

Riqualificazione fluviale



# Il Processo di Autodepurazione del Fiume

Bruna Gumiero

# L'autodepurazione dei fiumi è un processo complesso

L'autodepurazione di un ecosistema fluviale spesso dipende da processi fisici, chimici e biologici che lavorano simultaneamente:

- **Fattori fisici** (diluizione, dispersione, radiazione solare )
- **Fattori chimico-biologici** (ossidazione o bio-ossigenazione, riduzione).

I fattori che determinano l'autodepurazione:

- Temperatura
- Fattori idrografici e geomorfologici
- Rateo di re-areazione
- Disponibilità di OD
- Quantità e qualità della sostanza organica
- La comunità fluviale**

# L'autodepurazione biologica: i protagonisti



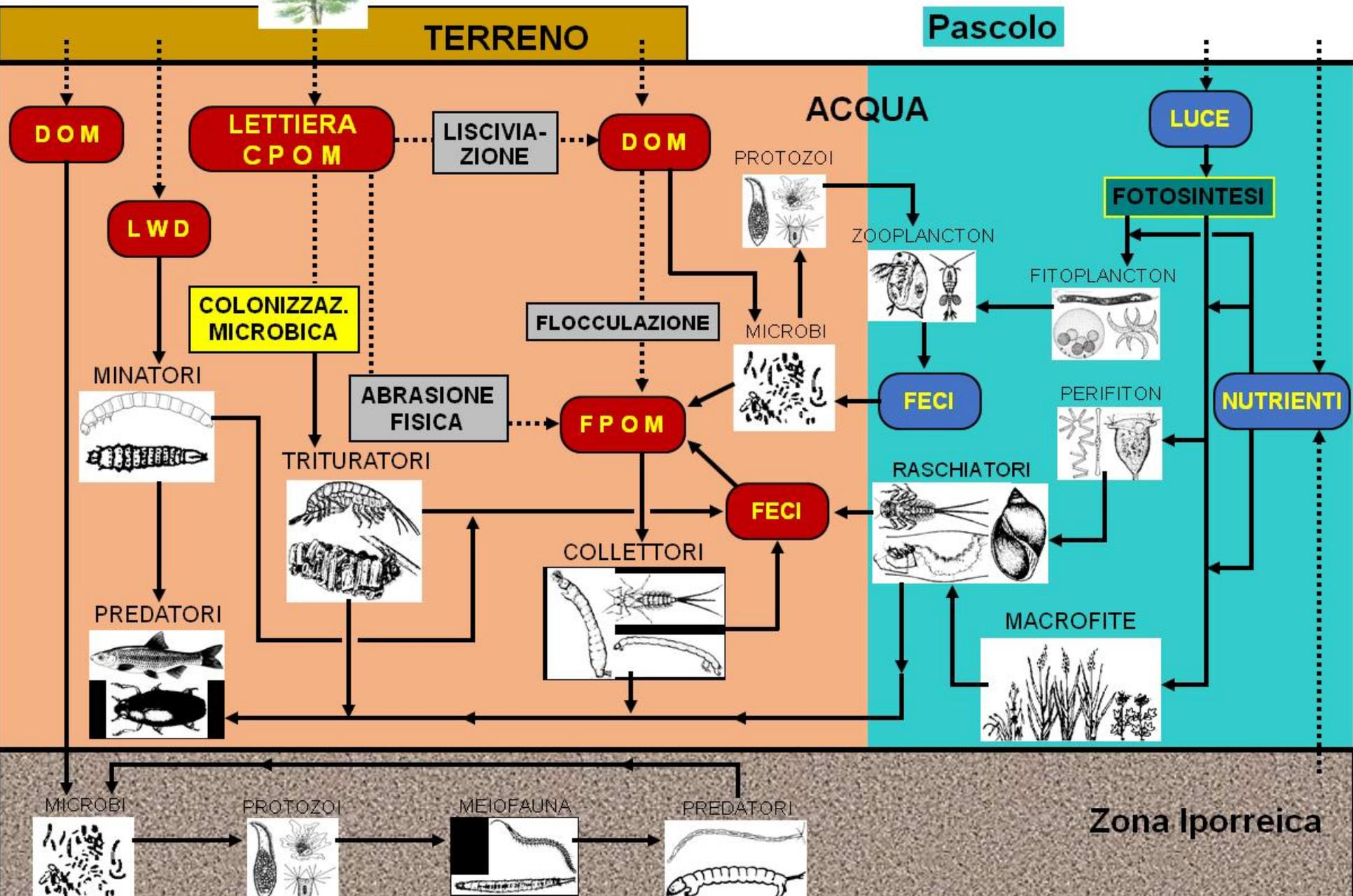
# Reti trofiche fluviali

Detrito



TERRENO

Pascolo



# Artificial and natural Leaf Packs/bags

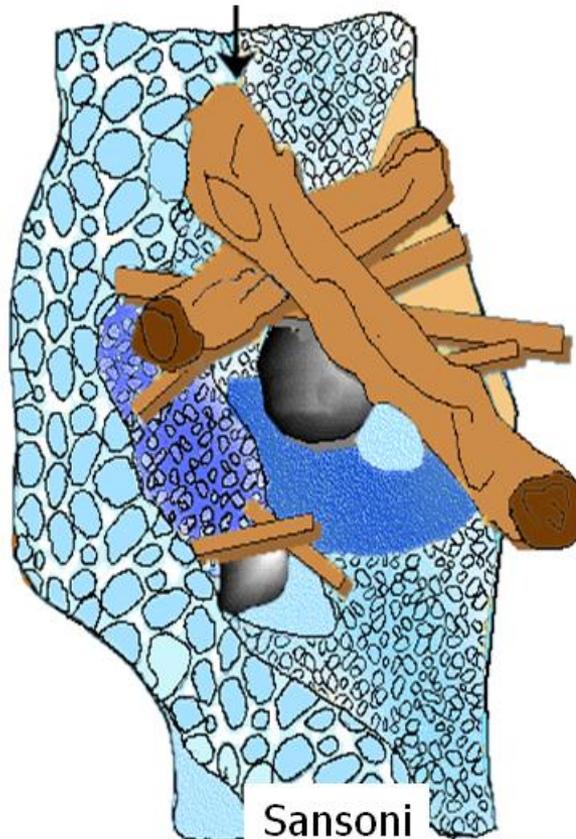
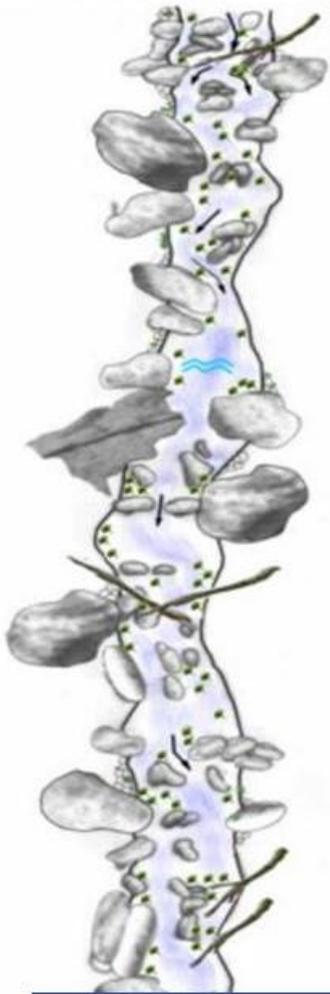
•Salmoiraghi, G., Gumiero, B. et al, **Breakdown rates and macroinvertebrate colonisation of alder (*Alnus glutinosa*) leaves in an acid lake (Lake Orta, N Italy), before, during and after a liming intervention.** (2001) *Journal of Limnology*, 60 (1), pp. 127-133.

