Trophic and Saprobic Levels

Biomass and turnover of autotrophic organisms characterise *trophic* levels

Biomass and turnover of heterotrophic organisms characterise *saprobic* levels

***trophic* level means the supply of an ecosystem with organic substancies;**

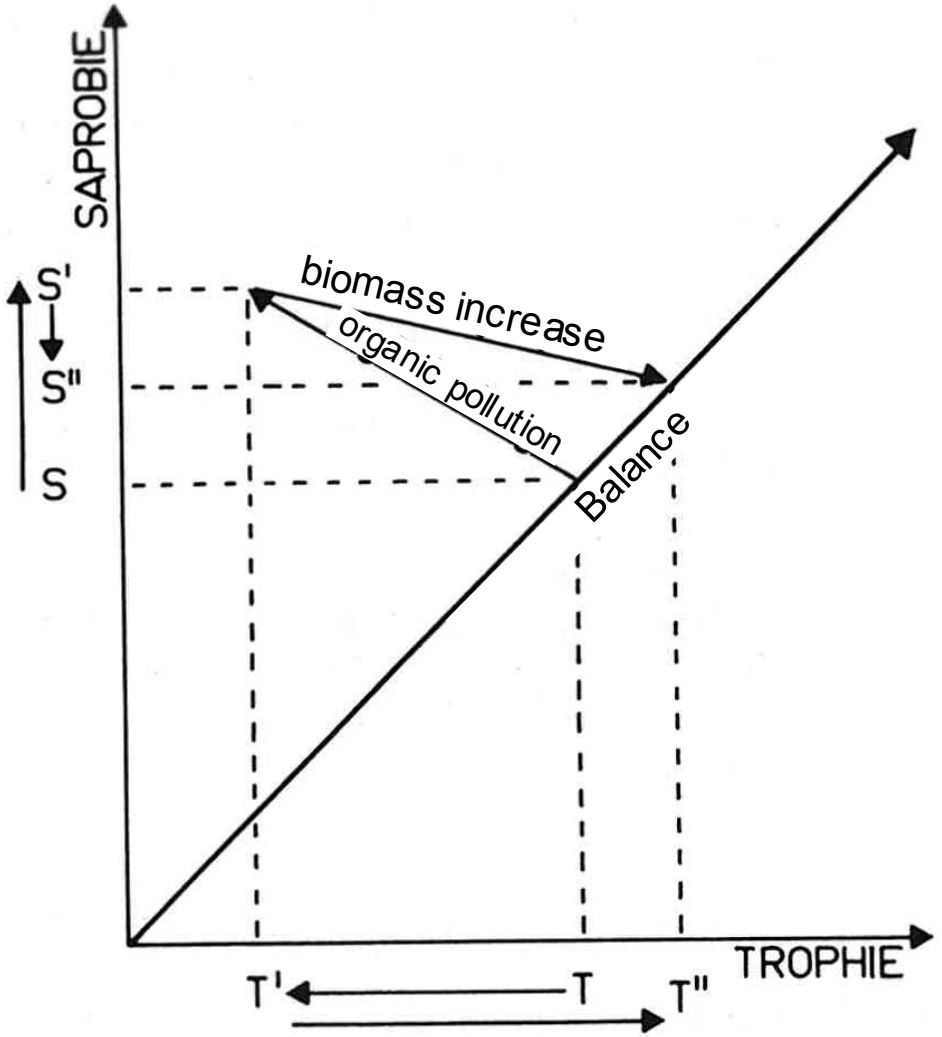
***saprobic* level means the intensity of destruction of organic substancies;**

Saprobie is the loss of potential energy.

***Trophie* and *Saprobie* are complementary processes**

RELATION BETWEEN TROPHIE AND SAPROBIE

- input of biodegradable wastewater →
- food availability increases (heterotrophes) →
- biomass of heterotrophes increases →
- saprobic level exceeds trophic level →
- respiration increases →
- activity of destruents increases (mineralisation) →
- balance on higher level



RELATION BETWEEN TROPHIE AND SAPROBIE

Where to put wastewater ? (even from purification plants...)

