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Effects of cyanobacterial toxicity and morphology on the population growth of freshwater zooplankton: Meta-analyses of laboratory experiments

Alan E. Wilson, Orlando Sarnelle and Angeline R. Tillmanns

Web Appendix 1

Table A1. List of studies used in the primary meta-analysis comparing *r* for grazers fed control foods comprising chlorophytes and/or flagellates and treatment foods containing cyanobacteria. Grazer types: cl = cladoceran (genera = [1]*Bosmina*, [2]*Ceriodaphnia*, [3]*Chydoris*, [4]*Daphnia*, [5]*Moina*, [6]*Moinadaphnia*, [7]*Scapholeberis*, [8]*Simocephalus*); and r = rotifer (genera = [9]*Asplanchna*, [10]*Brachionus*, [11]*Hexarthra*, [12]*Keratella*, [13]*Synchaeta*). Toxins analyzed and found to be present: [14]anatoxin, [15]deazaadenosine, [16]glucopyranoside, [17]microcystin. Morphology types: colonial = colonial [genera = [18]*Microcystis*], filament = filamentous [genera = [19]*Anabaena*, [20]*Aphanizomenon*, [21]*Cylindrospermopsis*, [22]*Oscillatoria*/*Planktothrix*], and single = single-celled (genera = [19]*Anabaena*, [23]*Anacystis*, [24]*Gleocapsa*, [25]*Merismopedia*, [18]*Microcystis*, [26]*Synechococcus*, [27]*Synechocystis*). ND = toxin presence not determined by chemical analysis. * Studies employing toxic *Microcystis* PCC7820.

Studies	Grazer type	Cyanobacterial toxicity	Cyanobacterial morphology	Unweighted estimate	Weighted estimate
Ahlgren et al. 1990	cl[3,4]	ND	single[18], filamentous[22]	4	0
Alva-Martínez et al. 2001	cl[2,4,5]	ND	single[18]	9	9
Alva-Martínez et al. 2004	cl[4]	ND	single[18]	8	8
Arnold 1971	cl[4]	nontoxic, ND	single[19,23,24,25,26,27]	14	0
Brett 1993	cl[4]	ND	single[18]	2	2
Cecchine 1997	r[10]	toxic[17]	single[18]	9	9
Chen and Xie 2003	cl[5]	ND	colonial[18]	3	0
Chen and Xie 2004*	cl[4]	toxic[17]	single[18]	4	0
Claska and Gilbert 1998	cl[4]	toxic[14,15,16]	filament[19]	25	23
de Bernardi et al. 1981	cl[4]	ND	single[18]	6	0
Ferrão-Filho and Azevedo 2003	cl[2,5]	toxic[17]	single[18], colonial[18]	16	16
Ferrão-Filho et al. 2000	cl[2,4,5,6]	toxic[17]	single[18]	25	23
Ferrão-Filho et al. 2002	cl[2,5]	toxic[17]	single[18]	2	2
Fulton and Paerl 1987	r[10]	ND	single[18], colonial[18]	4	0
Fulton and Paerl 1988	cl[4], r[10]	ND	colonial[18]	4	0
Gilbert 1990	cl[1,2,4], r[12,13]	toxic[15,16]	filament[19]	22	22
Gilbert 1994	r[12]	toxic[14]	filament[19]	1	0
Gilbert 1996*a*	r[10]	toxic[14]	filament[19]	5	4
Gilbert 1996*b*	r[9,10]	toxic[14]	filament[19]	6	6
Gilbert and Durand 1990	cl[4], r[12]	nontoxic	filament[19]	4	4
Hanazato and Yasuno 1987	cl[5]	ND	single[18], colonial[18]	2	0
Henning et al. 1991	cl[4]	toxic[17], nontoxic, ND	single[18]	4	0
Hietala et al. 1995*	cl[4]	toxic[17]	single[18]	10	8
Hietala et al. 1997*a**	cl[4]	toxic[17]	single[18]	18	15
Hietala et al. 1997*b**	cl[4]	toxic[17]	single[18]	4	4
Kurmayer 2001	cl[1,4]	nontoxic	filament[20]	4	4
Lundstedt and Brett 1991	cl[4]	ND	single[18]	1	0
Lürling 2003*a*	cl[4]	toxic[17], nontoxic	single[18]	8	8
Lürling 2003*b**	cl[4]	toxic[17], nontoxic	single[18]	16	16
Lürling and van der Grinten 2003	cl[4]	toxic[17], nontoxic	single[18]	5	5
Nandini and Rao 1998	cl[2,4,5,7,8], r[10,11]	ND	single[18], colonial[18]	32	32
Nandini et al. 2000	cl[4]	ND	colonial[18]	2	2
Porter and Orcutt 1980	cl[4]	toxic[14]	single[19], filament[19]	4	0
Repka 1996	cl[4]	toxic[17]	filament[22]	6	0
Repka 1997	cl[4]	toxic[17]	filament[22]	9	9
Repka 1998	cl[4]	toxic[17]	filament[22]	12	12
Rothhaupt 1991	r[10]	ND	single[18], filament[19,21]	8	5
Sartonov 1995	cl[4], r[12]	nontoxic	single[18]	4	4
Shurin and Dodson 1997	cl[4]	toxic[17]	single[18]	3	3
Smith and Gilbert 1995*	cl[4], r[12]	toxic[17], nontoxic	single[18]	18	17
Starkweather 1981	r[10]	nontoxic	filament[19]	2	0
Starkweather and Kellar 1983	r[10]	toxic[14]	filament[19]	3	3
Weithoff and Walz 1995	r[10]	toxic[17]	filament[22]	10	10
			Total	358	285

