

## ***Curriculum Vitae and Publications of Dr. Ingrid Chorus***

July 2022

### **Curriculum vitae**

Since 2019	Private consultant on toxic cyanobacterial management for the World Health Organisation, Health Canada and the Greater Beirut Water Supply Project
2008 – 2018	Head of Division <i>Drinking-Water and Swimming-Pool Hygiene</i> of the Federal Environmental Agency of Germany
1992 – 2008	Head of Section <i>Drinking-water Resources and Treatment</i> of the Federal Environment Agency of Germany
1991 – 1992	Senior research scientist at the Institute for Water-, Soil- and Air Hygiene of the Federal Health Agency of Germany
1987 – 1991	Research scientist in the DFG-funded Project “algal-borne taste-and odour substances“ at the Institut for Water-, Soil- and Air Hygiene
1981 – 1987	Research scientist at the Free University of Berlin; Faculty of Biology: university teaching contracts; Environmental research contracts for the state of Berlin and for the Federal Environment Agency
Education	1972-1982: Free University, Berlin, Biology. Dissertation on „ <i>Production, respiration, assimilation and net production efficiency of Daphnia longispina from Heiligensee</i> “ (Prof. Tilzer, Technical University Berlin) in the context of the “Ecosystem Study Heiligensee”  1959-1972: Elementary School in Alabama, USA and John-F-Kennedy Highschool, Berlin

### **Research fields**

Risk-based approaches to managing drinking-water and water used for recreation; resource management and lake restoration; elimination of pathogens and substances through underground filtration; phytoplankton ecology; cyanobacteria and their toxins; algal metabolites

### **Leading teams for research and for the development of guidance or policy**

Leading a department that combines research with the development of concepts for water management, of policy and of guidance for practitioners

Leading a range of interdisciplinary research teams for projects funded by the German Ministry for Research and Technology (3 projects), the German Research Foundation (2 projects) and the EU (1 project), typically with 3-10 partner institutions

Leading a team of 38 authors from 16 countries for developing WHO guidance on toxic cyanobacteria, including a strong focus on managing catchments and waterbodies

### **Language skills**

English and German as mother tongues; French on a level sufficient for a rudimentary technical discussion

### **Memberships in scientific societies**

WSA (*Water Science Alliance; member of the leading board*)

SIL (*Societas Internationalis Limnologiae*)

DGL (*German Limnological Society*)

2004 – 2012: Member of the German Research Foundation's Review Board for Water Research which oversees the process of peer review of project proposals

### **Further outreach activities**

Co-editor of *Limnologica* (since 2015)

Support of the World Health Organisation in the rolling revision of the WHO Guidelines for Drinking-water Quality and for Safe Recreational Water Environments

Supervision of diploma-, masters-, and PhD-theses in the context of research projects

Keynote presentations at numerous conferences that present health risks from toxic cyanobacteria in relation to those from other hazards in water, balance risks and benefits of – e.g. – recreational activity in waterbodies with cyanobacteria, and show ways forward in waterbody management to mitigate eutrophication and thus blooms

### **5 most influential papers and books**

Chorus I; Welker M (2021): *Toxic Cyanobacteria in Water: A Guide to Public Health Consequences, Monitoring and Management*. Published on behalf of WHO by CRS Press, London, 839 pp.

This book – in its first edition as well as in the totally revised 2<sup>nd</sup> edition, is by far Ingrid Chorus's most influential publication. It has been quoted more than 4100 times and is regarded as the fundamental textbook on toxic cyanobacteria. This has led to numerous invitations for keynote presentations and discussions on assessing cyanotoxin risks as well as management approaches to mitigate them.

Fastner, J., Beulker, C., Geiser, B., Hoffmann, A., Kröger, R., Teske, K., ... & Chorus, I. (2018). Fatal neurotoxicosis in dogs associated with tychoplanktic, anatoxin-a producing *Tychonema* sp. in mesotrophic lake Tegel, Berlin. *Toxins*, 10, 60.

As waterbodies are becoming clearer in the wake of re-oligotrophication, cyanobacteria are increasingly shifting from scum-forming to benthic. Toxic benthic mats that detach and concentrate along shorelines have sporadically killed dogs who appear to be attracted to such rotting material and ingest major amounts. As dog deaths are alarming, interest in toxin concentrations in such material and in the water is pronounced.

Fastner, J., Abella, S., Litt, A., Morabito, G., Vörös, L., Pálffy, K., ... & Chorus, I. (2016). Combating cyanobacterial proliferation by avoiding or treating inflows with high P load — experiences from eight case studies. *Aquatic Ecology*, 50(3), 367-383.

