

## 2. Aquatic Biocoenosis

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### Living Conditions

Conditions for aquatic organisms:

- High density of medium (water)
- Low salt medium (hypertension of aquatic organisms)
- High solvent capacity of medium for anorganic and organic matters
- Vertical gradients of different factors

Water is more dense than air (775 times); specific weight of organisms is about 1.05, hence water is able to take a load.

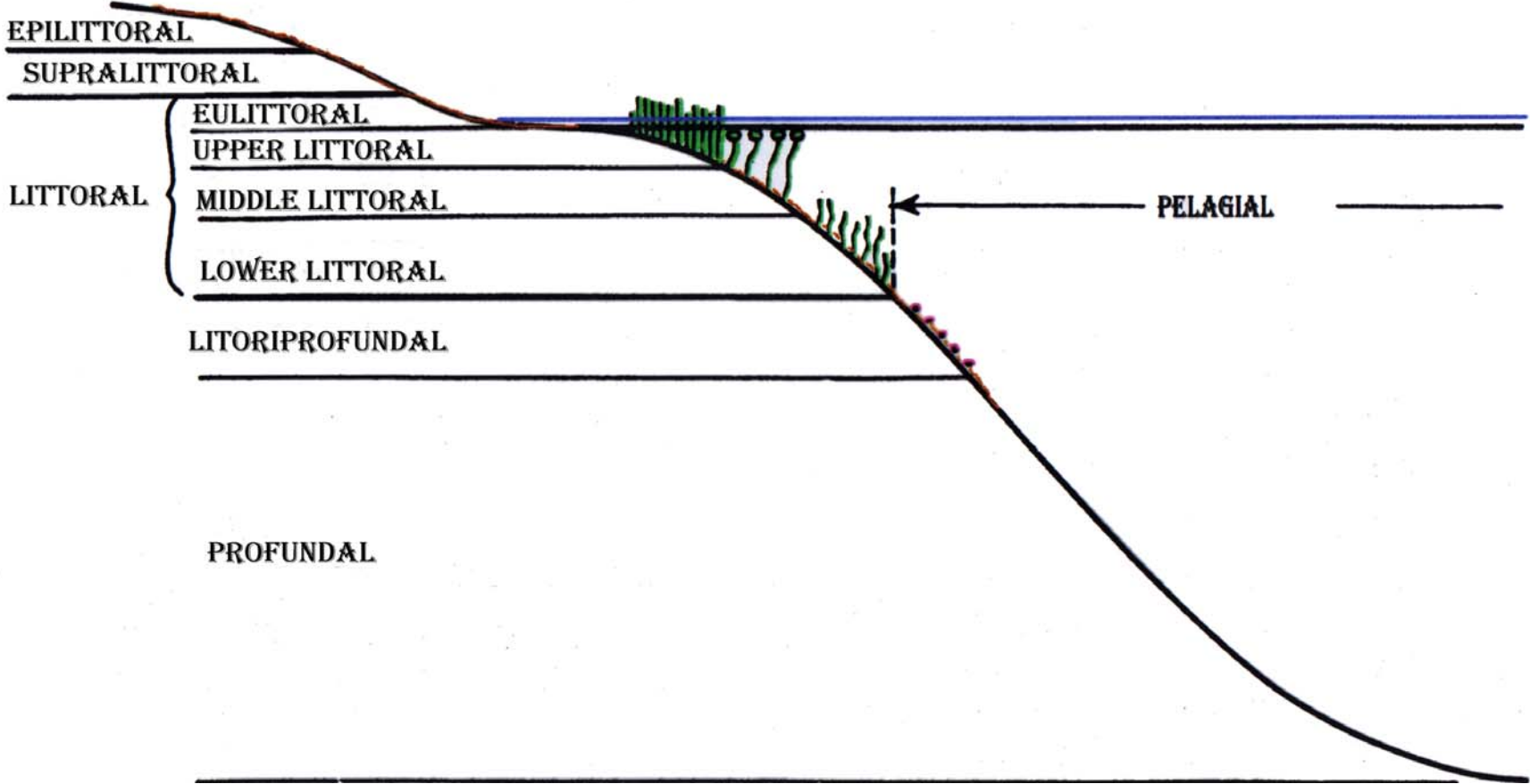
The whole water column is populated.

