

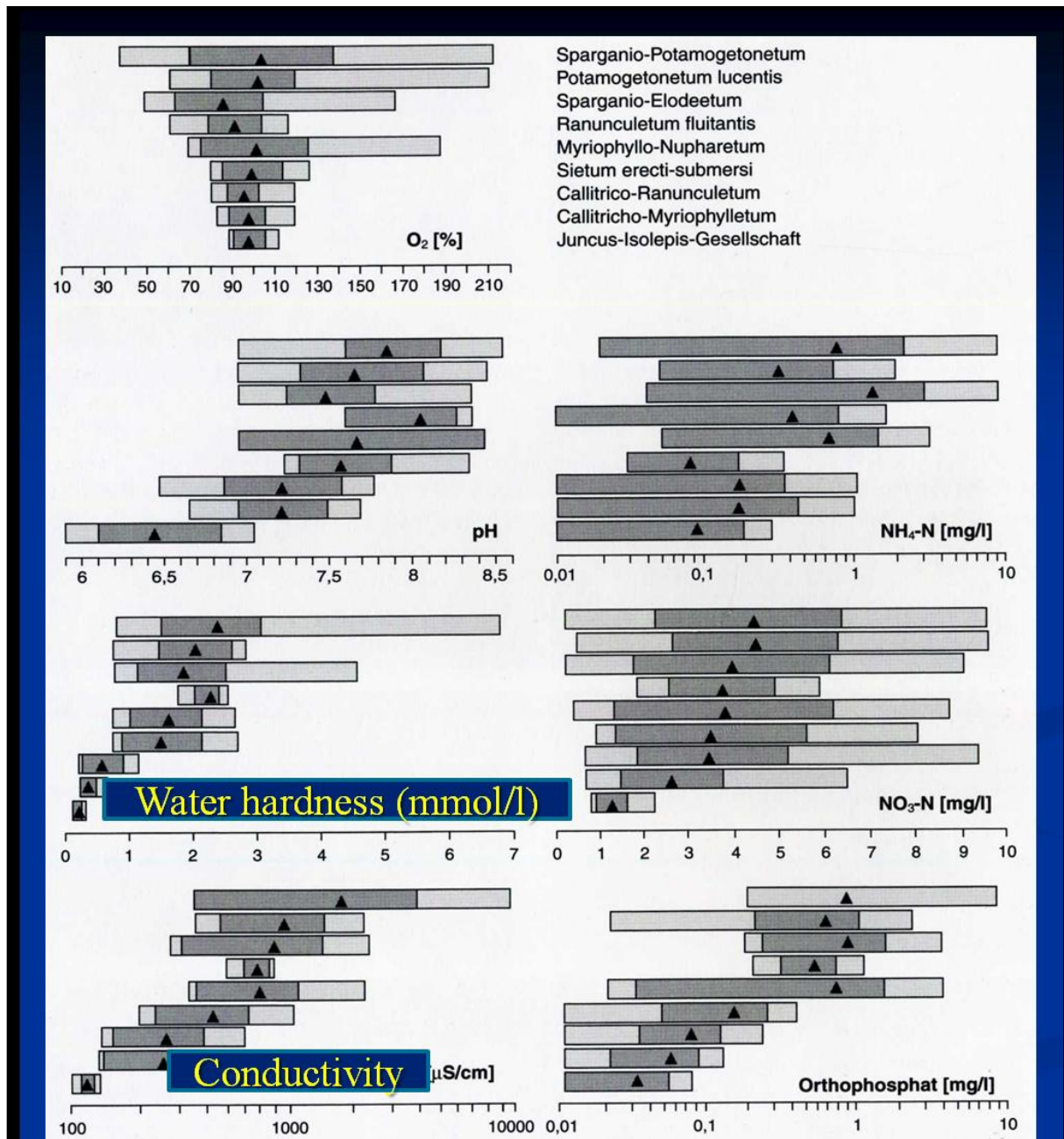
WATENV – Water, Soil and Vegetation

Lecture 7

8. Indicator function of macrophytes and macrophyte communities

- Anorganic nutrient concentrations have direct and indirect effects on the occurrences of hydrophytes and thus control the amount of the autochthonous primary production
- Gams already described the meaning of macrophytes as indicators due to their preference for certain locality factors
- Lohammar (1938) was the first one to extensively use macrophytes to assess the water chemistry and water quality
- The aim was to figure out indicator functions of hydrophyte communities,
- and to find boundaries for the indicator values for primary locality factors of single hydrophyte species

