Keystone species *Chydorus sphaericus* in shallow eutrophic Lake Võrtsjärv (Estonia) – 56 years of continuous zooplankton monitoring and research

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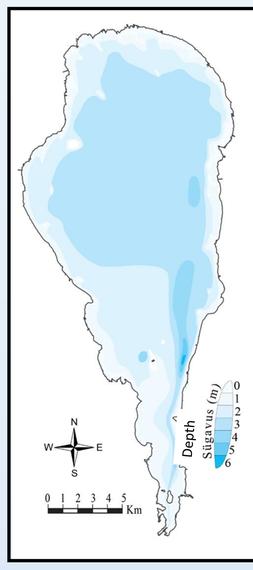
Introduction and aim of study

Small-bodied cladoceran *Chydorus sphaericus* can tolerate several environmental conditions and thus is found in various aquatic ecosystems. It is the most common plankter in eutrophic waters with extensive cyanobacterial blooms. In the large, shallow and eutrophic L. Võrtsjärv *C. sphaericus* is a keystone species and has increased its domination through six decades. **We aimed to study: (1) seasonal and long-term dynamics of *C. sphaericus*, (2) which limnological variables determine its abundance, individual weight and proportion of biomass out of total zooplankton biomass, (3) the role of *C. sphaericus* in a shallow eutrophic lake.**



Area: 270 km^2

Mean depth: 2.8 m

Max depth: 6 m

SD: <1m

pH: 8.0-8.6

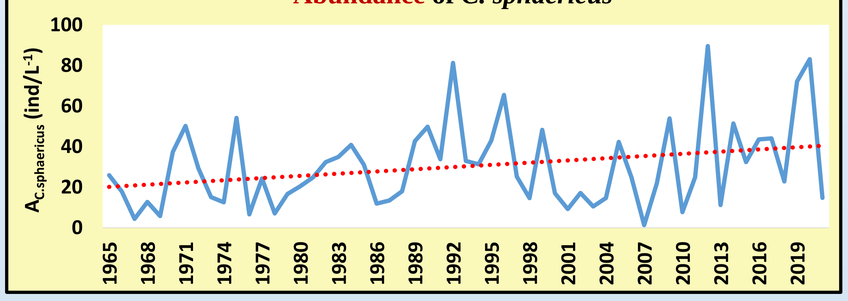
TP: 53 µg

TN: 1600 µg

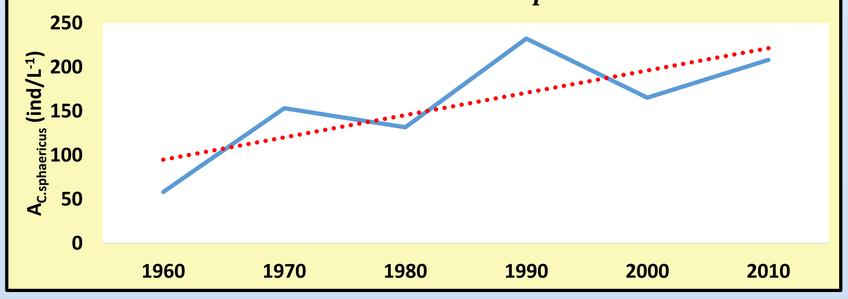
Chl *a*: 36 µg/L^{-1}

Chydorus sphaericus

Abundance of *C. sphaericus*



Maximum abundances of *C. sphaericus*



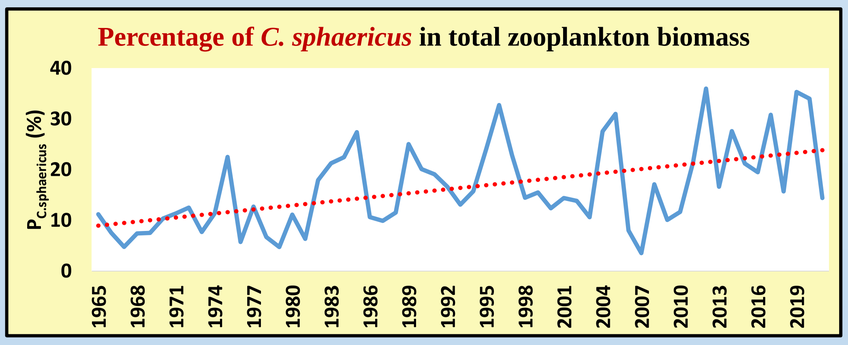
Statistical analysis

★ **Predictor selection**: on the monthly scale a machine-learning algorithm called boosted regression trees (BRT) was employed for sorting the most pertinent predictors for *Chydorus* metrics. On the annual scale, the most pertinent variables were selected using Pearson's correlation analysis instead.

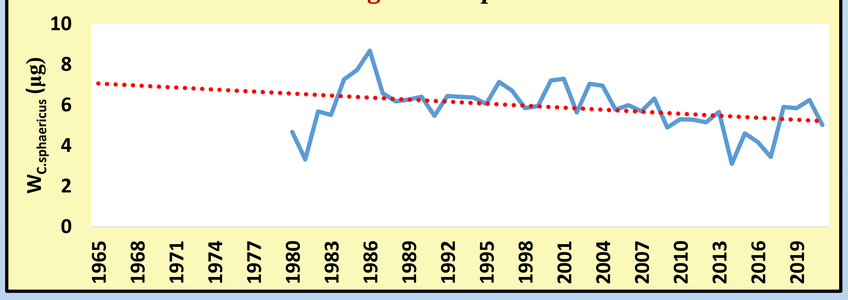
★ After the predictor selection, **quantitative analysis** consisted in using **linear models** with the best three predictors of each *Chydorus* metrics. All possible combinations between the predictors were tested and only the best model of each selection was kept. We also investigated the presence of interactions between predictors (additive, antagonistic, synergistic, opposing).