Table A2. List of studies used in the secondary meta-analysis comparing *r* derived from survivorship curves, LT_{50} estimates, or directly from papers for grazers fed treatment foods containing cyanobacteria and no food. Data types: survivor = survivorship curves, LT_{50} = LT_{50} estimates, and *r* = *r* provided in or calculated from paper. Grazer types: ana = anostracan [Genus = [1]*Thamnocephalus*], cl = cladoceran [Genera = [2]*Bosmina*, [3]*Ceriodaphnia*, [4]*Daphnia*, [5]*Moina*, [6]*Moinadaphnia*], cop = copepod [Genera = [7]*Cyclops*, [8]*Diaptomus*, [9]*Eudiaptomus*], and r = rotifer [Genus = [10]*Brachionus*]. Toxins analyzed and found to be present: [11]anatoxin, [12]cylindrospermopsin, [13]deazaadenosine, [14]glucopyranoside, [15]microcystin, [16]microviridin, [17]paralytic shellfish toxin]. Morphology types: filament = filamentous [Genera = [18]*Anabaena*, [19]*Aphanizomenon*, [20]*Cylindrospermopsis*], and single = single-celled [Genera = [18]*Anabaena*, [21]*Microcystis*, [22]*Planktothrix*]. ND = toxin presence not-determined by chemical analysis. * = studies employing toxic *Microcystis* PCC7820.

