



evropský
sociální
fond v ČR



EVROPSKÁ UNIE



MINISTERSTVO ŠKOLSTVÍ,
MLÁDEŽE A TĚLOVÝCHOVY



INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

Inovace studia hydrobiologických disciplín s důrazem na rozšíření možností uplatnění absolventů biologických oborů PřF UP v praxi.

reg. číslo: CZ.1.07/2.2.00/28.0173

RITRODAT LUNZ - 25 years concept in stream ecology

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maria.leichtfried@pchnet.at

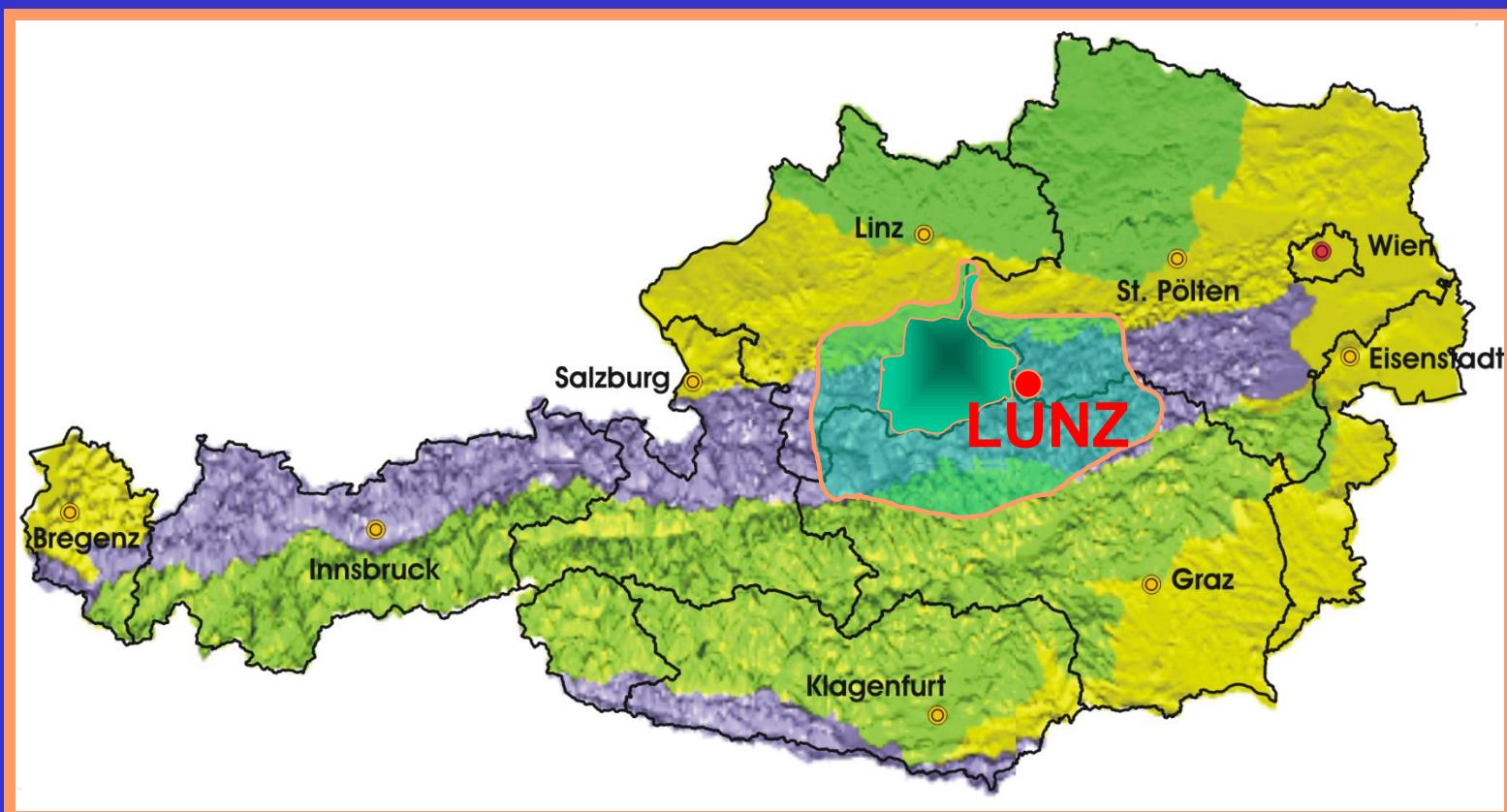
BACK to the ROOTS

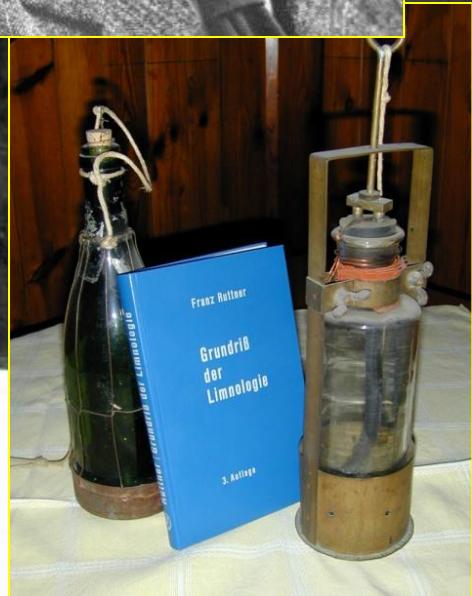
*Biological Station Lunz (1906 - 2003),
new built, new start 2011*



*Ritrodat-Lunz Concept (1977 - 2002)
Oberer Seebach*

(Bretschko 1978)



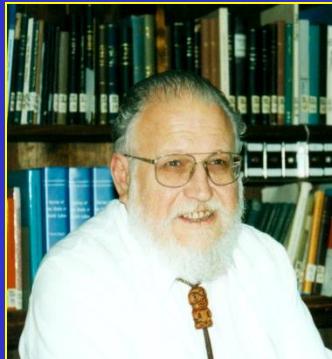
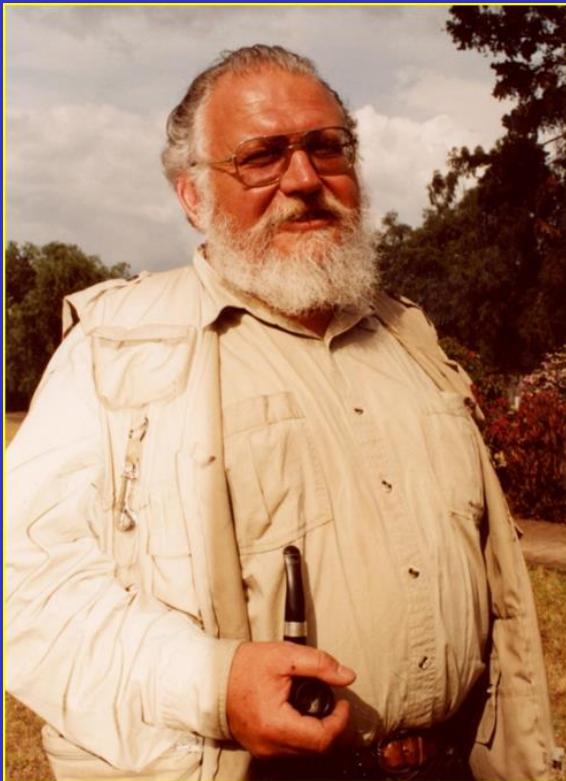


Biological Station Lunz
(1906 - 2003)

Franz Ruttner Head of the Inst. 1924-1957

Gernot Bretschko

Head of the Inst. 1977-2002



RITRODAT LUNZ

Main Focus in Lunz -
Stream Ecology

25 Years
Concept in
Stream Ecology

Functioning Stream \longleftrightarrow Water Canal



RITRODAT - concept (BRETSCHKO 1978)



duration:
1977 - 2002



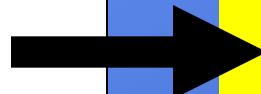
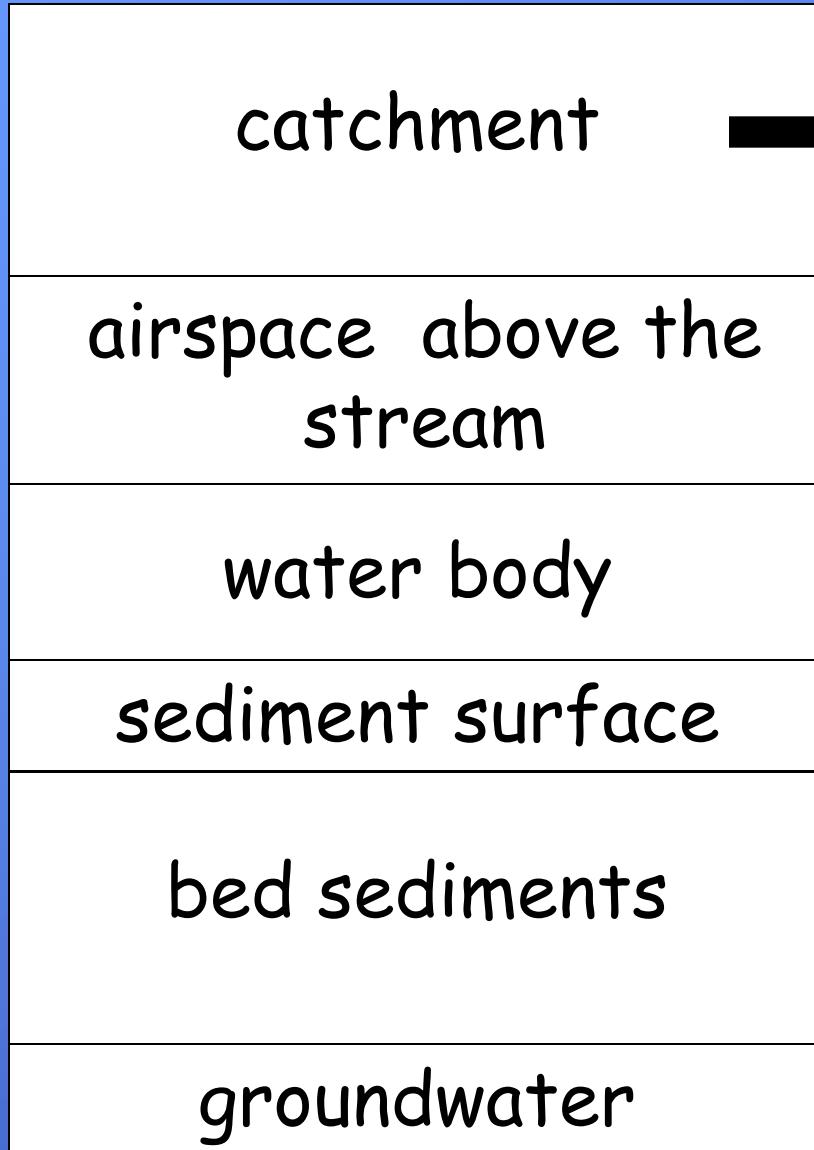
Objective:

Ecosystem analysis of a mountain stream
→ general patterns in streams

Realization:

- Scientific capacity of institute focuses on RITRODAT- study area
- Framework for Sub-Projects
- Integrating studies to ecosystem structure and function

RITRODAT - Concept (Bretschko 1978)



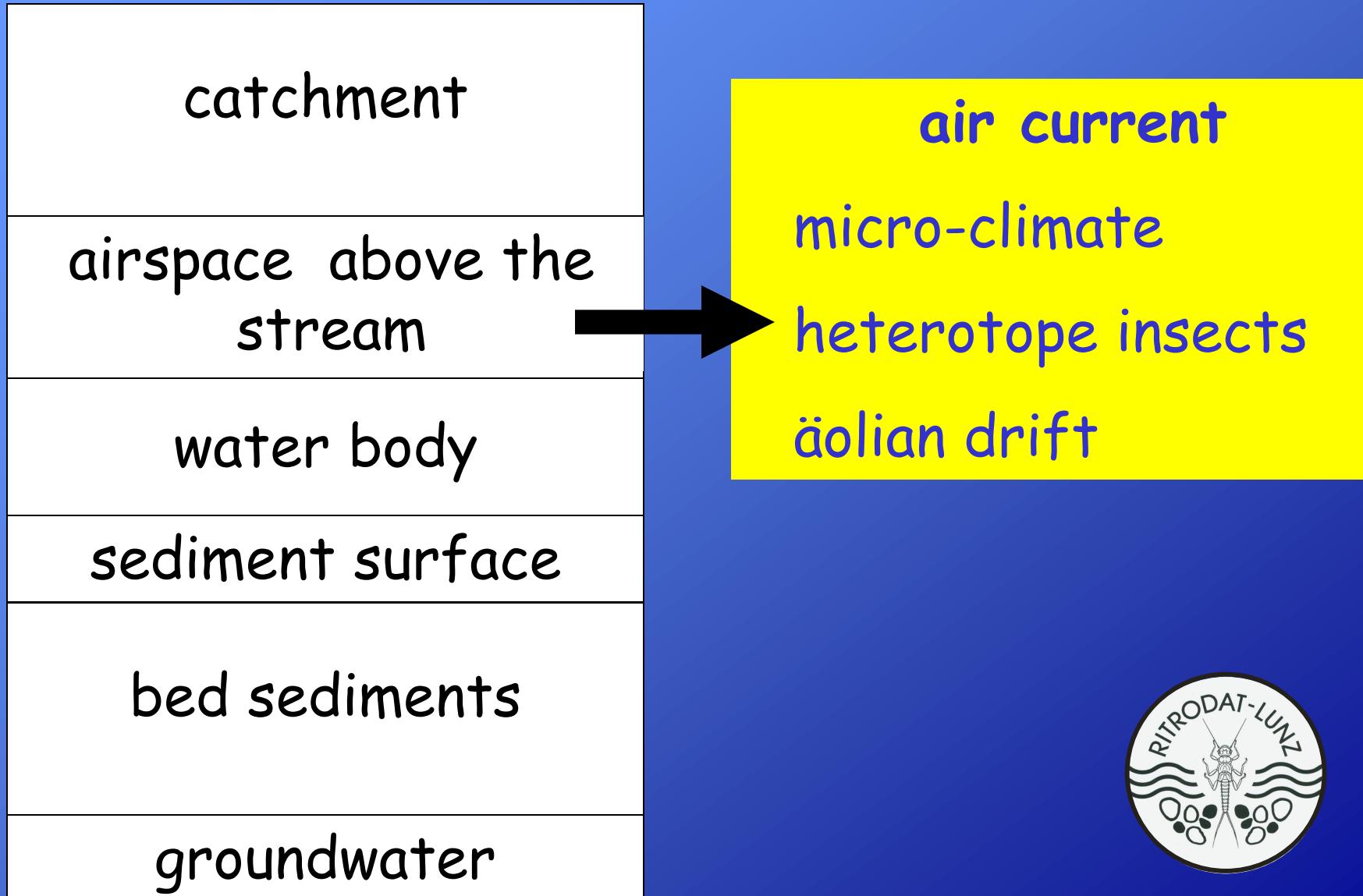
transport and
exchange between
air, soil and water

drift in surface
water

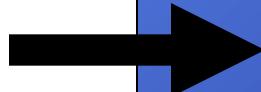
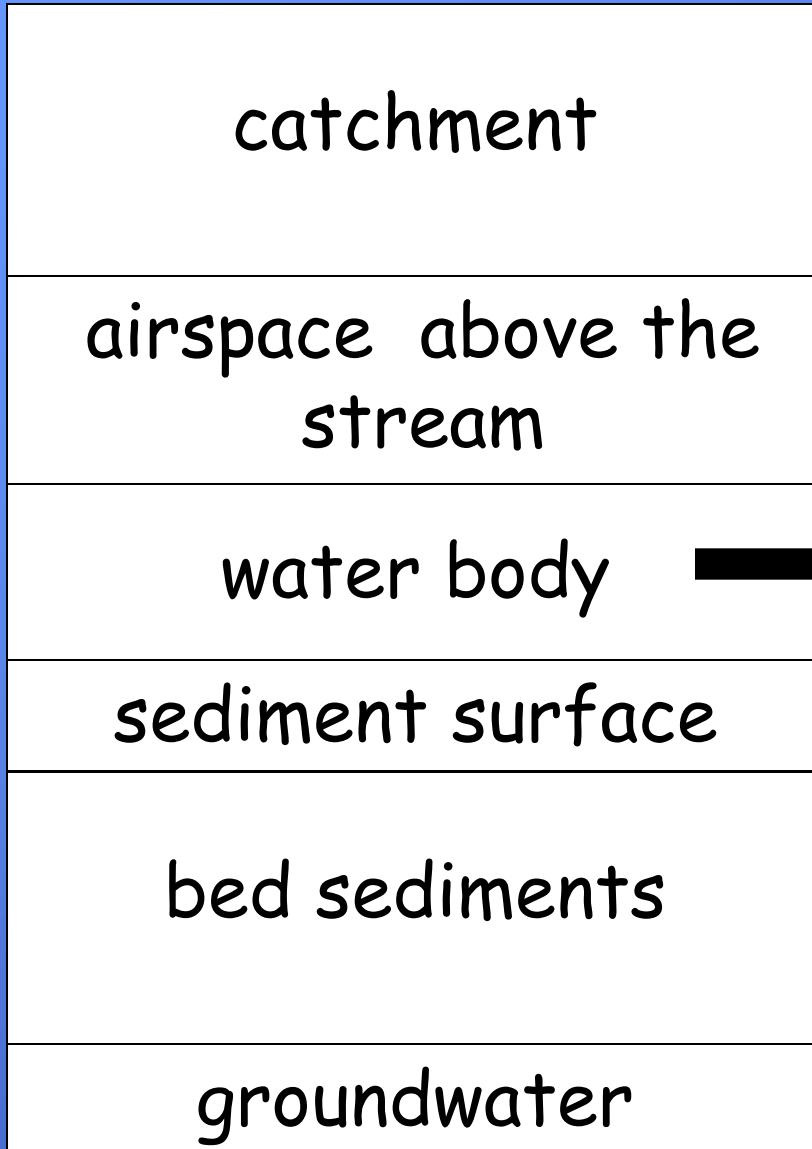
drift in sediment
interstices



