Phytoplankton biodiversity in the context of ecological and trophic states of freshwaters

Agnieszka Napiórkowska-Krzebietke

Inland Fisheries Institute, Olsztyn, Poland
e-mail: a.napiorkowska-krzebietke@infish.com.pl

Introduction and research topic

Biodiversity refers to the variety and variability of species living on Earth, and taxonomy provides the "key to life". The research focused on describing the variability in phytoplankton biodiversity caused by changes in ecological and trophic states of temperate freshwaters in Poland (Europe), as a case study. The diversity indices including primarily species richness (as a number of species per one sample/occassion) and Shannon Index were related with phytoplankton-based ecological status assessment, Carlson's TSI-based trophic state and alternative stable states (clear-water and turbid-water) of the lakes.

Results

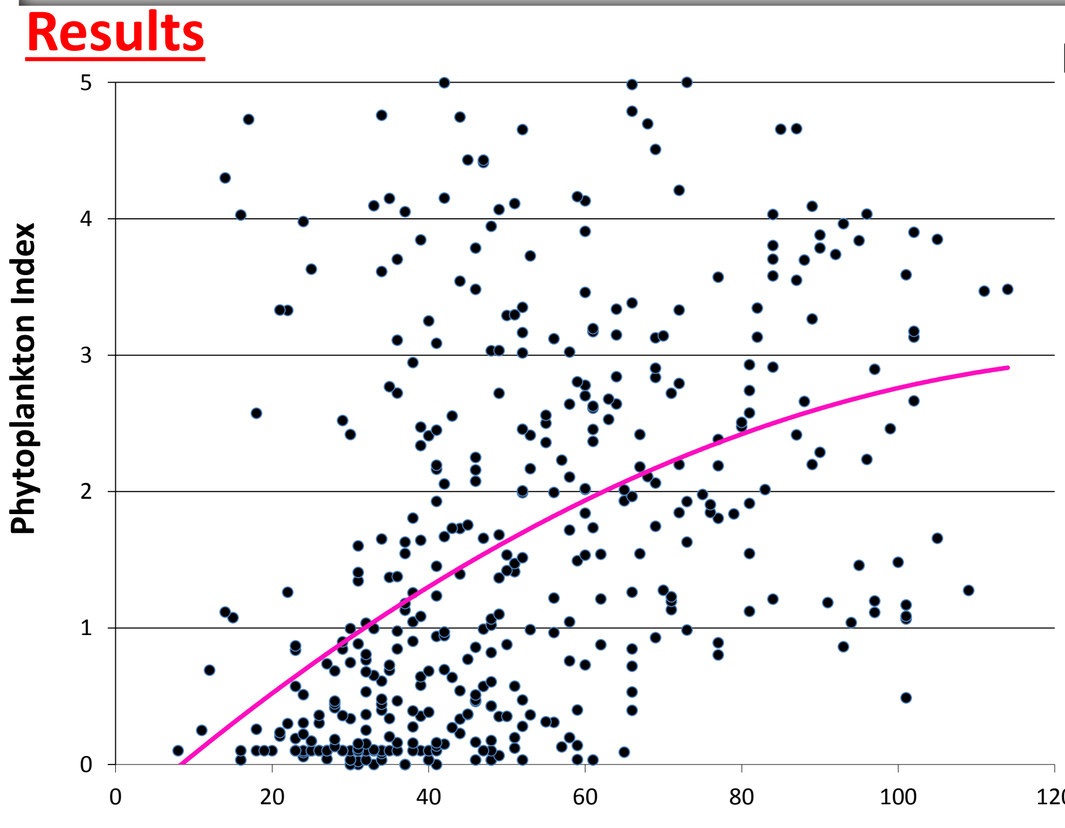
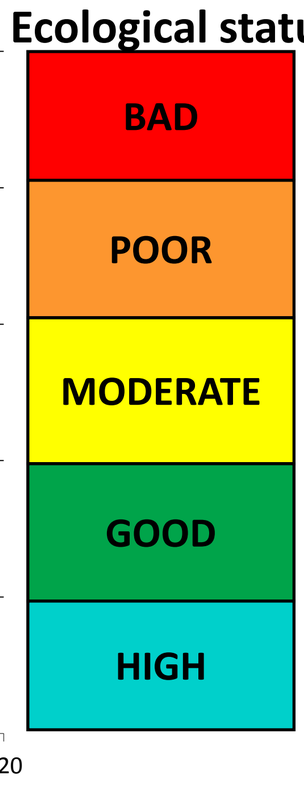


Figure 1. Species richnes versus ecological status classification (n-431; r=0.464; p<0.05)