Studies	Data type	Grazer types	Cyanobacterial toxicity	Cyanobacterial morphology	Treatment food – no food
Cecchine 1997	*r*	r[10]	toxic[15]	single[21]	1
DeMott et al. 1991*	survivor	cl[4], cop[8]	toxic[15], nontoxic	single[21]	12
Ferrão-Filho et al. 2000*	survivor	cl[3,4,5,6]	toxic[15]	single[21]	97
Fulton 1988*	survivor	cl[2,4,5]	toxic[11,15]	single[21], filament[18]	8
Gilbert 1998	survivor	cl[4]	toxic[13,14]	filament[18]	2
Henning et al. 1991	*r*	cl[4]	toxic[15], nontoxic	single[21]	2
Henning et al. 2001	survivor	cl[4]	toxic[15], nontoxic	single[21]	5
Kaebernick et al. 2001	survivor	cl[4]	toxic[15], nontoxic	single[21]	4
Kurmayer and Jüttner 1999	survivor	ana[1], cl[4], cop[7,9]	toxic[15]	single[22]	4
Lürling 2003*a*	*r*	cl[4]	toxic[15], nontoxic	single[21]	8
Matveev et al. 1994	survivor	cl[4]	toxic[15]	single[21]	1
Nizan et al. 1986*	survivor	cl[4]	toxic[15]	single[21]	4
Nogueira et al. 2004*a*	survivor	cl[4]	toxic[17]	filament[19]	1
Nogueira et al. 2004*b*	survivor	cl[4]	toxic[12], nontoxic	filament[20]	2
Porter and Orcutt 1980	*r*	cl[4]	toxic[11]	single[18], filament[18]	4
Reinikainen et al. 1994*	survivor	cl[4]	toxic[15]	single[21]	48
Rohrlack et al. 1999*a*	survivor	cl[4]	toxic[15], nontoxic	single[21]	2
Rohrlack et al. 1999*b*	LT_{50}	cl[4]	toxic[15], nontoxic	single[21]	6
Rohrlack et al. 2001	LT_{50}	cl[4]	toxic[15], nontoxic	single[21]	12
Rohrlack et al. 2004	survivor	cl[4]	toxic[16]	single[21]	2
Smith and Gilbert 1995	*r*	cl[4]	nontoxic	single[21]	1
Thostrup and Christoffersen 1999	survivor	cl[4]	toxic[15]	single[21]	1
van der Grinten et al. 2000	survivor	cl[4]	toxic[15], nontoxic	single[21]	12
				Total	239

Table A3. Grazer genera included in the primary and secondary meta-analyses comparing *r* for grazers fed control foods comprised of chlorophytes and/or flagellates and treatment diets containing cyanobacteria.

Meta-analysis	Genera	Grazer group	No. species	Unweighted effect size estimates
Primary	*Asplanchna*	rotifer	1	3
Primary	*Bosmina*	cladoceran	1	3
Primary	*Brachionus*	rotifer	2	50
Primary	*Ceriodaphnia*	cladoceran	2	34
Primary	*Chydoris*	cladoceran	1	2
Primary	*Daphnia*	cladoceran	10	200
Primary	*Hexarthra*	rotifer	1	4
Primary	*Keratella*	rotifer	3	19
Primary	*Moina*	cladoceran	2	27
Primary	*Moinadaphnia*	cladoceran	1	6
Primary	*Scapholeberis*	cladoceran	1	4
Primary	*Simocephalus*	cladoceran	1	4
Primary	*Synchaeta*	rotifer	1	2
Primary		Total	27	358
Secondary	*Bosmina*	cladoceran	1	2
Secondary	*Brachionus*	rotifer	1	1
Secondary	*Ceriodaphnia*	cladoceran	1	16
Secondary	*Cyclops*	copepod	1	1
Secondary	*Daphnia*	cladoceran	8	164
Secondary	*Diaptomus*	copepod	1	4
Secondary	*Eudiaptomus*	copepod	1	1
Secondary	*Moina*	cladoceran	1	21
Secondary	*Moinadaphnia*	cladoceran	1	28
Secondary	*Thamnocephalus*	anostracan	1	1
Secondary		Total	17	239

Table A4. List of excluded comparisons not used in the primary and secondary meta-analyses.