•Braioni, M.G., Gumiero, B., Salmoiraghi, G. - **Leaf bags and natural leaf packs: Two approaches to evaluate river functional characteristics.** (2001) *International Review of Hydrobiology*, 86 (4-5), pp. 439-451.

Braioni, M.G., Salmoiraghi, G., Gumiero, B., Cisotto, P. - **Breakdown and colonization of alder in regulated Italian watercourses.** (1997) *Limnetica*, 13 (2), pp. 25-32.



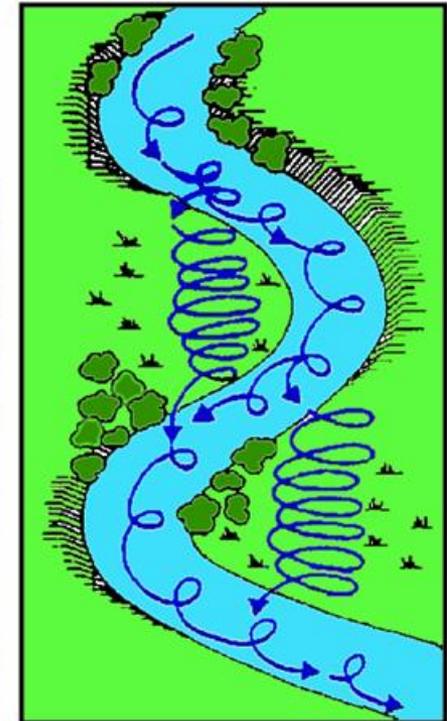
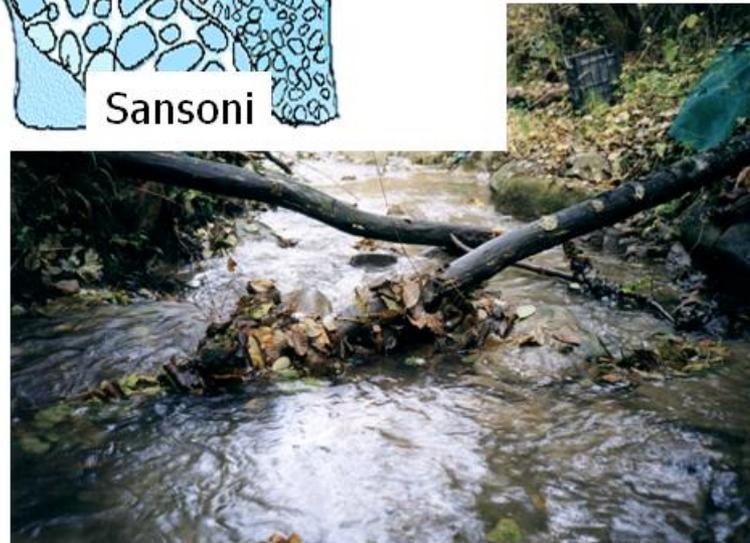
# RITENZIONE della sostanza org



- ❏ Ciottoli / profonda / rapida
- ❏ Ghiaia / profonda / turbolenta
- ❏ Limo / poco profonda / lenta
- ❏ Sabbia / profonda / lenta
- ❏ Ghiaia / poco profonda / lenta
- ❏ Sabbia / poco profonda / lenta



1000  
foglie  
di  
Ginkgo  
biloba



# BATTERI E FUNGHI



Scarico fognario



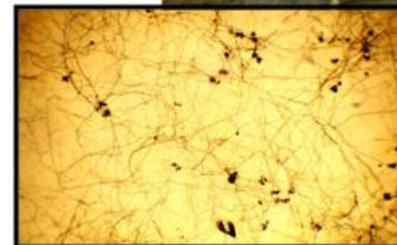
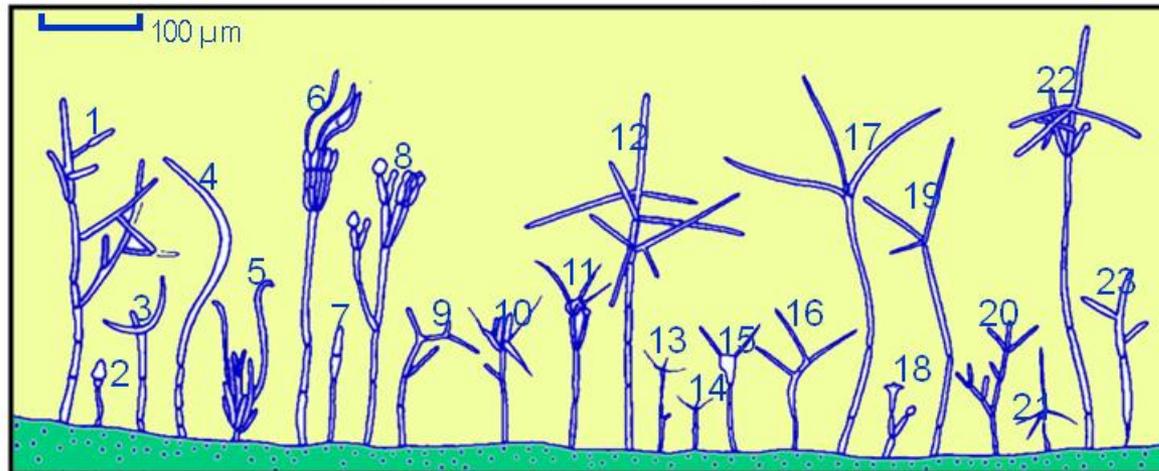
*Sphaerotilus*