- **heterotrophic and saprobic processes are linked to respiration →**
- **avoid stagnant waters, running waters have better oxygen footprints**
- **oxygen demand of organisms (biocoenosis) indicates saprobic level of water body**

- **biocoenosis of destruent microbes composes as a function of the molecular composition of wastewater, not as a function of its dilution**
- **the temporal sequenced phases of secondary consumption and decomposition (self-purification) by different groups of organisms, are spatially disposed in running waters**

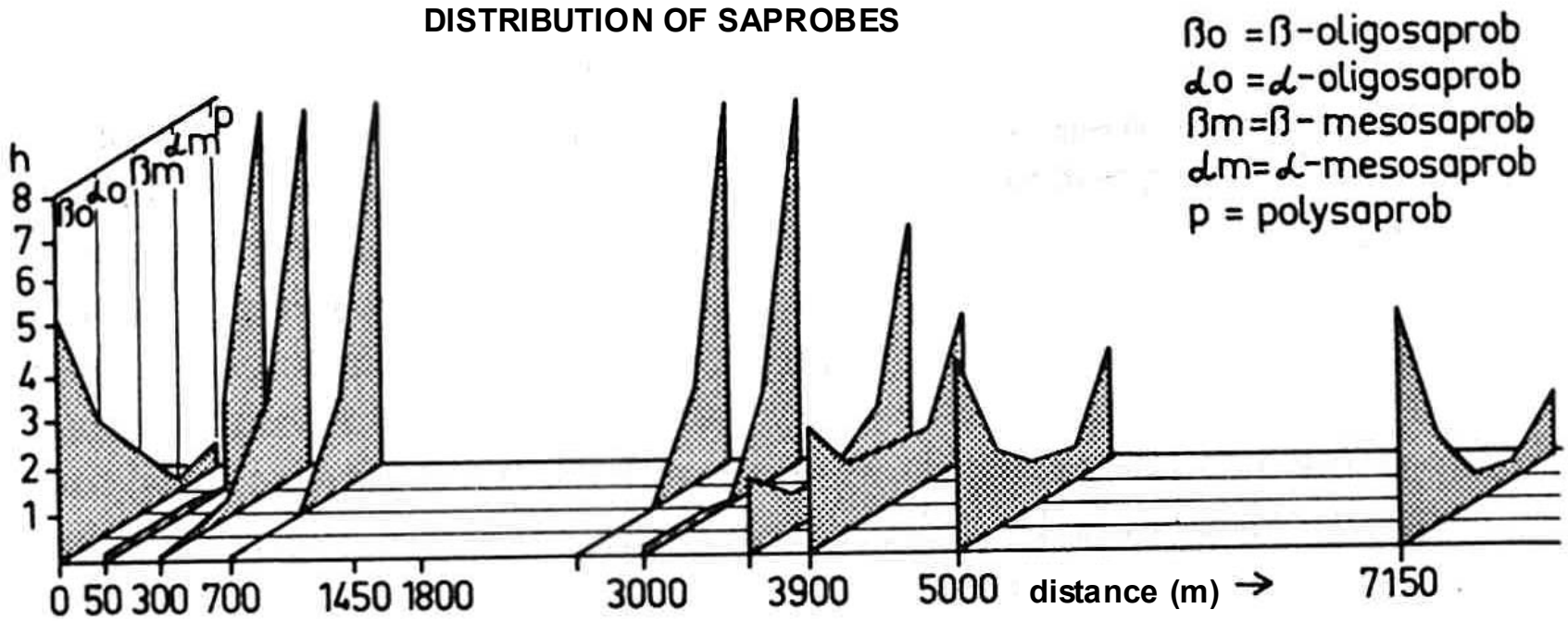
SAPROBIC SYSTEM

The relation between colonisation by aquatic organisms and water pollution encouraged Kolkwitz & Marsson (1902, 1908), based on studies from Cohn (1853), Mez (1898) and Lauterborn (1901, 1903), to compile catalogues with floral and faunal indicator organisms in running waters.

