

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Duckweed, *Lemna minor*	-	-	15 days	Increased amounts of polar lipids in chlorophyll-protein complexes of chloroplasts	248	Grenier et al. 1987
Duckweed, *Lemna minor*	-	-	10 days	Increased [^{14}C]-acetate incorporation into chloroplast lipids	248	Grenier et al. 1989
Duckweed, *Lemna minor*	-	-	2 days	Changes in chloroplast ultrastructure; increased chlorophyll content	248	Simard et al. 1990
Duckweed, *Lemna minor*	Technical or analytical	-	7 days	95% inhibition of growth	2,667	Peterson et al. 1994
Duckweed, *Lemna minor*	Technical	-	96 hr	NOEC (biomass)	75	Fairchild et al. 1997
Duckweed, *Lemna minor*	Technical	-	96 hr	LOEC (biomass)	150	Fairchild et al. 1997
Duckweed, *Lemna minor*	Technical	-	96 hr	EC50 (biomass)	153	Fairchild et al. 1997
Duckweed, *Lemna minor*	92.2%	-	4 days	EC50 (frond production)	92	Fairchild et al. 1998
Wild rice, *Zizania aquatica*	85%	-	83 days	Visibly senescent; 75% reduction in chlorophyll a in leaves	50	Detenbeck et al. 1996
Wild celery, *Vallisneria americana*	-	-	42 days	EC50 (total leaf length)	163	Davis 1981; Forney and Davis 1981

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Wild celery, *Vallisneria americana*	-	-	-	Reduced leaf growth and whole plant biomass	8	Cohn 1985
Wild celery, *Vallisneria americana*	-	-	-	Reduced tuber over-wintering success	4	Cohn 1985
Coontail, *Ceratophyllum dermersum*	85%	-	6-8 days	Reduced stem elongation	50	Detenbeck et al. 1996
Coontail, *Ceratophyllum* sp.	92.2%	-	14 days	EC50 (wet weight)	22	Fairchild et al. 1998
Cattail, *Typha latifolia*	85%	-	19 days	No effect upon growth	25	Detenbeck et al. 1996
Watermilfoil, *Myriophyllum heterophyllum*	92.2%	-	14 days	EC50 (wet weight)	132	Fairchild et al. 1998
Watermilfoil, *Myriophyllum spicatum*	-	-	28 days	EC50 (length)	1,104	Davis 1981; Forney and Davis 1981
Watermilfoil, *Myriophyllum spicatum*	-	-	24 hr	30% increase in net photosynthetic rate	10	Hoffmann and Winkler 1990
Watermilfoil, *Myriophyllum spicatum*	-	-	5 days	50% reduction in branch number	3,700	Bird 1993
Sago pondweed, *Potamogeton pectinatus*	-	-	28 days	Reduced biomass	100	Fleming et al. 1991
Bushy pondweed, *Najas* sp.	92.2%	-	14 days	EC50 (wet weight)	24	Fairchild et al. 1998
Egeria, *Egeria* sp.	-	-	14 days	EC50 (biomass)	<38	Fairchild et al. 1994a
Elodea, *Elodea canadensis*	-	-	28 days	EC50 (length)	80	Davis 1981; Forney and Davis 1981

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Elodea, *Elodea canadensis*	-	-	21 days	EC50 (length)	109	Davis 1981; Forney and Davis 1981
Elodea, *Elodea canadensis*	-	-	20 days	Dark respiration rate exceeded net photosynthesis rate	10	Hoffmann and Winkler 1990
Elodea, *Elodea canadensis*	85%	-	19 days	No effect upon growth	75	Detenbeck et al. 1996
Elodea, *Elodea canadensis*	92.2%	-	14 days	EC50 (wet weight)	21	Fairchild et al. 1998
Water moss, *Fontinalis antipyretica*	-	-	20 days	Dark respiration rate exceeded net photosynthesis rate	10	Hoffmann and Winkler 1990
Water moss, *Fontinalis hypnoides*	-	-	24 hr	90% reduction in net photosynthesis	2	Hoffmann and Winkler 1990
Water moss, *Fontinalis squamosa*	-	-	24 hr	20% reduction in net photosynthesis	10	Hoffmann and Winkler 1990
Mixed macrophytes, *Ceratophyllum* sp. and *Elodea* sp.	85.5%	47	30 days	18.3% increased biomass	10	Johnson 1986
Mixed macrophytes, *Ceratophyllum* sp. and *Elodea* sp.	85.5%	47	30 days	11.6% decreased biomass	100	Johnson 1986
Mixed macrophytes, *Ceratophyllum* sp. and *Elodea* sp.	85.5%	47	30 days	47.6% decreased biomass	1,000	Johnson 1986
Protozoa, *Acanthamoeba castellanii*	-	-	6 days	5% population decrease	100	Prescott et al. 1977
Protozoa, *Acanthamoeba castellanii*	-	-	6 days	14% population decrease	1,000	Prescott et al. 1977

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Protozoa, *Acanthamoeba castellanii*	-	-	6 days	15% population decrease	4,000	Prescott et al. 1977
Protozoa, *Acanthamoeba castellanii*	-	-	6 days	40% population decrease	10,000	Prescott et al. 1977
Protozoa, *Colpidium campylum*	-	-	24 hr	EC50 (cell number)	>50,000	Roberts et al. 1990
Protozoa, *Euglena gracilis*	-	-	8 hr	~11% inhibition of photosynthesis	10	Valentine and Bingham 1976
Protozoa, *Euglena gracilis*	-	-	8 hr	~28% inhibition of photosynthesis	100	Valentine and Bingham 1976
Protozoa, *Euglena gracilis*	-	-	8 hr	~83% inhibition of photosynthesis	1,000	Valentine and Bingham 1976
Protozoa, *Tetrahymena pyriformis*	-	-	24 hr	EC50	118,500	Huber et al. 1991
Protozoa, *Tetrahymena pyriformis*	-	-	48 hr	EC50 (cell number)	96,000	Schafer et al. 1994
Hydra, *Hydra viridis*	-	-	21 days	Reduced budding rate	5,000	Benson and Boush 1983
Rotifer, *Brachionus calyciflorus*	-	-	24 hr	LC50	7,840	Crisinel et al. 1994
Leech, *Glossiphonia complanata*	99.2%	-	27-28 days	LC50	6,300	Streit and Peter 1978
Leech, *Helobdella stagnalis*	99.2%	-	27-28 days	LC50	9,900	Streit and Peter 1978
Snail, *Lymnaea palustris*	97.8%	-	12 wk	No effect upon growth, fecundity or glycogen metabolism	125	Baturo et al. 1995
Snail, *Lymnaea palustris*	97.8%	-	12 wk	Inhibited BapH and GST enzyme activities	5	Baturo and Lagadic 1996

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Mussel (glochidia larva), *Anadonta imbecilis*	97.3%	40-50	24 hr	LC50	>60,000	Johnson et al. 1993
Mussel (1-2 d old juvenile), *Anadonta imbecilis*	97.3%	40-50	48 hr	LC50	>60,000	Johnson et al. 1993
Mussel (7-10 d old juvenile), *Anadonta imbecilis*	97.3%	40-50	48 hr	LC50	>60,000	Johnson et al. 1993
Anostracan, *Streptocephalus texanus*	-	-	24 hr	LC50	>30,000	Crisinel et al. 1994
Cladoceran, *Ceriodaphnia dubia*	>99%	57.1	4 days	MATC	7,100	Oris et al. 1991
Cladoceran, *Ceriodaphnia dubia*	>99%	57.1	4 days	MATC	14,100	Oris et al. 1991
Cladoceran, *Daphnia magna*	-	-	26 hr	LC50	3,600	Frear and Boyd 1967
Cladoceran, *Daphnia magna*	-	100	48 hr	BCF = 4.4	10	Ellgehausen et al. 1980
Cladoceran, *Daphnia magna*	-	100	48 hr	BCF = 2.2	10	Ellgehausen et al. 1980
Cladoceran, *Daphnia magna*	-	-	21 days	Reduced young production	2,000	Kaushik et al. 1985
Cladoceran, *Daphnia magna*	-	-	48 hr	10% mortality	22,000	Bogacka et al. 1990
Cladoceran, *Daphnia magna*	-	-	96 hr	30% mortality	16,900	Bogacka et al. 1990
Cladoceran, *Daphnia magna*	-	-	96 hr	60% mortality	48,300	Bogacka et al. 1990
Cladoceran, *Daphnia magna*	97.3%	40-50	48 hr	LC50	9,400[m]	Johnson et al. 1993
Cladoceran, *Daphnia magna*	-	-	24 hr	EC50	>30,000	Crisinel et al. 1994