Proliferazione batterica

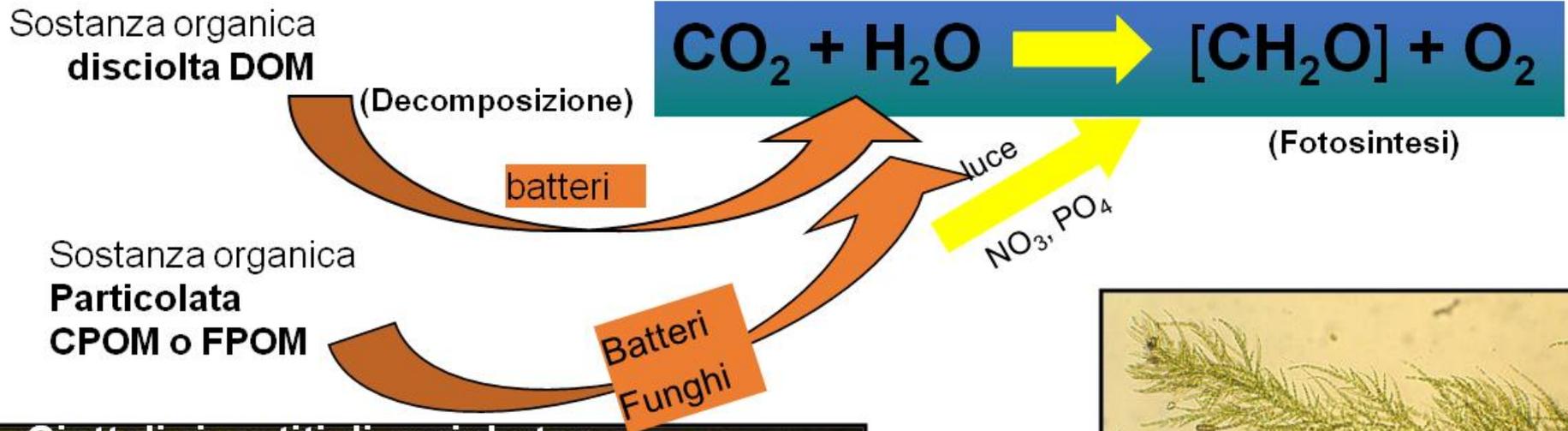


**Morte di pesci** (se il carico è eccessivo)

## Funghi imperfetti acquatici su foglie in decomposizione (condizionamento)



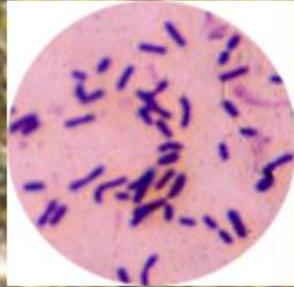
# Periphyton: un microcosmo che depura



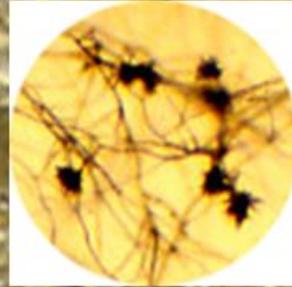
Ciottoli rivestiti di periphyton



# Periphyton: un microcosmo che depura



batteri



funghi



Ciliati



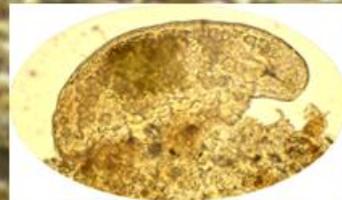
(riproduzione)



(predazione)