Meta-analysis	Study	Comparisons excluded	Reason for exclusion
Primary	Ahlgren et al. 1990	2	control *r* near or below 0
Primary	Chen and Xie 2003	9	control *r* near or below 0
Primary	Ferrão-Filho et al. 2000	4	unable to calculate treatment *r*
Primary	Laurén-Määttä et al. 1997	4	control *r* near or below 0
Primary	Lundstedt and Brett 1991	2	control *r* near or below 0
Primary	Weithoff and Walz 1995	1	control *r* near or below 0
Primary	Total	22	
Secondary	Arnold 1971	14	starvation *r* above 0
Secondary	Total	14	

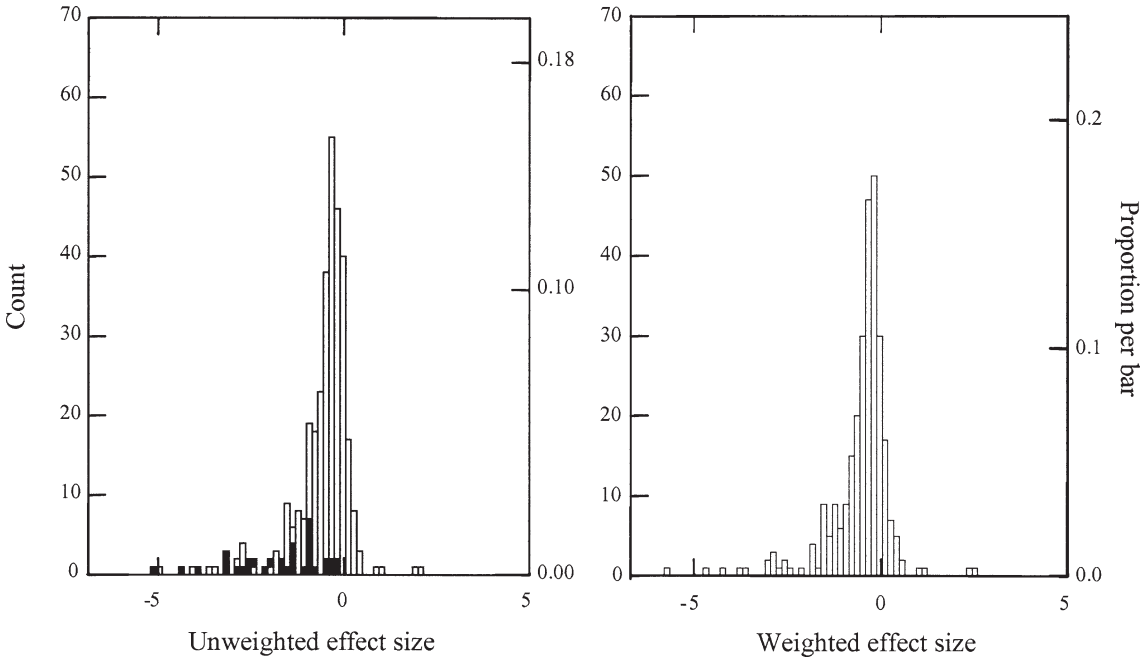

Figure A1. Frequency distribution of effect sizes for unweighted and weighted estimates of *r* comparisons for grazers fed control foods composed of chlorophytes and/or flagellates and treatment foods containing cyanobacteria used in the primary meta-analysis. Most effect sizes were calculated by using *r* estimates collected directly from the studies (white bars); however, a few *r* estimates were calculated from survivorship data (black bars).