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Cladoceran, *Daphnia magna*	-	-	48 hr	EC50	>30,000	Crisinel et al. 1994
Cladoceran, *Daphnia magna*	85%	-	48 hr	Significantly decreased survival	25	Detenbeck et al. 1996
Cladoceran, *Daphnia magna*	85%	-	48 hr	No effect upon survival	50	Detenbeck et al. 1996
Cladoceran, *Daphnia pulex*	-	-	3 hr	LC50	>40,000	Nishiuchi and Hashimoto 1967, 1969
Cladoceran, *Daphnia pulex*	99.2%	-	28 days	11.7% decreased survival and 28.2% decreased reproduction	1,000	Schober and Lampert 1977
Cladoceran, *Daphnia pulex*	99.2%	-	28 days	4.2% decreased survival and 26.8% decreased reproduction	2,000	Schober and Lampert 1977
Cladoceran, *Daphnia pulex*	99.2%	-	~70 days	41.7% decreased reproduction	2,000	Schober and Lampert 1977
Cladoceran, *Daphnia pulex*	99.2%	-	28 days	20.2% decreased survival and 45.5% decreased reproduction	3,000	Schober and Lampert 1977
Cladoceran, *Daphnia pulex*	99.2%	-	28 days	9.6% decreased survival and 48.3% decreased reproduction	4,000	Schober and Lampert 1977
Cladoceran, *Daphnia pulex*	99.2%	-	28 days	42% decreased reproduction	5,000	Schober and Lampert 1977
Cladoceran, *Daphnia pulex*	99.2%	-	70 days	48.2% decreased reproduction	5,000	Schober and Lampert 1977
Cladoceran, *Daphnia pulex*	99.2%	-	28 days	14.9% decreased survival; 53.9% decreased reproduction	10,000	Schober and Lampert 1977
Cladoceran, *Daphnia pulex*	99.2%	-	70 days	62.6% decreased reproduction	10,000	Schober and Lampert 1977

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Cladoceran, *Daphnia pulex*	99.2%	-	28 days	96.5% decreased reproduction	20,000	Schober and Lampert 1977
Cladoceran, *Daphnia pulex*	-	-	10 min	10% reduction in food consumption	350	Pott 1980
Cladoceran, *Daphnia pulex*	-	-	10 min	50% reduction in food consumption	1,600	Pott 1980
Cladoceran, *Daphnia pulex*	98%	-	18 hr	LC50	700	Bowman et al 1981
Cladoceran (adult), *Moina macrocopa*	-	-	3 hr	LC50	>40,000	Nishiuchi and Hashimoto 1967, 1969
Cladoceran, *Moina macrocopa*	-	-	4-6 wk	40% mortality; 10% increase in potential production; reduced actual population growth	1,000	Shcherban 1972a,b
Amphipod (1st instar), *Gammarus fasciatus*	94%	-	48 hr	LC50	5,700	Macek et al. 1976
Amphipod (approx 2nd instar), *Hyalella azteca*	98%	-	18 hr	LC50	2,000	Bowman et al. 1981
White dotted mosquito, *Culex restuans*	98%	-	18 hr	LC50	~60,000	Bowman et al. 1981
Midge (2nd instar), *Chironomus riparius*	-	151	10 days	LC50	18,900	Taylor et al. 1991
Midge (~10 d), *Chironomus tentans*	97.1%	42-44	96 hr (fed)	LC50	>28,000	McNamara 1991b
Rainbow trout (embryo), *Oncorhynchus mykiss*	80%	50	23 days (at hatching)	LC50	736	Birge et al. 1979
Rainbow trout (embryo), *Oncorhynchus mykiss*	80%	200	23 days (at hatching)	LC50	888	Birge et al. 1979

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Rainbow trout (sac fry), *Oncorhynchus mykiss*	80%	50	27 days (4 days post-hatch)	LC50	696	Birge et al. 1979
Rainbow trout (sac fry), *Oncorhynchus mykiss*	80%	200	27 days (4 days post-hatch)	LC50	864	Birge et al. 1979
Rainbow trout (sac fry), *Oncorhynchus mykiss*	80%	50	27 days (4 days post-hatch)	LC1	23.2	Birge et al. 1979
Rainbow trout (sac fry), *Oncorhynchus mykiss*	80%	200	27 days (4 days post-hatch)	LC1	61.8	Birge et al. 1979
Rainbow trout (sac fry), *Oncorhynchus mykiss*	80%	50	27 days (4 days post-hatch)	3% teratic larvae	43.2	Birge et al. 1979
Rainbow trout (sac fry), *Oncorhynchus mykiss*	80%	50	27 days (4 days post-hatch)	6% teratic larvae	432	Birge et al. 1979
Rainbow trout (sac fry), *Oncorhynchuls mykiss*	80%	50	27 days (4 days post-hatch)	62% teratic larvae	4,020	Birge et al. 1979
Rainbow trout (sac fry), *Oncorhynchuls mykiss*	80%	200	27 days (4 days post-hatch)	2% teratic larvae	13.6	Birge et al. 1979
Rainbow trout (sac fry), *Oncorhynchus mykiss*	80%	200	27 days (4 days post-hatch)	3% teratic larvae	48.0	Birge et al. 1979
Rainbow trout (sac fry), *Oncorhynchus mykiss*	80%	200	27 days (4 days post-hatch)	4% teratic larvae	416	Birge et al. 1979
Rainbow trout (sac fry), *Oncorhynchus mykiss*	80%	200	27 days (4 days post-hatch)	65% teratic larvae	4,020	Birge et al. 1979
Rainbow trout (juvenile), *Oncorhynchus mykiss*	99.3%	-	48 hr	LC50	5,660	Pluta 1989

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Rainbow trout (juvenile), *Oncorhynchus mykiss*	-	-	28 days	Changes in renal corpuscle ultrastructure	5	Fischer-Scherl et al. 1991
Rainbow trout (juvenile), *Oncorhynchus mykiss*	-	-	28 days	Changes in renal corpuscle and tubule ultrastructure	10	Fischer-Scherl et al. 1991
Rainbow trout, *Oncorhynchus mykiss*	-	-	28 days	Slight ultrastructural changes in renal corpuscles	5	Schwaiger et al. 1991
Rainbow trout, *Oncorhynchus mykiss*	-	-	28 days	Slight histopathologic al changes in liver; increased ultrastructural changes in renal corpuscles	10	Schwaiger et al. 1991
Rainbow trout, *Oncorhynchus mykiss*	-	-	28 days	Ultrastructural changes in renal corpuscles and histopathologic al changes in liver	20	Schwaiger et al. 1991
Rainbow trout (juvenile), *Oncorhynchus mykiss*	93.7%	-	14 days	No effect upon survival, body weight, liver weight, or liver xenobiotic-metabolizing enzyme activities	10	Egaas et al. 1993
Rainbow trout (juvenile), *Oncorhynchus mykiss*	98%	-	10 days	Reduced plasma protein	3.0	Davies et al. 1994b
Rainbow trout (juvenile), *Oncorhynchus mykiss*	98%	-	10 days	Reduced plasma protein	50	Davies et al. 1994b
Rainbow trout (juvenile), *Oncorhynchus mykiss*	99%	380	5 wk	Ultrastructural alterations in kidney proximal tubules	12.4	Oulmi et al. 1995