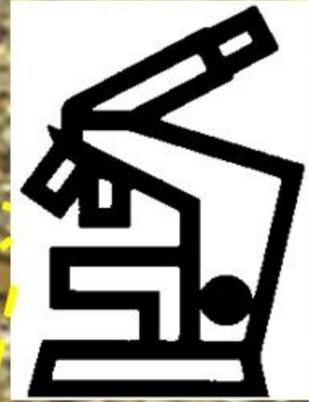
Rotiferi



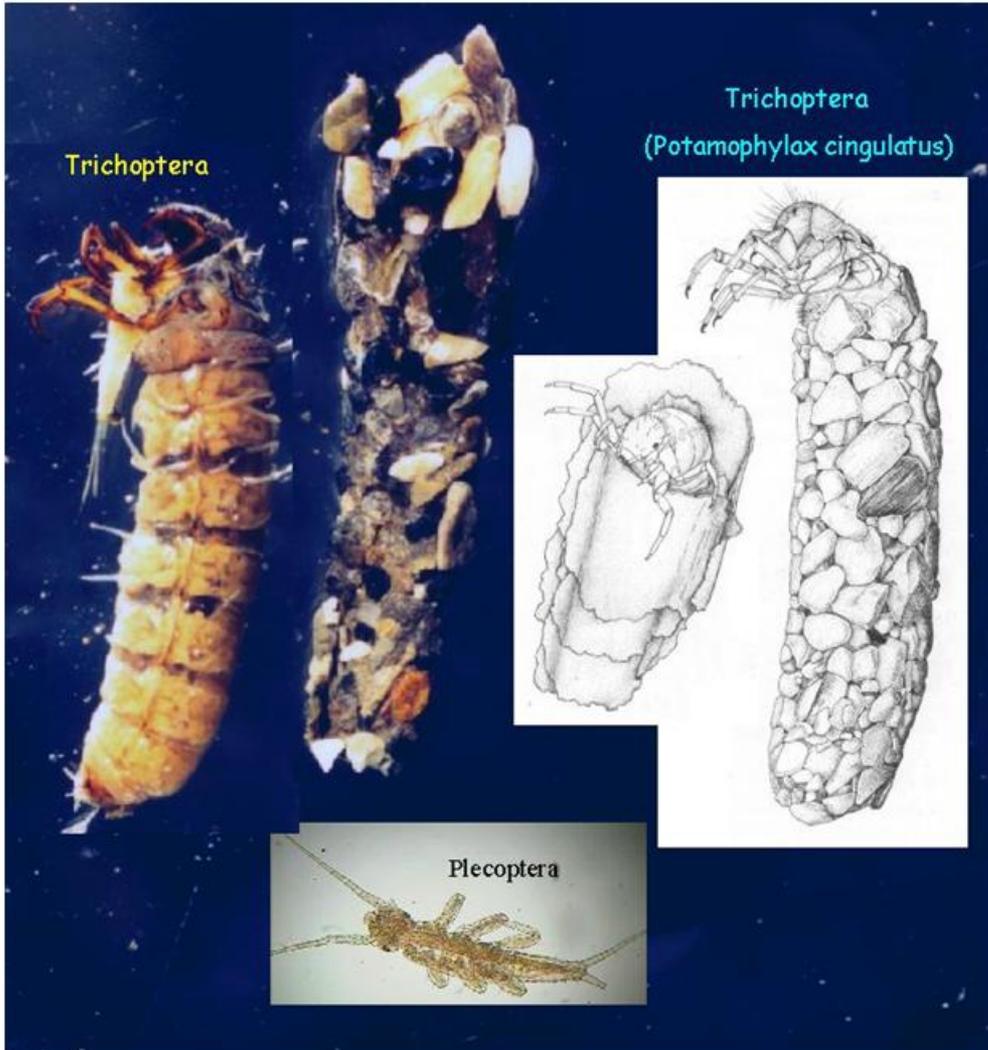
Tardigradi



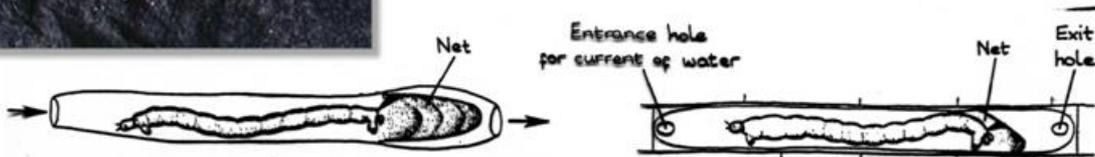
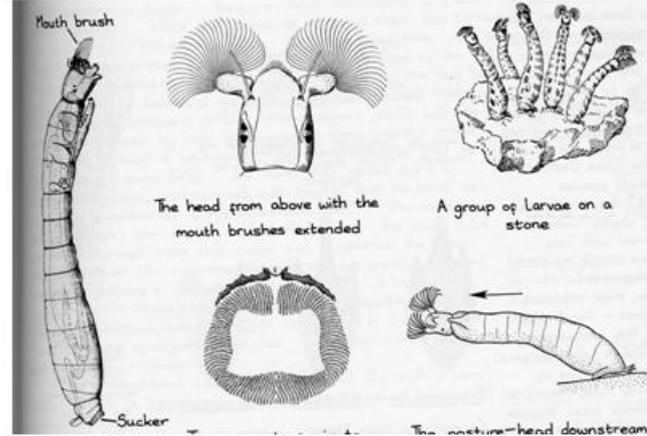
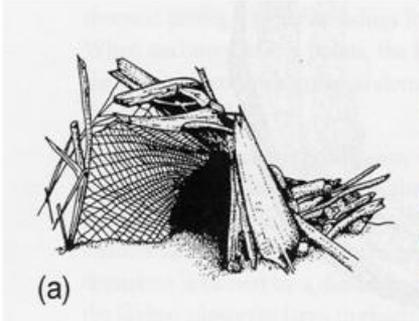
Diatomee ed altre alghe



# Macroinvertebrati TRITURATORI - C

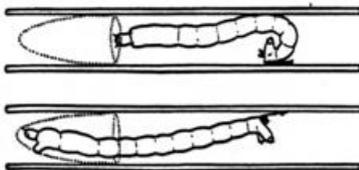


# FILTRATORI e RACCOGLITORI - FPOM



Endochironomus in a tube of its own secretion on the surface of a leaf, and the net it has spun within it. Arrows show the direction of the current set up by the undulating body of the larva.

A larva of Glyptotendipes ensconced in a tube that it has excavated inside a leaf and within which it has spun a net.



Endochironomus making its net. In this case the larva has been put in a glass tube the better to reveal its activities