Overview over several hydrochemical locality factors of typical macrophyte communities of northern German streams:



The black triangles show perfect growth conditions, the dark grey bars represent ranges of good growth conditions, and the light grey bars indicate ranges of poor growth conditions for the respective plants or plant communities.

8.1 Features of good indicators

- Macrophytes or macrophyte communities can only serve as indicators when they show a minor ecological amplitude concerning the water quality or certain nutrient parameters respectively have other features typical for a locality
- The single species mostly follow two different reaction patterns:
- **Stenoecius** species only grow within very narrow ecological amplitudes and thus are good indicators

- **Euryoecius** hydrophytes, though, have a very broad optimal range, beyond which they can still survive in lesser density or diversity
- However, euryoecius species often show sociological and synecological optima within a certain plant community, while they only occur differentiatingly in neighbored types
- They only have special subassociations and formations of followup- and contact communities there

9. The meaning of trophic levels for aquatic ecosystems

- A large-scale study of 524 lakes in the northeastern German lowlands at the end of the 1970's already showed that over 59% of those waters were eutrophic and another 37% polytrophic to hypertrophic
- Large **oligotrophic clear water lakes**, like the Königssee in the Alps, or the 425 ha big Stechlinsee in Brandenburg became rare in Central Europe even in the Alp's foothills and especially in the planar level

9.1. The term trophy

- The budget of waters is characterized by three biologically effective values: nutrient and oxygen concentration as well as biomass production
- The nutrient budget with its meaning for the vegetation is described with the term trophy
- For the trophy, only the intensity of the primary production is of interest, thus the construction of phytomass using the entering light and the available nutrients
- Thus, the trophic level of a lake resembles the availability respectively the concentration of single or several nutrients which have limiting effects on primary production
- „**Key**“-nutrients for that are mostly plant-accessible nitrogen and phosphate compounds as well as exploitable carbon
- Over 90% of the primary production in deeper waters is executed by benthic or planktic algae, while macrophytes only have a percentage of 2 to 5 %

9.2. Water typing according to trophy

- The development of the basics of an originally tripartite lake type system based upon the trophy was conducted by Thienemann and Naumann
- Thus, the limnic ecosystems are assigned to different trophy types depending on the nutrient levels, which directly influence the amount of the primary production
- An overview about the actually most important trophy classification models was created by Mietz
- Regarding important trophy parameters, the silting-up conditions as well as special trophy parameters, a classification into oligotrophic and hypertrophic main types can be compiled

Trophic level	Nutrient content	Productivity
ultraoligotrophic	very poor	very low
oligotrophic	poor	low
mesotrophic	moderately rich	low to intermediate
eutrophic	rich	intermediate
eutrophic to polytrophic	rich	intermediate to high
polytrophic	very rich	high
Hypertrophic (saprotrophic)	excessively rich	excessive

Broadened system of trophic levels of waters.
A quantification is possible with the chlorophyll content

- The partially extreme anthropogenic nutrient enrichment demands for the definition of non-natural polytrophic and hypertrophic types of waters
- They have specific plant communities, which are adapted to the temporary preponderance of anaerobic depletion processes
- According to Hamm, the introduction of the term "**saprotrophic**" instead of "**hypertrophic**" is reasonable, because regarding those trophic levels, the trophic classification gets very close to the saprobity classification
- The term "**dystrophic**" does not designate a autonomous trophic level
- It is used for humin-rich, thus brown-colored, mostly acid waters with peaty substrate respectively peat mud on the ground, which are oligotrophic to mesotrophic under natural conditions
- Thus, dystrophy only describes a certain manifestation of other trophic levels