RITRODAT - Concept (Bretschko 1978)

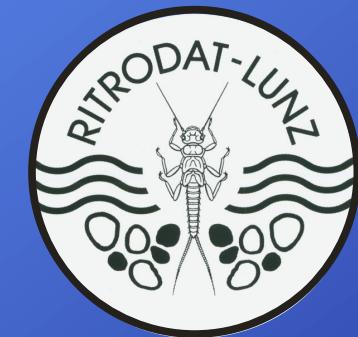
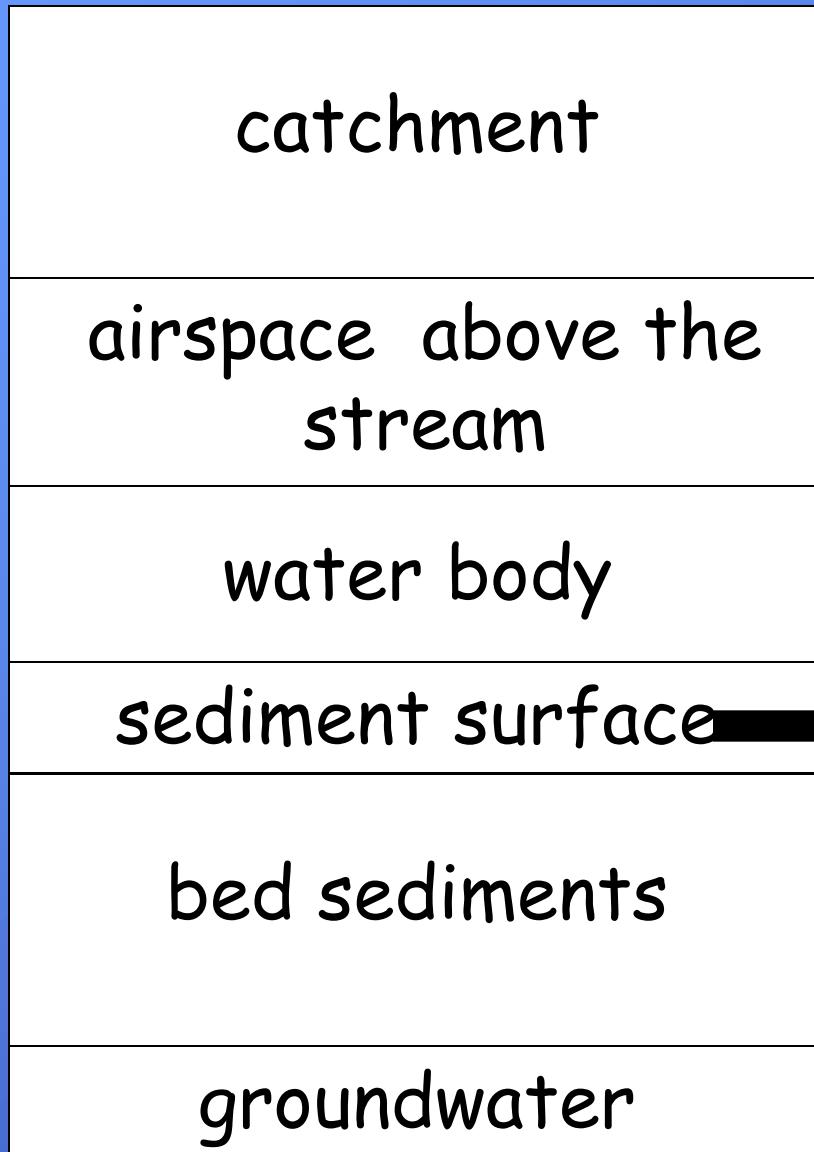


RITRODAT - Concept (Bretschko 1978)



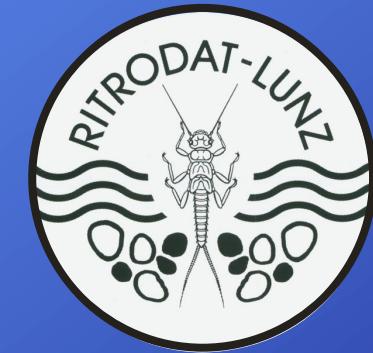
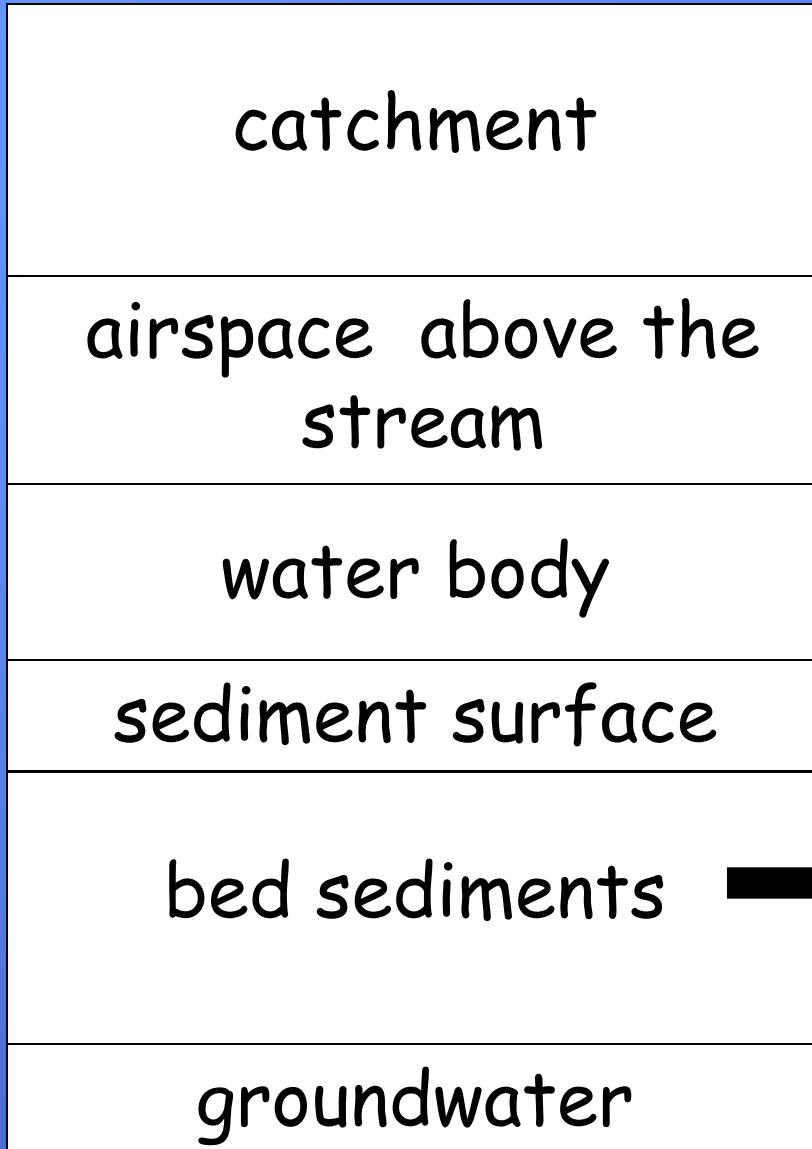
variables
hydrographic
physical
chemical
drift

RITRODAT - Concept (Bretschko 1978)



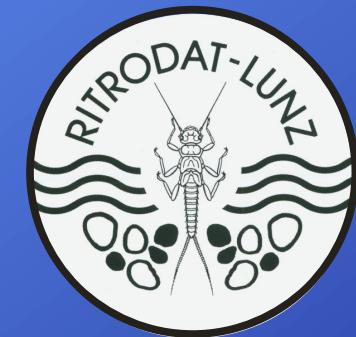
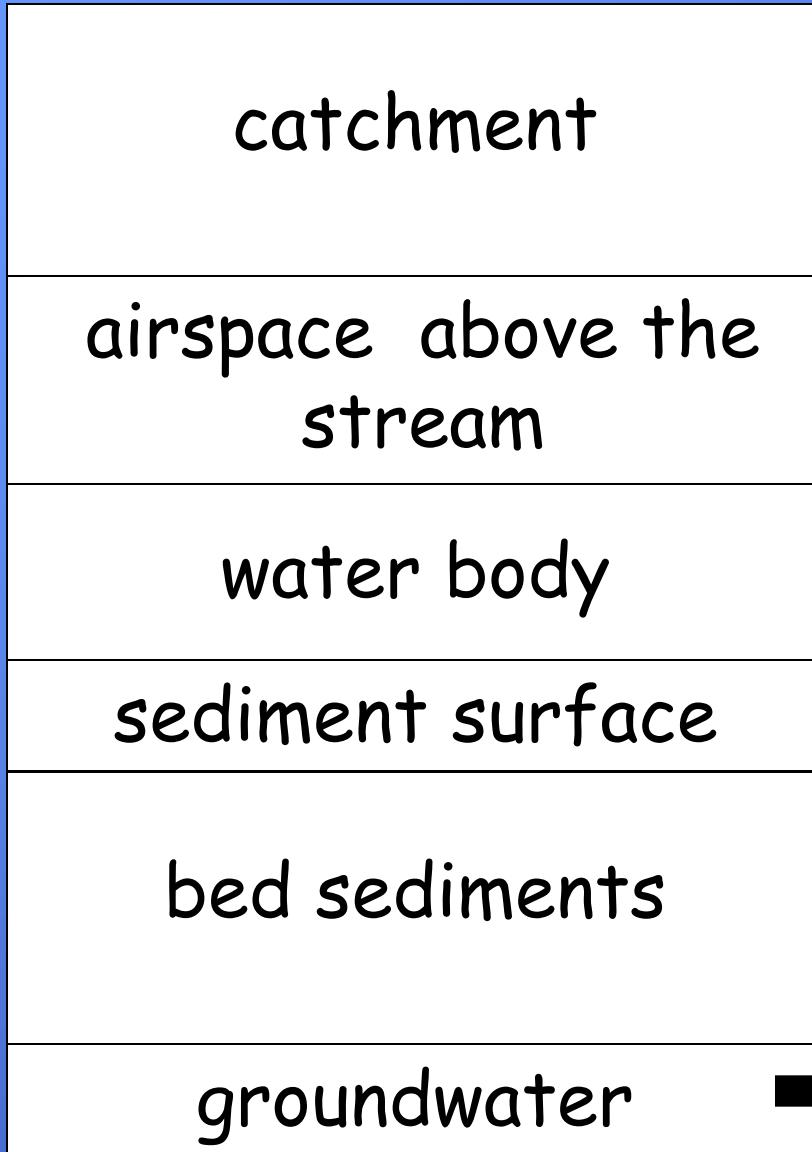
autochthonous production
"living space"
exchange processes

RITRODAT - Concept (Bretschko 1978)



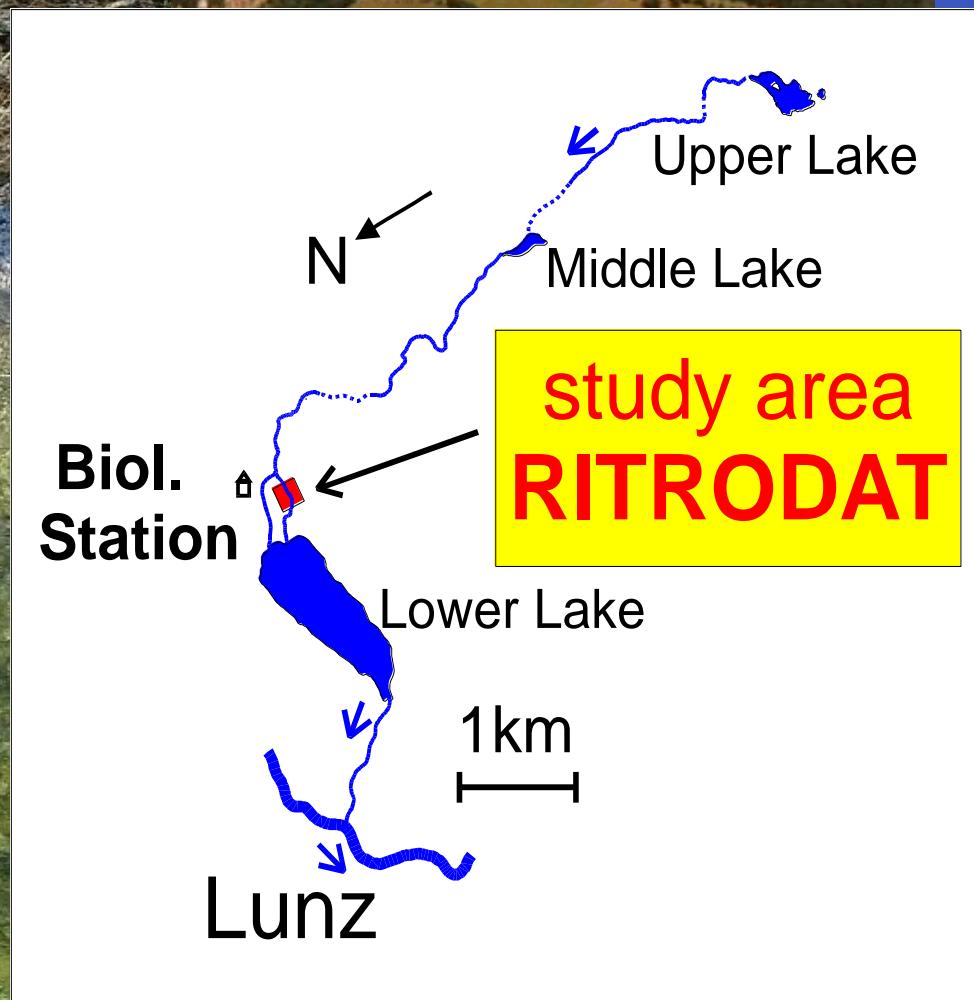
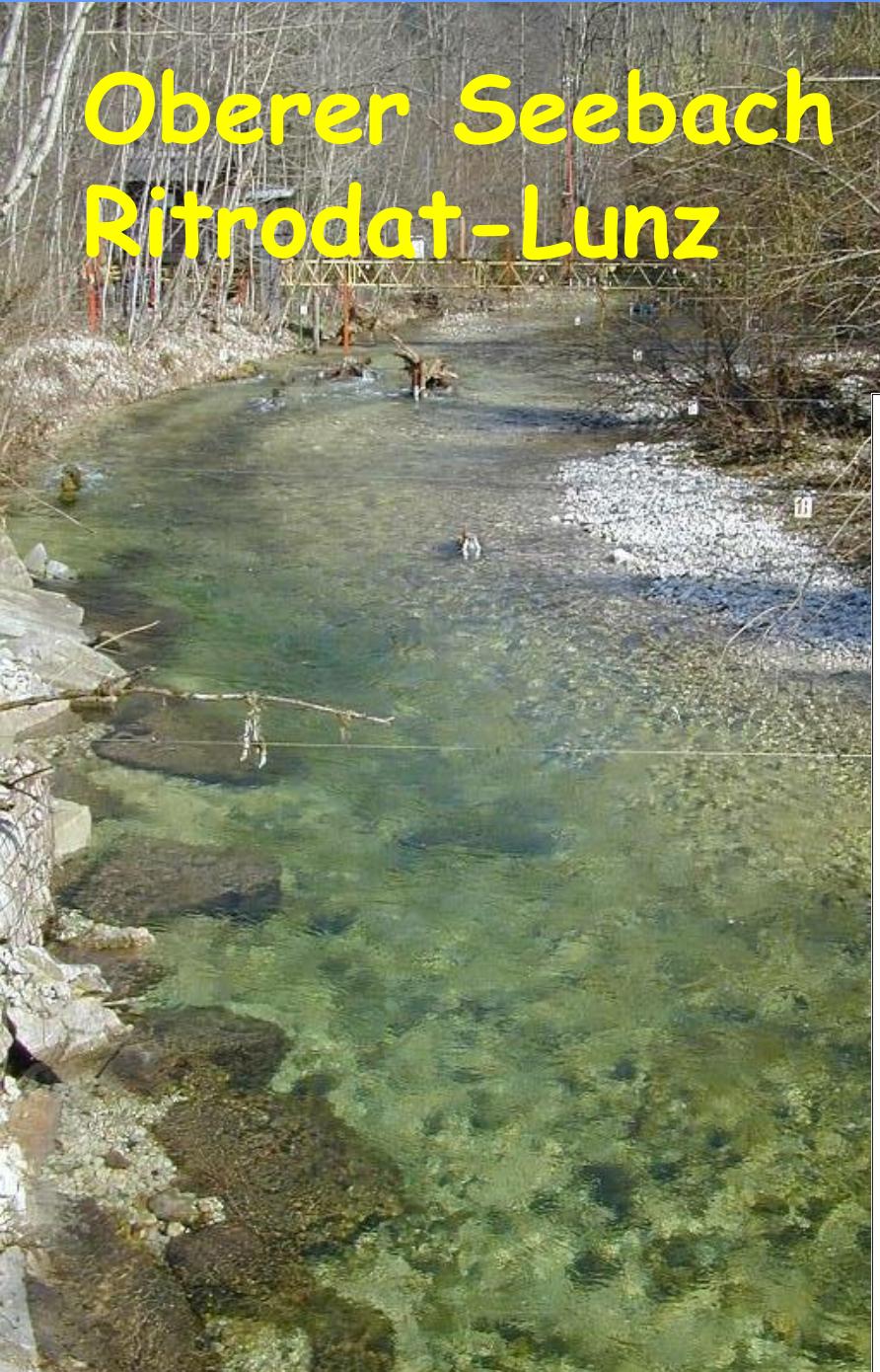
flow velocity
invertebrate distribution
sediment composition