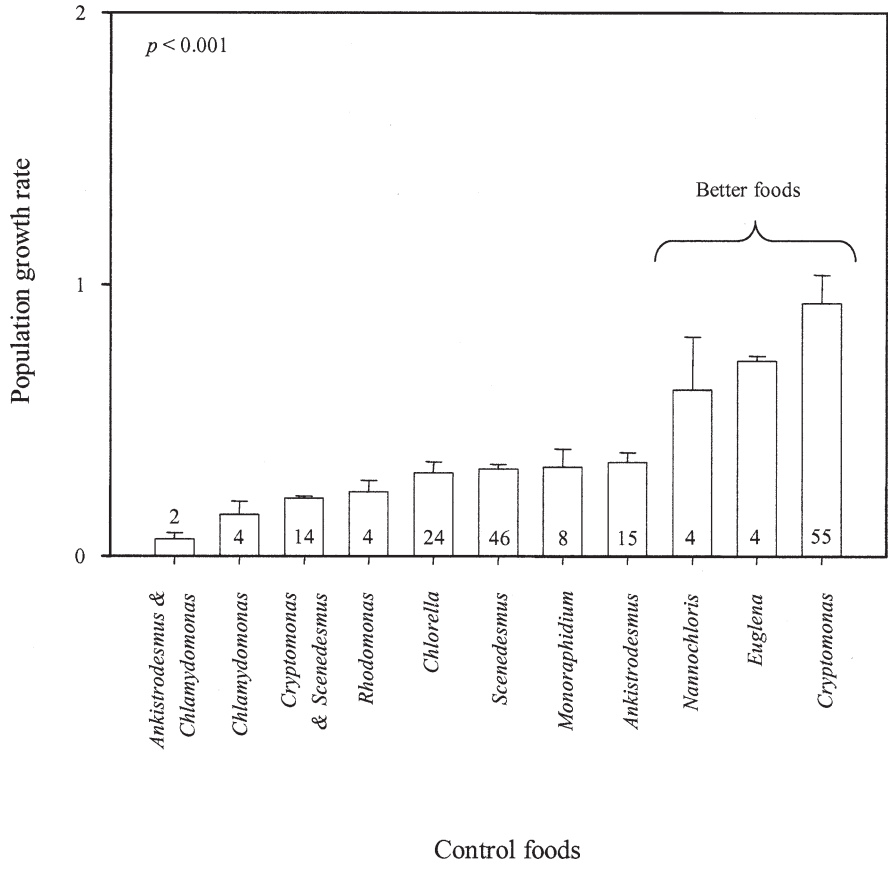

Figure A2. Control food population growth rates (mean ± 1 SE) for grazers used in the primary meta-analysis. Inset numbers indicate sample size for each estimate where each control food growth rate estimate was used only once per study, even if multiple effect size estimates incorporated the same control food growth rate estimate more than once.

References

Ahlgren, G., L. Lundstedt, M. Brett, and C. Forsberg. 1990. Lipid composition and food quality of some freshwater phytoplankton for cladoceran zooplankters. J. Plankton Res. **12:** 809–818.

Alva-Martínez, A. F., S. S. S. Sarma, and S. Nandini. 2001. Comparative population dynamics of three species of cladocera in relation to different levels of *Chlorella vulgaris* and *Microcystis aeruginosa*. Crustaceana **74:** 749–764.

———. 2004. Population growth of *Daphnia pulex* (Cladocera) on a mixed diet (*Microcystis aeruginosa* with *Chlorella* or *Scenedesmus*). Crustaceana **77:** 973–988.

Arnold, D. E. 1971. Ingestion, assimilation, survival, and reproduction by *Daphnia pulex* fed seven species of blue-green algae. Limnol. Oceanogr. **16:** 906–920.

Brett, M. T. 1993. Resource quality effects on *Daphnia longispina* offspring fitness. J. Plankton Res. **15:** 403–412.

Cecchine, G. A. 1997. Combinations of natural and anthropogenic stressors affect populations of freshwater rotifers. Georgia Institute of Technology.

Chen, F. Z., and P. Xie. 2003. The effects of fresh and decomposed *Microcystis aeruginosa* on cladocerans from a subtropic Chinese Lake. J. Freshw. Ecol. **18:** 97–104.

———. 2004. The toxicities of single-celled *Microcystis aeruginosa* PCC7820 and liberated *M. aeruginosa* to *Daphnia carinata* in the absence and presence of the green alga *Scenedesmus obliquus*. J. Freshw. Ecol. **19:** 539–545.

Claska, M. E., and J. J. Gilbert. 1998. The effect of temperature on the response of *Daphnia* to toxic cyanobacteria. Freshw. Biol. **39:** 221–232.

de Bernardi, R., G. Diussani, and E. L. Pedretti. 1981. The significance of blue-green algae as food for filter feeding zooplankton: Experimental studies of *Daphnia* spp. fed *Microcystis aeruginosa*. Verh. Int. Verein. Limnol. **21:** 477–483.