While the number of publications evaluating large data sets covering many lakes, not many time series are available showing the trophic development of individual lakes over several decades. This publication has been well received by others working on restoration projects and in need for information on success factors.

Chorus, I.; Falconer, I.; Salas, H.; Bartram, J. 2000: Health risks caused by freshwater cyanobacteria in recreational waters. *J. Toxicol. Environ. Health* 3, 323 – 347

This publication, also translated into Spanish, was one of the first providing some guidance on assessing health risks from toxic cyanobacteria in waterbodies used for

recreation. It has been quoted more than 540 times and has been used by many practitioners (who often do not publish).

Via-Ordorika, L.; Fastner, J.; Kurmayer, R.; Hisbergues, M.; Dittmann, E.; Komarek, J.; Erhard, M.; Chorus, I. 2004: Distribution of microcystin-producing and non-microcystin-producing *Microcystis* sp. In European freshwater bodies: Detection of microcystins and microcystin genes in individual colonies. *System. Appl. Microbiol.* 27, 592 – 602

This publication was one of the first to assess genotype (i.e. cells containing the genetic code for microcystin production), chemotype (i.e. cells containing microcystin, with MALDI-TOF) and morphotype (i.e. cells classified by their morphological structure with expert support) for individual colonies of *Microcystis* spp. from a range of European countries, showing typical toxin patterns for specific morphotypes across Europe. This was a major step in elucidating microcystin production and clarifying whether it is a constitutive trait of strains with the respective intact genes.

### **Publications since 2000**

#### Books and Documents edited:

Chorus I, Welker M (2021): Toxic cyanobacteria in water: a guide to their public health consequences, monitoring and management, 858 pp. Taylor & Francis on behalf of WHO.

Dieter H, Mendel B, Krüger W, Chorus I (2021): Trinkwasser Aktuell. Erich Schmidt Verlag, Berlin

Rickert B; Chorus I; Schmoll O (2016): Protecting Surface waters for Health: Protecting surface water for health: Identifying, assessing and managing drinking-water quality risks in surface-water catchments. WHO Drinking-water Quality Series,

Chorus, I. (2005; 2012): Current approaches to Cyanotoxin risk assessment, risk management and regulations in different countries. Federal Environment Agency (Umweltbundesamt), Dessau. 147 pp. <http://www.uba.de/uba-info-medien-e/4390.html>.

Schmoll O; Howard G; Chilton J; Chorus, I (2006): Protecting Groundwater for Health: Managing the Quality of Drinking-water Sources. WHO Drinking-water Quality Series, IWA Publishing, London 678 pp.

Chorus I (2001): Cyanotoxins: Occurrence, Causes, Consequences. Springer Publishers Heidelberg 357 pp.

Chorus I; Bartram J (1999): Toxic Cyanobacteria in Water: A Guide to Public Health Significance, Monitoring and Management. Published on behalf of WHO by E&FN Spon/Chapman & Hall, London, 416 pp.

#### Publications in peer-reviewed journals (chronologically):

Chorus I, Fastner J, Welker M (2021). Cyanobacteria and cyanotoxins in a changing environment: Concepts, controversies, challenges. *Water*, 13(18), 2463.

Chorus I, Koehler A, Beulker C, Fastner J, van de Weyer K, Hegewald T, Hupfer M (2020). Decades needed for ecosystem components to respond to a sharp and drastic phosphorus load reduction. *Hydrobiologia*, 847(21), 4621-4651.

Chorus I, Spijkerman E (2021). What Colin Reynolds could tell us about nutrient limitation, N: P ratios and eutrophication control. *Hydrobiologia*, 848(1), 95-111.

Fastner, J., Beulker, C., Geiser, B., Hoffmann, A., Kröger, R., Teske, K., ... & Chorus, I. (2018). Fatal neurotoxicosis in dogs associated with tychoplanktic, anatoxin-a producing *Tychonema* sp. in mesotrophic lake Tegel, Berlin. *Toxins*, 10, 60.

