How algae 'enslavement' threatens freshwater bodies

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How toxic, blue-green algae out-compete other organisms through a form of selfish "enslavement" -- and by so doing proliferate dangerously in freshwater bodies -- has been described by a researcher at the Hebrew University of Jerusalem.

In general, the increasing occurrence of toxic cyanobacterial (blue-green algae) blooms in freshwater bodies is a matter of growing international concern due to their detrimental impact on drinking water quality and, in extreme cases, causing death to humans, livestock and wild animals. Thus, the new Hebrew University research can be of value to water authorities seeking ways to control this algae infiltration.

A toxic blue-green alga known as Aphanizomenon ovalisporum was first detected in Lake Kinneret (Sea of Galilee) in 1994, and its presence has been noted each summer thereafter. The conditions promoting these toxic blooms and other toxin formations in freshwater bodies were not known.

However, now in a paper to be published online on Aug. 12 in *Current Biology*, Yehonatan Bar-Yosef, a Ph.D. student in Prof. Aaron Kaplan's group at the Alexander Silberman Institute of Life Sciences at the Hebrew University of Jerusalem, has suggested a novel mechanism to explain the ability of Aphanizomenon to form massive toxic blooms by overcoming competition from other microorganisms in the water. (Kaplan is the Bernice and Aaron Beare Family Professor of Environmental Plant Physiology.)

Aphanizomenon is known to produce the toxin cylindrospermopsin (CYN). Secretion of the CYN, Bar-Yosef found, induces phosphate-limitation responses in other microorganisms in the ecosystem, even in the presence of ample phosphate in the water. The phosphate mineral is an essential nutrient for growth in many organisms.

The result is that Aphanizomenon is able to attain a relative advantage in phosphate-absorption capability, thus gaining dominance in the competition for nutrients.

The investigators have used the term "enslavement" to describe this novel interspecies interaction, mediated by CYN. This research provides an explanation for the significant rise in massive cyanobacterial bloom events worldwide during the last decade despite attempts of water management authorities to reduce the inflow of nutrients, especially phosphate, entering from watersheds.

The research on the Kinneret water was carried out close cooperation with Dr. Assaf Sukenik and Dr. Ora Hadas from the Kinneret laboratory of the Israel Institute of Limnology and Oceanography.

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