RITRODAT - Concept (Bretschko 1978)



exchange processes
demarcation

Oberer Seebach Ritrodat-Lunz





Physico-Chemical Data

OBERER SEEBACH

Geology: karstic limestone

2nd order stream, flashy

Altitude: 605 m

Canopy: shading 70%

Water temp.: 6.4 °C

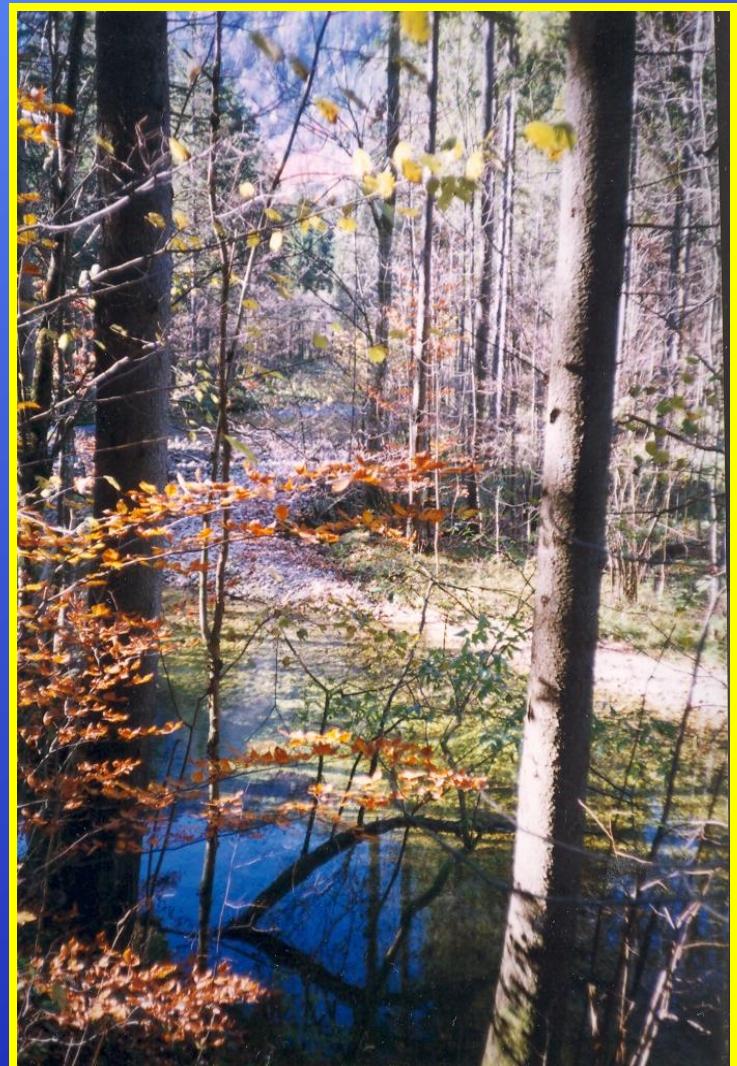
Mean stream width: 4.4 m

Mean discharge: 0.040 m³/s

Mean conductivity: 237 µS/cm

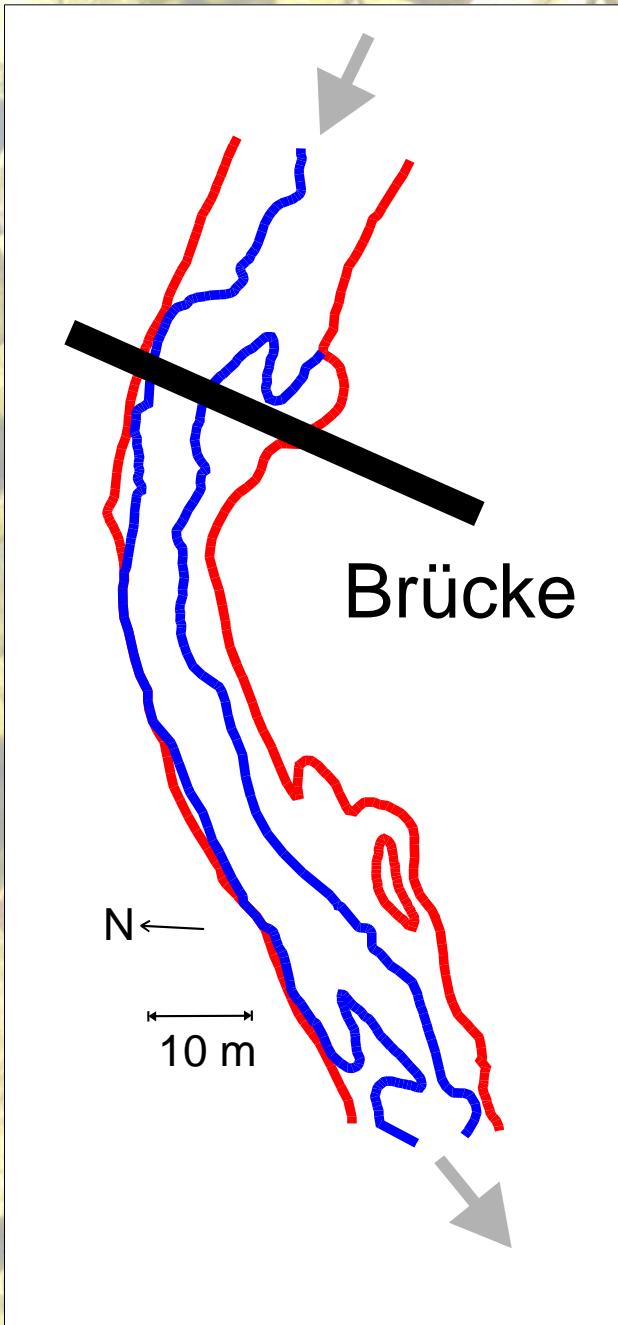
Total N: 0.79 mg/l

Inorganic P: 0.027 mg/l



Leichtfried 1986

RITRODAT - LUNZ



Oberer Seebach

Long-term Monitoring
(since 1978):

abiotic:

meteorological data

water temperature

water level / discharge

shore line

topography

permanent photo shots

sediment
retention



Sampling Methods

► Quantitative:

► Drift in surface water: Box-type Drift Sampler

► Benthos at the surface:

Surber Sampler

Hess Sampler

Lunz Sampler



► Benthos in the hyporheic zone

Stand Pipe Trap

Cage Pipe Trap

Freezing Core Method

with electro-positioning

► Emerging adults:

Emergence Trap

► Water: Box-type Drift Sampler



Sampling Methods



Emergence Trap



- Exposed up to 24 traps for 25 years
- Collecting of emerging insects from defined area
- Conservation already in the cup with glycol
- Working during flood also

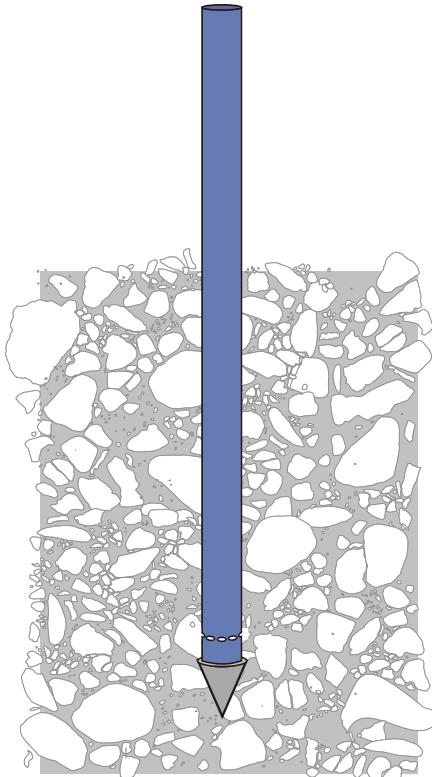
Sampling Methods



Quantitative: Hyporheic Zone

► Benthos, Chemistry:

→ Stand Pipe Trap

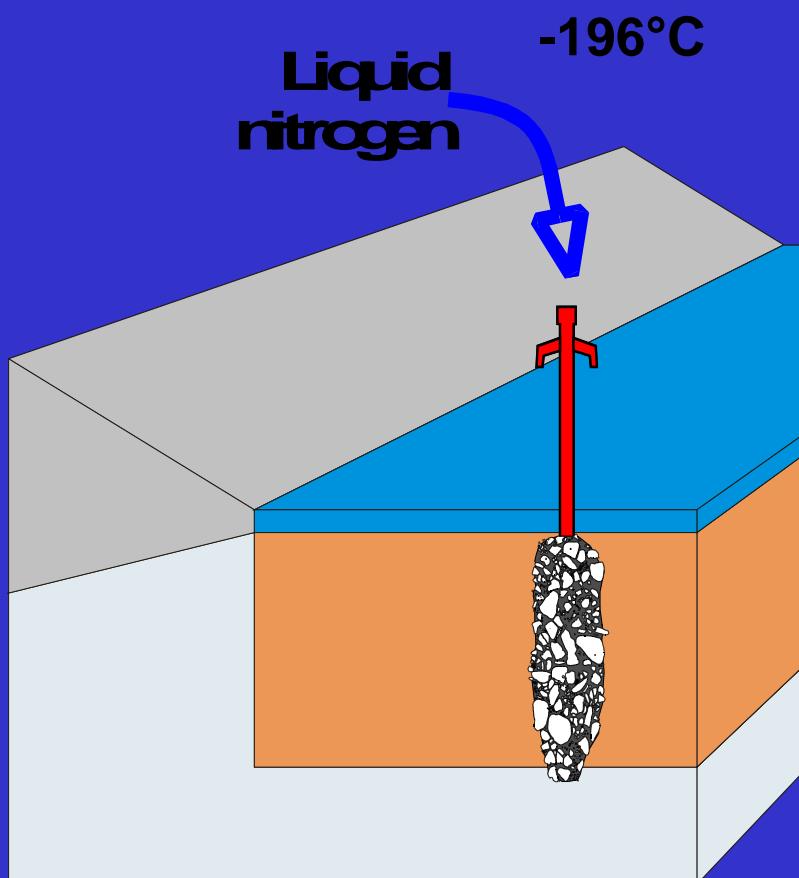


Bedsediments



Freeze Core Technique

Sampling bedsediments
in natural texture



Bedsediments

Ritrodat Study Area

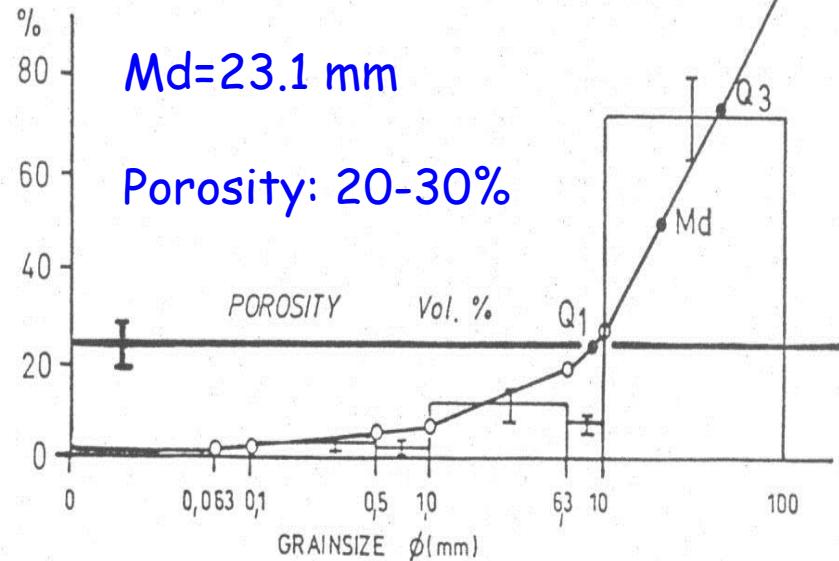
Dominated by grain sizes
 $> 10 \text{ mm}$

Grain size $< 1 \text{ mm}$:

Sediment analysis:

$Md=23.1 \text{ mm}$

Porosity: 20-30%



annual mean, $n=216$

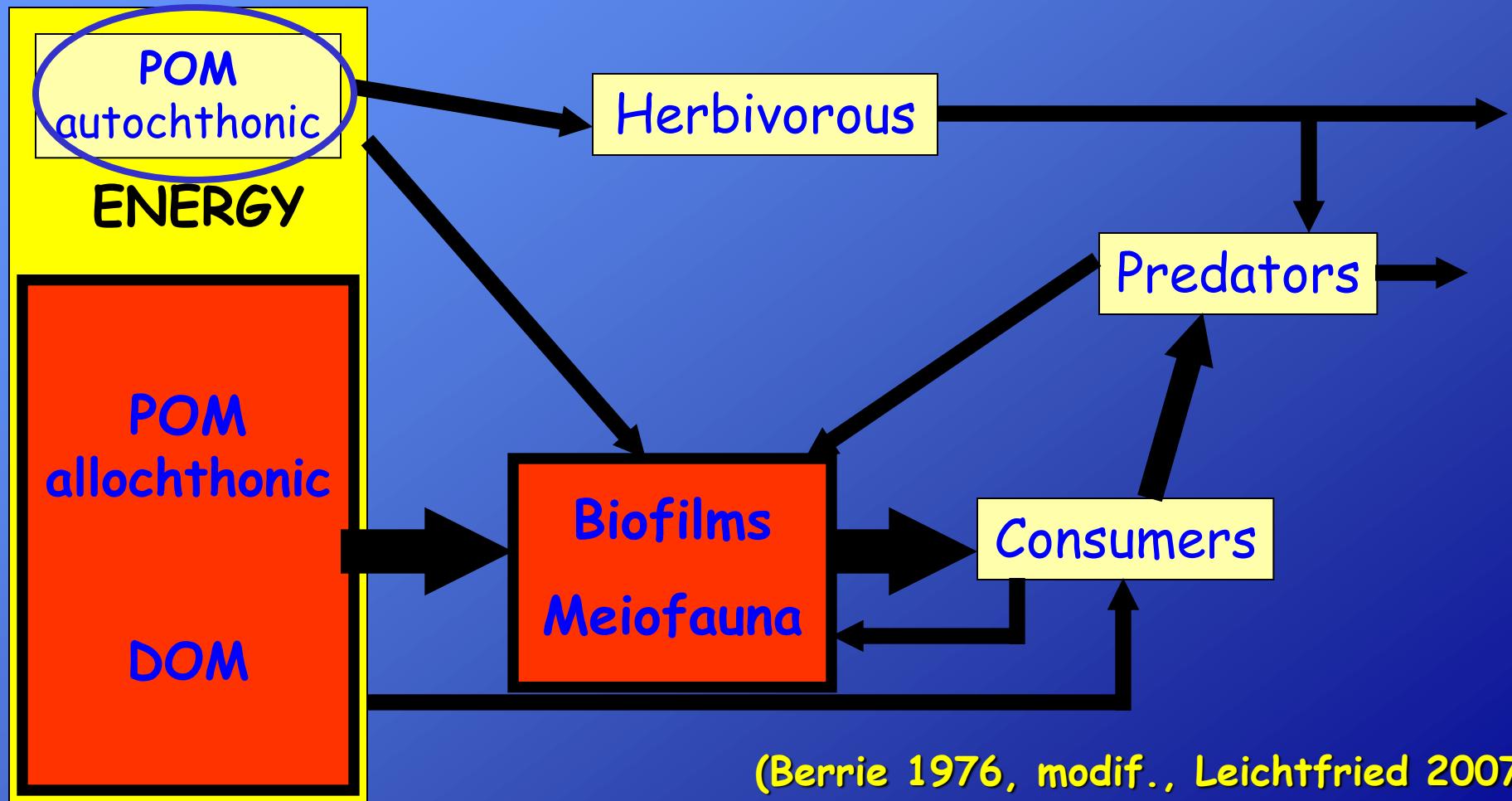
- rel. amount only $< 10 \%$

- TOC content up to 80 %
- TON content up to 88 %



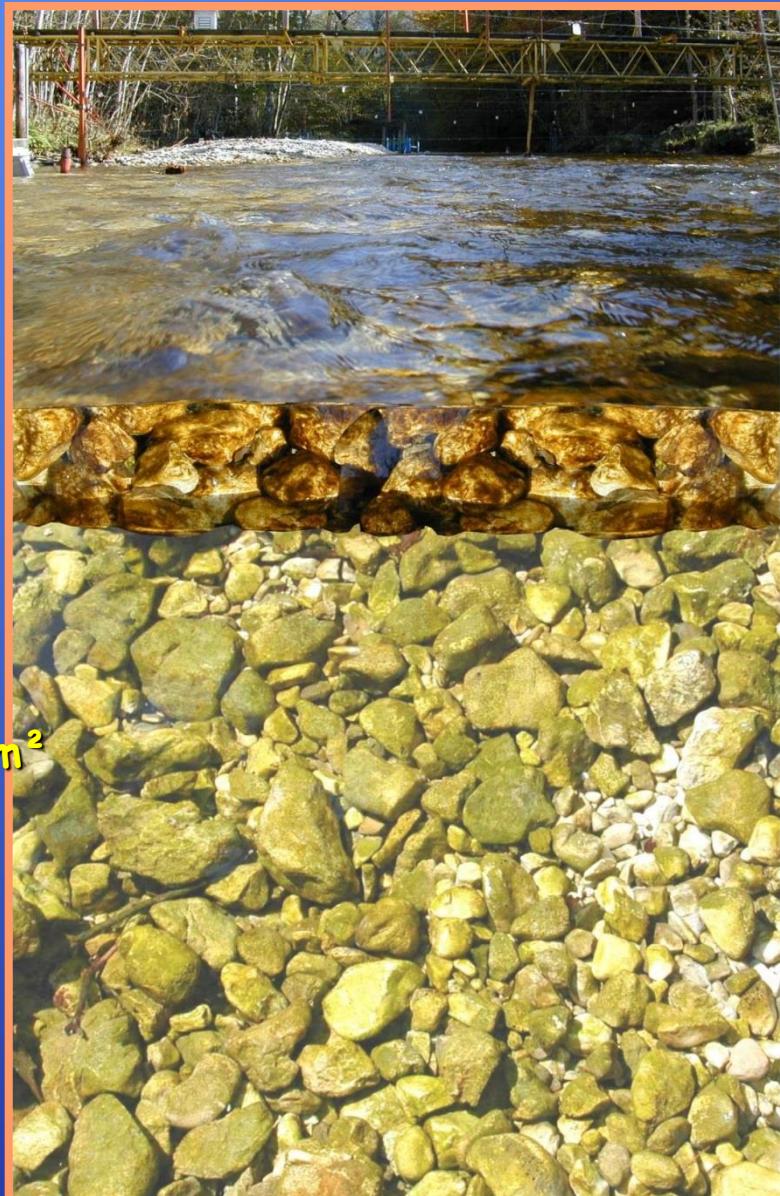
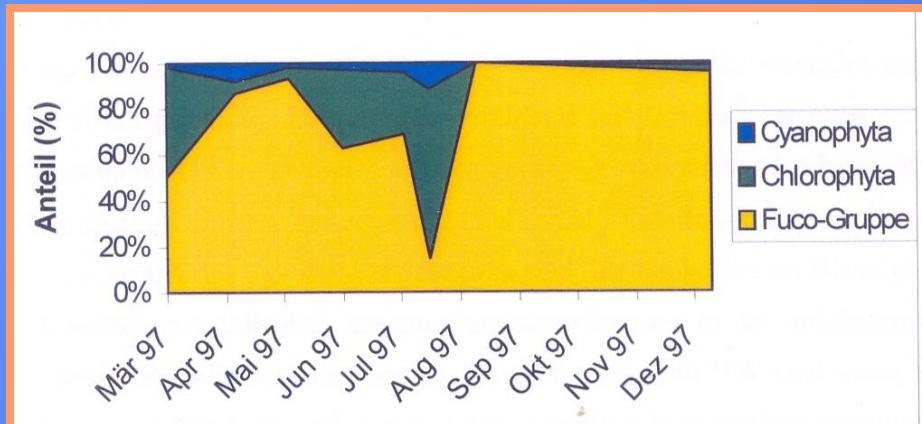
General Patterns in Streams:

Energy flow in low order streams

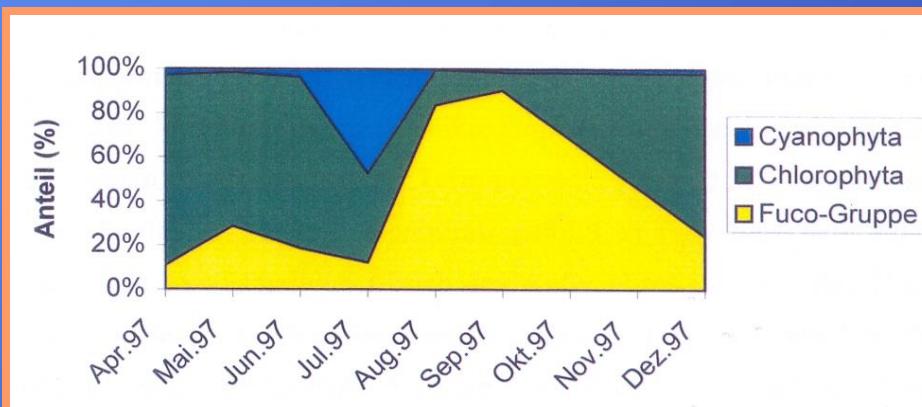


Relative Temporal Distribution of Phytobenthic Community

Main Channel: 0,41-9,67 $\mu\text{gChl-a/cm}^2$



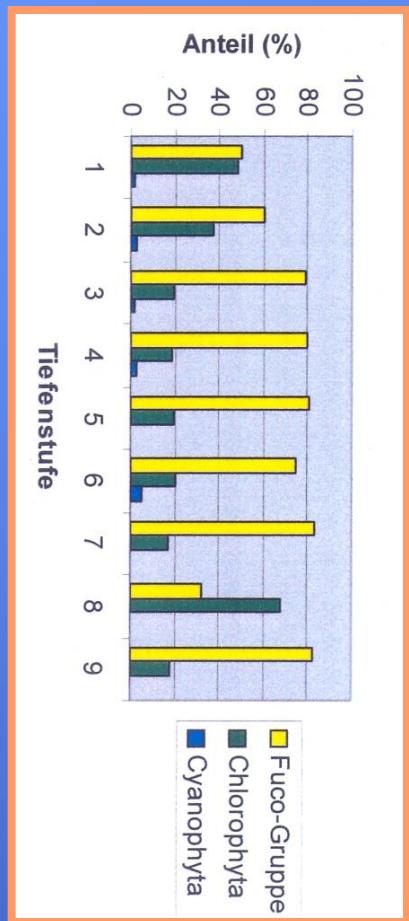
Riffle/Pool Transition Area: 1,40-18,39 $\mu\text{gChl-a/cm}^2$



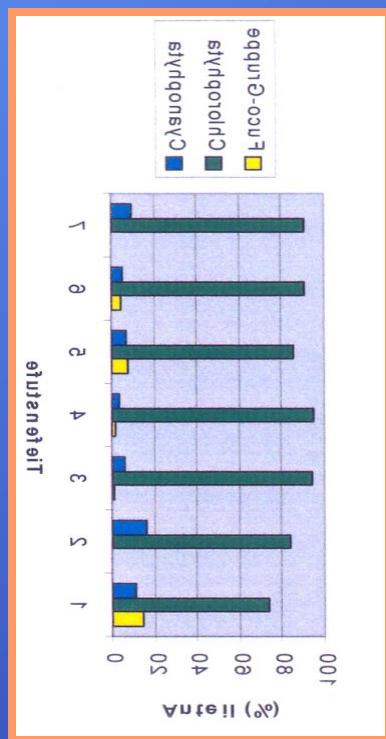
Relative Vertical Distribution of Phytobenthic Community in Main Channel



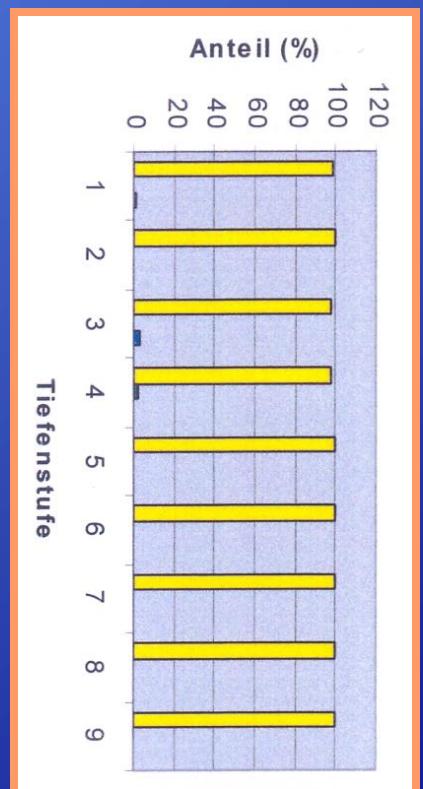
III. 1997



VII. 1997

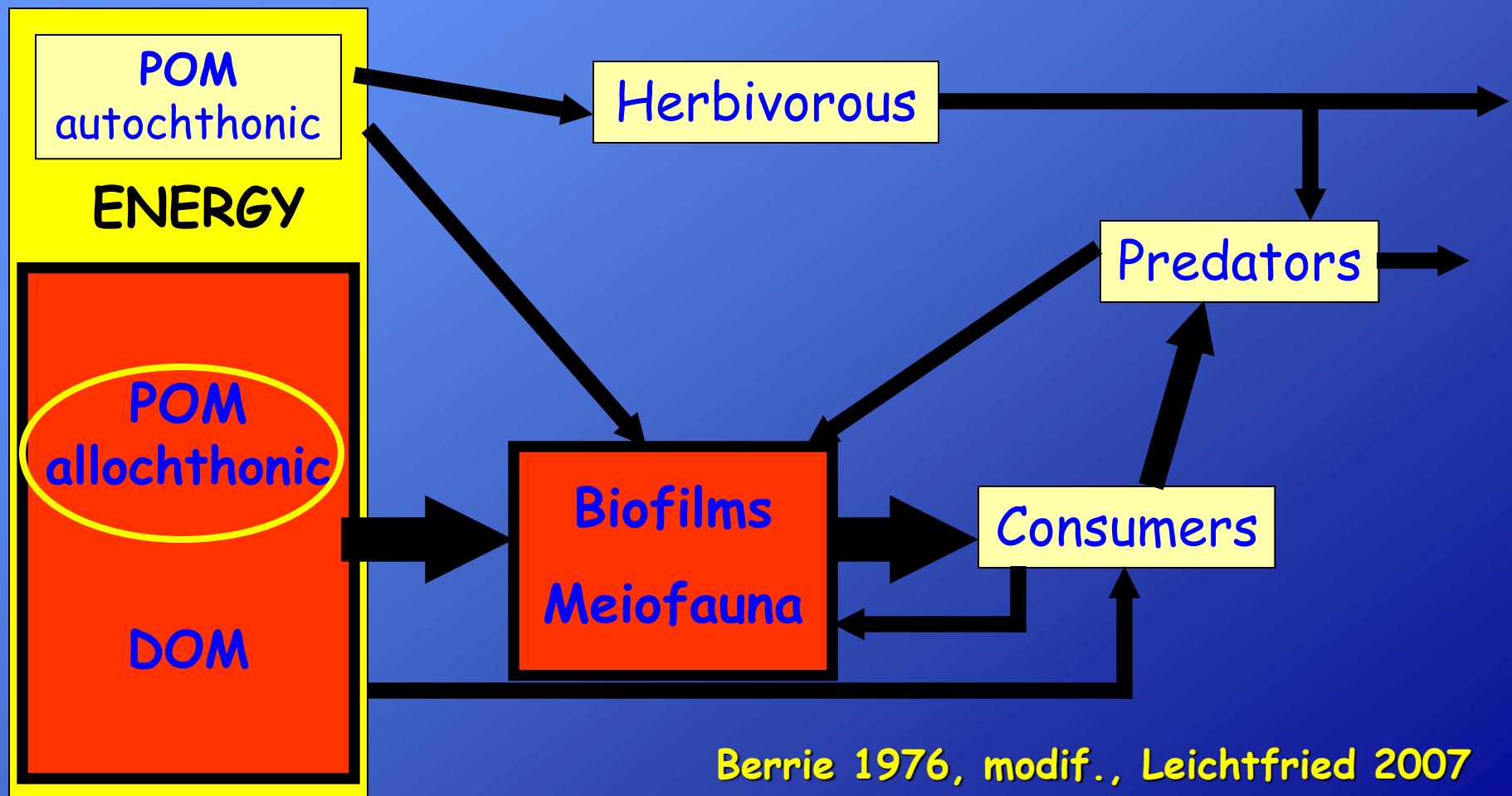


IX. 1997



Müllner 1998

Energy flow in low order streams



Berrie 1976, modif., Leichtfried 2007



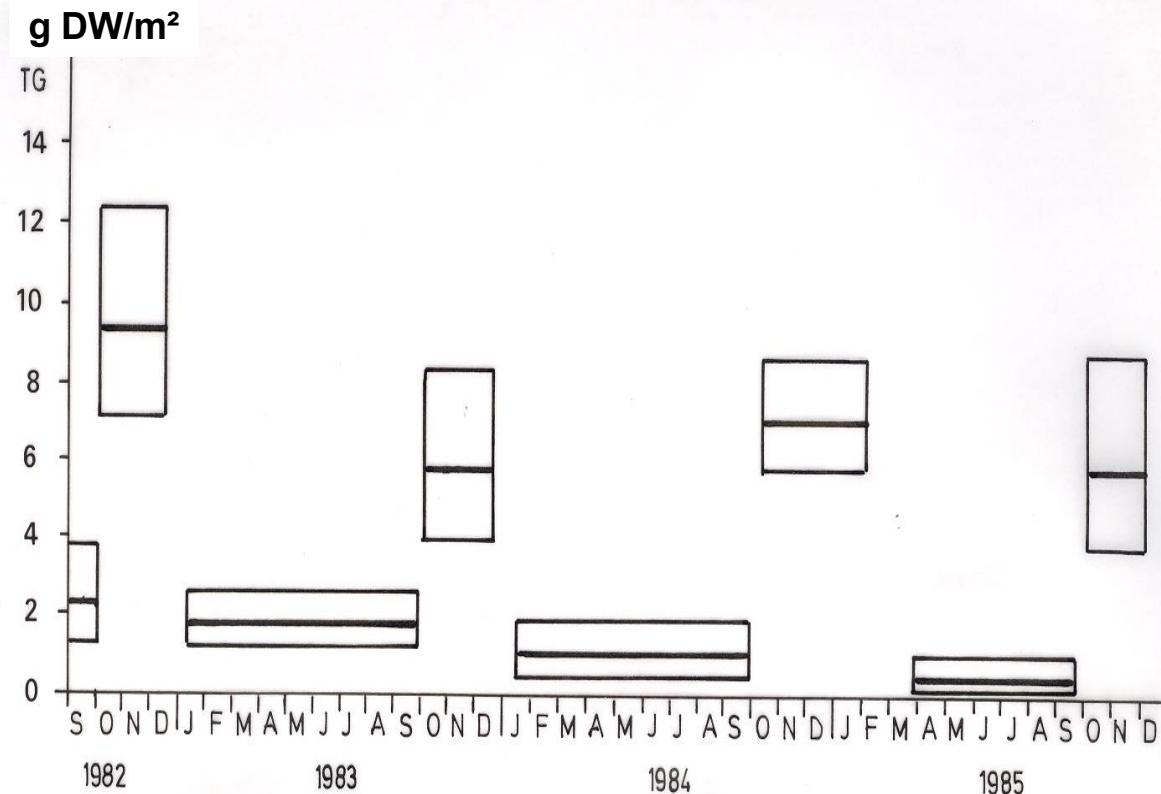
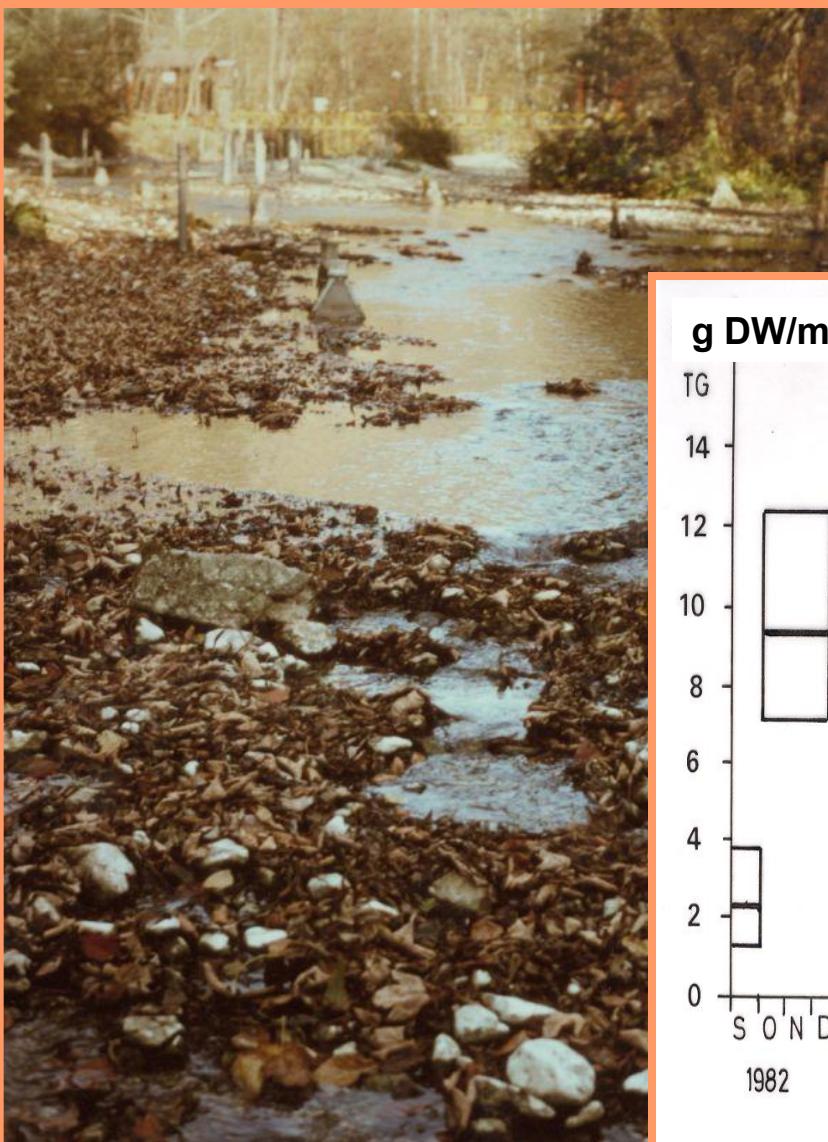
Input of Allochthonous Organic Matter