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Rainbow trout (juvenile), *Oncorhynchus mykiss*	99%	380	5 wk	Ultrastructural alterations in kidney proximal and distal tubules	24.0	Oulmi et al. 1995
Atlantic salmon (parr), *Salmo salar*	-	-	30 min	Reduced olfactory response to female pheromone	2.0	Moore and Waring 1998
Atlantic salmon (parr), *Salmo salar*	-	-	5 days	Reduction in milt and plasma 17,20 P levels	0.04	Moore and Waring 1998
Goldfish, *Carassius auratus*	-	-	48 hr	LC50	>10,000	Nishiuchi and Hashimoto 1967, 1969
Goldfish (6-9 g), *Carassius auratus*	97.9%	-	24 hr (10 min flowing)	Burst swimming	0.5 (0.1 test dripping)	Saglio and Trijasse 1998
Common carp, *Cyprinus carpio*	-	-	48 hr	LC50	>10,000	Nishiuchi and Hashimoto 1967, 1969
Common carp (30-50 g), *Cyprinus carpio*	-	-	12 hr	~125% increased serum cortisol	100	Hanke et al. 1983
Common carp (30-50 g), *Cyprinus carpio*	-	-	24 hr	~300% increased serum cortisol	100	Hanke et al. 1983
Common carp (30-50 g), *Cyprinus carpio*	-	-	6 hr	~40% increased serum cortisol	500	Hanke et al. 1983
Common carp (30-50 g), *Cyprinus carpio*	-	-	12 hr	~60% increased serum cortisol	500	Hanke et al. 1983
Common carp (30-50 g), *Cyprinus carpio*	-	-	24 hr	~250% increased serum cortisol	500	Hanke et al. 1983
Common carp (30-50 g), *Cyprinus carpio*	-	-	12 hr	~60% increased serum glucose	100	Hanke et al. 1983

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Common carp (30-50 g), *Cyprinus carpio*	-	-	24 hr	~35% increased serum glucose	100	Hanke et al. 1983
Common carp (30-50 g), *Cyprinus carpio*	-	-	6 hr	~15% increased serum glucose	500	Hanke et al. 1983
Common carp (30-50 g), *Cyprinus carpio*	-	-	12 hr	~40% increased serum glucose	500	Hanke et al. 1983
Common carp (30-50 g), *Cyprinus carpio*	-	-	24 hr	~70% increased serum glucose	500	Hanke et al. 1983
Common carp (30-50 g), *Cyprinus carpio*	-	-	72 hr	~180% increased serum glucose; ~40% decreased liver glycogen	1,000	Hanke et al. 1983
Common carp (30-50 g), *Cyprinus carpio*	-	-	4 hr	~25% increase in gill total ATPase activity; ~20% increase in gill Na-K dependent ATPase	100	Hanke et al. 1983
Common carp (30-50 g), *Cyprinus carpio*	-	-	6 hr	~10% increase in gill total ATPase; ~30% decrease in gill Na-K dependent ATPase	100	Hanke et al. 1983
Common carp (30-50 g), *Cyprinus carpio*	-	-	12 hr	~40% decrease in gill total ATPase; ~30%decrease in gill Na-K dependent ATPase	100	Hanke et al. 1983
Common carp (30-50 g), *Cyprinus carpio*	-	-	24 hr	~5% decrease in gill total ATPase; ~25% decrease in gill Na-K dependent ATPase	100	Hanke et al. 1983
Common carp (30-50 g), *Cyprinus carpio*	-	-	4 hr	~60% increase in serum AChE	100	Hanke et al. 1983

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Common carp (30-50 g), *Cyprinus carpio*	-	-	6 hr	~15% increase in serum AChE	100	Hanke et al. 1983
Common carp (30-50 g), *Cyprinus carpio*	-	-	12 hr	~35% increase in serum AChE	100	Hanke et al. 1983
Common carp (30-50 g), *Cyprinus carpio*	-	-	24 hr	~25% decrease in serum AChE	100	Hanke et al. 1983
Common carp, *Cyprinus carpio*	-	-	72 hr	Increased serum glucose and cortisol; decreased liver and muscle glycogen; decreased serum protein and cholesterol	100	Gluth and Hanke 1984, 1985
Common carp (juvenile), *Cyprinus carpio*	99.3%	-	48 hr	LC50	16,100	Pluta 1989
Common carp (juvenile), *Cyprinus carpio*	93.7%	141-223	96 hr (fed)	LC50	18,800	Neskovic et al. 1993
Common carp (juvenile), *Cyprinus carpio*	93.7%	141-223	14 days	Increased serum alkaline phosphatase; decreased alkaline phosphatase in heart, liver and kidneys; increased GPT in liver and kidneys; hyperplasia of some gill epithelial cells	1,500	Neskovic et al. 1993
Common carp (50 - 60 g), *Cyprinus carpio*	94%	-	14 days	NOEC (gill, liver, and kidney histopathology)	1,500	Poleksic et al. 1997
Fathead minnow (24h), *Pimephales promelas*	97	60	7 days	NOEC (biomass)	4,900	Jop 1991b
Fathead minnow (larvae), *Pimephales promelas*	85%	-	7	No effect upon survival	75	Detenbeck et al. 1996

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Fathead minnow (juvenile), *Pimephales promelas*	85%	-	13 days	No effect upon survival or growth	75	Detenbeck et al. 1996
Channel catfish (embryo), *Ictalurus punctatus*	80%	50	4.5 days (at hatching)	LC50	272	Birge et al. 1979
Channel catfish (embryo), *Ictalurus punctatus*	80%	200	4.5 days (at hatching)	LC50	248	Birge et al. 1979
Channel catfish (sac fry), *Ictalurus punctatus*	80%	50	8.5 days (4 days post-hatch)	LC50	176	Birge et al. 1979
Channel catfish (sac fry), *Ictalurus punctatus*	80%	200	8.5 days (4 days post-hatch)	LC50	192	Birge et al. 1979
Channel catfish (sac fry), *Ictalurus punctatus*	80%	50	8.5 days (4 days post-hatch)	1% teratic larvae	22.4	Birge et al. 1979
Channel catfish (sac fry), *Ictalurus punctatus*	80%	50	8.5 days (4 days post-hatch)	4% teratic larvae	47.2	Birge et al. 1979
Channel catfish (sac fry), *Ictalurus punctatus*	80%	50	8.5 days (4 days post-hatch)	13% teratic larvae	344	Birge et al. 1979
Channel catfish (sac fry), *Ictalurus punctatus*	80%	50	8.5 days (4 days post-hatch)	69% teratic larvae	3,864	Birge et al. 1979
Channel catfish (sac fry), *Ictalurus punctatus*	80%	50	8.5 days (4 days post-hatch)	100% teratic larvae	37,360	Birge et al. 1979
Channel catfish (sac fry), *Ictalurus punctatus*	80%	200	8.5 days (4 days post-hatch)	1% teratic larvae	26.4	Birge et al. 1979
Channel catfish (sac fry), *Ictalurus punctatus*	80%	200	8.5 days (4 days post-hatch)	4% teratic larvae	43.2	Birge et al. 1979

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Channel catfish (sac fry), *Ictalurus punctatus*	80%	200	8.5 days (4 days post-hatch)	16% teratic larvae	336	Birge et al. 1979
Channel catfish (sac fry), *Ictalurus punctatus*	80%	200	8.5 days (4 days post-hatch)	47% teratic larvae	3,848	Birge et al. 1979
Channel catfish (sac fry), *Ictalurus punctatus*	80%	200	8.5 days (4 days post-hatch)	86% teratic larvae	37,360	Birge et al. 1979
Mosquitofish, *Gambusia affinis*	Technical	-	48 hr	No mortality	10,000	Darwazeh and Mulla 1974
Guppy, *Poecilia reticulata*	-	-	48 hr	LC50	38,200	Tscheu-Schluter 1976
Guppy, *Poecilia reticulata*	-	-	72 hr	LC50	31,600	Tscheu-Schluter 1976
Guppy, *Poecilia reticulata*	-	-	96 hr	40% mortality	28,600	Bogacka et al. 1990
Guppy, *Poecilia reticulata*	-	-	96 hr	53.2% mortality	37,200	Bogacka et al. 1990
Mozambique tilapia, *Tilapia mossambica*	-	-	90 days	Decreased red and white blood cell counts, hemoglobin, packed cell volume, mean corpuscular hemoglobin; decreased whole animal oxygen consumption; increased mean cell volume, blood volume and blood water content	1,100	Prasad et al. 1991a

