Managing a Lake Ecosystem using a food-web model – Lake Kinneret as a case study

Eyal Ofir  
*Kinneret Limnological Laboratory, Israel Oceanographic & Limnological Research (IOLR)*, ofiree@gmail.com

Gideon Gal  
*Kinneret Limnological Laboratory, Israel Oceanographic & Limnological Research (IOLR)*, gal@ocean.org.il

James Shapiro  
*The Israeli Ministry of Agriculture, Department of Fisheries Management*, jamess@moag.gov.il

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Paper Title: Managing a Lake Ecosystem using a food-web model – Lake Kinneret as a case study

Ofir Eyal\textsuperscript{a}, Gal Gideon\textsuperscript{b}, Shapiro James\textsuperscript{c}

\textsuperscript{a} Kinneret Limnological Laboratory, Israel Oceanographic & Limnological Research (IOLR): (ofiree@gmail.com)

\textsuperscript{b} Kinneret Limnological Laboratory, Israel Oceanographic & Limnological Research (IOLR): (gal@ocean.org.il)

\textsuperscript{c} The Israeli Ministry of Agriculture, Department of Fisheries Management (jamess@moag.gov.il)

Abstract: Lake Kinneret is a freshwater lake located in the northern part of Israel. The lake is one of the most important freshwater resources in Israel, and maintaining a stable ecosystem is of prime importance. The ecosystem has, however, changed dramatically during the last 20 years. Following the destabilization that occurred in the lake ecosystem biomanipulation measures such as fish stocking of certain species and removal of another were used in order to restabilize the ecosystem. Most biomanipulation measures did not succeed in achieving their goals. For instance, 10 years of intense fishing efforts to remove the Lavnum fish (Acanthobrama terraesanctae) in order to improve water quality failed, with no evidence of any change in the ecosystem.

In order to understand the behavior of the ecosystem and to provide management recommendations, a food-web model using Ecopath with Ecosim was developed as part of a project intended to provide lake managers with a tool for testing management strategies for the lake. The static, mass-balance, Ecopath model of the lake included all tropic levels from detritus and bacteria up to the top predators and commercial fisheries. All together there were 29 groups in the model that included 7 phytoplankton groups, 3 zooplankton functional groups, all commercial fish's species and top predators like the catfish and cormorant birds.

The time dynamic model (Ecosim) was calibrated and used to test the effects of the biomanipulation measures. During this process we ran 20-year biomanipulation scenarios and compared the results to a non-biomanipulation simulation. The results provided insights into the reasons for the failure of the biomanipulation measures and clearly showed that the actions can have negative effects on water quality. The case study illustrates the benefits of food-web models in managing ecosystem services.

Keywords: Lake Kinneret. Food-web. Ecosystem services. Ecopath. Ecosim. Ecosystem management