- Chernoff, N., Hill, D. J., Chorus, I., Diggs, D. L., Huang, H., King, D., ... & Wood, C. R. (2018). Cylindrospermopsin toxicity in mice following a 90-d oral exposure. *Journal of Toxicology and Environmental Health, Part A*, 81(13), 549-566.
- Fastner, J., Abella, S., Litt, A., Morabito, G., Vörös, L., Pálffy, K., ... & Chorus, I. (2016). Combating cyanobacterial proliferation by avoiding or treating inflows with high P load—experiences from eight case studies. *Aquatic Ecology*, 50(3), 367-383.
- Klitzke, S., J. Schroeder, H.-C. Selinka, R. Szewzyk, and I. Chorus (2015). Attenuation and colloidal mobilization of bacteriophages in natural sediments under anoxic as compared to oxic conditions. *Science of the Total Environment*, 518-519, 130–138.
- Rigosi, A.; P. Hanson; D. P. Hamilton; M. Hipsey; J. A. Rusak; J. Bois; K. Sparber; I. Chorus; A. J. Watkinson; B. Qin; B. Kim and J. D. Brookes (2015): Determining the probability of cyanobacterial blooms: the application of Bayesian networks in multiple lake systems. *Ecological Applications*. 25 (1), S. 186-199
- Frohnert, A.; S. Apelt; S. Klitzke; I. Chorus; R. Szewzyk; H.-C. Selinka (2014): Transport and removal of viruses in saturated sand columns under oxic and anoxic conditions – Potential implications for groundwater protection. *International Journal of Hygiene and Environmental Health*, 217, S. 861-870
- K. Preußel; I. Chorus and J. Fastner (2014): Nitrogen Limitation Promotes Accumulation and Suppresses Release of Cylindrospermopsins in Cells of *Aphanizomenon* Sp. *Toxins*, 6, 2932-2947
- Bas W. Ibelings, Lorraine C. Backer; W. Edwin; A. Kardinaal; I. Chorus (2014): Current approaches to cyanotoxin risk assessment and risk management around the globe: *Harmful Algae* 40, S. 63-74
- Schmoll, O.; I. Chorus; I. Feuerpfeil; H.-C. Selinka; R. Szewzyk (2012): Die Bewertung gesundheitlicher Risiken durch Krankheitserreger im Trinkwasser. *Theoretische Maßstäbe und praktische Konsequenzen. Umweltmed Forsch Prax* 17 (2) 81-95
- Schmoll, O.; Castell-Exner, C., Chorus, I. (2011): From international developments to local practice: Germany's evaluation and dialogue process towards Water Safety Plan implementation. *Water Science & Technology: Water Supply* 11 (4)
- Klitzke, S.; S. Apelt; C. Beusch; C. Weiler; J. Fastner and I. Chorus (2010): The Fate of Cylindrospermopsin and Anatoxin-a during Sediment Passage. In: Official program and abstract book, the 8th International Conference on Toxic Cyanobacteria, p. 30.
- Grützmacher, G.; G. Wessel; S. Klitzke, I. Chorus (2010): Microcystin Elimination during Sediment Contact. *Environm. Sci. Technol.* 44, No. 2, 657-662
- Klitzke, S., S. Apelt, C. Weiler, J. Fastner, and I. Chorus (2010). Retention and Degradation of the cyanobacterial Toxin Cylindrospermopsin in Sediments - The Role of Sediment preconditioning and DOM composition. *Toxicon*, 55, 999 – 1007.
- Hilt, S., van de Weyer, K., Köhler, A., Chorus, I.: Submerged macrophyte responses to reduced phosphorus concentrations in two periurban lakes. *Restoration ecology*, 18, 452–461
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- Klitzke, S.; S. Apelt, C. Weiler, J. Fastner and I. Chorus (2009): Fate of the cyanotoxin cylindrospermopsin in sediments. *Geochimica et Cosmochimica Acta* 73. No. 13S, A669.
- Preußel, K.; Wessel, G.; Fastner, J.; Chorus, I. (2009): Response of cylindrospermopsin production and release in *Aphanizomenon flos-aquae* (Cyanobacteria) to varying light and temperature conditions: *Harmful Algae*. 8(2009) 645-650
- Schauser, I.; Chorus, I: Water and phosphorus mass balance of Lake Tegel and Schlachtensee - a modelling approach. *Water Research*, 43, 1788-1800 doi: 10.1016/j.watres.2009.01.007