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Mozambique tilapia, *Tilapia mossambica*	-	-	30 days	Changed enzyme activity and levels of amino acids, proteins, ammonia, and urea in brain and liver	1,100	Prasad et al. 1991b
Mozambique tilapia, *Tilapia mossambica*	-	-	30 days	Increased lipase activity, free fatty acids, acetoacetate concentration, and total cholesterol in liver and muscle; decreased total lipids, glycerol and phospholipids in liver and muscle.	1,100	Srinivas et al. 1991
Mozambique tilapia, *Tilapia mossambicus*	-	-	90 days	Increased body weight, percent water, serum Na^+ and serum K^+; decreased serum Ca^{++}, Mg^{++}, and HCO_3^-	1,100	Prasad and Reddy 1994
Bullfrog (embryo and tadpole), *Rana catesbeiana*	80%	113	8 days (4 days post-hatch)	LC1	7.4	Birge et al. 1980
Bullfrog (embryo and tadpole), *Rana catesbeiana*	80%	113	8 days (4 days post-hatch)	LC10	44.9	Birge et al. 1980
Bullfrog (embryo and tadpole), *Rana catesbeiana*	80%	113	8 days (4 days post-hatch)	LC50	410	Birge et al. 1980
Bullfrog (embryo and tadpole), *Rana catesbeiana*	80%	113	4 days (to hatch)	1% teratic surviving larvae	51	Birge et al. 1980
Bullfrog (embryo and tadpole), *Rana catesbeiana*	80%	113	4 days (to hatch)	3% teratic surviving larvae	410	Birge et al. 1980

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Bullfrog (embryo and tadpole), *Rana catesbeiana*	80%	113	4 days (to hatch)	7% teratic surviving larvae	6,330	Birge et al. 1980
Bullfrog (embryo and tadpole), *Rana catesbeiana*	80%	113	4 days (to hatch)	22% teratic surviving larvae	14,800	Birge et al. 1980
Bullfrog (embryo and tadpole), *Rana catesbeiana*	80%	113	4 days (to hatch)	47% teratic surviving larvae	26,400	Birge et al. 1980
Bullfrog (embryo and tadpole), *Rana catesbeiana*	80%	113	4 days (to hatch)	100% teratic surviving larvae	45,800	Birge et al. 1980
Leopard frog (embryo and tadpole), *Rana pipiens*	80%	115	9 days (4 days post-hatch)	LC1	32.6	Birge et al. 1980
Leopard frog (embryo and tadpole), *Rana pipiens*	80%	115	9 days (4 days post-hatch)	LC10	378.9	Birge et al. 1980
Leopard frog (embryo and tadpole), *Rana pipiens*	80%	115	9 days (4 days post-hatch)	LC50	7,680	Birge et al. 1980
Leopard frog (embryo and tadpole), *Rana pipiens*	80%	115	5 days (to hatch)	2% teratic surviving larvae	110	Birge et al. 1980
Leopard frog (embryo and tadpole), *Rana pipiens*	80%	115	5 days (to hatch)	2% teratic surviving larvae	210	Birge et al. 1980
Leopard frog (embryo and tadpole), *Rana pipiens*	80%	115	5 days (to hatch)	5% teratic surviving larvae	1,113	Birge et al. 1980
Leopard frog (embryo and tadpole), *Rana pipiens*	80%	115	5 days (to hatch)	9% teratic surviving larvae	6,540	Birge et al. 1980
Leopard frog (embryo and tadpole), *Rana pipiens*	80%	115	5 days (to hatch)	13% teratic surviving larvae	13,200	Birge et al. 1980

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Leopard frog (embryo and tadpole), *Rana pipiens*	80%	115	5 days (to hatch)	46% teratic surviving larvae	48,700	Birge et al. 1980
Leopard frog (tadpole), *Rana pipiens*	85%	-	41 days	No effect upon growth or survival	25	Detenbeck et al. 1996
Pickerel frog (embryo and tadpole), *Rana palustris*	80%	103	8 days (4 days post-hatch)	LC50	17,960	Birge et al. 1980
Pickerel frog (embryo and tadpole), *Rana palustris*	80%	103	4 days (to hatch)	2% teratic surviving larvae	10,400	Birge et al. 1980
Pickerel frog (embryo and tadpole), *Rana palustris*	80%	103	4 days (to hatch)	5% teratic surviving larvae	20,600	Birge et al. 1980
Pickerel frog (embryo and tadpole), *Rana palustris*	80%	103	4 days (to hatch)	18% teratic surviving larvae	33,900	Birge et al. 1980
American toad (embryo and tadpole), *Bufo americanus*	80%	-	7 days (4 days post-hatch)	LC50	>48,000	Birge et al. 1980
American toad (embryo and tadpole), *Bufo americanus*	80%	-	3 days (to hatch)	2% teratic surviving larvae	490	Birge et al. 1980
American toad (embryo and tadpole), *Bufo americanus*	80%	-	3 days (to hatch)	2% teratic surviving larvae	5,560	Birge et al. 1980
American toad (embryo and tadpole), *Bufo americanus*	80%	-	3 days (to hatch)	3% teratic surviving larvae	10,800	Birge et al. 1980
American toad (embryo and tadpole), *Bufo americanus*	80%	-	3 days (to hatch)	6% teratic surviving larvae	24,800	Birge et al. 1980
American toad (embryo and tadpole), *Bufo americanus*	80%	-	3 days (to hatch)	17% teratic surviving larvae	48,200	Birge et al. 1980

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
African clawed frog (embryo), *Xenopus laevis*	40.8%	-	96 hr	100% abnormal embryos	8,000	Morgan et al. 1996
African clawed frog (embryo), *Xenopus laevis*	40.8%	-	96 hr	LC50	126,000	Morgan et al. 1996
African clawed frog (embryo), *Xenopus laevis*	40.8%	-	96 hr	LOEC (teratogenesis)	1,100	Morgan et al. 1996
Tiger salamander, *Ambystoma tigrinum*	-	333	86 days	Stimulated plasma thyroxine; delayed development - retarded growth	82	Larson et al. 1998
Stream mixed algal species	80%	-	1 day to 3 wk	39-78% reduction in gross productivity	10	Kosinski et al. 1985; Kosinski and Merkle 1984
Stream mixed algal species	80%	-	3 days	Reduced net primary productivity	100	Moorhead and Kosinski 1986
Experimental stream periphyton community	80%	-	14 days	Severe population density reductions in several species; total destruction of *Cladophora glomerata*	1,000	Kosinski 1984
Stream mixed community	Technical	164-202	30 days	No effect upon macroinvertebrate community structure, periphyton production or biomass, and community P/R ratio	25	Lynch et al. 1985

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Experimental laboratory stream community	96.5	-	2 wk	Decreased diurnal fluctuation and mean values for pH and dissolved oxygen; increased nitrate nitrogen; parameters rapidly returned to control levels when treatment ended	100	Malanchuk and Kollig 1985
Stream aufwuchs community	-	-	12 days	4% biomass reduction at 10°C	24	Krieger et al. 1988
Stream aufwuchs community	-	-	12 days	24% biomass reduction; 30% chlorophyll a reduction at 25°C	24	Krieger et al. 1988
Stream aufwuchs community	-	-	12 days	47% biomass reduction; 40% chlorophyll a reduction at 10°C	134	Krieger et al. 1988
Stream aufwuchs community	-	-	12 days	31% biomass reduction; 44% chlorophyll a reduction at 25°C	134	Krieger et al. 1988
Natural stream periphyton community	98%	-	24 hr	No effect upon algal cell numbers or biomass	77.5	Jurgenson and Hoagland 1990
Natural stream plankton community	Commercial product	-	6 mo	Initial decrease in phytoplankton species (6 wks) followed by a recovery	~0.5	Lakshminarayana et al. 1992

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Stream algal and benthic invertebrate community	90%	-	14 days	No effect upon attached algal chlorophyll a concentrations or benthic invertebrate populations	5	Gruessner and Watzin 1996
Artificial stream periphyton community	-	-	30 days	Community photosynthesis inhibited	100	Pearson and Crossland 1996
Pond microcosm, (static system)	98.2%	-	7 days	No effect upon diurnal oxygen production	5.0	Brockway et al. 1984
Pond microcosm, (static system)	98.2%	-	12 days	25-30% decreased oxygen production	50	Brockway et al. 1984
Pond microcosm, (static system)	98.2%	-	7 days	40-50% decreased diurnal oxygen production	100	Brockway et al. 1984
Pond microcosm, (static system)	98.2%	-	12 days	90% decreased diurnal oxygen production	500	Brockway et al. 1984
Pond microcosm, (static system)	98.2%	-	12 days	100% inhibition of diurnal oxygen production	5,000	Brockway et al. 1984
Lake microcosm plankton community	98%	-	10-21 days	Seasonal and species-dependent effects; growth generally stimulated for Chryptophytes and Chrysophytes, but inhibited in *Chlorella vulgaris*	10	Berard et al. 1999