- Aerial Drift - plant litter, pollen.....
- Bank Runoff
- Subsurface Input

Cummins 1974, Boling et al. 1975



Leave Material Deposited on Sediment Surface



Geom. means of dry weight in g/m²
with 95% confidence limits

Leichtfried 1988, Bretschko 1986



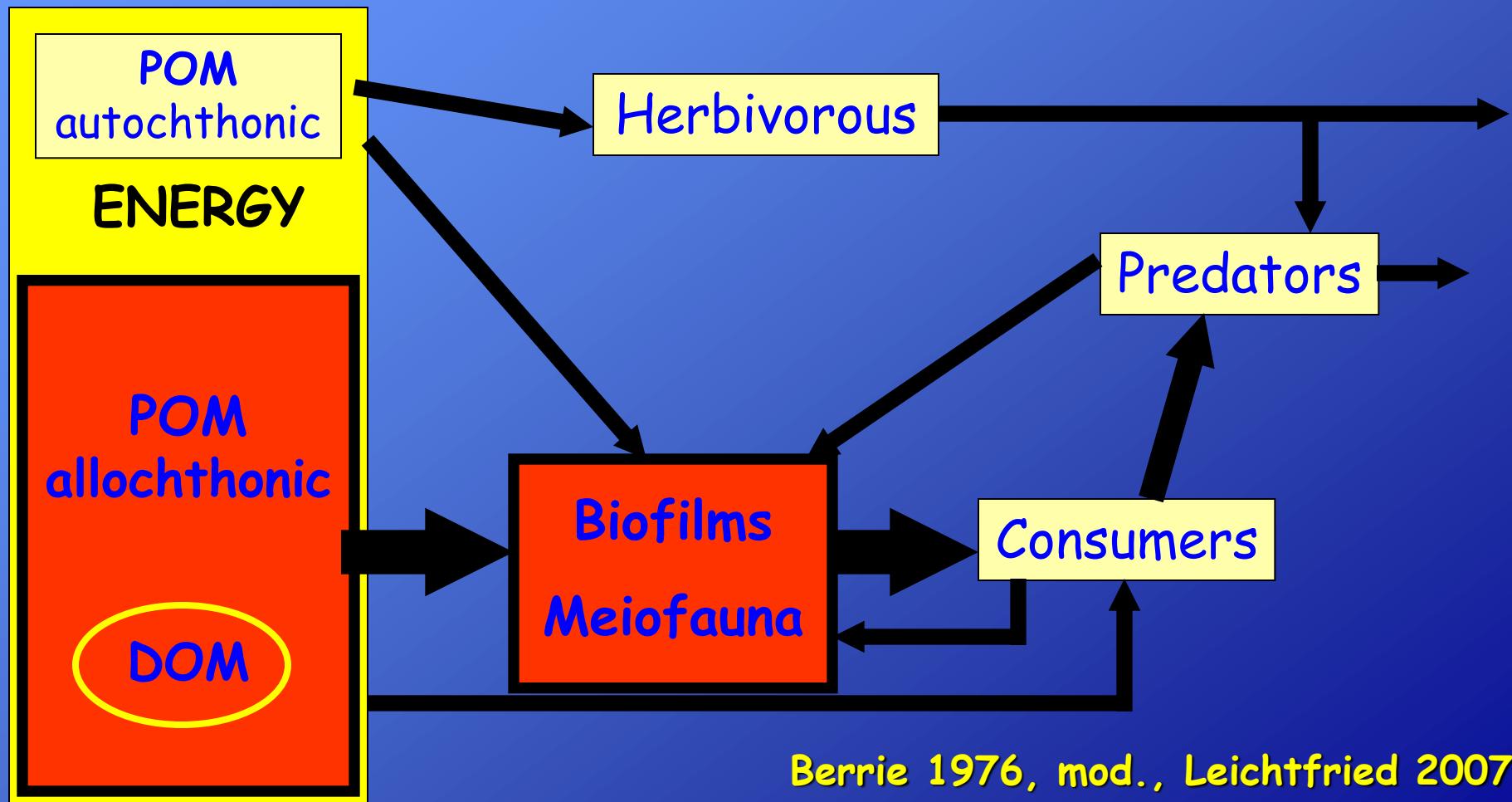
Plant Tissue - CPOM - Decomposition



e.g. M` Erimba & Leichtfried 1998

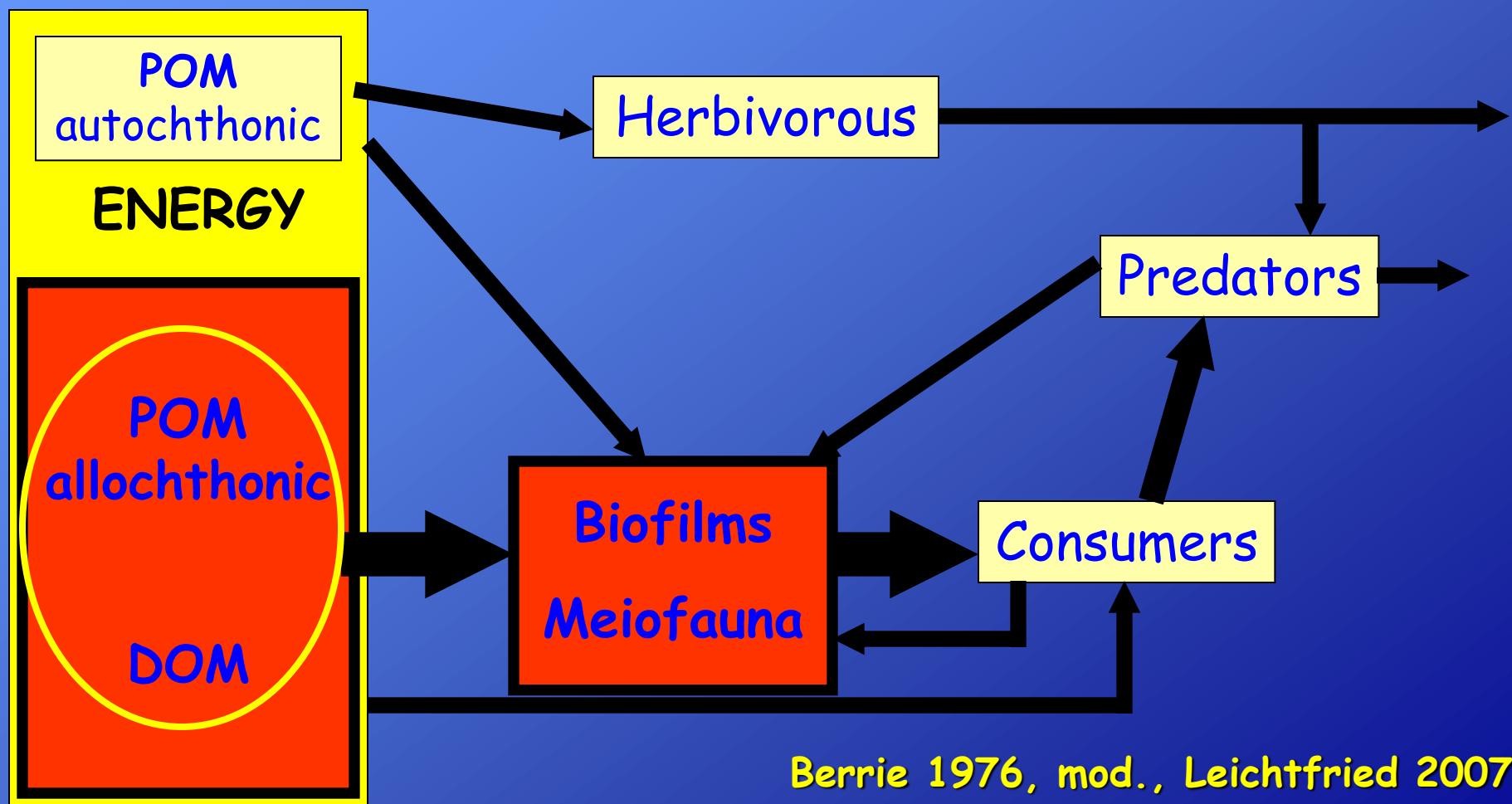
e.g. Leichtfried & Fleituch 1999 - 2004

Energy flow in low order streams



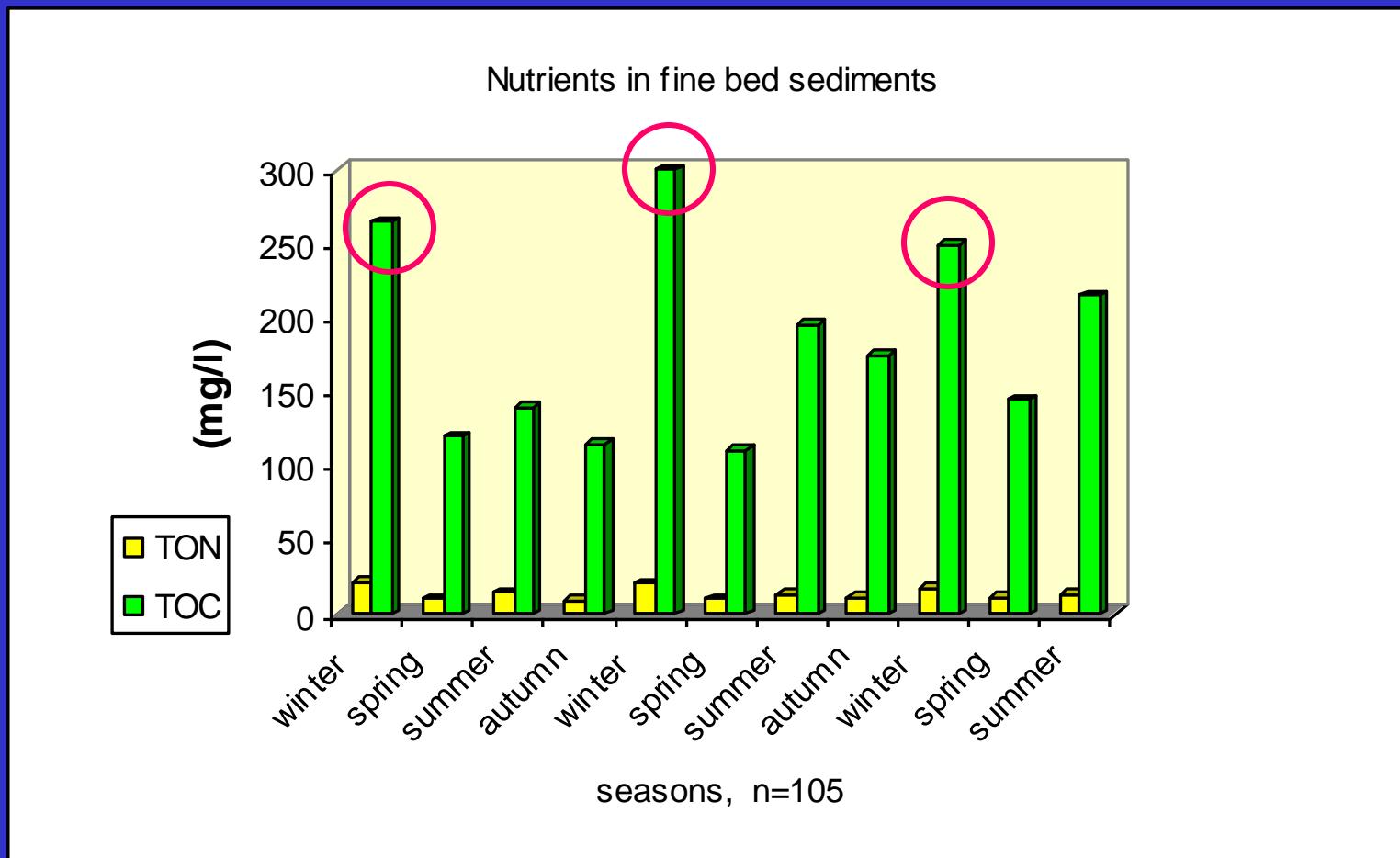
Berrie 1976, mod., Leichtfried 2007

Energy flow in low order streams



Berrie 1976, mod., Leichtfried 2007

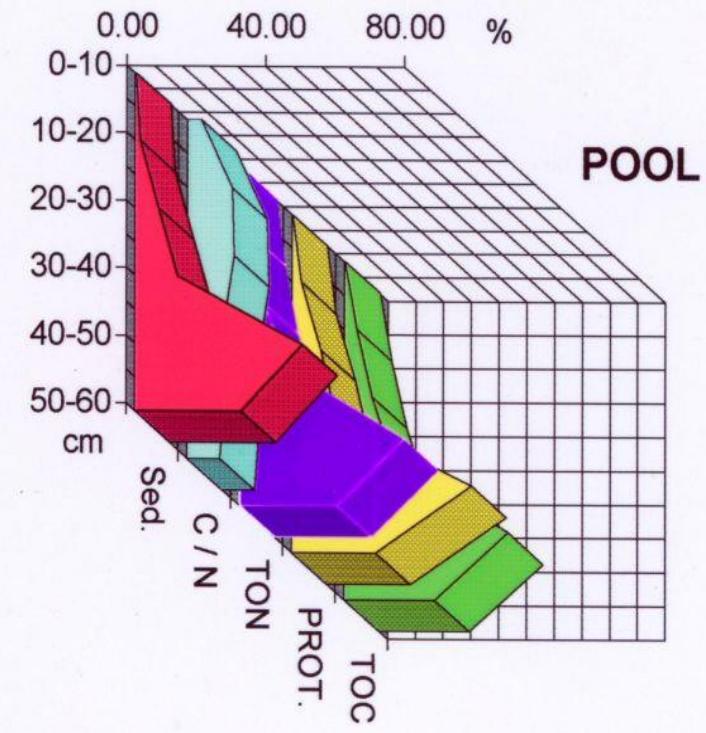
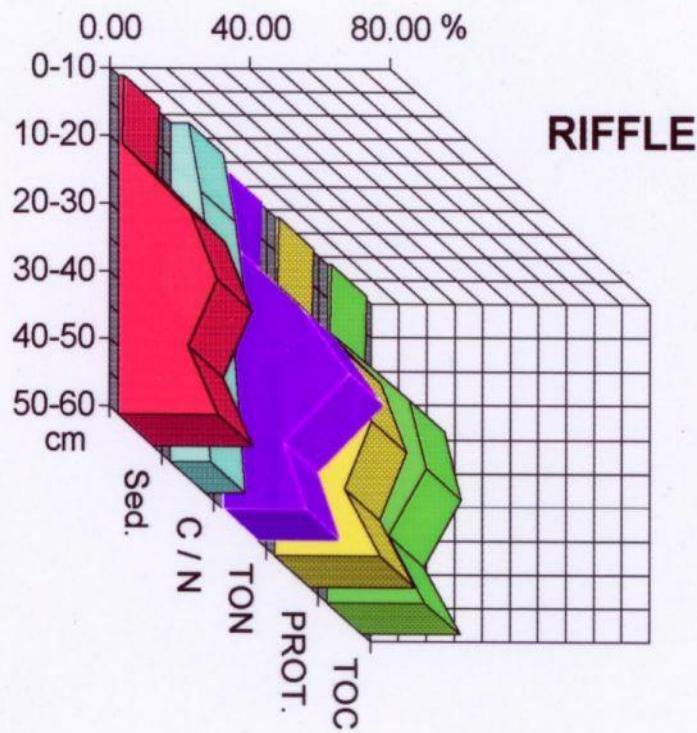
POM in Bedsediments - Temporal Distribution



