

Preface

Lake Kinneret, known also as the Sea of Galilee and Lake Tiberias, has attracted people's attention since ancient times. The lake and its vicinity served as important sites for much of human history in the region, including that associated with the life of Jesus Christ and his ministry. Several of Jesus' disciples were local fishermen and Lake Kinneret plays a prominent role in his teachings. The Northwestern shore of Lake Kinneret at Tabgha is the site of the Miracle of Loaves and Fishes, as described in the *New Testament*. According to the biblical story, five loaves of bread and two small fish that Jesus handed out were sufficient to feed 5,000 people. While this miracle has been explained at times as an act of a higher power, our current understanding of the limnology of Lake Kinneret provides a plausible basis for the story. After the onset of thermal stratification in April or May during years of extremely high spring productivity, the lower water mass (hypolimnion) can become devoid of oxygen relatively early in the season. Internal wave activity, driven primarily by strong westerly winds, can cause strong upwelling of these anoxic waters on the Northwestern shores near Tabgha, trapping and suffocating large schools of bleak ("the Kinneret sardine") and other fish that float to the surface in the thousands. These fish are not poisoned or sick and are fine to eat, even several hours after the upwelling event. As scientists, we can only suspect that the loaves portion of the miracle can be attributed to poetic license.

The modern scientific curiosity about the Sea of Galilee attracted travelers and naturalists such as Fredrik Hasselquist, a student of Charles Linnaeus, who in 1766, provided the first scientific description of the local *Tilapia* fish species. He was followed by settlers who explored the lake, first for its fishery and later as a reliable source of freshwater for domestic and agricultural uses. The Ministry of National Infrastructures, Energy and Water, and the Israel Water Authority initiated and supported advanced monitoring and research programs aimed at elucidation of physical, geochemical, biological, and ecological processes that affect the lake ecosystem.

Unraveling the mechanisms underlying the functioning of the Lake Kinneret ecosystem is at the heart of this book. The accumulated current knowledge on the structure and functioning of Lake Kinneret as an aquatic ecosystem is comprehensively described, with implications to lake management practices.

Since its establishment in 1967, the Kinneret Limnological Laboratory (KLL) of the Israel Oceanographic and Limnological Research (IOLR) serves as a research center on Lake Kinneret. The contribution of KLL-IOLR scientists and other researchers from Israel and other countries presented in this book demonstrates the interdisciplinary approach taken to unveil this complex ecosystem.

The editors and the contributors are indebted to the professional field and technical crew of KLL that assisted in the field and laboratory work conducted over the last 2–3 decades, including Boaz Avraham, Bonnie Azoulay, Yochi Cahila, Sara Chava, Moti Diamant, James Easton, Eva Feldman, Meir Hatab, Rivka Hershkowitz, Semion Kaganovsky, Bina Kaplan, Mochik Leder, Miki Shlichter, Beny Sulimani, Oz Tzabary-Dar, Shimshon Zakai.

The Israel Water Authority funded the monitoring program on Lake Kinneret right from its beginning in 1969. The team of experts constituting the Lake Kinneret and Watershed Steering Committee of the Israel Water Authority, made substantial contributions toward the constant upgrade and modernization of the Kinneret monitoring program, including support in funding of essential scientific instrumentation. Many granting agencies funded much of the research conducted at the Kinneret Limnological Laboratory, including the research funds of the Israel Water Authority, Israel Ministry of Energy and Water, the Israel Ministry of Science, Technology and Space (MOST), Israel Ministry of Agriculture, the Israel Science Foundation, the USA-Israel binational Science Foundation, the Germany-Israel BMBF, and the Germany Israel Foundation (GIF), the European Community. Lastly, we gratefully acknowledge the long-term financial support and encouragement provided by the North American Friends of IOLR (NAF/IOLR).

The monitoring data presented in this book were collected by several organizations, deposited into a single database, and made available to the interested scientists. In addition to the data collected as part of the Kinneret monitoring program by the Kinneret Limnological Laboratory, the Watershed Unit of Mekorot water company conducted most of the chemical analyses on Kinneret samples and all the analyses on the watershed and salt spring samples. The Hydrological Services of the Israel Water Authority shared discharge data. The Meteorological Services provided meteorological data. The Fisheries Department of the Ministry of Agriculture shared fish harvest and stocking data.

Furthermore, we are greatly indebted to many referees who willingly contributed to the improvement of the contents of the book. These referees were—Amotz Agnon, Jason Antenucci, Yoram Avnimelech, Yuval Bartov, Michael Beyth, Revital Bookman, Patrick Brezonik, Marco Cantonati, Deeksha Narula Katyal, Ray Drenner, Zvi Dubinsky, Yael Duboswsky, Reiner Eckmann, Larell Fabro, Giovanna Flaim, Eran Friedler, Amatzia Genin, Michail Gladishev, Avraham Golik, Noam Greenbaum, Hans Guede, Haim Gvirtzman, Debora Hart, Karl E Havens, Brendan Hicks, Chuck Howard, Danny Ionescu, Alexey Kamishny, Amitai Katz, Avner Kessler, Hanoach Lavee, M Iggi Litaor, Ramon Massana, Tamara Mikeheyeva, Yaacov Nir, Brigitte Nixdorf, Mikko Olin, Adina Paytan, Jarone Pinhassi, Antonio Quaseda, Emil Rydin, Nico Salmaso, Rana Samuels, John Schalles, Amit Segev, Yaela Shaked, Evelyne Sherr, Rhena Schumann, Nadezhda Sushchi, Max Tilzer, Monica

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Finally, a word about Tom Berman, who enthusiastically joined the team of book editors. He died unexpectedly in April 2013 while hiking alone in the Galapagos Islands, at the age of 79. His contribution to the last stages of finalizing this book was greatly missed. Tom was the first director of KLL (1967–1971) and again became its director for the period of 1986–1998. He foresaw the crucial role of long-term records for understanding the functioning of ecosystems, and fostered the close ties between monitoring and research, understanding that this combination forms both, the basis for future research and the basis for recommendations regarding the management of the lake as a main source of drinking water for the State of Israel.

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