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Freshwater microcosm	-	-	7 wk	No effects upon species composition of phytoplankton, zooplankton or benthic macroinverte-brates; slight decrease in photosynthetic activity	5.1	Van den Brink 1995
Periphyton-dominated microcosm	96.5%	-	1 day	77% decrease in daily net productivity	100	Hamala and Kollig 1985
Periphyton-dominated microcosm	96.5%	-	14 days	~75% decrease in P/R ratio	100	Hamala and Kollig 1985
Phytoplankton, zooplankton and benthos microcosm	-	-	60 days	Reduced ^{14}C uptake/chlorophyll a ratio	43.8	Stay et al. 1985
Phytoplankton, zooplankton and benthos microcosm	-	-	25 days	Reduced net primary productivity	~50	Stay et al. 1985
Pond mesocosm community	-	-	70 days	Changed population densities of zooplankton (rotifers, crustaceans and insect larvae)	200	Peichl et al. 1984
Pond mesocosm community	-	-	121 days	Changed phytoplankton community composition; increased rotifer population	10	Peichl et al. 1985

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Pond mesocosm community	41%	-	805 days	Reduced phytoplankton production and biomass, macrophyte, populations, and populations of benthic insect grazers, *Rana catesbiana* tadpoles, grass carp and bluegills	20	deNoyelles et al. 1982, 1989, 1994
Pond mesocosm community	41%	-	4 yr single annual applications	Reduced photosynthesis in 24 hr bioassays, followed by recovery in 20-day bioassays and long-term pond studies	20-500	deNoyelles and Kettle 1985
Pond mesocosm community	97%	-	9-112 days	Significant reductions of herbivorous benthic insect species richness, abundance, and total insect emergence (89%), shift to earlier emergence for some herbivorous species; destabilization of ecosystem	20[a]	Dewey 1986; Dewey and deNoyelles 1994

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Pond mesocosm community	97%	-	9-112 days	Significant reductions of herbivorous benthic insect species richness, abundance, and total insect emergence (95%), shift to earlier emergence for some herbivorous species; reduced species evenness; destabilization of ecosystem	100[n]	Dewey 1986; Dewey and deNoyelles 1994
Pond mesocosm community	97%	-	9-112 days	Significant reductions of herbivorous benthic insect species richness, abundance, and total insect emergence (85%), shift to earlier emergence for some herbivourous species; reduced species evenness; destabilization of ecosystem	500[n]	Dewey 1986; Dewey and de Noyelles 1994
Pond mesocosm community	40.8%	-	8 wk	Altered macrophyte community species composition; no effects upon primary productivity, total plant biomass, zooplankton or fish	50	Fairchild et al. 1994a
Pond mesocosm plankton community	-	-	2 mo	No effect	5	Juttner et al. 1995

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Pond mesocosm plankton community	-	-	2 mo	Decreased O_2, pH and conductivity	10	Juttner et al. 1995
Pond mesocosm plankton community	-	-	2 mo	Decreased phytoplankton populations	182	Juttner et al. 1995
Pond mesocosm plankton community	-	-	2 mo	Reduced peak egg ratios in *Daphnia longispina* and elimination of *Polyarthra* sp. rotifers	318	Juttner et al. 1995
Pond microbial microcosm community	98.6%	~70	21 days	NOEC for concentrations of Mg, Ca and dissolved oxygen	10	Pratt et al. 1988
Pond microbial microcosm community	98.6%	~70	21 days	MATC for concentrations of Mg, Ca and dissolved oxygen	17.9	Pratt et al. 1988
Pond microbial microcosm community	98.6%	~70	21 days	LOEC for concentrations of Mg, Ca and dissolved oxygen	32.0	Pratt et al. 1988
Pond microbial microcosm community	98.6%	~70	21 days	NOEC for protozoan colonization, biomass protein, chlorophyll a, and potassium concentration	110	Pratt et al. 1988
Pond microbial microcosm community	98.6%	`70	21 days	MATC for protozoan colonization, biomass protein, chlorophyll a, and potassium concentration	193	Pratt et al. 1988

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Pond microbial microcosm community	98.6%	~70	21 days	LOEC for protozoan colonization, biomass protein, chlorophyll a and potassium concentration	337	Pratt et al. 1988
Phyto- and zooplankton microcosm community	-	-	42 days	No or little effect upon net primary productivity, P/R ratio, and pH	~15	Stay et al. 1989
Phyto- and zooplankton microcosm community	-	-	42 days	Reduced net primary productivity, P/R ratio, and pH	~84	Stay et al. 1989
Experimental pond community	-	-	39 days after treatment	EC50 (^{14}C uptake)	96	Larsen et al. 1986
Experimental pond community	-	-	43 days after treatment	EC50 (^{14}C uptake)	131	Larsen et al. 1986
Experimental pond community	-	-	101 days after treatment	EC50 (^{14}C uptake)	109	Larsen et al. 1986
Experimental pond community	-	-	177 days after treatment	EC50 (^{14}C uptake)	24	Larsen et al. 1986
Experimental pond community	-	-	249 days after treatment	EC50 (^{14}C uptake)	27	Larsen et al. 1986
Experimental pond community	-	-	259 days after treatment	EC50 (^{14}C uptake)	37	Larsen et al. 1986
Experimental pond community	-	-	373 days after treatment	EC50 (^{14}C uptake)	100	Larsen et al. 1986

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Mixed pond community	99.2%	-	4 mo	Elimination of *Lemna minor* population	60-120	Gunkel 1983
Mixed pond community	99.2%	-	4 mo	Rapid succession of algal species; reduced reproduction rate in *Daphnia pulicaria*	60-120	Gunkel 1983
Pond mesocosm community	99%	-	2 yr	Decreased green algal species, cell numbers and cladoceran populations; increased cryptomonad cell numbers	20	Neugebauer et al. 1990
Pond mesocosm community	99%	-	2 yr	Decreased green algal species, cell numbers and cladoceran populations; increased cryptomonad cell numbers	100	Neugebauer et al. 1990
Pond mesocosm community	99%	-	2 yr	Decreased green algal species, cell numbers and cladoceran populations; increased cryptomonad cell numbers	300	Neugebauer et al. 1990

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Pond mesocosm community	Reagent grade	-	2 yr	Atrazine applied in May and June each year: decreased abundance of *Endochironomus nigricans* in June and of total macroinverte-brates in both May and June, followed by recovery in July; epiphytes decreased in abundance in June, followed by recovery in July; detritovore abundance decreased in May, followed by recovery in June; generalists decreased in May and June, followed by recovery in July	20	Huggins et al. 1994
Pond mesocosm community	Reagent grade	-	2 yr	Results similar to those at 20 µg/L in May and June; *Caenis* sp. significantly increased in July; also increased abundance of *Caenis* sp., total macroinverte-brates, detrito-vores and generalists in late July	100	Huggins et al. 1994

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Pond mesocosm community	Reagent grade	-	2 yr	Results similar to those at 20 and 100 g/L in May and June: *Caenis* sp. were significantly reduced in abund- ance in early July but not in late July; the abundance of epi- phytes decreased, while the abund- ance of total macroinverte- brates and generalists increased in late July	500	Huggins et al. 1994
Mixed algae from pond	-	-	>3 hr	Increased fluorescence rate for photosystem II	10	Ruth 1996
Lake limnocorral community	80%	-	34 days	Reduced periphyton ash-free dry weight	80-140	Herman et al. 1986
Lake limnocorral community	80%	-	9 wk (2 applications 6 weeks apart)	36-67% reduction in chlorophyll a, organic matter, and total peri- phyton algal biomass	80-140 (first application); ~110-190 (second application)	Herman et al. 1986
Lake limnocorral periphyton community	80%	-	50 days	~50% reduction in ash-free dry weight	80	Hamilton et al. 1987
Lake limnocorral periphyton community	80%	-	230 days	Reductions of ~60% in biomass, ~22% in cell numbers, and ~32% in number of species	80	Hamilton et al. 1987