DeMott, W. R., Q. X. Zhang, and W. W. Carmichael. 1991. Effects of toxic cyanobacteria and purified toxins on the survival and feeding of a copepod and three species of *Daphnia*. Limnol. Oceanogr. **36:** 1346–1357.

Ferrão-Filho, A. S., S. Azevedo, and W. R. DeMott. 2000. Effects of toxic and nontoxic cyanobacteria on the life history of tropical and temperate cladocerans. Freshw. Biol. **45:** 1–19.

Ferrão-Filho, A. S., P. Domingos, and S. Azevedo. 2002. Influences of a *Microcystis aeruginosa* Kutzing bloom on zooplankton populations in Jacarepagua Lagoon (Rio de Janeiro, Brazil). Limnologica **32:** 295–308.

Ferrão-Filho, A. S., and S. Azevedo. 2003. Effects of unicellular and colonial forms of toxic *Microcystis aeruginosa* from laboratory cultures and natural populations on tropical cladocerans. Aquat. Ecol. **37:** 23–35.

Fulton, R. S. 1988. Resistance to blue-green algal toxins by *Bosmina longirostris*. J. Plankton Res. **10:** 771–778.

Fulton, R. S., and H. W. Paerl. 1987. Toxic and inhibitory effects of the blue-green alga *Microcystis aeruginosa* on herbivorous zooplankton. J. Plankton Res. **9:** 837–855.

———. 1988. Effects of the blue-green alga *Microcystis aeruginosa* on zooplankton competitive abilities. Oceologia **76:** 383–389.

Gilbert, J. J. 1990. Differential effects of *Anabaena affinis* on cladocerans and rotifers: Mechanisms and implications. Ecology **71:** 1727–1740.

———. 1994. Susceptibility of planktonic rotifers to a toxic strain of *Anabaena flos-aquae*. Limnol. Oceanogr. **39:** 1286–1297.

———. 1996*a*. Effect of food availability on the response of planktonic rotifers to a toxic strain of the cyanobacterium *Anabaena flos-aquae*. Limnol. Oceanogr. **41:** 1565–1572.

———. 1996*b*. Effect of temperature on the response of planktonic rotifers to a toxic cyanobacterium. Ecology **77:** 1174–1180.

———. 1998. Differential sensitivity of *Synchaeta* and *Daphnia* to nucleosides from *Anabaena affinis*. Hydrobiologia **388:** 277–281.

Gilbert, J. J., and M. W. Durand. 1990. Effect of *Anabaena flos-aquae* on the abilities of *Daphnia* and *Keratella* to feed and reproduce on unicellular algae. Freshw. Biol. **24:** 577–596.

Hanazato, T., and M. Yasuno. 1987. Evaluation of *Microcystis* as food for zooplankton in a eutrophic lake. Hydrobiologia **144:** 251–259.

Henning, M., H. Hertel, H. Wall, and J. G. Kohl. 1991. Strain-specific influence of *Microcystis aeruginosa* on food ingestion and assimilation of some cladocerans and copepods. Int. Rev. Gesamten Hydrobiol. **76:** 37–45.

Henning, M., T. Rohrlack, and J. G. Kohl. 2001. Responses of *Daphnia galeata* fed with *Microcystis* strains with and without microcystins, p. 266–280. *In* I. Chorus [ed.], Cyanotoxins. Springer.

Hietala, J., C. Laurén-Määttä, and M. Walls. 1997*a*. Life history responses of *Daphnia* clones to toxic *Microcystis* at different food levels. J. Plankton Res. **19:** 917–926.

———. 1997*b*. Sensitivity of *Daphnia* to toxic cyanobacteria: Effects of genotype and temperature. Freshw. Biol. **37:** 299–306.

Hietala, J., M. Reinikainen, and M. Walls. 1995. Variation in life history responses of *Daphnia* to toxic *Microcystis aeruginosa*. J. Plankton Res. **17:** 2307–2318.