- Preußel, K., Wessel, G., Fastner, J., Chorus, I. (2008): Response of cylindrospermopsin production and release in *Aphanizomenon flos-aquae* (Cyanobacteria) to varying light and temperature conditions: Harmful Algae.
- Wiedner, C.; Rücker, J., Fastner, J.; Chorus, I.; Nixdorf, B. (2008): Seasonal dynamics of cylindrospermopsis and cylindrospermopsin in two German lakes. *Toxicon* 52, 677-686
- Ibelings, B., Chorus, I. 2007: Accumulation of cyanobacterial toxins in freshwater „seafood“ and its consequences for public health – a review. *Environmental Pollution*, accepted
- Naselli-Flores, L.; Barone, R.; Chorus, I.; Kurmayer, R. (2007): Toxic Cyanobacterial blooms in reservoirs under a semi-arid mediterranean climate: the magnification of a problem. *Environm. Toxicol.* 399-404
- Fastner, J.; Rücker, J.; Stüken, A.; Preußel, K.; Nixdorf, I.; Chorus, I.; Köhler, A.; Wiedner, C., 2007: Occurrence of the cyanobacterial toxin cylindrospermopsin in Northeast Germany. *Environm. Toxicol.* 22, 26-32
- Schauser, I.; Chorus, I. 2007: Assessment of the success of external and internal restoration measures in two Berlin lakes, *Lake and Reservoir Management* (accepted Dec. 2006)
- Niesel, V.; Chorus, I.; Sudbrack, R.; Willmitzer, H.; Hoehn, E. 2007: The probability of occurrence of the dinoflagellates *Gymnodinium uberrimum* and *Peridinium willeii* in German reservoirs. *Journal of Plankton Research*; doi: 10.1093/plankt/fbm017
- Schauser, I.; Heinzmann, B.; Chorus, I. 2007: Strategy and current status of combating eutrophication in lakes for safeguarding drinking water resources, *Wat. Science Techn.* (accepted)
- Schauser, I.; Chorus, I.; Lewandowski, J. 2006: Effects of nitrate on phosphorus release: comparison of two Berlin lakes. *Acta hydrochim. Hydrobiol.*
- Preussel, K.; Stüken, A.; Wiedner, C.; Chorus, I.; Fastner, J. 2006: First report on cylindrospermopsin producing *Aphanizomenon flos-aquae* (Cyanobacteria) isolated from two German lakes. *Toxicon* 47, S. 156 - 162
- Gijsbertsen-Abrahamse, A.J., W. Schmidt, I. Chorus, S.G.J. Heijman 2006: Removal of cyanotoxins by ultrafiltration and nanofiltration, *Journal of Membrane Science* 276, 252-259
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- Via-Ordorika, L.; Fastner, J.; Kurmayer, R.; Hisbergues, M.; Dittmann, E.; Komarek, J.; Erhard, M.; Chorus, I. 2004: Distribution of microcystin-producing and non-microcystin-producing *Microcystis* sp. In European freshwater bodies: Detection of microcystins and microcystin genes in individual colonies. *System. Appl. Microbiol.* 27, 592 – 602

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- Kurmayer, R.; Christiansen, G.; Chorus, I. 2003: The abundance of microcystin-producing genotypes correlates positively with colony size in *Microcystis* and determines its microcystin net production in Lake Wannsee. *Appl. and Environm. Microbiol.* 69, 787 - 795.
- Naselli-Flores, L.; Padisák, J.; Dokulil, M.T.; Chorus, I. 2003: Equilibrium/steady-state concept in phytoplankton ecology. *Hydrobiologia* 502, 395 - 403
- Grützmaker, G.; Böttcher, G.; Chorus, I.; Bartel, H. 2002: Removal of microcystins by slow sand filtration. *Environ. Toxicol.* 17, 386 – 394
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- Grützmaker, G.; Böttcher, G.; Chorus, I.; Knappe, A.; Pekdeger, A. 2002: Cyanobacterial toxins in bank filtered water from Lake Wannsee, Berlin. In: Dillon, P.J. (ed.): Management of Aquifer Recharge for Sustainability. – *Proceedings of the 4<sup>th</sup> international symposium on artificial recharge of groundwater, ISAR-4, Adelaide, South Australia 22. – 26. September 2002*, 175 – 180
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- Törökne, K.; László, E.; Chorus, I.; Fastner, J.; Heinze, R.; Padisák, J.; Barbosa, F.A.R. 2000: Water quality monitoring by Thamnotoxkit FTM including cyanobacterial blooms. *Wat. Sci. Tech.* 42, 381-385.

#### Book contributions (with peer review)

- Chorus, I. 2004: Water Safety Plans – a better regulatory approach to prevent human exposure to harmful cyanobacteria. In: J. Huisman, H.C.P. Matthijs and P.M. Visser (eds.): Harmful Cyanobacteria. Kluwer Academic Publishers, 201 – 227
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- Chorus, I, J. Clasen, J. Fastner 2002, 2019: Biologische Aspekte der Wassernutzung und Wasserqualität - Stehende Gewässer. In: A. Grohmann (Hrsg.; ehemals Höll): Wasser. Nutzung im Kreislauf. Hygiene, Analyse und Bewertung. Verlag deGruyter. 408 – 443
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