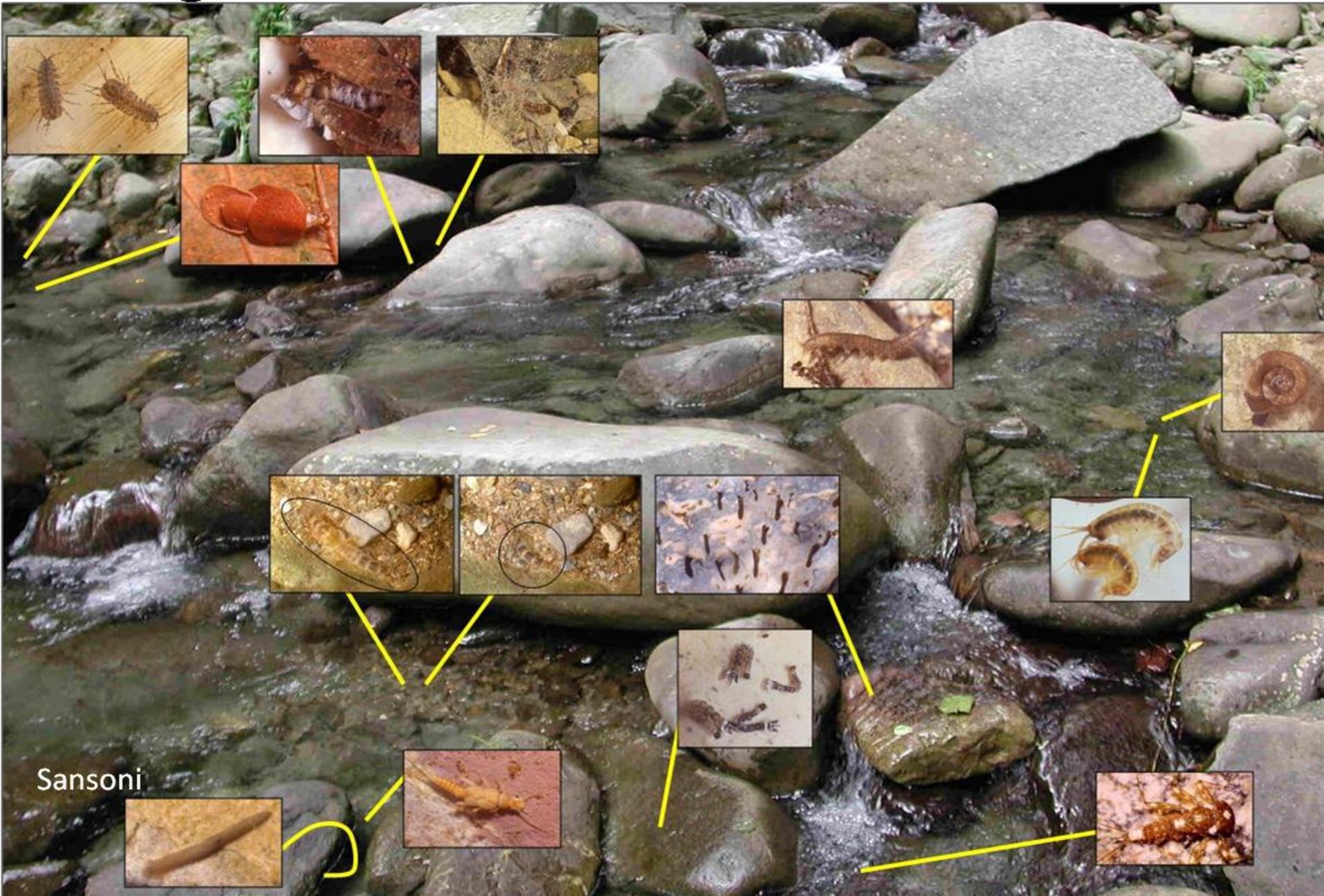
A larva of Rhectanytarsus within its elaborate case attending to its net.



