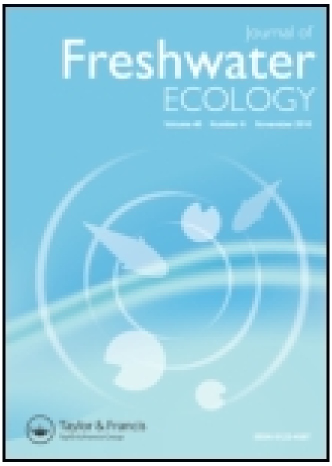


Journal of Freshwater Ecology
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/tjfe20

# The Impact of Planktivorous Fishes on Microcystin Concentrations in Meiliang Bay, Lake Taihu, China

Hua Yang [a] , Ping Xie [a] , Zhixin Ke [a] , Yaqin Liu [a] , Shikai Wu [a] , Jun Xu [a] & Longgen Guo [a]

[a] Donghu Experimental Station of Lake Ecosystems State Key Laboratory for Freshwater Ecology and Biotechnology of China , Institute of Hydroiology Chinese Academy of Sciences , Wuhan, 430072, P. R. China

Published online: 06 Jan 2011.

To cite this article: Hua Yang , Ping Xie , Zhixin Ke , Yaqin Liu , Shikai Wu , Jun Xu & Longgen Guo (2006) The Impact of Planktivorous Fishes on Microcystin Concentrations in Meiliang Bay, Lake Taihu, China, Journal of Freshwater Ecology, 21:4, 721-723, DOI: 10.1080/02705060.2006.9664136

To link to this article: http://dx.doi.org/10.1080/02705060.2006.9664136

**-NOTE-**

# The Impact of Planktivorous Fishes on Microcystin Concentrations in Meiliang Bay, Lake Taihu, China

ABSTRACT

In an eight-month enclosure experiment in Meiliang Bay of Lake Taihu, a shallow subtropical lake in China, silver carp (*Hypophthalmichthys molitrix*) and bighead carp (*Aristichthys nobilis*) collectively reduced cyanobacterial biomass. Microcystin concentration was six times higher in the 0.35 $km^2$ control enclosure (without fish) than in two similar-sized enclosures that had been stocked with both carp species. Furthermore, toxic *Microcystis* spp. increased microcystin production when exposed to silver carp and bighead carp.

Several studies have documented the influence of planktivorous fishes on cyanobacteria and have led to the suggestion that the use of silver carp (*Hypophthalmichthys molitrix*) and bighead carp (*Aristichthys nobilis*) might be a way to control excess bluegreen algae (Starling and Rocha 1990, Starling 1993, Fukushima et al. 1999, Xie and Liu 2001). Consequently, we conducted an enclosure experiment for eight months in Meiliang Bay of Lake Taihu in China to assess whether silver carp and bighead carp could suppress natural cyanobacterial blooms.

Using steel posts and polyethylene fish nettings (3.5-4.0 cm mesh), we constructed three enclosures of about 0.35 $km^2$ each in Meiliang Bay (120° 12' 46" – 120° 13' 07"E, 31° 29' 07" – 31° 29'55"N). Three hundred thousand silver carp and bighead carp (1:3 ratio) were introduced into two of the enclosures; the third was used as a control and lacked fish. The average individual weights at stocking were 100 g for silver carp and 125 g for bighead carp. Replicate water samples were collected monthly from April to November 2005. Each water sample was a mixture of two sub-samples – one from 0.5 m

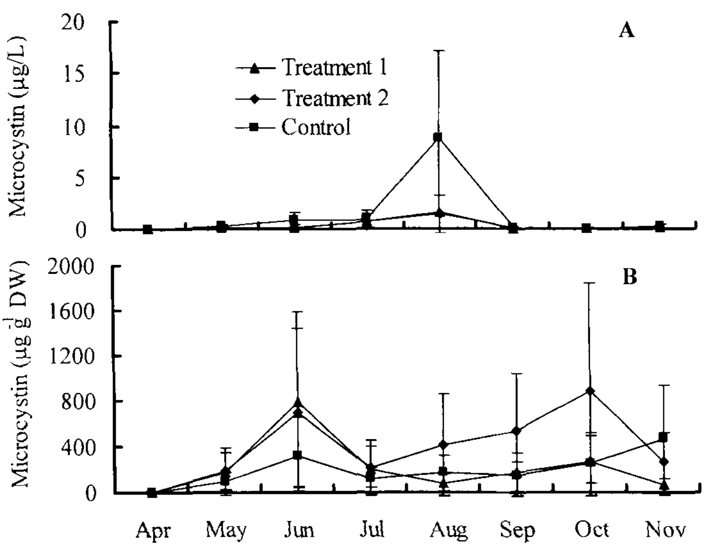


Figure 1. Seasonal variations in total microcystin concentration in water (A) and microcystin in the algae per se (B) in enclosure systems in Meiliang Bay, Lake Taihu.

below the surface and one from 0.5 m above the bottom. Phytoplankton was preserved with 1 % acidified Lugol's iodine solution and counted under 400× magnification. Taxonomic identification was according to Hu et al. (1979). Biomass was estimated from approximate geometric volumes of each taxon, and microcystin was measured according to Park (1998) and Welker et al. (1999).