Kaebernick, M., T. Rohrlack, K. Christoffersen, and B. A. Neilan. 2001. A spontaneous mutant of microcystin biosynthesis: Genetic characterization and effect on *Daphnia*. Environ. Microbiol. **3:** 669–679.

Kurmayer, R. 2001. Competitive ability of *Daphnia* under dominance of nontoxic filamentous cyanobacteria. Hydrobiologia **442:** 279–289.

Kurmayer, R., and F. Jüttner. 1999. Strategies for the co-existence of zooplankton with the toxic cyanobacterium *Planktothrix rubescens* in Lake Zurich. J. Plankton Res. **21:** 659–683.

Laurén-Määttä, C., J. Hietala, and M. Walls. 1997. Responses of *Daphnia pulex* populations to toxic cyanobacteria. Freshw. Biol. **37:** 635–647.

Lundstedt, L., and M. T. Brett. 1991. Differential growth rates of three cladoceran species in response to mono- and mixed-algal cultures. Limnol. Oceanogr. **36:** 159–165.

Lürling, M. 2003*a*. *Daphnia* growth on microcystin-producing and microcystin-free *Microcystis aeruginosa* in different mixtures with the green alga *Scenedemsus obliquus*. Limnol. Oceanogr. **48:** 2214–2220.

———. 2003*b*. Effects of microcystin-free and microcystin containing strains of the cyanobacterium *Microcystis aeruginosa* on growth of the grazer *Daphnia magna*. Environ. Toxicol. **18:** 202–210.

Lürling, M., and E. van der Grinten. 2003. Life-history characteristics of *Daphnia* exposed to dissolved microcystin-LR and to the cyanobacterium *Microcystis aeruginosa* with and without microcystins. Environ. Toxicol. Chem. **22:** 1281–1287.

Matveev, V., L. Matveeva, and G. L. Jones. 1994. Study of the ability of *Daphnia carinata* King to control phytoplankton

and resist cyanobacterial toxicity: Implications for biomanipulation in Australia. Aust. J. Mar. Freshw. Res. **45:** 889–904.

Nandini, S., and T. R. Rao. 1998. Somatic and population growth in selected cladoceran and rotifer species offered the cyanobacterium *Microcystis aeruginosa* as food. Aqat. Ecol. **31:** 283–298.

Nandini, S., S. S. S. Sarma, and P. Ramírez-García. 2000. Life table demography and population growth of *Daphnia laevis* (Cladocera, Anomopoda) under different densities of *Chlorella vulgaris* and *Microcystis aeruginosa*. Crustaceana **73:** 1273–1286.

Nizan, S., C. Dimentman, and M. Shilo. 1986. Acute toxic effects of the cyanobacterium *Microsystis aeruginosa* on *Daphnia magna*. Limnol. Oceanogr. **31:** 497–502.

Nogueira, I. C. G., P. Pereira, E. Dias, S. Pflugmacher, C. Wiegand, S. Franca, and V. M. Vasconcelos. 2004*a*. Accumulation of paralytic shellfish toxins (PST) from the cyanobacterium *Aphanizomenon issatschenkoi* by the cladoceran *Daphnia magna*. Toxicon **44:** 773–780.

Nogueira, I. C. G., M. L. Saker, S. Pflugmacher, C. Wiegand, and V. M. Vasconcelos. 2004*b*. Toxicity of the cyanobacterium *Cylindrospermopsis raciborskii* to *Daphnia magna*. Environ. Toxicol. **19:** 453–459.

Porter, K. G., and J. D. Orcutt. 1980. Nutritional adequacy, manageability, and toxicity as factors that determine the food quality of green and blue-green algae for *Daphnia*, p. 268–281. *In* W. C. Kerfoot [ed.], Evolution and ecology of zooplankton communities. Univ. Press of New England.