Freshwater organisms are hypertonic, electrolyte concentration is higher and different from freshwater medium.

Freshwater organisms are able to osmoregulate and to regulate the ionic composition of their body fluids.

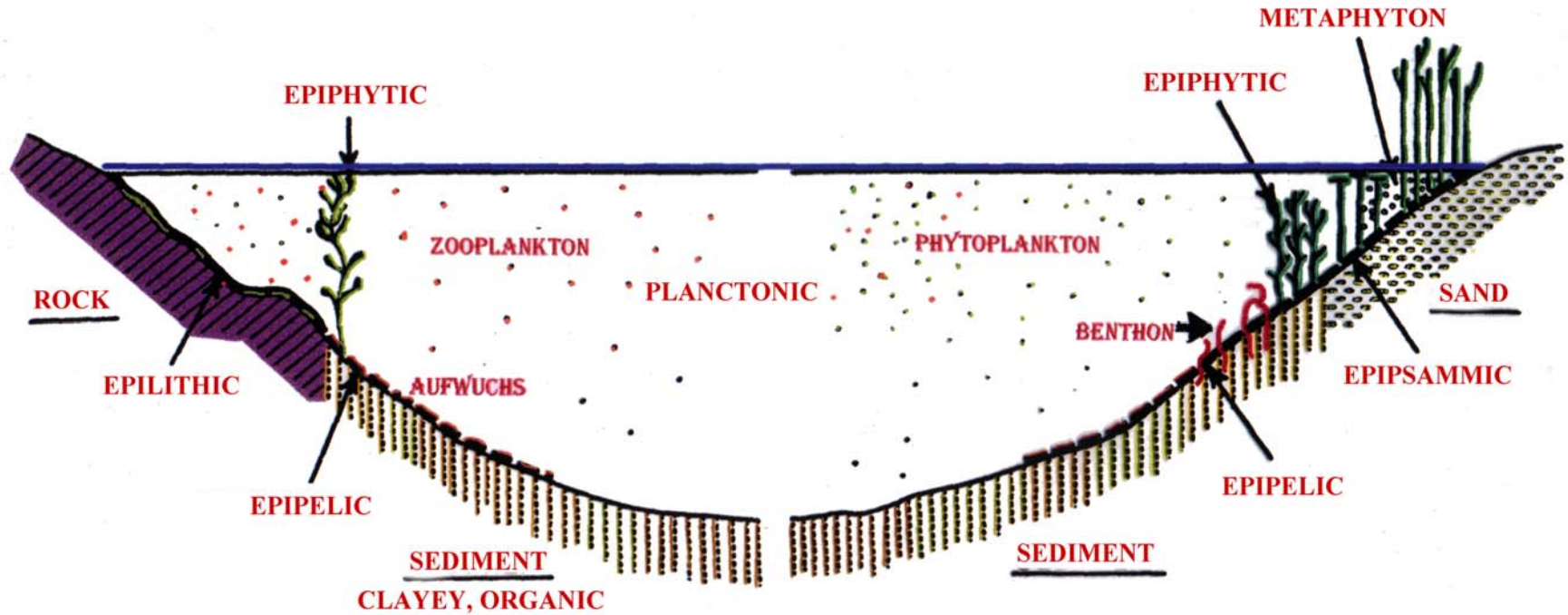
# 2. Aquatic Biocoenosis

## ZONATION (HABITATS) IN STAGNANT WATERS



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### HABITATS AND COMMUNITIES IN STAGNANT WATERS



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### AQUATIC COMMUNITIES

#### Benthos

Bacteriobenthos

Microphytobenthos

Macrophytobenthos