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Lake limnocorral periphyton community	80%	-	56 days	Reductions of ~50% in chlorophyll a, ~32% in biomass, ~14% in cell numbers, and 33% in number of species	140	Hamilton et al. 1987
Lake limnocorral periphyton community	80%	-	56 days	Reductions of ~55% in chlorophyll a, ~68% in biomass, ~19% in cell numbers, and ~48% in number of species	1,560	Hamilton et al. 1987
Lake limnocorral community	80%	-	Two exposures 35 days apart	Different phytoplankton species assem- blages for up to 114 days after second applica- tion; increased Secchi disc readings and decreased levels of dissolved oxygen, chloro- phyll, and organic carbon; phyto- plankton communities were similar by day 323.	100 (1st applic.) 155 (2nd applic.)	Hamilton et al. 1988, 1989
Lake mesocosm plankton community	-	-	18 days	Decreased chlorphyll a, dissolved oxygen, nauplii, *Daphnia*, *Cyclops*; increased particulate organ- ic carbon	1	Lampert et al. 1989

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Lake mesocosm plankton community	-	-	10 days°	Decreased algal photosynthetic production, dissolved oxygen and *Daphnia* population; apparent recoveries after about 25 days	0.1	Lampert et al. 1989
Lake bacterial and algal species in microcosm study	-	-	-	Decreased algal population density and decreased "scope for change in ascendance" of community	250	Genoni 1992
Lake mesocosm community	-	-	20 days	No effect upon tolerance to atrazine by phytoplankton and periphyton communities or upon length of *Cladocera*; minor changes in species composition, POC/PON ratio and chlorophyll concentration	20	Gustavson and Wangberg 1995
Lake mesocosm phytoplankton community	-	-	20 days	EC50	58	Gustavson and Wangberg 1995
Lake mesocosm phytoplankton community	-	-	20 days	EC50	52	Gustavson and Wangberg 1995
Lake mesocosm periphyton community	-	-	20 days	EC50	52	Gustavson and Wangberg 1995
Lake mesocosm periphyton community	-	-	20 days	EC50	54	Gustavson and Wangberg 1995
Lake phytoplankton	-	-	3 hr	EC50 (carbon assimilation)	100	Brown and Lean 1995

Table 6 (continued)

Species	Chemical	Hardness (mg/L as $CaCO_3$)	Duration	Effect	Concentration (µg/L)	Reference
Lake phytoplankton	-	-	3 hr	EC50 (phosphate assimilation)	14,000	Brown and Lean 1995
Lake phytoplankton	-	-	3 hr	EC50 (ammonium assimilation)	>33,000	Brown and Lean 1995
Stream periphyton community	85.5%	-	<4 hr	LOEC (chlorophyll a)	109	Day 1993
Stream phytoplankton community	-	-	Spring season	Reduction in populations of green algae	40.4 maximum	Caux and Kent 1995
Wetland mesocosm community	85%	-	9-27 days	Decreased periphyton gross productivity; increased dissolved nutrients	15	Detenbeck et al. 1996

Species	Chemical	Salinity (g/kg)	Duration	Effect	Concentration (µg/L)	Reference
			SALTWATER SPECIES			
Green alga, *Chlamydomonas* sp.	-	30	90 min	EC50 (oxygen evolution)	60	Hollister and Walsh 1973
Green alga, *Chlorella* sp.	-	30	90 min	EC50 (oxygen evolution	143	Hollister and Walsh 1973
Green alga, *Chlorococcum* sp.	Technical	30	90 min	EC50 (oxygen evolution)	100	Walsh 1972
Green alga, *Chlorococcum* sp.	80.0%	30	90 min	EC50 (oxygen evolution)	400	Walsh 1972

Table 6 (continued)

Species	Chemical	Salinity (g/kg)	Duration	Effect	Concentration (µg/L)	Reference
Green alga, *Chlorococcum* sp.	Technical	30	90 min	EC100 (oxygen evolution)	400	Walsh 1972
Green alga, *Chlorococcum* sp.	80.0%	30	90 min	EC100 (oxygen evolution)	800	Walsh 1972
Green alga, *Chlorococcum* sp.	Technical	30	10 days	EC50 (growth)	100	Walsh 1972
Green alga, *Chlorococcum* sp.	80.0	30	10 days	EC50 (growth)	100	Walsh 1972
Green alga, *Chlorococcum* sp.	Technical	30	10 days	EC100 (growth)	500	Walsh 1972
Green alga, *Chlorococcum* sp.	80.0%	30	10 days	EC100 (growth)	500	Walsh 1972
Green alga, *Chlorococcum* sp.	-	30	90 min	EC50 (oxygen evolution)	80	Hollister and Walsh 1973
Green alga, *Dunaliella tertiolecta*	Technical	30	90 min	EC50 (oxygen evolution)	300	Walsh 1972
Green alga, *Dunaliella tertiolecta*	80.0%	30	90 min	EC50 (oxygen evolution)	600	Walsh 1972
Green alga, *Dunaliella tertiolecta*	Technical	30	90 min	EC100 (oxygen evolution)	700	Walsh 1972
Green alga, *Dunaliella tertiolecta*	80.0%	30	90 min	EC100 (oxygen evolution)	1,000	Walsh 1972
Green alga, *Dunaliella tertiolecta*	Technical	30	10 days	EC50 (growth)	300	Walsh 1972

Table 6 (continued)

Species	Chemical	Salinity (g/kg)	Duration	Effect	Concentration (µg/L)	Reference
Green alga, *Dunaliella tertiolecta*	80.0%	30	10 days	EC50 (growth)	400	Walsh 1972
Green alga, *Dunaliella tertiolecta*	Technical	30	10 days	EC100 (growth)	1,200	Walsh 1972
Green alga, *Dunaliella tertiolecta*	80.0%	30	10 days	EC100 (growth)	1,500	Walsh 1972
Green alga, *Dunaliella tertiolecta*	-	30	90 min	EC50 (oxygen evolution)	159	Hollister and Walsh 1973
Green alga, *Dunaliella tertiolecta*	97%	-	5 days	EC50 (cell number)	170	Hughes 1986; Hughes et al. 1986, 1988
Green alga, *Dunaliella tertiolecta*	97%	-	5 day exposure, 9 day recovery	NOEC (cell numbers)	< 100	Hughes 1986; Hughes et al. 1986, 1988
Green alga, *Dunaliella tertiolecta*	97%	-	5 day exposure, 9 day recovery	Algistatic concentration	1,450	Hughes 1986; Hughes et al. 1986, 1988
Green alga, *Dunaliella tertiolecta*	97%	-	5 day exposure, 9 day recovery	Algicidal concentration	>3,200	Hughes 1986; Hughes et al. 1986, 1988
Green alga, *Dunaliella tertiolecta*	-	-	15 min	EC50 (oxygen evolution)	270	Samson and Popovic 1988
Green alga, *Dunaliella tertiolecta*	-	-	15 min	EC50 (complementary area)	37	Samson and Popovic 1988
Green alga, *Dunaliella tertiolecta*	-	-	96 hr	EC50 (cell number)	132	Gaggi et al. 1995
Green alga, *Dunaliella bioculata*	Technical	-	48 hr	35% reduction in growth	216	Felix et al. 1988

Table 6 (continued)

Species	Chemical	Salinity (g/kg)	Duration	Effect	Concentration (µg/L)	Reference
Green alga, *Dunaliella bioculata*	Technical	-	48 hr	85% reduction in growth	3,240	Felix et al. 1988
Green alga, *Dunaliella bioculata*	Technical	-	48 hr	100% growth inhibition	21,570	Felix et al. 1988
Green alga, *Nannochloris oculata*	-	15	7 days	21% change in doubling time	50	Karlander et al. 1983; Mayasich et al. 1986
Green alga, *Nannochloris oculata*	-	15	7 days	11% change in doubling time	50	Karlander et al. 1983; Mayasich et al. 1986
Green alga, *Nannochloris oculata*	-	15	7 days	12% change in doubling time	50	Karlander et al. 1983; Mayasich et al. 1986
Green alga, *Nannochloris oculata*	-	15	7 days	34% change in doubling time	50	Karlander et al. 1983; Mayasich et al. 1986
Green alga, *Nannochloris oculata*	-	15	7 days	35% change in doubling time	50	Karlander et al. 1983; Mayasich et al. 1986
Green alga, *Nannochloris oculata*	-	15	7 days	33% change in doubling time	50	Karlander et al. 1983; Mayasich et al. 1986
Green alga, *Nannochloris oculata*	-	15	7 days	42% change in doubling time	50	Karlander et al. 1983; Mayasich et al. 1986
Green alga, *Nannochloris oculata*	-	15	7 days	35% change in doubling time	50	Karlander et al. 1983; Mayasich et al. 1986

Table 6 (continued)