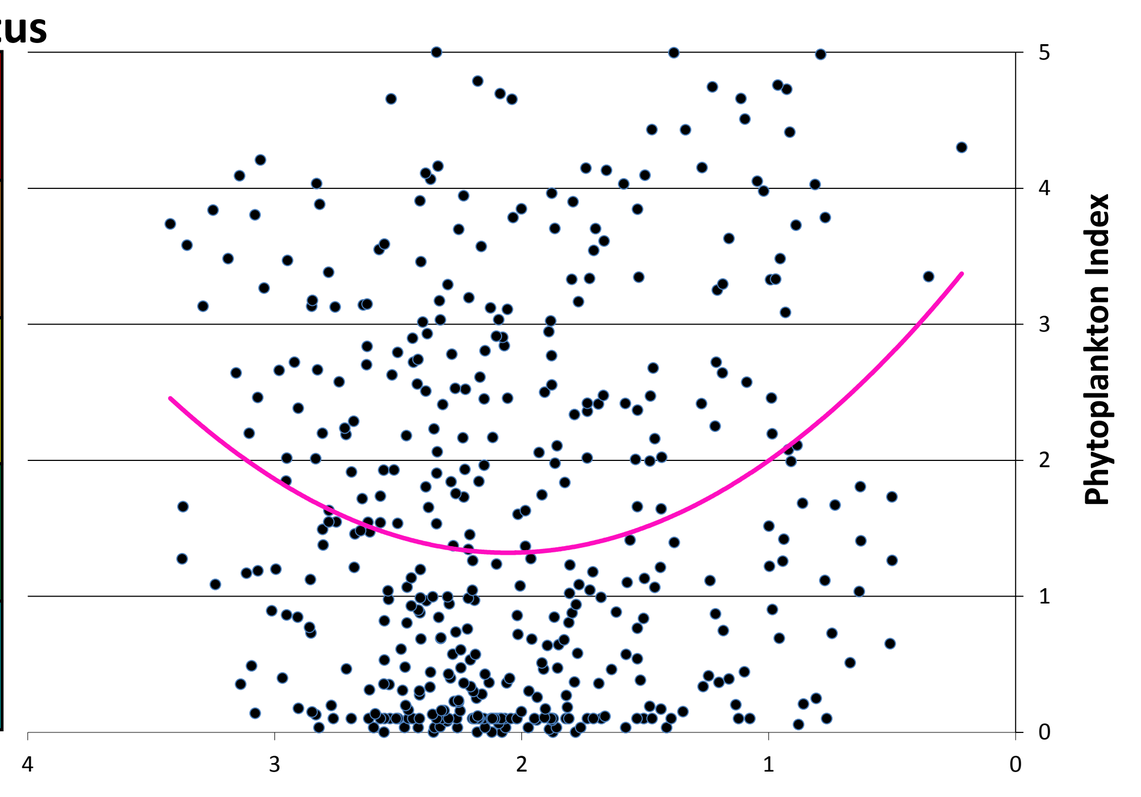


Figure 2. Shannon Index versus ecological status classification (n-431; r=0.231; p<0.05)

Present findings suggest that a lower species richness was noted in the lakes having a high ecological status according to Water Framework Directive required assessment (Fig. 1). A higher species richness was recorded in the lakes having worse water quality, with increasing trend from good towards poor ecological status. Similarly, species richness was generally higher in eutrophic waters while it was significantly lower in hypereutrophic waters (Fig. 3).

Such an increasing tendency with deterioration of the water quality was not so obvious concerning Shannon Index (SI) (Fig. 2). Assessing an ecological status, the ranges and mean values of SI were similar for the lakes having from high to poor ecological status. The exceptionally lower SI was for bad status. Similar trend was also recorded in case of SI values and trophic level (Fig. 4).

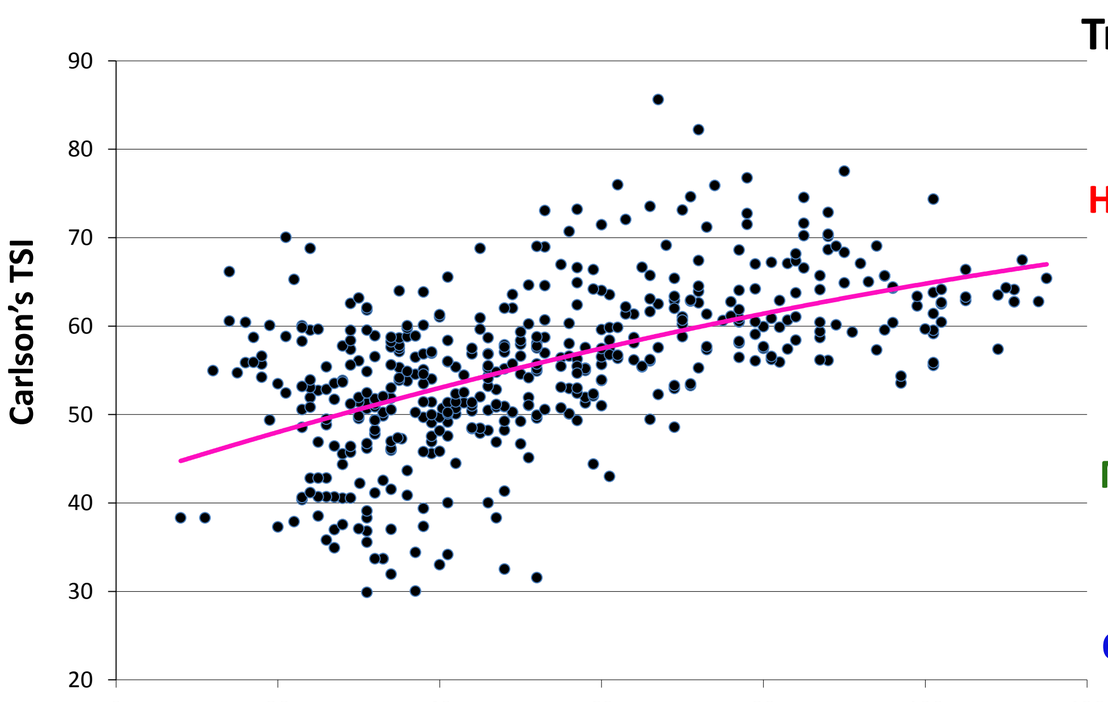
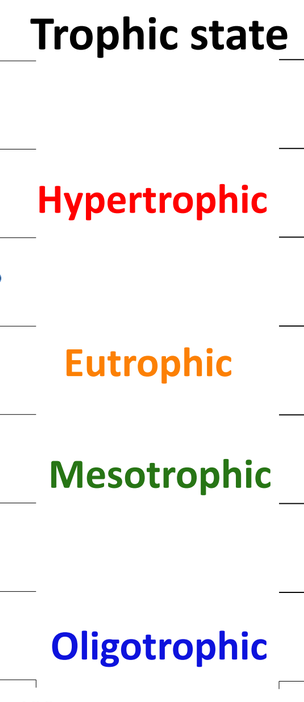