Microzoobenthos

Macrozoobenthos

#### Plankton

Bacterioplankton

Phytoplankton

Zooplankton

#### Nekton

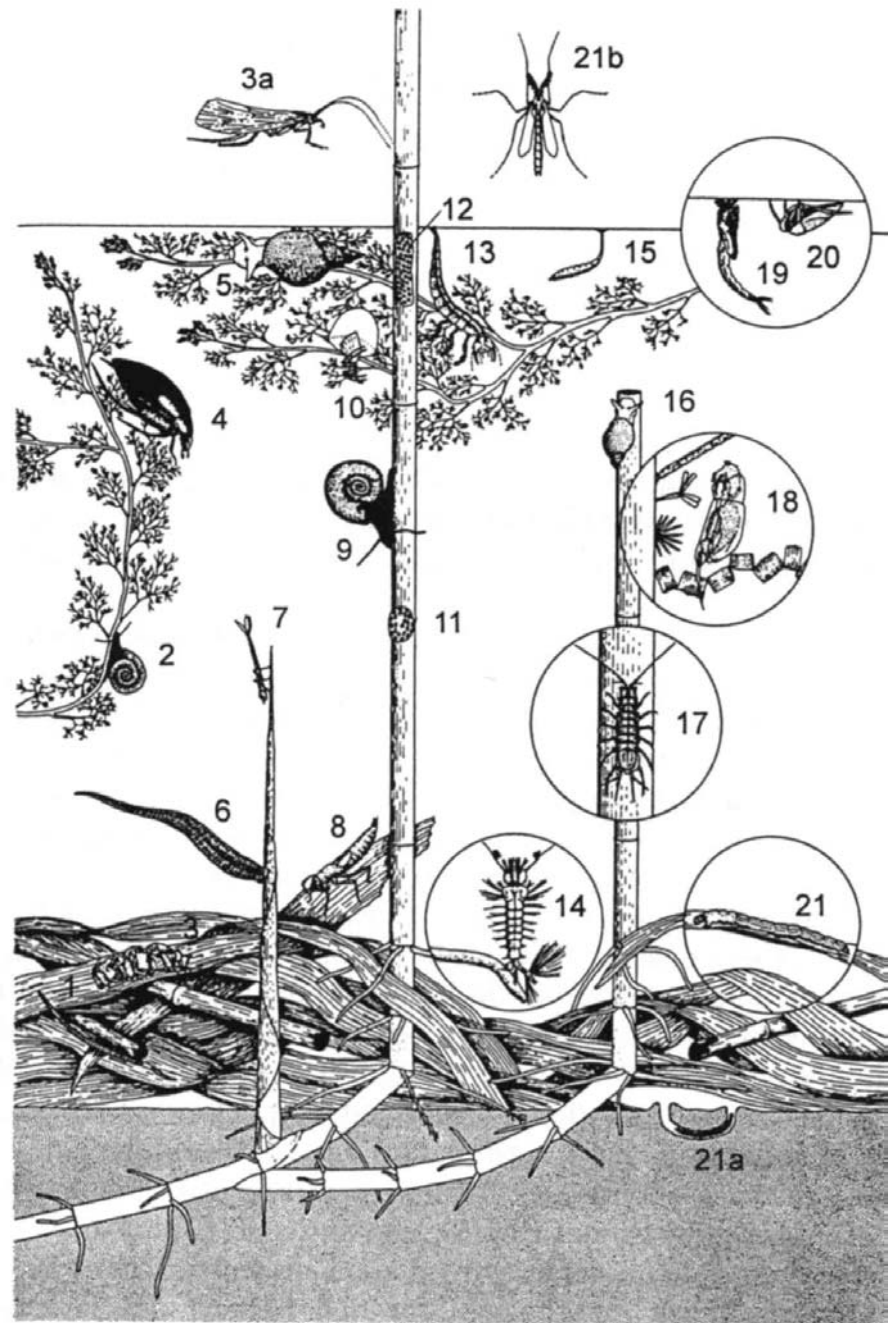
Pisces / Fish

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### AQUATIC COMMUNITIES

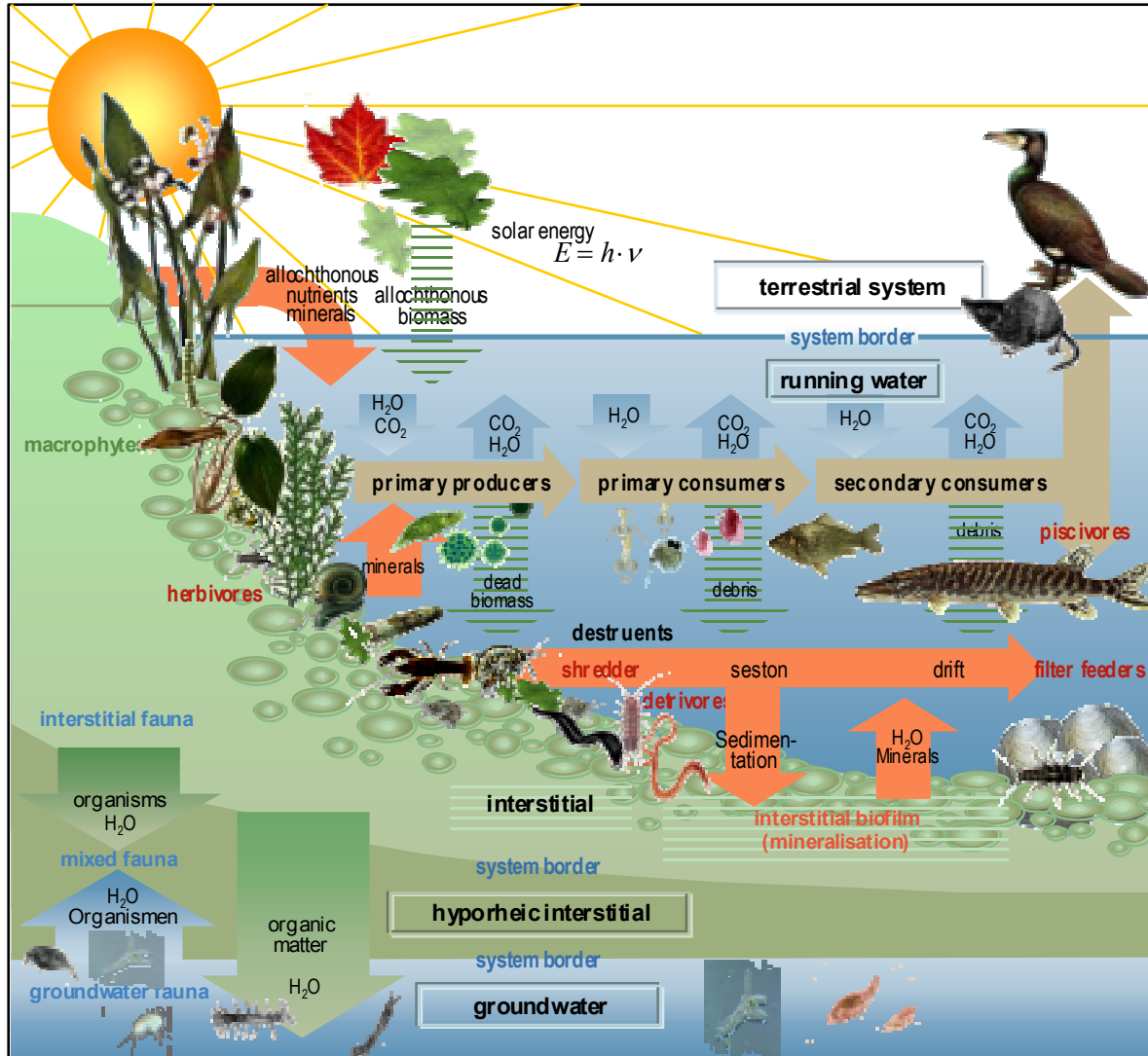
#### Aquatic Community in *Typha* spp.:

- 1 = *Lumbriculus* (worm)
  - 2 = Planorbidae (snail)
  - 3 = Trichoptera, *Limnephilus*
  - 3a = adult Trichoptera, *Limnephilus*
  - 4 = *Hydrous piceus* (beetle)
  - 5 = *Lymnaea palustris* (snail)
  - 6 = *Hirudo medicinalis* (leech)
  - 7 = Zygoptera (dragonfly)
  - 8 = Anisoptera (dragonfly)
  - 9 = *Planorbis* spec. (snail)
  - 10 = *Argyroneta aquatica* (water spider)
  - 11 = Eggs from Planorbidae
  - 12 = Eggs from Lymnaeidae
  - 13 = *Dytiscus marginalis* (great diving beetle)
  - 14 = *Mansonia* spec. (gnat)
  - 15 = *Stratiomys* spec. (fly)
  - 16 = *Lymnaea peregra* (snail)
  - 17 = *Asellus aquaticus* (waterlouse)
  - 18 = Algae with rotifer;
  - 19 = Chironomidae (non-biting midge)
  - 20 = *Notonecta* spec. (water boatman, backswimmer)
  - 21 = Fam. Chironomidae;
  - 21a = larvae
  - 21b = adult
- (from Löffler 1974)