Species	Chemical	Salinity (g/kg)	Duration	Effect	Concentration (µg/L)	Reference
Green alga, *Nannochloris oculata*	-	15	7 days	28% change in doubling time	50	Karlander et al. 1983; Mayasich et al. 1986
Green alga, *Nannochloris oculata*	-	15	7 days	46% change in doubling time	100	Karlander et al. 1983; Mayasich et al. 1986
Green alga, *Nannochloris oculata*	-	15	7 days	35% change in doubling time	100	Karlander et al. 1983; Mayasich et al. 1986
Green alga, *Nannochloris oculata*	-	15	7 days	21% change in doubling time	100	Karlander et al. 1983; Mayasich et al. 1986
Green alga, *Nannochloris oculata*	-	15	7 days	59% change in doubling time	100	Karlander et al. 1983; Mayasich et al. 1986
Green alga, *Nannochloris oculata*	-	15	7 days	52% change in doubling time	100	Karlander et al. 1983; Mayasich et al. 1986
Green alga, *Nannochloris oculata*	-	15	7 days	47% change in doubling time	100	Karlander et al. 1983; Mayasich et al. 1986
Green alga, *Nannochloris oculata*	-	15	7 days	57% change in doubling time	100	Karlander et al. 1983; Mayasich et al. 1986
Green alga, *Nannochloris oculata*	-	15	7 days	56% change in doubling time	100	Karlander et al. 1983; Mayasich et al. 1986

Table 6 (continued)

Species	Chemical	Salinity (g/kg)	Duration	Effect	Concentration (µg/L)	Reference
Green alga, *Nannochloris oculata*	-	15	7 days	54% change in doubling time	100	Karlander et al. 1983; Mayasich et al. 1986
Green alga, *Nannochloris oculata*	-	15	7 days	change in doubling time	15	Mayasich et al. 1987
Green alga, *Neochloris* sp.	-	30	90 min	EC50 (oxygen evolution)	82	Hollister and Walsh 1973
Green alga, *Platymonas* sp.	-	30	90 min	EC50 (oxygen evolution)	102	Hollister and Walsh 1973
Diatom, *Achnanthes brevipes*	-	30	90 min	EC50 (oxygen evolution)	93	Hollister and Walsh 1973
Diatom, *Amphora exigua*	-	30	90 min	EC50 (oxygen evolution)	300	Hollister and Walsh 1973
Diatom, *Cyclotella nanna*	-	30	90 min	EC50 (oxygen evolution)	84	Hollister and Walsh 1973
Diatom, *Isochrysis galbana*	Technical	30	90 min	EC50 (oxygen evolution)	100	Walsh 1972
Diatom, *Isochrysis galbana*	80.0%	30	90 min	EC50 (oxygen evolution)	200	Walsh 1972
Diatom, *Isochrysis galbana*	Technical	30	90 min	EC100 (oxygen evolution)	200	Walsh 1972
Diatom, *Isochrysis galbana*	80.0%	30	90 min	EC100 (oxygen evolution)	500	Walsh 1972

Table 6 (continued)

Species	Chemical	Salinity (g/kg)	Duration	Effect	Concentration (µg/L)	Reference
Diatom, *Isochrysis galbana*	Technical	30	10 days	EC50 (growth)	100	Walsh 1972
Diatom, *Isochrysis galbana*	80.0%	30	10 days	EC50 (growth)	100	Walsh 1972
Diatom, *Isochrysis galbana*	Technical	30	10 days	EC100 (growth)	200	Walsh 1972
Diatom, *Isochrysis galbana*	80.0%	30	10 days	EC100 (growth)	200	Walsh 1972
Diatom, *Isochrysis galbana*	-	30	90 min	EC50 (oxygen evolution)	100	Hollister and Walsh 1973
Diatom, *Minutocellus polymorphus*	-	-	72 hr	EC50 (cell numbers)	50	Walsh et al. 1988
Diatom, *Monochrysis lutheri*	-	30	90 min	EC50 (oxygen evolution)	77	Hollister and Walsh 1973
Diatom, *Navicula inserta*	-	30	90 min	EC50 (oxygen evolution)	460	Hollister and Walsh 1973
Diatom, *Nitzschia closterium*	-	30	90 min	EC50 (oxygen evolution)	287	Hollister and Walsh 1973
Diatom, *Nitzschia* (Ind. 684)	-	30	90 min	EC50 (oxygen evolution)	434	Hollister and Walsh 1973
Diatom, *Nitzschia sigma*	-	20	7 days	Reduced photosynthesis	220	Plumley and Davis 1980
Diatom, *Nitzschia sigma*	-	20	7 days	Reduced chlorophyll and cell number	2,200	Plumley and Davis 1980
Diatom, *Phaeodactylum tricornutum*	Technical	30	90 min	EC50 (oxygen evolution)	100	Walsh 1972

Table 6 (continued)

Species	Chemical	Salinity (g/kg)	Duration	Effect	Concentration (µg/L)	Reference
Diatom, *Phaeodactylum tricornutum*	80.0%	30	90 min	EC50 (oxygen evolution)	200	Walsh 1972
Diatom, *Phaeodactylum tricornutum*	Technical	30	90 min	EC100 (oxygen evolution)	200	Walsh 1972
Diatom, *Phaeodactylum tricornutum*	80.0%	30	90 min	EC100 (oxygen evolution)	600	Walsh 1972
Diatom, *Phaeodactylum tricornutum*	Technical	30	10 days	EC50 (growth)	200	Walsh 1972
Diatom, *Phaeodactylum tricornutum*	80.0%	30	10 days	EC50 (growth)	200	Walsh 1972
Diatom, *Phaeodactylum tricornutum*	Technical	30	10 days	EC100 (growth)	500	Walsh 1972
Diatom, *Phaeodactylum tricornutum*	80.0%	30	10 days	EC100 (growth)	500	Walsh 1972
Diatom, *Phaeodactylum tricornutum*	-	30	90 min	EC50 (oxygen evolution)	100	Hollister and Walsh 1973
Diatom, *Phaeodactylum tricornutum*	-	-	7 days	Limited effect on doubling time	50	Mayasich et al. 1987
Diatom, *Skeletonema costatum*	-	-	48 hr	EC50 (cell numbers)	20	Walsh et al. 1988
Diatom, *Stauroneis amphoroides*	-	30	90 min	EC50 (oxygen evolution)	348	Hollister and Walsh 1973
Diatom, *Thalassiosira fluviatilis*	-	20	7 days	Reduced chlorophyll	220	Plumley and Davis 1980
Diatom, *Thalassiosira fluviatilis*	-	20	7 days	Reduced cell number and photosynthesis	2,200	Plumley and Davis 1980

Table 6 (continued)

Species	Chemical	Salinity (g/kg)	Duration	Effect	Concentration (µg/L)	Reference
Diatom, *Thalassiosira fluviatilis*	-	30	90 min	EC50 (oxygen evolution)	110	Hollister and Walsh 1973
Red alga, *Porphyridium cruentum*	-	30	90 min	EC50 (oxygen evolution)	79	Hollister and Walsh 1973
Kelp, *Laminaria hyperborea*	-	-	28 days	LOEC (growth of new sporophytes)	10	Hopkins and Kain 1971
Kelp, *Laminaria hyperborea*	-	-	24 hr	LOEC (respiration)	>1,000	Hopkins and Kain 1971
Kelp, *Laminaria saccharina*	70%	30	2 days	No effect on sexual reproduction	33.2	Thursby and Tagliabue 1990
Kelp, *Laminaria saccharina*	70%	30	2 days	66% reduction in fertilization	72.2	Thursby and Tagliabue 1990
Redheadgrass pondweed, *Potamogeton perfoliatus*	-	8-12	2 hr	IC50 (photosynthesis)	77	Jones and Winchell 1984
Redheadgrass pondweed, *Potamogeton perfoliatus*	99.7%	10	4 hr	IC50 (photosynthesis)	80	Jones et al. 1986
Euraisian watermilfoil, *Myriophyllum spicatum*	-	8-12	2 hr	IC50 (photosynthesis)	104	Jones and Winchell 1984
Aquatic vascular plant, *zannichellia palustris*	-	8-12	2 hr	IC50 (photosynthesis)	91	Jones and Winchell 1984
Widgeon grass, *Ruppia maritima*	-	8-12	2 hr	IC50 (photosynthesis)	120	Jones and Winchell 1984
Vallisneria, *Vallisneria americana*	-	3	42 days	47% decrease in growth as length, and 48% decrease as dry weight	100	Forney 1980; Forney and Davis 1981