Figure 3. Species richnes versus trophic state classification (n-474; r=0.553; p<0.05)



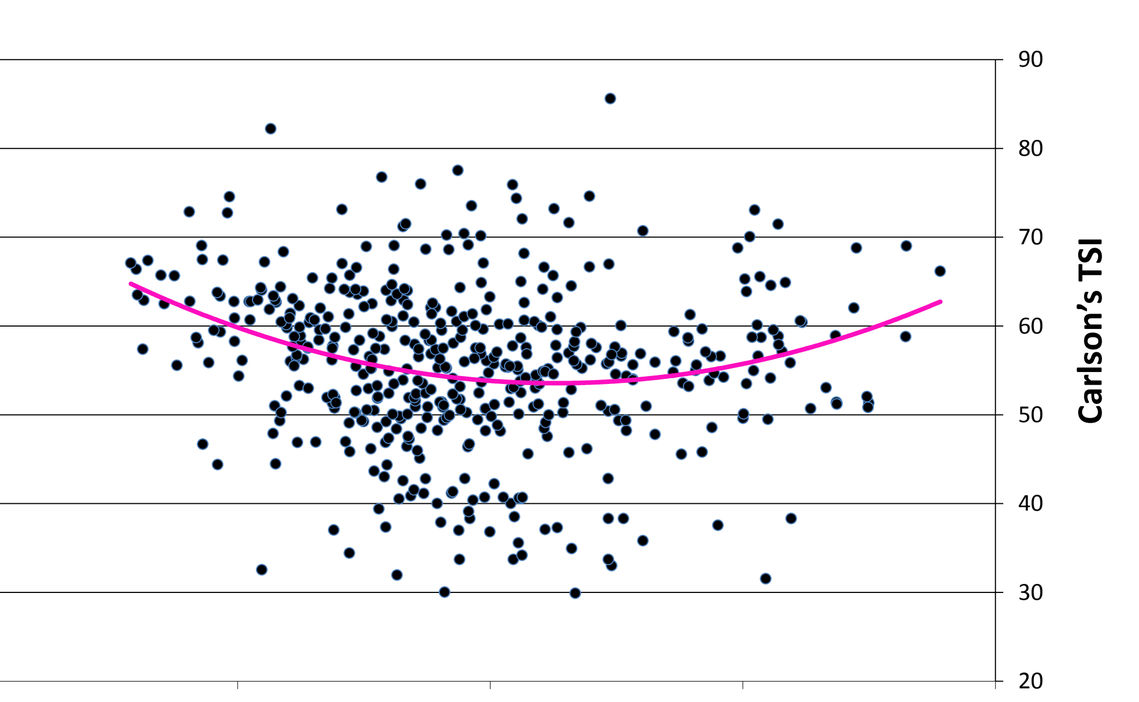


Figure 4. Shannon Index versus trophic state classification (n-474; r=0.254; p<0.05)

Figure 5. Species richnes versus alternative stable states of the lake (KW-H(1;83) = 11.6702; p = 0.0006)

Higher species richness (Fig. 5) and the other diversity indices were generally recorded during the "turbid-water state" than the "clear-water state" of a lake. It was confirmed that strong competition and allelopathic effect of *Chara* species significantly helped to stabilize a better water quality on the one hand, but negatively influenced the phytoplankton biodiversity on the other hand.

Conclusions

Present findings suggest that phytoplankton biodiversity expressed primarily as species richness tends to increase :

1. **with the worsening the water quality expressed as ecological status (from good towards poor ecological status), except for bad status;**
2. **with the increasing of trophic level (from mesotrophy to eutrophy), except for hypertrophy.**
3. **with the changes from "clear-water state" into „turbid-water state" of the lakes.**