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### RUNNING WATERS: TROPHIC LEVELS AND MATERIAL FLOW



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### **RUNNING WATERS: HABITATS AND COMMUNITIES**

#### **Pelagial (flowing water body):**

- **Transport of rich in species plankton (allochthonous !)**
- **Phytoplankton needs slow flow velocity, light, nutrients**
- **Fish migrate through waterbody, need breeding and hiding places**

#### **Benthal (flowing water body):**

- **Organisms are bound to solid substrates to resist the current**
- **Organisms settle on, under and between stones, pebbles, gravel, wood etc.**

#### **Interstitial:**

- **Breeding place for most organisms**
- **Shelter for organisms in times of abiotic pessima**

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### RUNNING WATERS: FISH ZONATION (EUROPE)

<b><u>Krenal</u></b>	<b>OUTFLOW AREA (SPRINGS)</b>	<b>FIRE SALAMANDER REGION</b>
<b><u>Rhithral</u></b>	<b>UPPER TROUT REGION</b>	<b>SALMONID REGION</b>
	<b>LOWER TROUT REGION</b>	
	<b>GRAYLING REGION</b>	
<b><u>Potamal</u></b>	<b>BARBEL REGION</b>	<b>CYPRINID REGION</b>
	<b>CARP BREAM REGION</b>	
<b><u>Estuaries</u></b>	<b>RUFF-FLOUNDER-REGION</b>	<b>RIVER OUTLET REGION</b>

Zonations are based on (worldwide):

- the annual temperature amplitude
- morphological structure of the riverbed



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### RUNNING WATERS: FISH ZONATION (EUROPE)

<b><u>Krenal</u></b>	outflow area (springs)
<b><u>Rhithral</u></b>	area of (mountain- ) stream (= salmonid region), max. temp. < 20 °C
	Epirhithral                                    upper trout region
	Metarhithral                                   lower trout region
	Hyporhithral                                   grayling region
<b><u>Potamal</u></b>	area of lowland river, max. temp. > 20 °C (sometimes)
	Epipotamal                                    barbel region
	Metapotamal                                   carp bream region
	Hypopotamal                                   ruff-flounder-region

### Limnological terms (biotope – coenosis - ecosystem)

- **Krenal** - **Krenon** - **Krenocoen**
- **Rhithral** - **Rhithron** - **Rhithrocoen**
- **Potamal** - **Potamon** - **Potamocoen**

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### RUNNING WATERS: ZONATION

Extension of running waters zonation is dependant on

- Altitude and Latitude

In similar altitude rhithral areas decrease from polar to tropical regions, potamal areas increase.