Peaks in the winter, after the decomposition of autumn input

Leichtfried 2007

POM in Bedsediments - Vertical Distribution

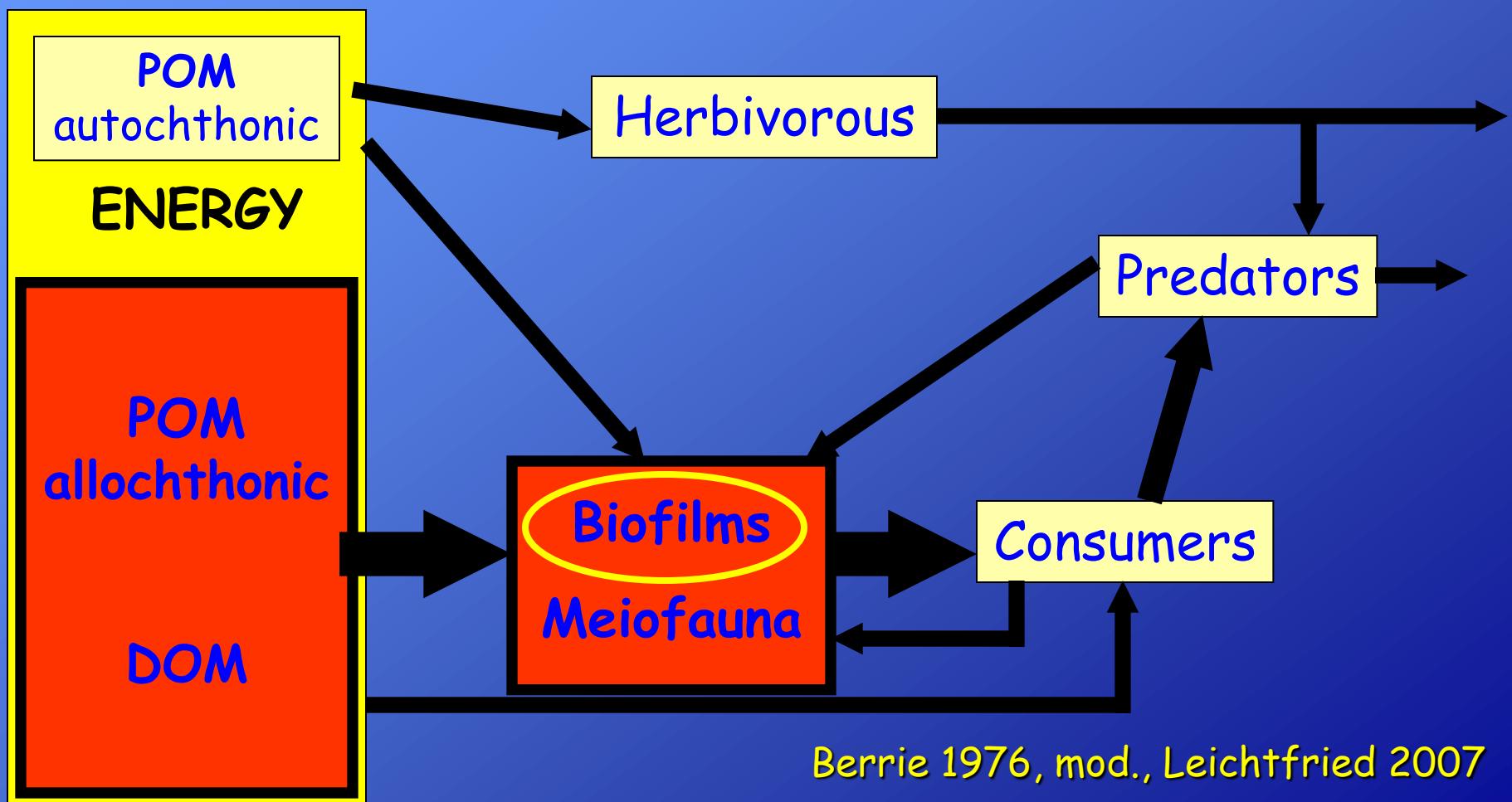


biannual means; n=72

Max. amount in 30 - 40 cm sed. depth, following
pattern of grain size class <1mm

Leichtfried 1988, 1994, 1998 etc.

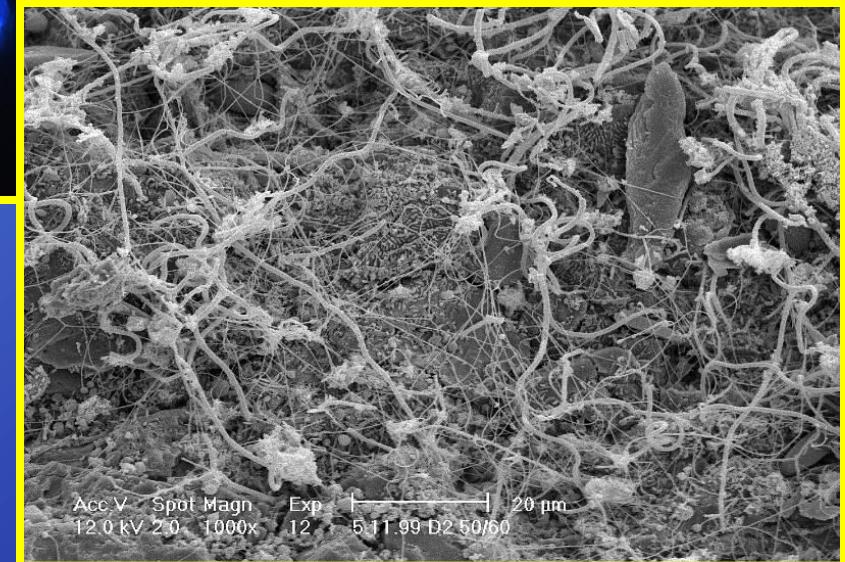
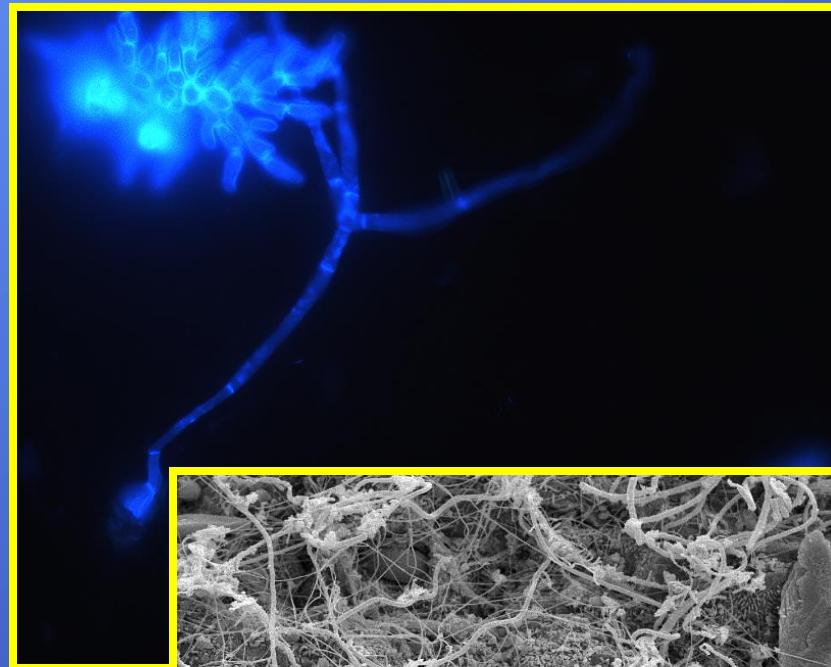
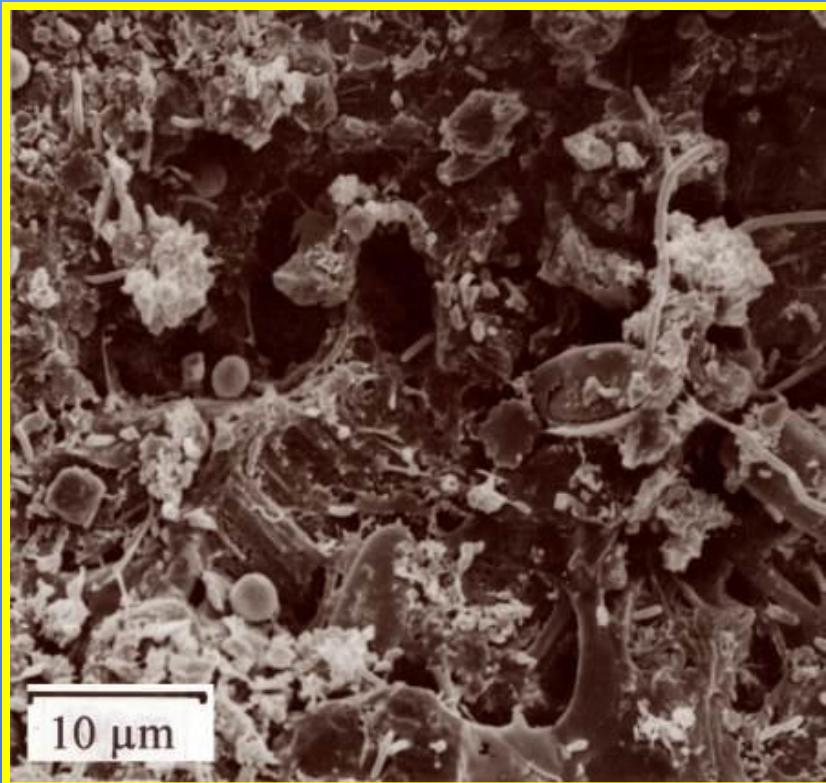
Energy flow in low order streams



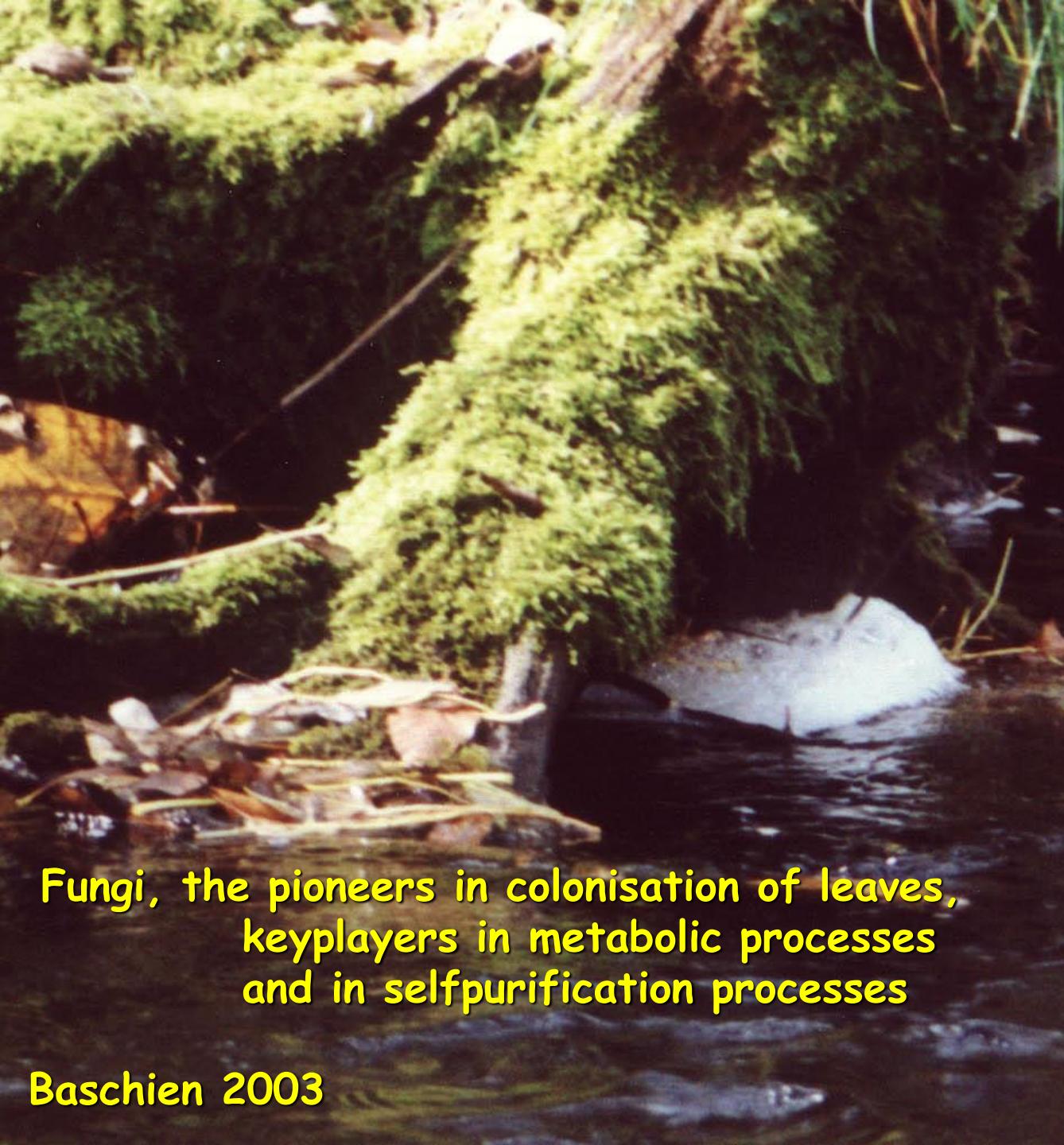
Biofilms

Microbiocenosis (Fungi, Bacteria, Protozoa...) and their organic excretions (exocellular polymers) attached to surfaces.