# Comunità di macroinvertebrati fluviali

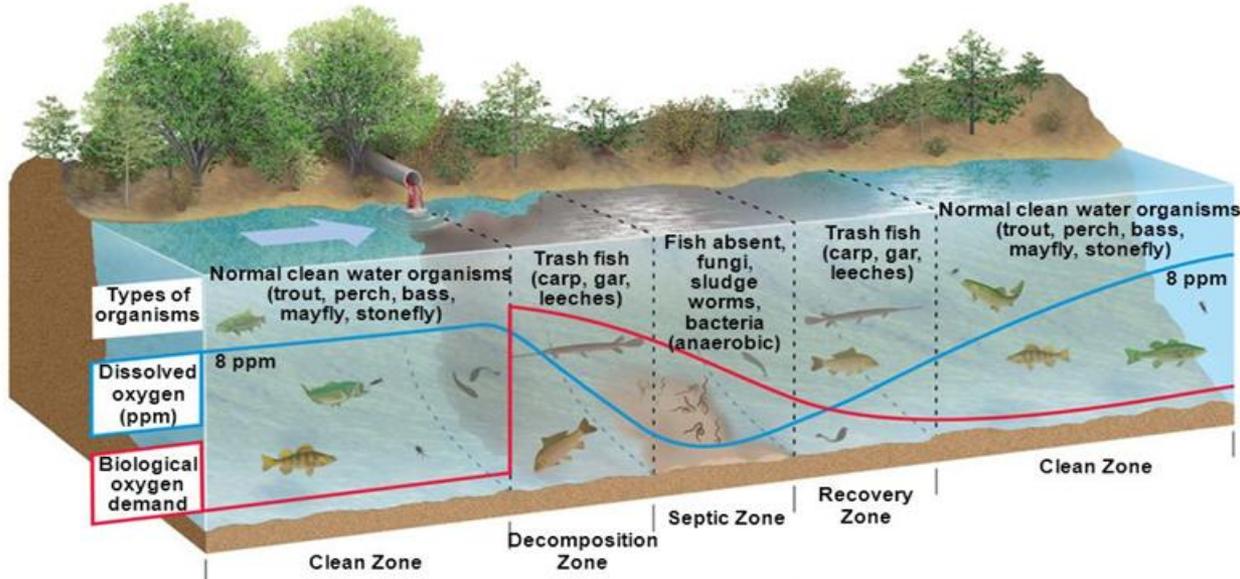


# Eterogeneità del substrato

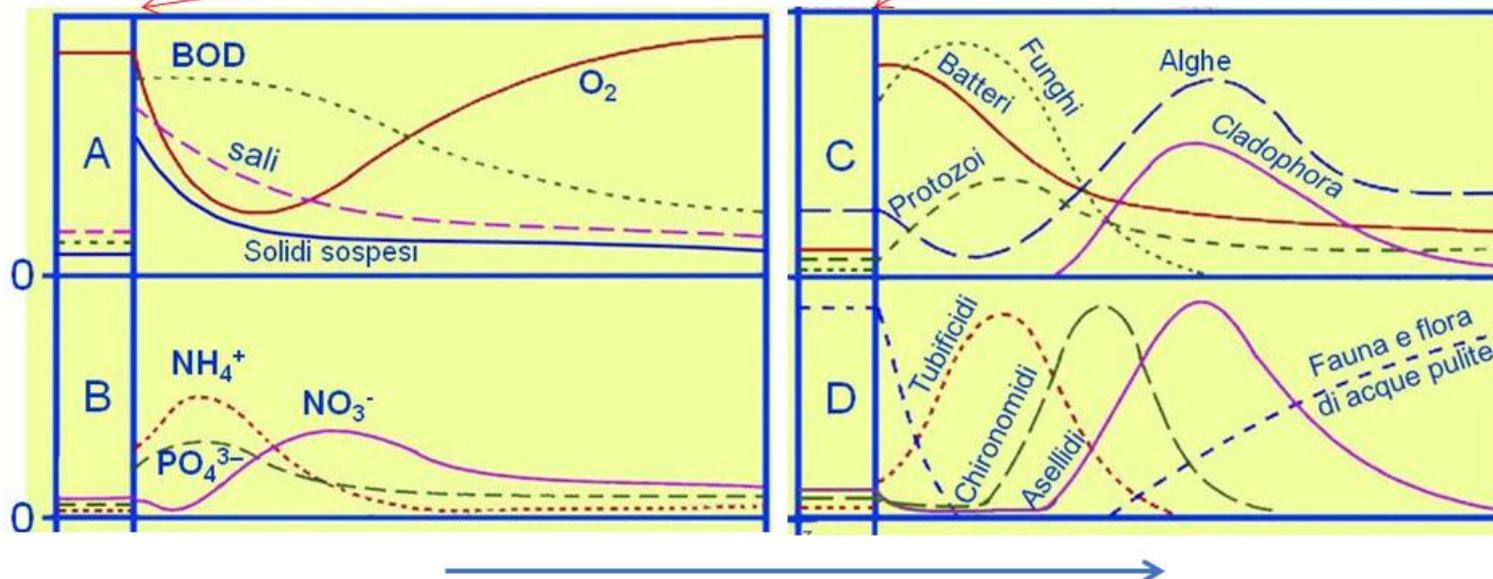


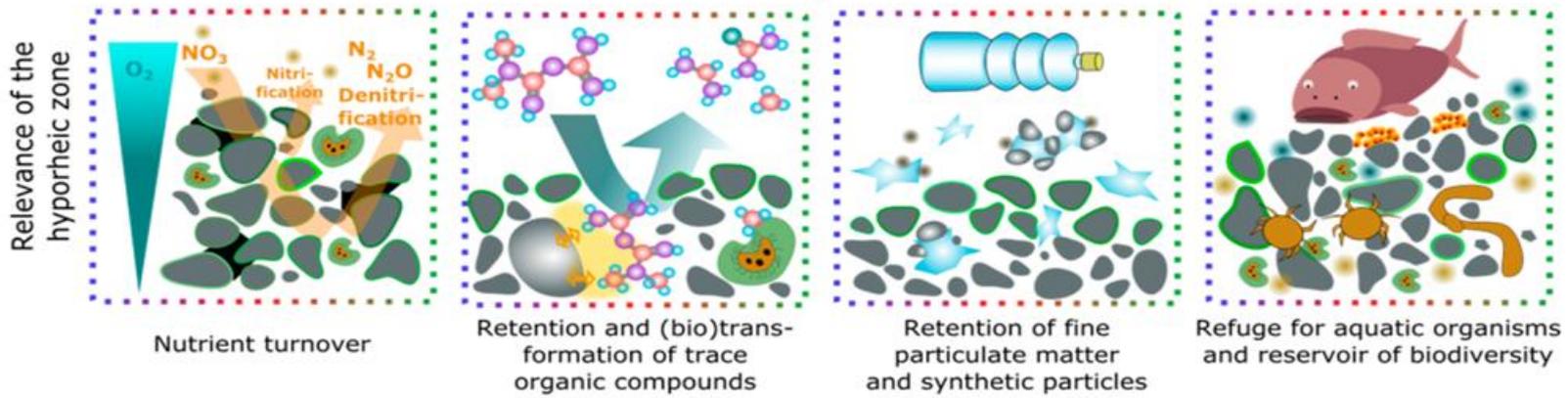
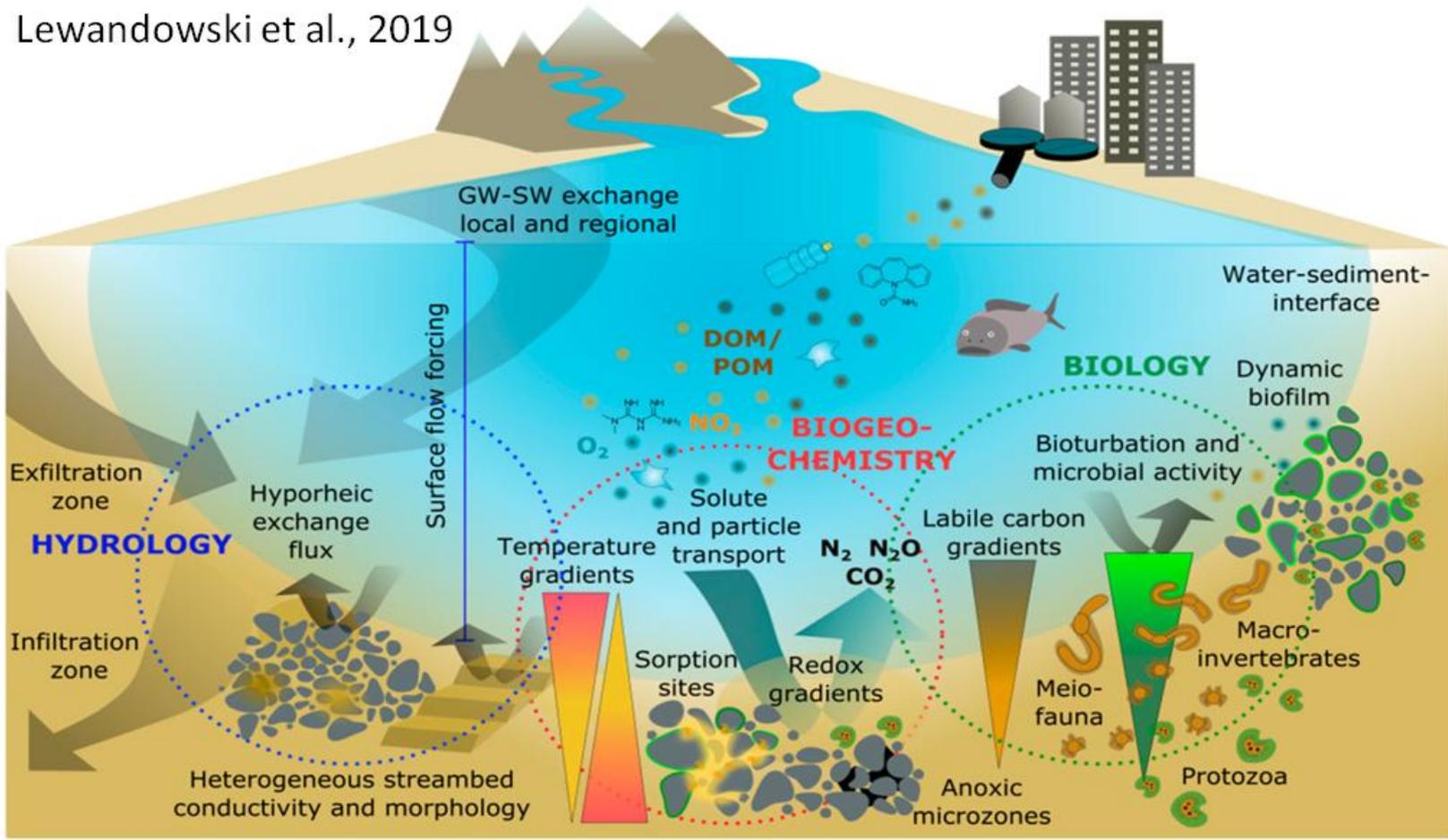
Sansoni