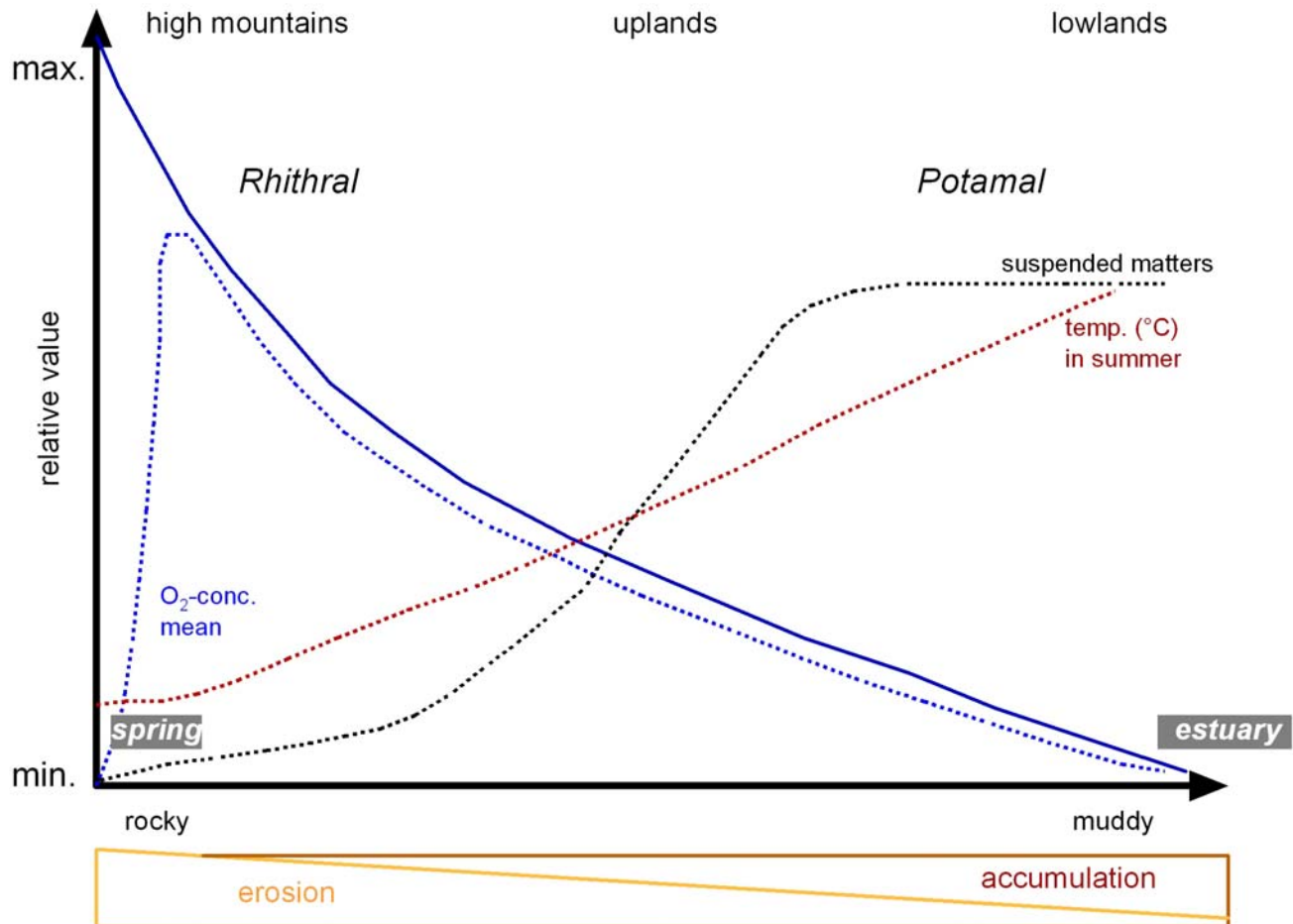
Water temperature seems to be main factor, followed by morphological structure of the riverbed and hydraulic conditions.

Rhithral zone is populated with species of similar habitus and life-cycles worldwide. Adaptation to abiotic milieu was convergent.

Coenosis of the Rhithral is an «Isocoenosis».