Marshall et al. 1984

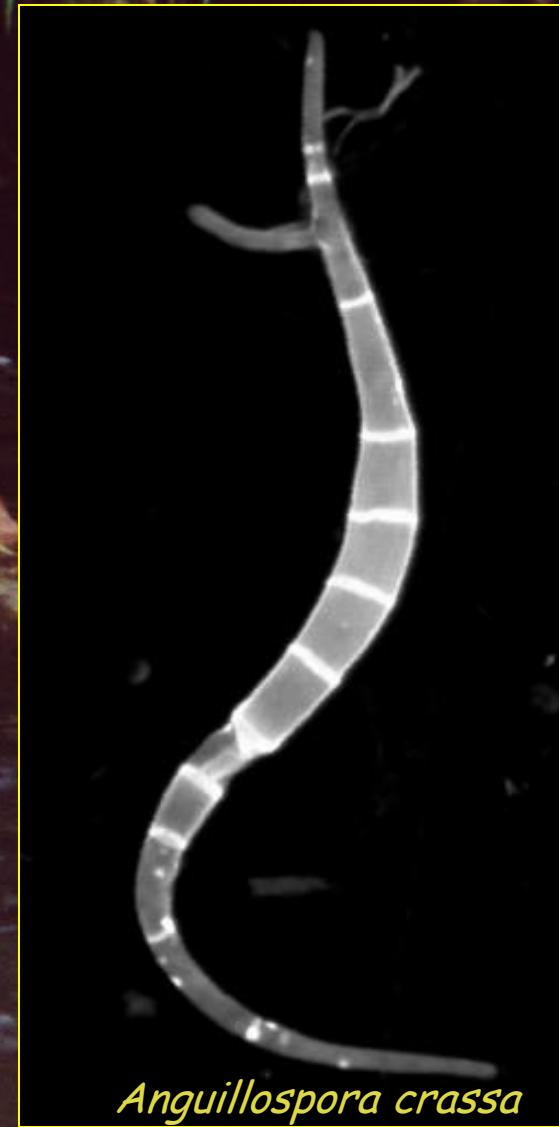


Photos by Steiner 1991, Klepal 1991 and Leichtfried 2005



Fungi, the pioneers in colonisation of leaves,
keyplayers in metabolic processes
and in selfpurification processes

Baschien 2003



Anguillospora crassa

Aquatic Hyphomycetes

3-point-landing



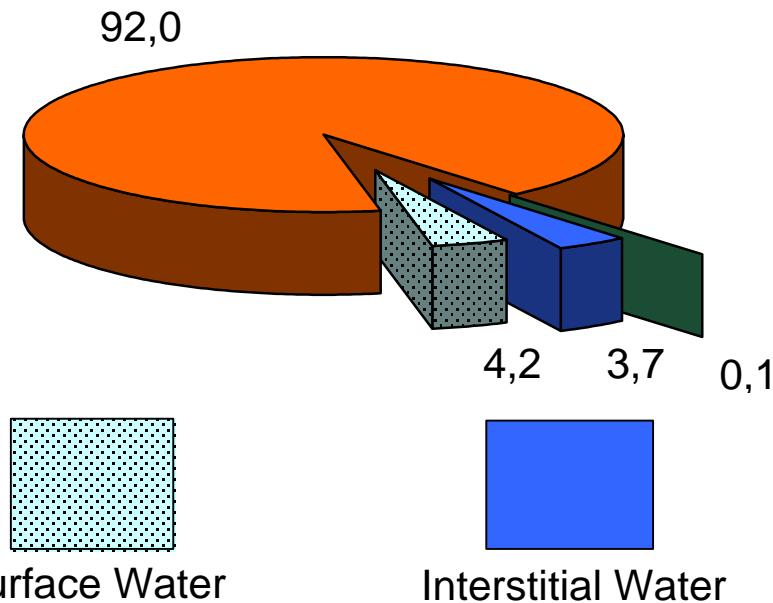
Air bubble and conidia

Sporulating on leaf surface

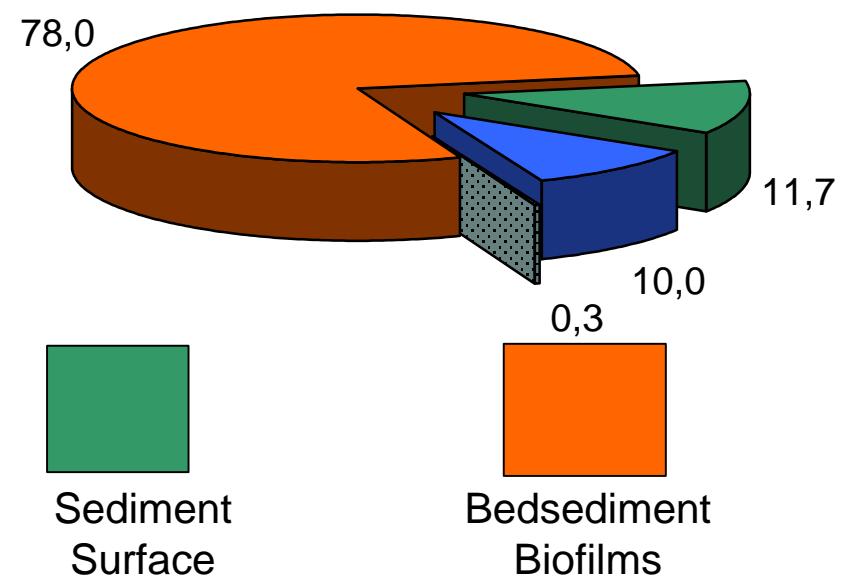


Bacteria Distribution in the Ritrodat-Lunz Study Area, Oberer Seebach

High discharge

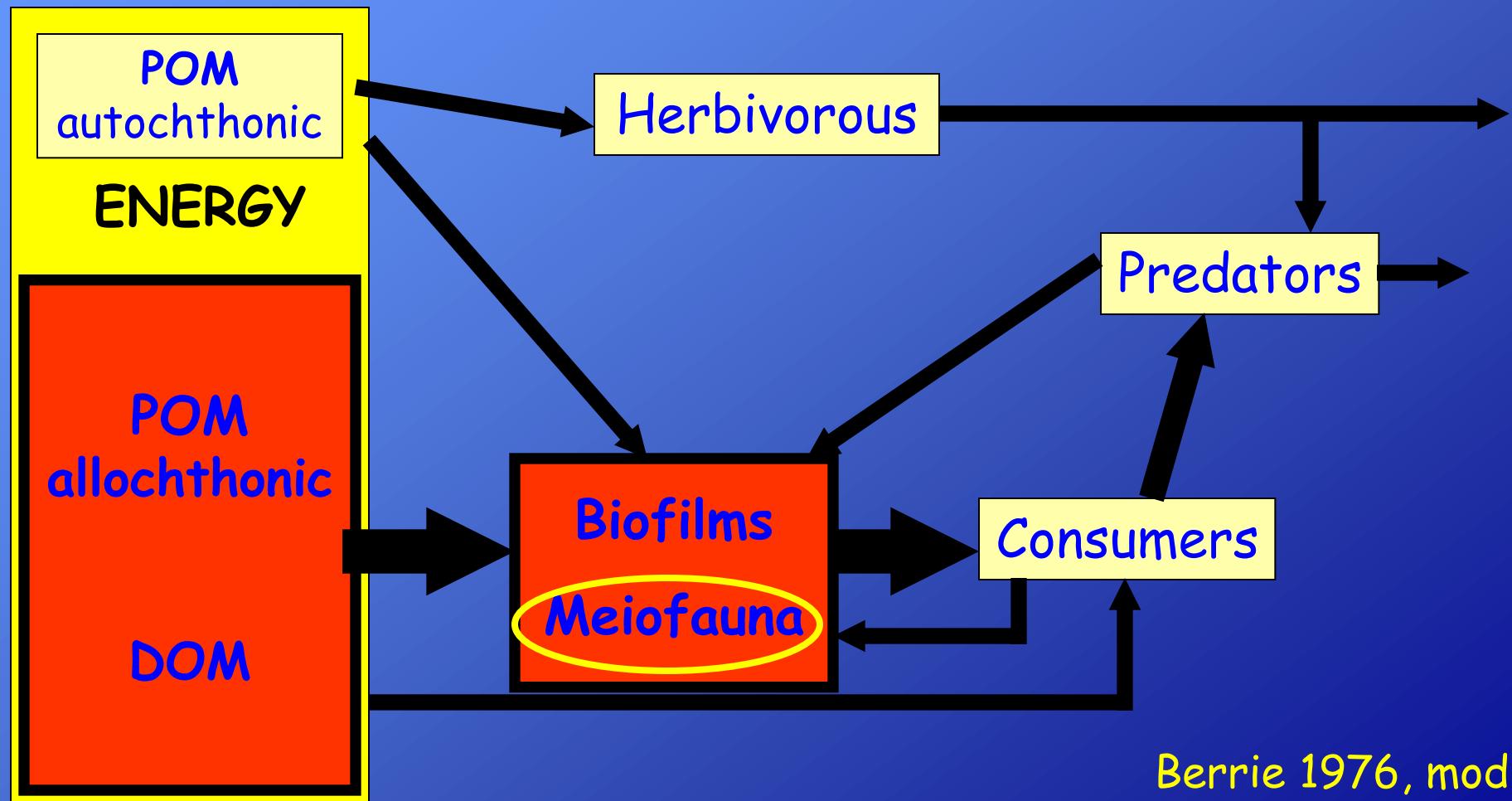


Low discharge



Kasimir 1991

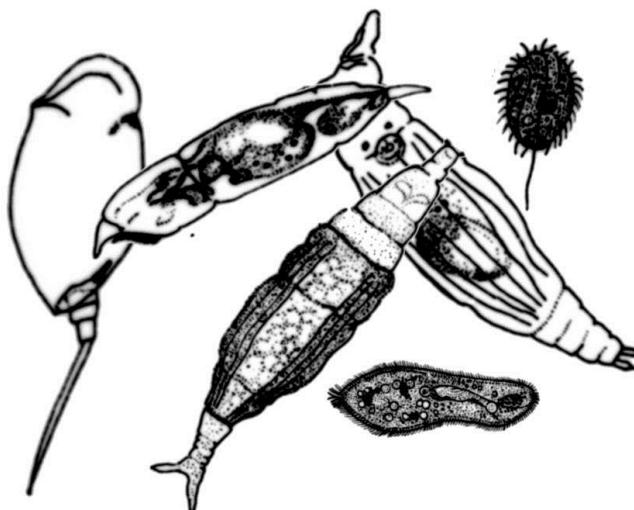
Energy flow in low order streams



Crustacea
Copepoda, Cladocera, Ostracoda



Acari: Hydrachnidia Protozoa: Testacea



Meiobenthic Fauna in Streams

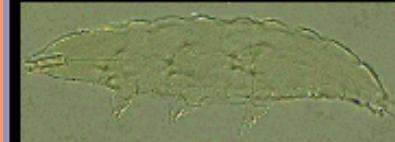


- Rarely studied
- Mostly flushed away
- Rich in Abundance, Diversity and Biomass