The Saprobic System (in words and colours):

• polysaprobic zone	maximum pollution
• α-mesosaprobic zone	medium-strength pollution
• β-mesosaprobic zone	medium-slight pollution
• oligosaprobic zone	slight pollution
• catharobic zone	no pollution

SAPROBIC SYSTEM



Distribution of macrobenthos in a stream with organic pollution (Schreiber 1976)

TROPHIC SYSTEM

TROPHIC LEVEL is the intensity of autotrophic production of organic substancies (biomass)

- ***nutrient input*** **into waters causes increasing bioproduction**
- ***increasing growth*** **of macrophytes and algae affect availability of water as drinking water, process (industrial) water, etc.**
- ***enhanced biosynthesis*** **of organic matter demands oxygen, increases quantitiy of bacteria by algal matters, influences colour, taste, toxicity, etc.**
- ***enhanced biosynthesis*** **changes the food web and in this way structure and capability of the ecosystem**

The Trophic System (in words and colours):	
• polytrophic	high nutritent supply
• eutrophic	good nutrient supply
• mesotrophic	medium nutrient supply
• oligotrophic	low nutrient supply

TROPHIC SYSTEM

SOURCES OF NUTRIENT CHARGE FOR WATERS

- increase of agricultural and industrial production
- increase of communal/urban wasterwater (population density)
- increased and accelerated material currents (stoffströme) from landscape (drainage)

Sources of nutrient charge for waters are

- local (punctate) (sewage treatment plant)
- diffuse (agricultural, silvicultural)

ITEMS OF ECOLOGICAL INVESTIGATION

Protection of waters and their utilisation requires consideration of inherent bioactivity.

It is necessary to avoid unwanted results of this bioactivity and to protect natural functions of aquatic ecosystems

Investigation procedures:

- **analysis of trophic level**
- **analysis of saprobic level**
- **detection, evaluation and clarification of toxic influences**
- **evaluation of waters concerning fisheries and clarification of fishery damage**
- **supporting chemical analysis by ecotoxicological assessment**
- **clarification of causes for colour, turbidity, smell and taste of water**
- **monitoring of sewage treatment plants**
- **biocoenotic characterisation of waters in the context of integrated evaluation of waters and their viability**

ITEMS OF ECOLOGICAL INVESTIGATION

Aquatic ecosystems are investigated by analysing <u>Biological Compartments</u>

Biol. Compartment	*Object of Study (e.g.)*
Bacteria	cell numbers, metabolic types, enterobacteria (E. coli)
Phytobenthos	(indicator-) species, cell numbers, species composition, biovolume, biomass
Phytoplankton	(indicator-) species, cell numbers, species composition, biovolume, biomass
Zooplankton	(indicator-) species, cell numbers, species composition, biovolume, biomass
Makrophytes	(indicator-) species, species composition, coverage ratio, biomass
Microzoobenthos	(indicator-) species, species composition, abundance, biomass
Macrozoobenthos	(indicator-) species, species composition, abundance, biomass
Fish	(indicator-) species, species composition, abundance, biomass

ITEMS OF ECOLOGICAL INVESTIGATION

Additional physicochemical parameters (in the field)

Parameter	*Unit*
Oxygen	concentration (mg/l), saturation (% sat.)
Temperatur	degree celsius (°C)
pH-Value	dimensionless
Conductivity (electr.)	Siemens (µS/cm), (mS/m)

Additional hydrographical parameters (in the field)

Parameter	*Unit*
flow velocity	(m/sec.)
depth	(cm)
width	(m)
shadowing	percentage of water surface (%)