Table 6 (continued)

Species	Chemical	Salinity (g/kg)	Duration	Effect	Concentration (µg/L)	Reference
Vallisneria, *Vallisneria americana*	-	6	42 days	27% decrease in growth as length, and 30% decrease as dry weight	100	Forney 1980; Forney and Davis 1981
Vallisneria, *Vallisneria americana*	-	3	42 days	27% decreased in growth as length, and 41% decrease as dry weight	320	Forney 1980; Forney and Davis 1981
Vallisneria, *Vallisneria americana*	-	6	42 days	32% decrease in growth as length, and 29% decrease as dry weight	320	Forney 1980; Forney and Davis 1981
Vallisneria, *Vallisneria americana*	-	5	47 days	67% reduction in leaf production & 76% reduction in leaf area	12	Correll and Wu 1982
Eelgrass, *Zostera marina*	-	-	24 hr	Reduced net oxygen evolution	100	Kemp et al. 1982a
Eelgrass, *Zostera marina*	-	-	24 hr	No net oxygen evolution	1,000	Kemp et al. 1982a
Eelgrass, *Zostera marina*	97.2%	14	10 days	100% growth inhibition	1,900	Schwarzchild et al. 1994
Turtlegrass, *Thalassia testudinum*	Technical 99.7%	30	40 hr	EC50 (photosynthesis)	320	Walsh et al. 1982
Salt-marsh grass, *Spartina alterniflora*	97.1%	-	35 days	Increased peroxidase activity	30	Lytle and Lytle 1998

Table 6 (continued)

Species	Chemical	Salinity (g/kg)	Duration	Effect	Concentration (µg/L)	Reference
Salt-march grass, *Spartina alterniflora*	97.1%	-	35 days	No effect upon shoot growth, lipid peroxidation products or chlorophyll production; enhanced peroxidase activity	3,100	Lytle and Lytle 1988
Salt-marsh rush, *Juncus roemerianus*	97.1%	-	35 days	Reduced chlorphyll a; Increased peroxidase activity and lipid peroxidation products	30	Lytle and Lytle 1998
Salt-marsh rush, *Juncus roemerianus*	97.1%	-	35 days	Reduced shoot growth, chlorophyll a, chlorophyll b; increased lipid peroxidation products	3,800	Lytle and Lytle 1998
Eastern oyster (juvenile), *Crassostrea virginica*	Technical 99.7%	28	96 hr	EC50 (shell growth)	>1,000	Butler 1964; Mayer 1987
Copepod, *Acartia tonsa*	97.1%	30-34	72 hr	LC50	6,100	McNamara 1991b
Copepod, *Acartia tonsa*	97.1%	30-34	48 hr	LC50	8,400	McNamara 1991b
Copepod, *Acartia tonsa*	97.1%	30-34	24 hr	LC50	15,000	McNamara 1991b
Brown shrimp (juvenile), *Penaeus aztecus*	Technical 99.7%	30	48 hr	EC50	1,000	Mayer 1987
Brown shrimp, *Penaeus aztecus*	-	-	24 hr	20% mortality	1,000	Butler 1964

Table 6 (continued)

Species	Chemical	Salinity (g/kg)	Duration	Effect	Concentration (µg/L)	Reference
Brown shrimp, *Penaeus aztecus*	-	-	48 hr	30% mortality	1,000	Butler 1964
Mud crab (field), *Panopeus* sp.	80%	-	70 days	No effect on number per m^2 after a single application	10,000,000	Plumley et al. 1980
Drift line crab (field), *Sesarma cinereum*	80%	-	70 days	No effect on number per m^2 after a single application	10,000,000	Plumley et al. 1980
Fiddler crab (field), *Uca pugnax*	80%	-	70 days	No effect on number per m^2 after a single application	1,000,000	Plumley et al. 1980
Fiddler crab (field), *Uca pugnax*	80%	-	70 days	94% reduction in number per m^2 relative to control after a single application	10,000,000	Plumley et al. 1980
Fiddler crab, *Uca pugnax* (animals collected in August)	80%	20	8 days	25% mortality of large males; 100% mortality of large females; 100% mortality of small males; 75% mortality of small females	100,000	Plumley et al. 1980
Fiddler crab, *Uca pugnax* (animals collected in August 1977)	80%	20	8 days	50% mortality of large males; 100% mortality of large females; 75% mortality of small males, 50% mortality of small females	1,000,000	Plumley et al. 1980
Fiddler crab, *Uca pugnax* (animals collected in November)	80%	20	30 days	No effect on survival of small males	1,000,000	Plumley et al. 1980

Table 6 (continued)

Species	Chemical	Salinity (g/kg)	Duration	Effect	Concentration (µg/L)	Reference
Fiddler crab, *Uca pugnax* (animals collected in March)	80%	20	9 days	No effect on survival of small males	1,000,000	Plumley et al. 1980
Fiddler crab, *Uca pugnax* (animals collected in August 1978)	80%	20	9 days	60% mortality	100,000	Plumley et al. 1980
Fiddler crab, *Uca pugnax* (animals collected in August 1978)	80%	20	9 days	90% mortality	180,000	Plumley et al. 1980
Fiddler crab, *Uca pugnax* (animals collected in August 1978)	80%	20	9 days	80% mortality	320,000	Plumley et al. 1980
Fiddler crab, *Uca pugnax* (animals collected in August 1978)	80%	20	9 days	90% mortality	560,000	Plumley et al. 1980
Fiddler crab, *Uca pugnax* (animals collected in August 1978)	80%	20	9 days	90% mortality	1,000,000	Plumley et al. 1980
Fiddler crab, *Uca pugnax* (animals collected in August 1978)	80%	20	9 days	100% mortality	10,000,000	Plumley et al. 1980
Spot (juvenile), *Leiostomas santhurus*	Technical 99.7%	29	48 hr	LC50	>1,000	Butler 1964; Mayer 1987
Estuarine microbial community	-	7-25	9 days	Effects on phototrophic component - chlorophyll a, carbon assimilation, biovolume, and changes in species composition	40	DeLorenzo et al. 1999a

Table 6 (continued)

Species	Chemical	Salinity (g/kg)	Duration	Effect	Concentration (µg/L)	Reference
Estuarine microbial community	97%	-	24 hr	Effects on phototrophic component - chlorophyll a, carbon assimilation, and biovolume	47	DeLorenzo et al. 1999b
Mesocosm, Mixed marine phytoplankton	Residue grade	-	15 days	Reduced pH, particulate carbohydrates, chlorophyll, photosynthesis, primary production; increased dissolved organic phosphorus, dissolved organic nitrogen, and dissolved amino acids	0.12	Bester et al. 1995
Mesocosm, Mixed marine phytoplankton	Residue grade	-	15 days	Reduced pH, particulate carbohydrates, chlorophyll, photosynthesis, primary production; increased dissolved organic phosphorus, dissolved organic nitrogen, and dissolved amino acids	0.56	Bester et al. 1995

Table 6 (continued)

Species	Chemical	Salinity (g/kg)	Duration	Effect	Concentration (µg/L)	Reference
Mesocosm, Mixed marine phytoplankton	Residue grade	-	15 days	Reduced pH, particulate carbohydrates, chlorophyll, photosynthesis, primary production; increased dissolved organic phosphorus, dissolved organic nitrogen, and dissolved amino acids	5.80	Bester et al. 1995

[a] Test was run using a Taub and Dollar (1964) medium.
[b] Test was run using an algal assay medium (U.S. EPA 1971).
[c] Algae were pre-conditioned for 4 days with 531 g/L of atrazine.
[d] Test performed with an atrazine-sensitive strain.
[e] Test performed with an atrazine-resistant strain
[f] Nephelometric determination.
[g] Colorimetric determination.
[h] Only 2.3 to 4.7 percent of this concentration remained on day 7.
[i] Test performed with water from microcosm 30 days after atrazine had been introduced.
[j] Test performed directly with atrazine in water without a microcosm exposure.
[k] EC50 obtained using an algal assay medium.
[l] EC50 obtained using creek water as the test medium.
[m] Animals were fed at 24 hr.
[n] Two single annual applications at nominal concentration indicated.
[o] Atrazine concentrations were below detection after 10 days; however, the study continued for 42 days.