Microturbellaria



Tardigrada



Nematoda

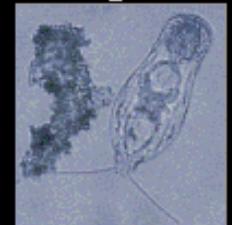


Gastrotricha

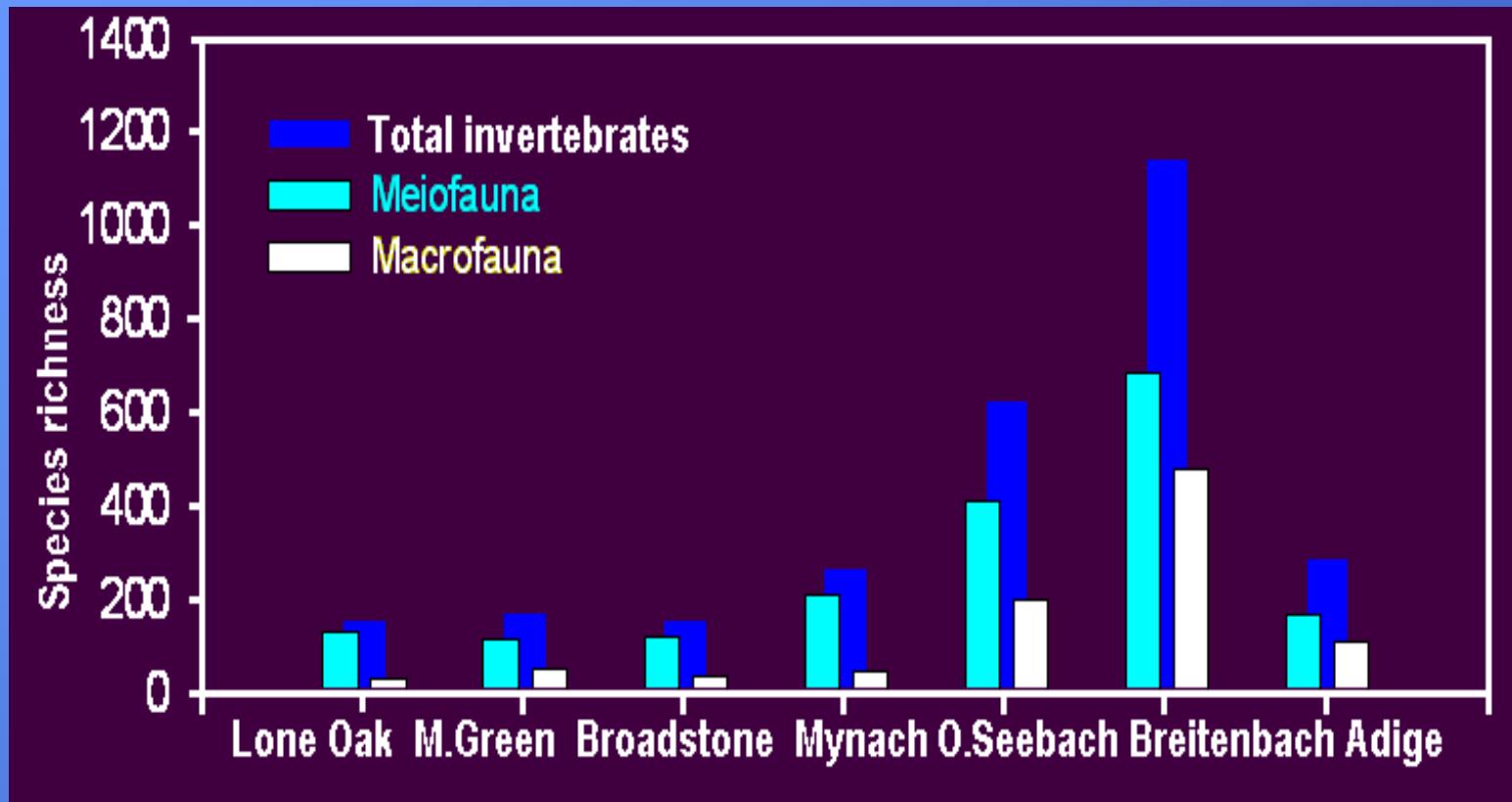


Rotifera

Bdelloidea Monogononta

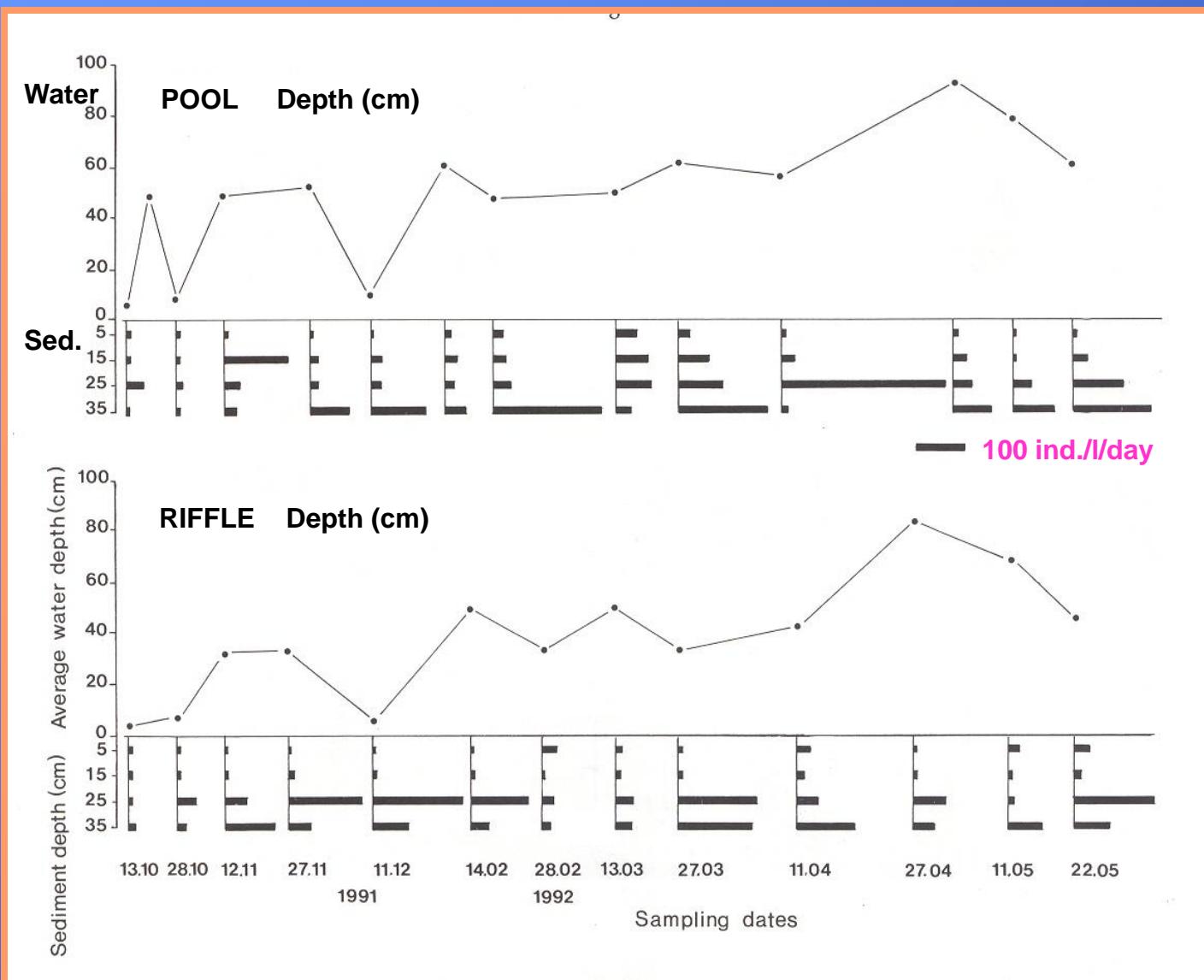


Species Richness of Meiofauna in Bed Sediments

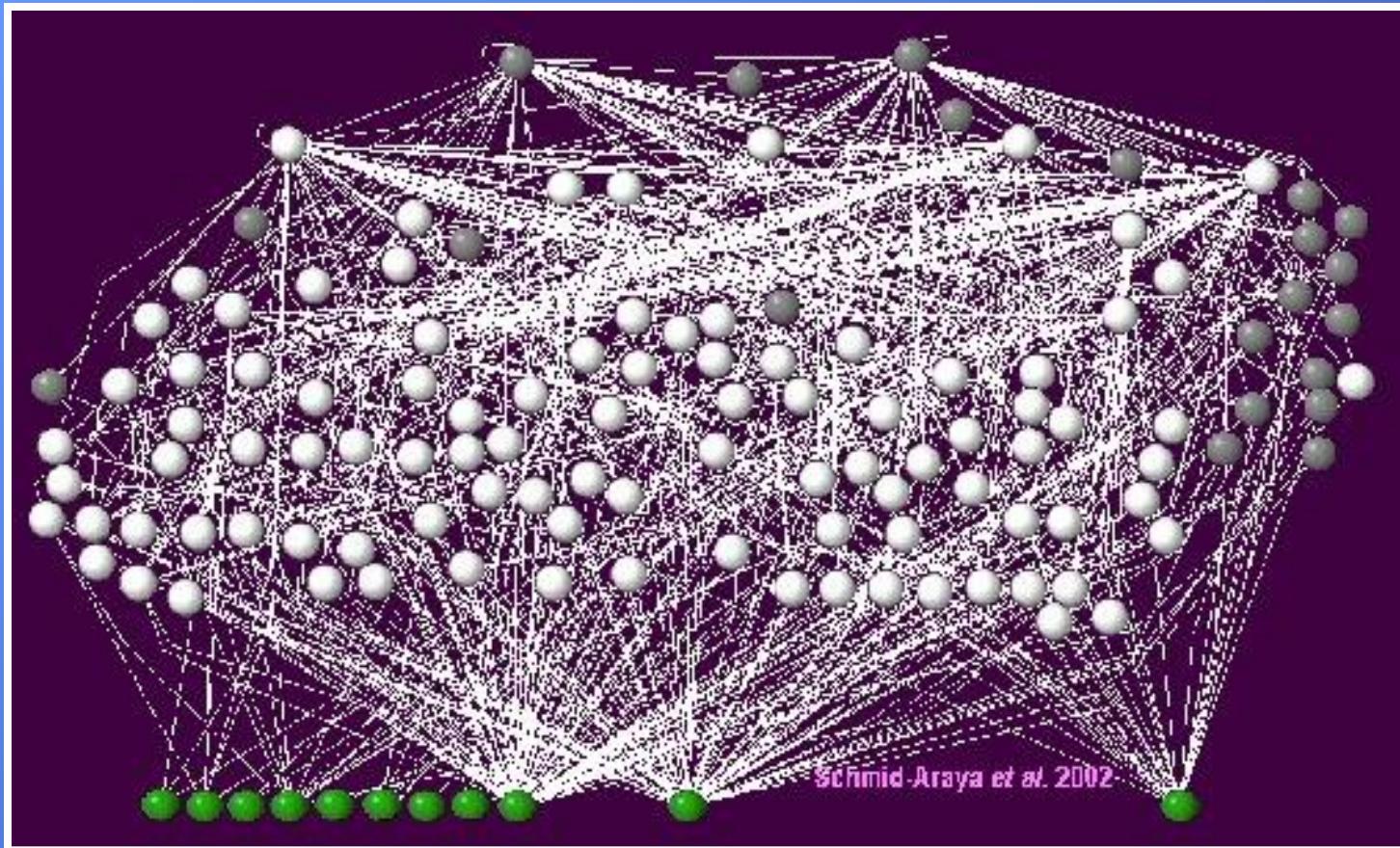


Greater number of species, high densities

Vertical Distribution of Mean Abundances of Rotatoria in Bed Sediments (*Schmid-Araya 1994*)



Meiofauna in Stream Food Webs



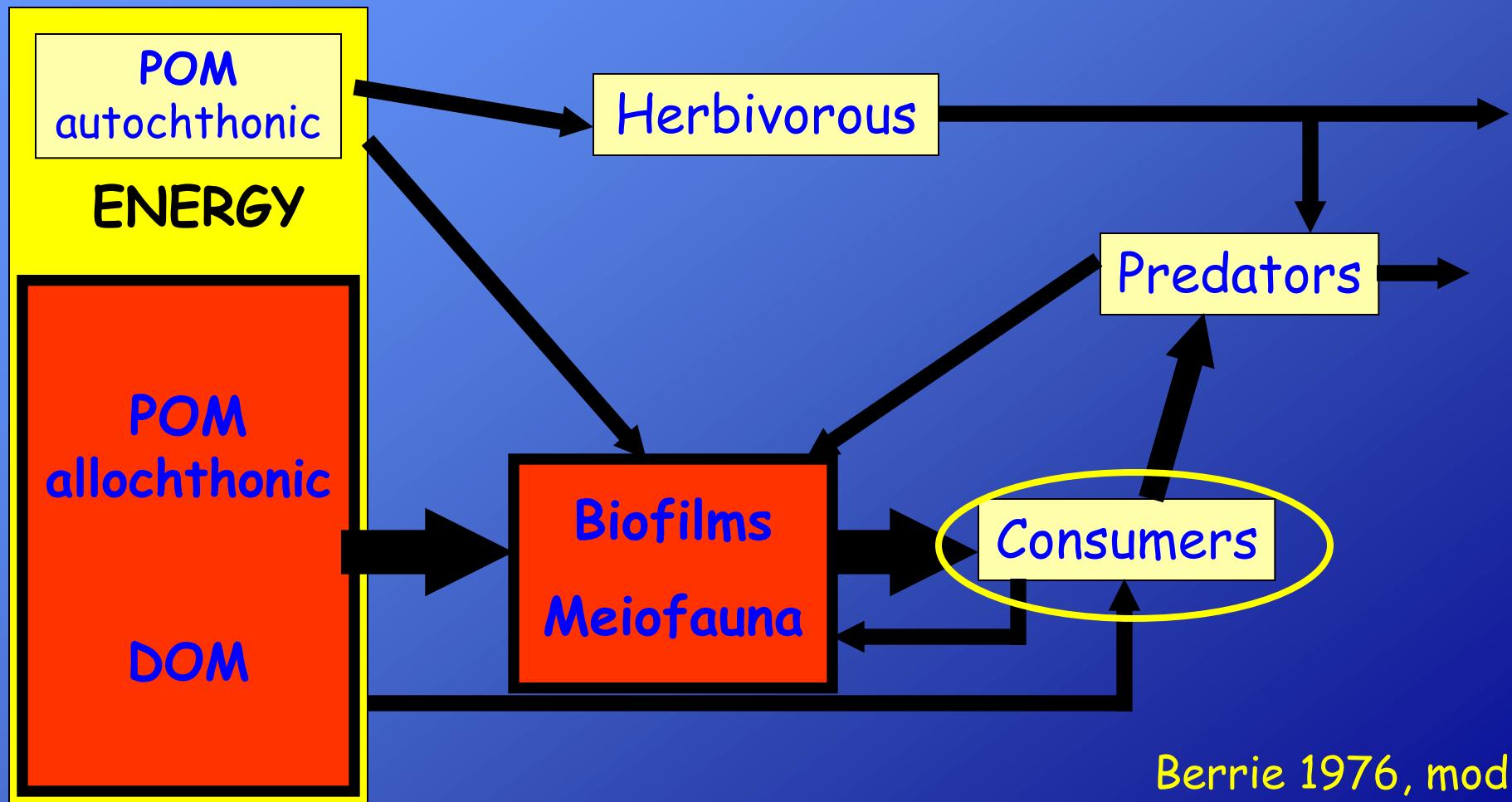
Meiofauna



Macrofauna and others

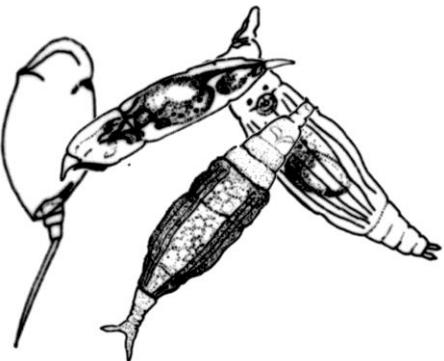
Meiofauna increases the number of intermediate species drastically!

Energy flow in low order streams



Berrie 1976, mod.

Benthic Animals

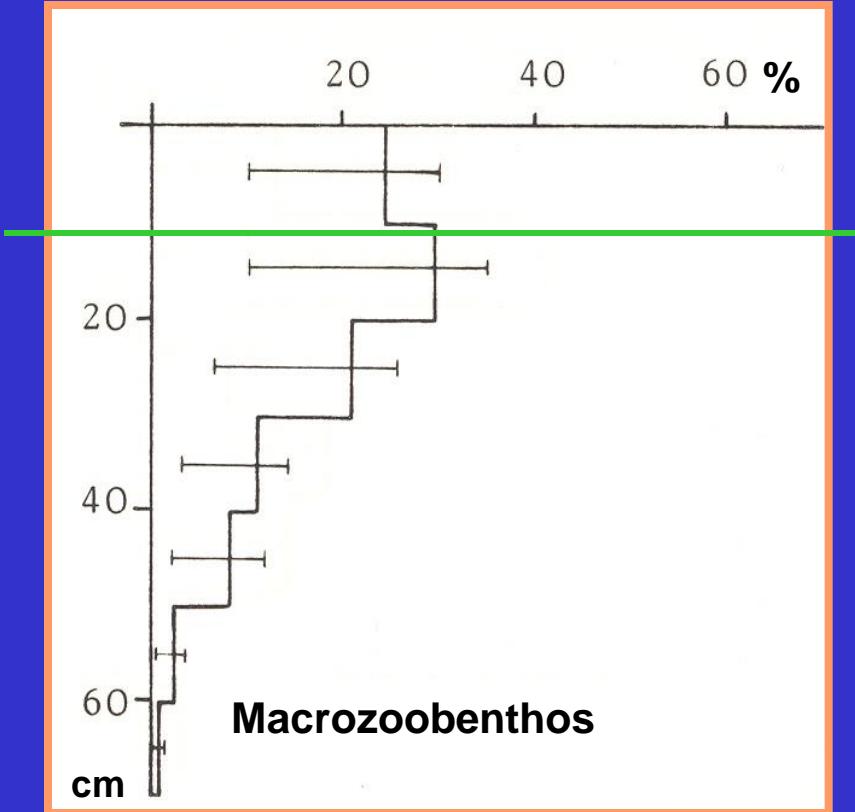


Benthic Fauna in Bedsediments - Relative Vertical Distribution

Mean Abundance:

125 500 ind. m⁻² ($>100 \mu\text{m}$)

(max. 300 000 ind. m⁻²)

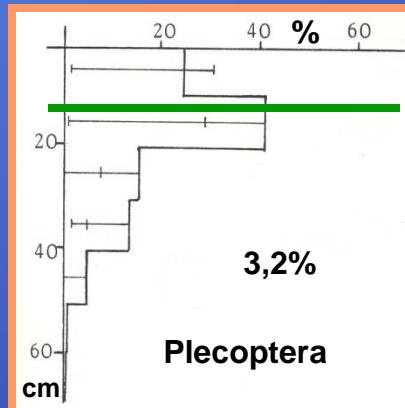
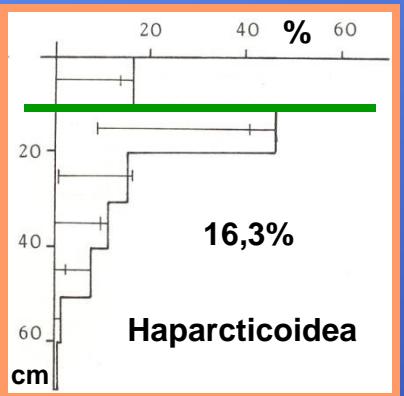
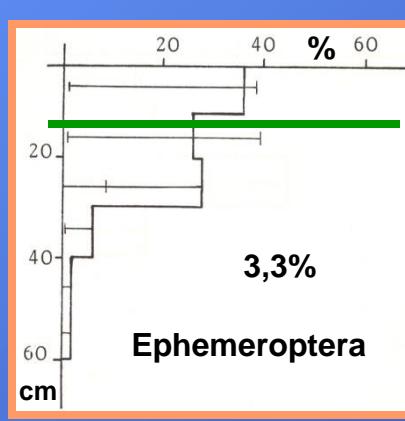
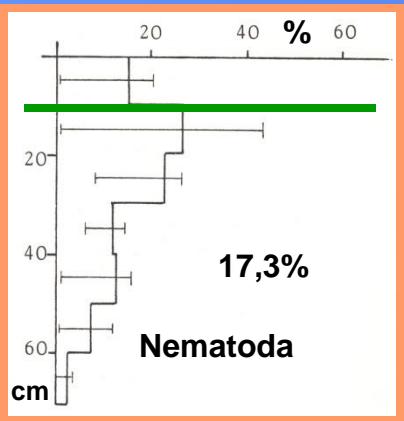
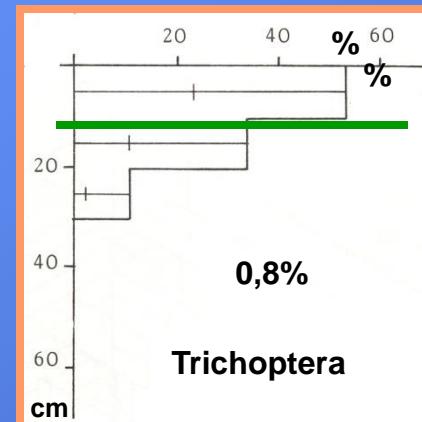
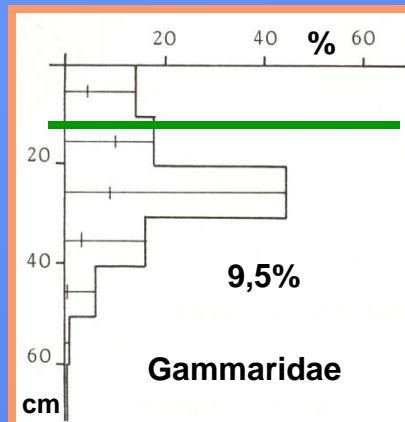
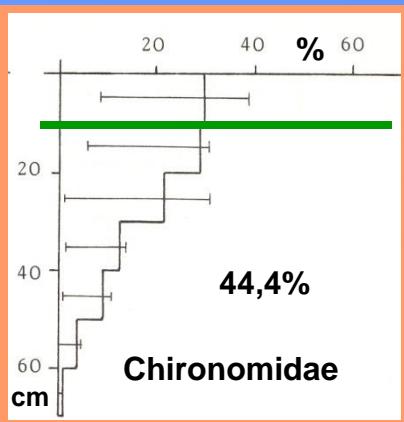


Species described: 579



Hynes 1974, Bretschko & Klemens 1986,
Klemens 1985

DISTRIBUTION IN BED SEDIMENTS



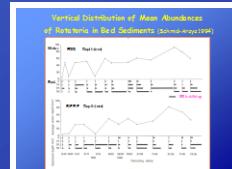
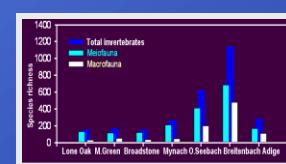
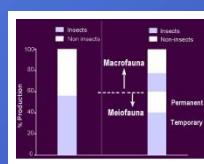
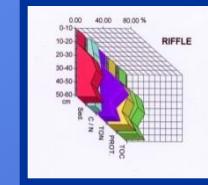
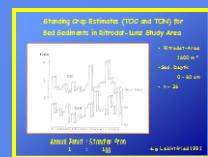
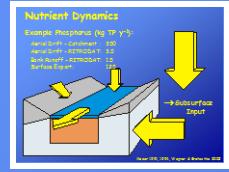
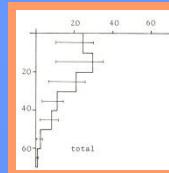
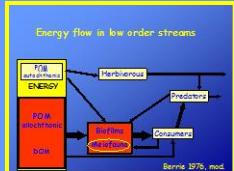
Different Groups of Invertebrates



Different Vertical Distribution

Light Discontinuity 10-13 cm
sediment depth !

Klemens 1985, Kowarc 1991



Conclusions..Suggestions..Messages

- Running waters are complex ecosystems with many important structures and functions
 - Energy basis of the consumer community: allochthonous POM and DOM, but the..
 - Role of subsurface DOM is not studied sufficiently yet
 - Consumer community is very important compartment, meiobenthic part should be studied more intensively
 - Many processes around biofilms and their compartments should be studied yet

Assambling the Mosaic Stones





Thank you for
your attention !



Schmid-Araya 2005

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- etc.....

Benthic Animals

Example