★ Statistical analyses were conducted with the **R software** (packages gbm, dismo, MuMIn, nlme, lme4 and usdm). Pearson correlation analysis was made with **JASP**.

Percentage of *C. sphaericus* in total zooplankton biomass



Mean weight of *C. sphaericus*



Results and discussion

★ During 1965-2021, **817** zooplankton samples along with other biotic and abiotic parameters were analysed.

★ The **average abundance** of *C. sphaericus* has doubled since the mid 1960's.

★ The **maximum abundance** values have also increased over decades and have shifted from July to June.

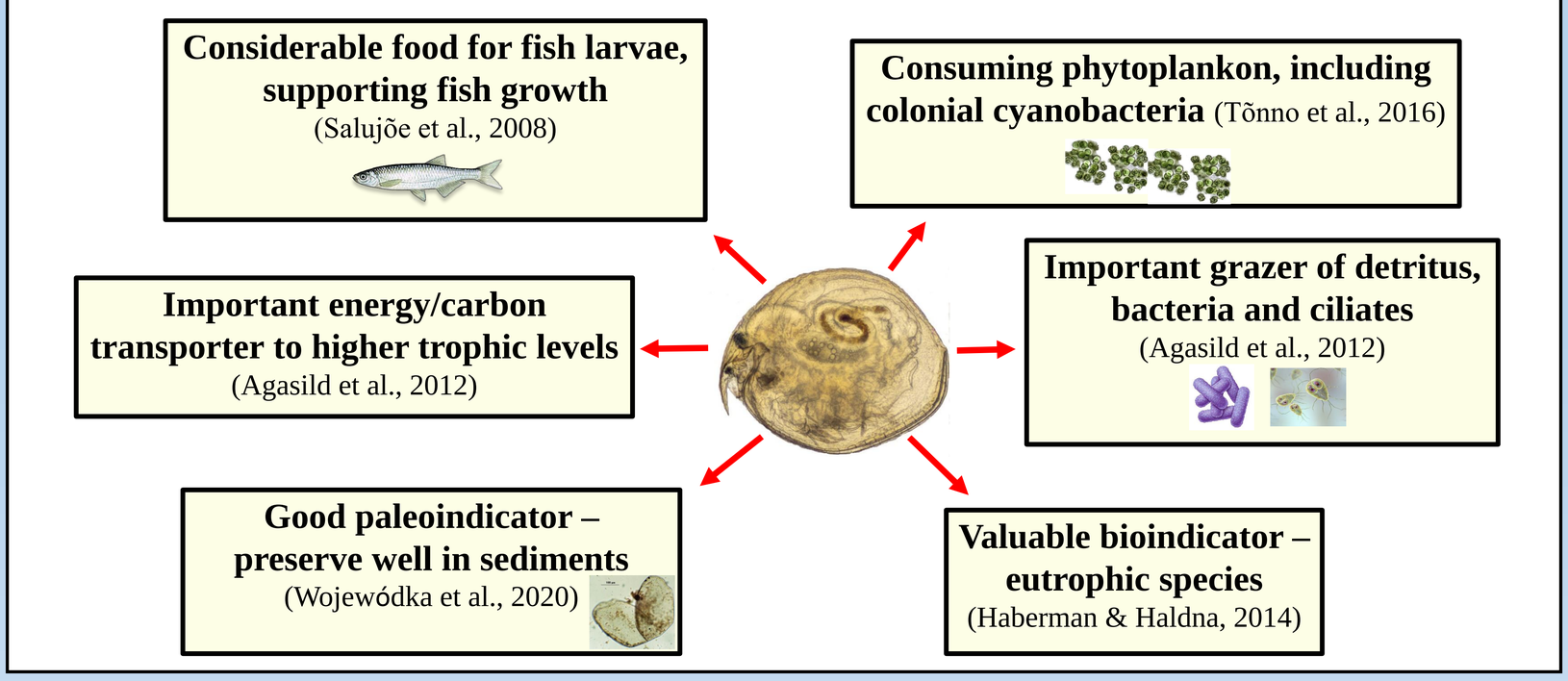
★ Also, its **proportion in total zooplankton biomass** has increased significantly. The cyanobacteria biomass together with pH were strong predictors and had a positive effect on these major changes.

★ At the same time, **mean individual weight** of *C. sphaericus* decreased. Physico-chemical parameters (air temperature, pH, O_2) and fish (common bleak *Alburnus alburnus*) feeding were the most detrimental variables explaining *C. sphaericus* loss of weight.

As eutrophic species, *C. sphaericus* doesn`t have a good reputation, but in the ecosystem of L. Võrtsjärv it is irreplaceable

***C. sphaericus* is a keystone species who supports the functioning of ecosystem of eutrophic L. Võrtsjärv**

The role of *C. sphaericus* in ecosystem of eutrophic L. Võrtsjärv



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