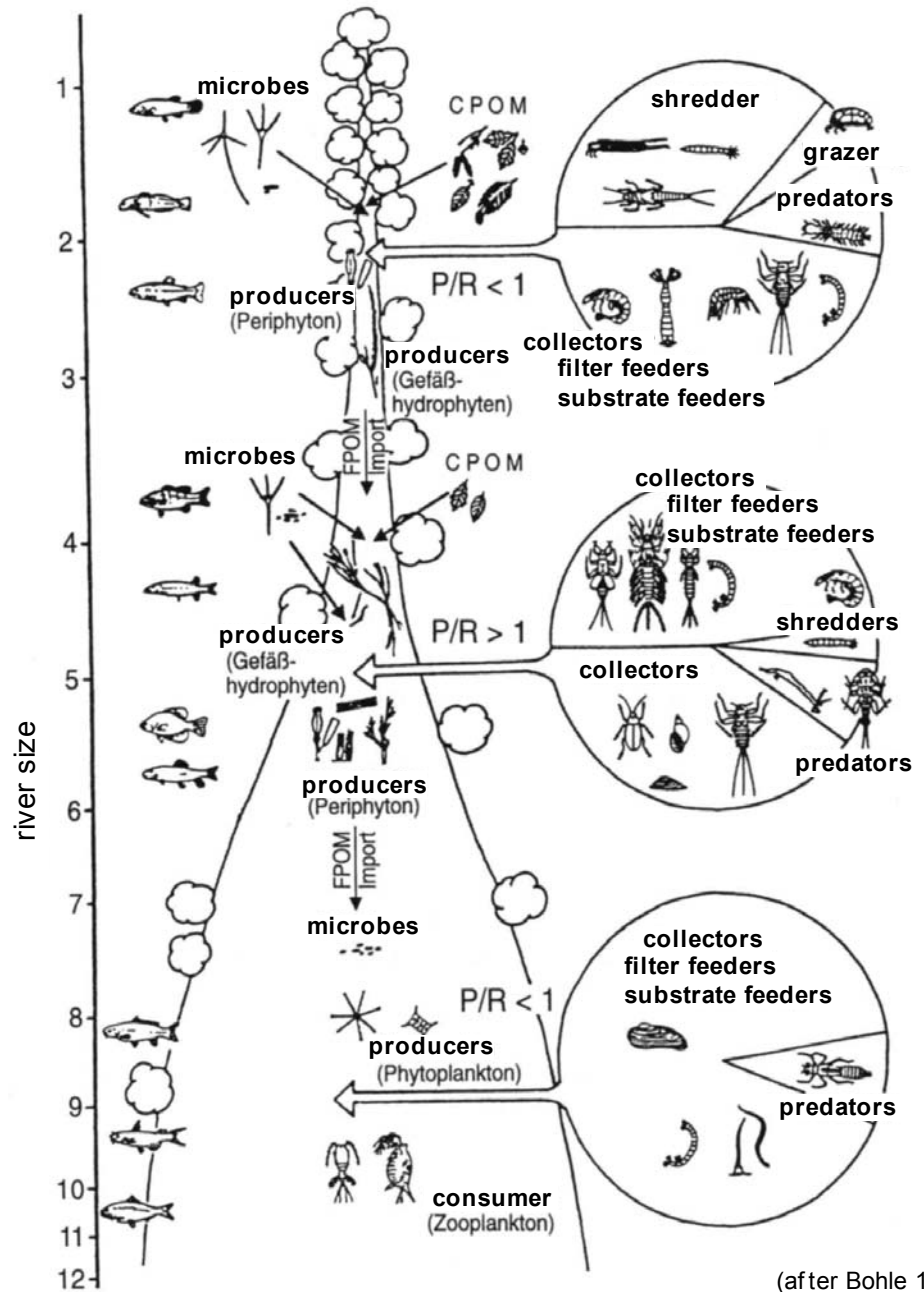
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### ABIOTIC FACTORS IN FLOW DIRECTION OF A RIVER



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### RIVER CONTINUUM CONCEPT



(after Bohle 1995)

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### BIOGENOUS TURNOVER OF SUBSTANCES (1)

#### Functional groups

- **Producers**: synthesize biomass from anorganic compounds by fixing radiation energy biochemically = PRIMARY NEOGENESIS OF ORGANIC MATTER
- **Consumers**: generate energy by CONVERSION OF (mostly living) PARTICULATE ORGANIC MATTER (POM)
- **Destruents**: generate energy by destruction of dead organic matter to anorganic compounds = CONVERSION of organic matter (mineralisation)

#### Primary production

- Measure for trophic level (intensity of primary production = trophic level)
- Main producers are BENTHIC (Phytobenthos) and PLANKTONIC ALGAE (Phytoplankton), in littoral zones MACROPHYTES (0 – 8 m depth)

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### **BIOGENOUS TURNOVER OF SUBSTANCES (2)**

**Temporal distribution of primary production depends on**

- **nutrient concentration,**
- **water temperature**
- **thermal stratification**
- **thickness of euphotic zone**
- **grazing intensity (zooplankton)**

**Spatial distribution of primary production depends on**

- **distribution of light energy**
- **floatation (locomotion) of algae**

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### **BIOGENOUS TURNOVER OF SUBSTANCES (3)**

#### **Consumption**

- **herbivorous primary consumers**
- **carnivorous secondary consumers**

#### **Feeding types**

- **Filter feeder (catch suspended particles, bacteria, algae, detritus)**
- **Grazer (feed on "Aufwuchs", biofilms by scraping, rasping, scratching)**
- **Schredder (decomposing, dissecting fallen leaves, detritus)**
- **Sediment feeder (consuming detritus, bacteria, algae, organic particles)**