# A valle di uno scarico



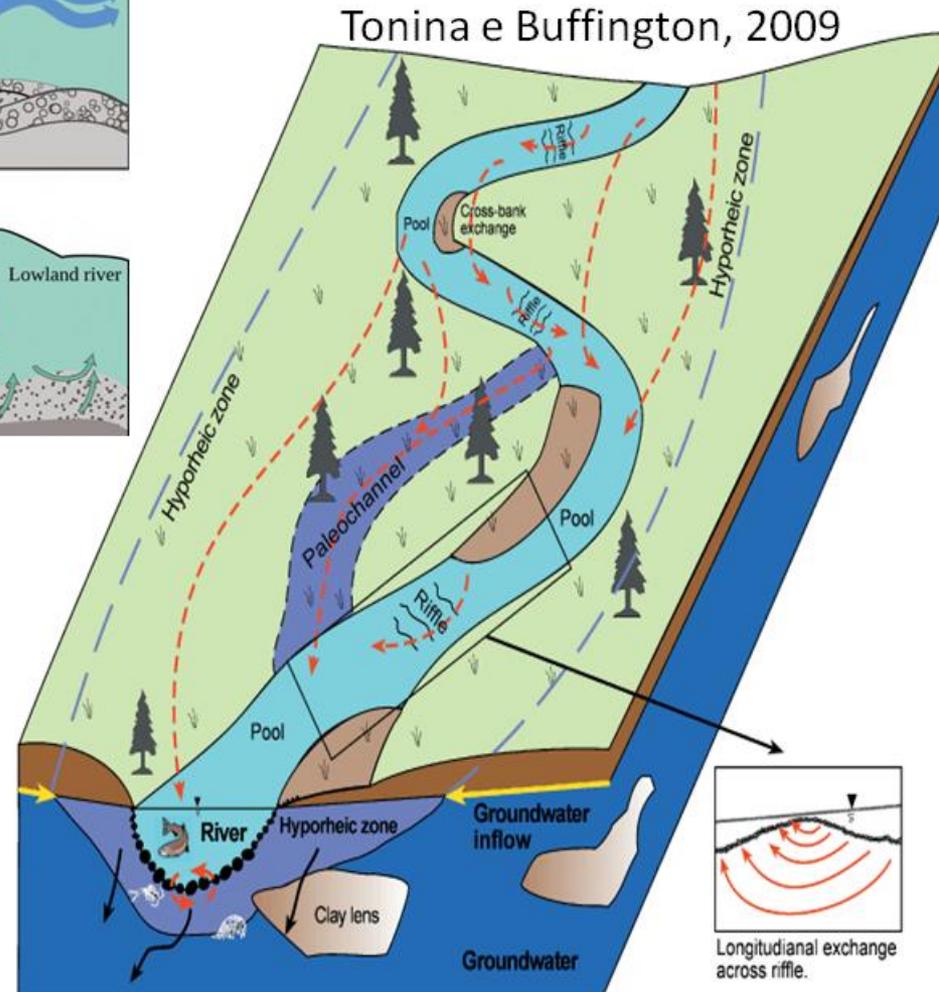
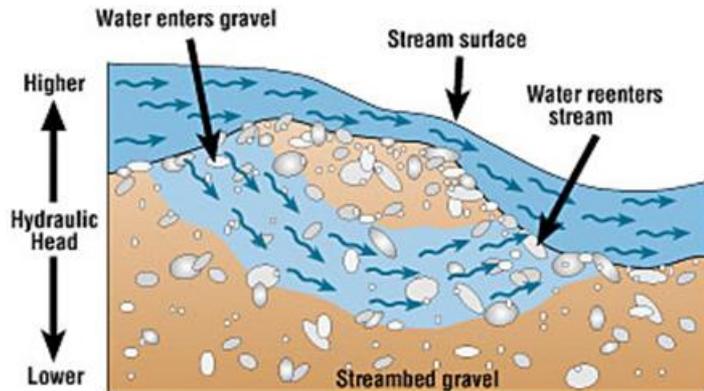
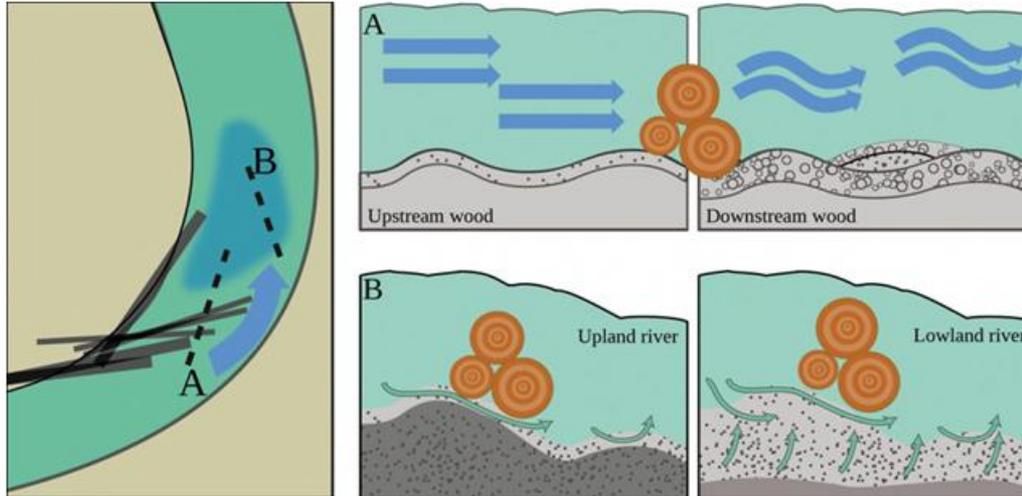
Immissione scarico