Three cyanobacterial taxa dominated during the study period – *Microcystis* spp. (95 %), *Spirulina* spp. (3 %), and *Anabaena* spp. (2 %). In August, the peak of the algal bloom, biomass in the control enclosure was 93 mg $L^{-1}$, which was 5 - 22 times greater than the biomass in the two treatments enclosures (Fig. 1). At the same time, the total microcystin concentration in water was six time higher in the control (8.76 μg $L^{-1}$) as in the treatment enclosures (1.5 and 1.6 μg $L^{-1}$). Additionally, toxic *Microcystis* spp. increased microcystin production in the treatment enclosures when exposed to silver carp and bighead carp. Microcystin content of the blooming algae was 0.32 μg $g^{-1}$ (dry weight) in the control but was 0.70 - 0.79 μg $g^{-1}$ in the treatment enclosures (Fig. 1).

In an enclosure experiment, Kajak et al. (1975) found that silver carp reduced bluegreen algae and total phytoplankton biomass. Through enclosure experiments in Lake Donghu China, Xie (1996) also reported that both silver carp and bighead carp could eliminate cyanobacterial blooms directly by grazing. Our study provided strong support for the view that silver carp and bighead carp could effectively control cyanobacterial blooms.

## ACKNOWLEDGEMENTS

We thank Feizhou Chen and Jingxian Wang for their many valuable comments on the manuscript. This research was supported by an 863 project titled "Study on Eco-techniques for Improving Water Quality of Drinking Water Source in Meiliang Bay, Lake Taihu" (Grant No. 2002AA601011).

## LITERATURE CITED

Fukushima, M., N. Takamura, L. Sun, M. Nakagawa, K. Matsushige, and P. Xie. 1999. Changes in the plankton community following introduction of filter-feeding planktivorous fish. Freshwater. Biol. 42: 719-735.

Hu, H., R. Li, Y. Wei, C. Zhu, J. Chen, and Z. Shi. 1979. Freshwater algae in China. Science Press, Shanghai, China.

Kajak, Z., J. I. Rybak, I. Spodniewska, and W. A. Gadlewska-Lipowa. 1975. Influence of the planktivorous fish, *Hypophthalmichthys molitrix*, on the plankton and benthos of the eutrophic lake. P. Arch. Hydrobiol. 22: 301-310.

Park, H. D., C. Iwami, M. F. Watanabe, K. I. Harada, T. Okino, and H. Hayashi. 1998. Temporal variabilities of concentrations of intra- and extracellular microcystin and toxic *Microcystis* species in a hypertrophic lake, Lake Suwa, Japan (1991-1994) Environ. Toxicol. Water. Qual. 13: 61-72

Staring, F. L. and A. J. Rocha. 1990. Experimental study of the impacts of planktivorous fishes on plankton community and eutrophication of tropical Brazilian reservoir. Hydrobiologia 200/201: 581-591.

Staring, F. L. 1993. Control of eutrophication by silver carp (*Hypophthalmichthys molitrix*) in the tropical Paranoa Reservoir (Brasilia, Brazil): a mesocosm experiment. Hydrobiologia 257: 143-152.

Welker, M., S. Hoeg, and C. Steinberg. 1999. Hepatotoxic cyanobacteria in the shallow lake Muggelsee. Hydrobiologa 408/409: 263-268.

Xie, P. 1996. Expenmental studies on the role of planktivorous fishes in the elimination of *Microcystis* blooms from Donghu Lake using enclosure method. Chin. J. Oceanol. Limnol. 14:193-204.

Xie, P. and J. K. Liu. 2001. Practical success of biomanipulation using filter-feeding fish to control cyanobacteria blooms. The Scientific World. 1: 337-356.

Hua Yang, Ping Xie[a], Zhixin Ke,
Yaqin Liu, Shikai Wu, Jun Xu, and Longgen Guo
*Donghu Experimental Station of Lake Ecosystems*
*State Key Laboratory for Freshwater Ecology and*
*Biotechnology of China, Institute of Hydroiology*
*Chinese Academy of Sciences*
*Wuhan 430072 P.R. China*



[a] Corresponding author; E-mail: xieping@ihb.ac.cn



Received: 20 March 2006 Accepted: 1 June 2006