Reinikainen, M., M. Ketola, and M. Walls. 1994. Effects of the concentration of toxic *Microcystis aeruginosa* and an alternative food on the survival of *Daphnia pulex*. Limnol. Oceanogr. **39:** 424–432.

Repka, S. 1996. Inter- and intraspecific differences in *Daphnia* life histories in response to two food sources: The green alga *Scenedesmus* and the filamentous cyanobacterium *Oscillatoria*. J. Plankton Res. **18:** 1213–1223.

———. 1997. Effects of food type on the life history of *Daphnia* clones from lakes differing in trophic state. I. *Daphnia galeata* feeding on *Scenedesmus* and *Oscillatoria*. Freshw. Biol. **38:** 675–683.

———. 1998. Effects of food type on the life history of *Daphnia* clones from lakes differing in trophic state. II. *Daphnia cucullata* feeding on mixed diets. Freshw. Biol. **38:** 685–692.

Rohrlack, T., K. Christoffersen, M. Kaebernick, and B. A. Neilan. 2004. Cyanobacterial protease inhibitor microviridin J causes a lethal molting disruption in *Daphnia pulicaria*. Appl. Environ. Microbiol. **70:** 5047–5050.

Rohrlack, T., E. Dittmann, T. Börner, and K. Christoffersen. 2001. Effects of cell-bound microcystins on survival and feeding of *Daphnia* spp. Appl. Environ. Microbiol. **67:** 3523–3529.

Rohrlack, T., E. Dittmann, M. Henning, T. Börner, and J. G. Kohl. 1999*a*. Role of microcystins in poisoning and food ingestion inhibition of *Daphnia galeata* caused by the cyanobacterium *Microcystis aeruginosa*. Appl. Environ. Microbiol. **65:** 737–739.

Rohrlack, T., M. Henning, and J. Kohl. 1999*b*. Does the toxic effect of *Microcystis aeruginosa* on *Daphnia galeata* depend on microsystin ingestion rate? Arch. Hydrobiol. **146:** 385–395.

Rothhaupt, K. O. 1991. The influence of toxic and filamentous blue-green algae on feeding and population growth of the rotifer, *Brachionus rubens*. Int. Rev. Gesamten Hydrobiol. **76:** 67–72.

Sartonov, A. 1995. Effects of *Microcystis aeruginosa* on interference competition between *Daphnia pulex* and *Keratella cochlearis*. Hydrobiologia **307:** 117–126.

Shurin, J. B., and S. I. Dodson. 1997. Sublethal toxic effects of cyanobacteria and nonylphenol on environmental sex determination and development in *Daphnia*. Environ. Toxicol. Chem. **16:** 1269–1276.

Smith, A. D., and J. J. Gilbert. 1995. Relative susceptibilities of rotifers and cladocerans to *Microcystis aeruginosa*. Arch. Hydrobiol. **132:** 309–336.

Starkweather, P. L. 1981. Trophic relationships between the rotifer *Brachionus calyciflorus* and the blue-green alga *Anabaena flos-aquae*. Verh. Int. Verein. Limnol. **21:** 1507–1514.

Starkweather, P. L., and P. E. Kellar. 1983. Utilization of cyanobacteria by *Brachionus calyciflorus*: *Anabaena flos-aquae* (NRC-44-1) as a sole or complementary food source. Hydrobiologia **104:** 373–377.

Thostrup, L., and K. Christoffersen. 1999. Accumulation of microcystin in *Daphnia magna* feeding on toxic *Microcystis*. Arch. Hydrobiol. **145:** 447–467.

van der Grinten, E., M. Lürling, and T. Burger-Wiersma. 2000. Is *Microcystis* really toxic to *Daphnia*? Verh. Int. Verein. Limnol. **27:** 3226–3229.

Weithoff, G., and N. Walz. 1995. Influence of the filamentous cyanobacterium *Planktothrix agardhii* on population growth and reproductive pattern of the rotifer *Brachionus calyciflorus*. Hydrobiologia **313:** 381–386.