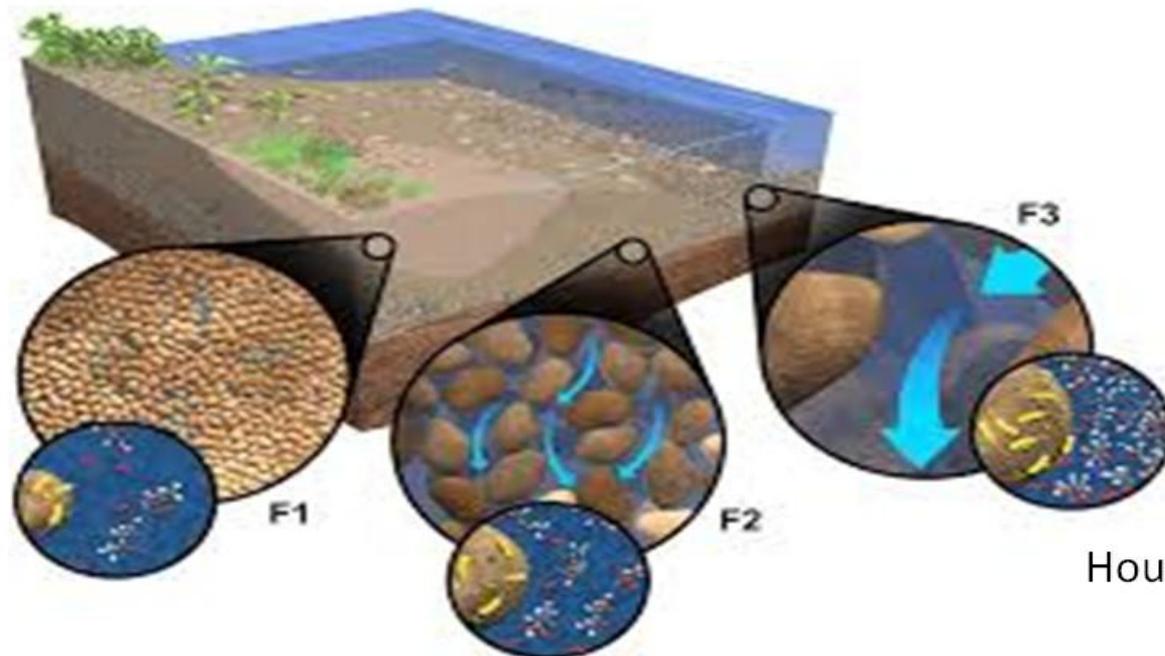


# La zona iporreica

Elevata superficie → esteso biofilm batterico → elevata attività di filtro e trasformatore biologico → respirazione ( $\downarrow O_2$ ,  $\downarrow DOM$ ,  $\downarrow pH$ ), nitrificazione (poi eventuale denitrificazione)

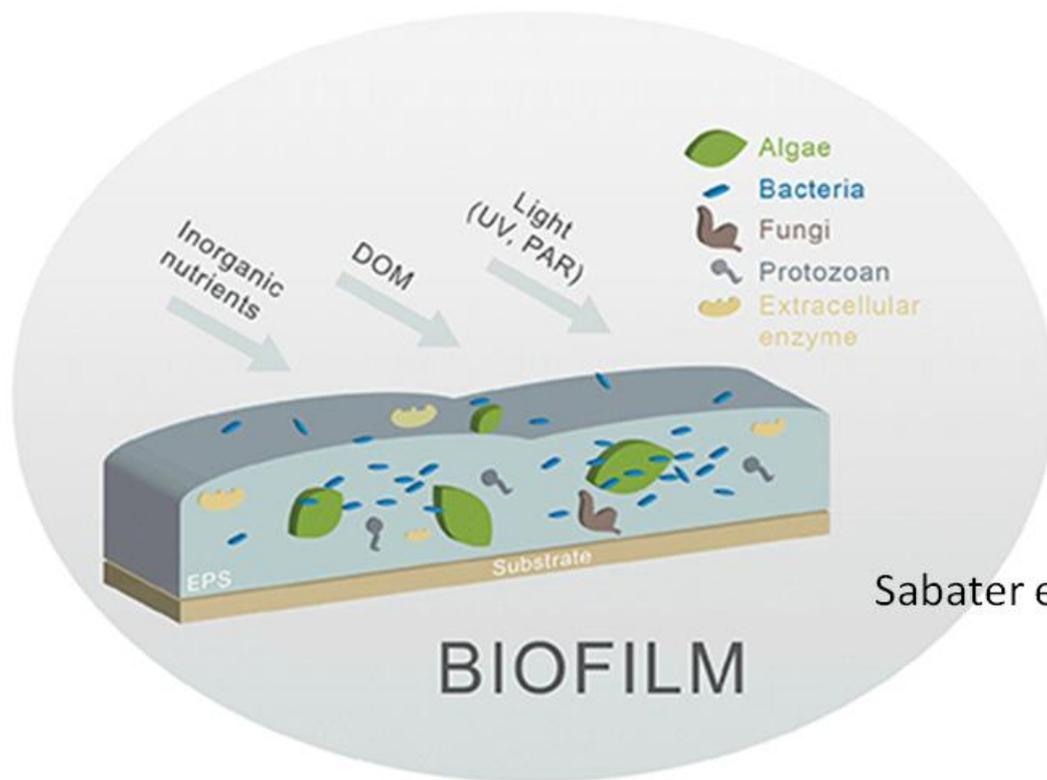


Le comunità iporreiche sono sostenute dalla **DOM** (adsorbita dalla matrice polisaccaridica dell'epilimon e utilizzata in seguito dai batteri: riserva a breve termine), dalla **FPOM** (riserva a medio termine) e dalla **CPOM** apportata dalle piene (riserva a lunghissimo termine). Le dimensioni dei sedimenti determinano la connettività idraulica e determinano la composizione della comunità microbica



Hou et al., 2017

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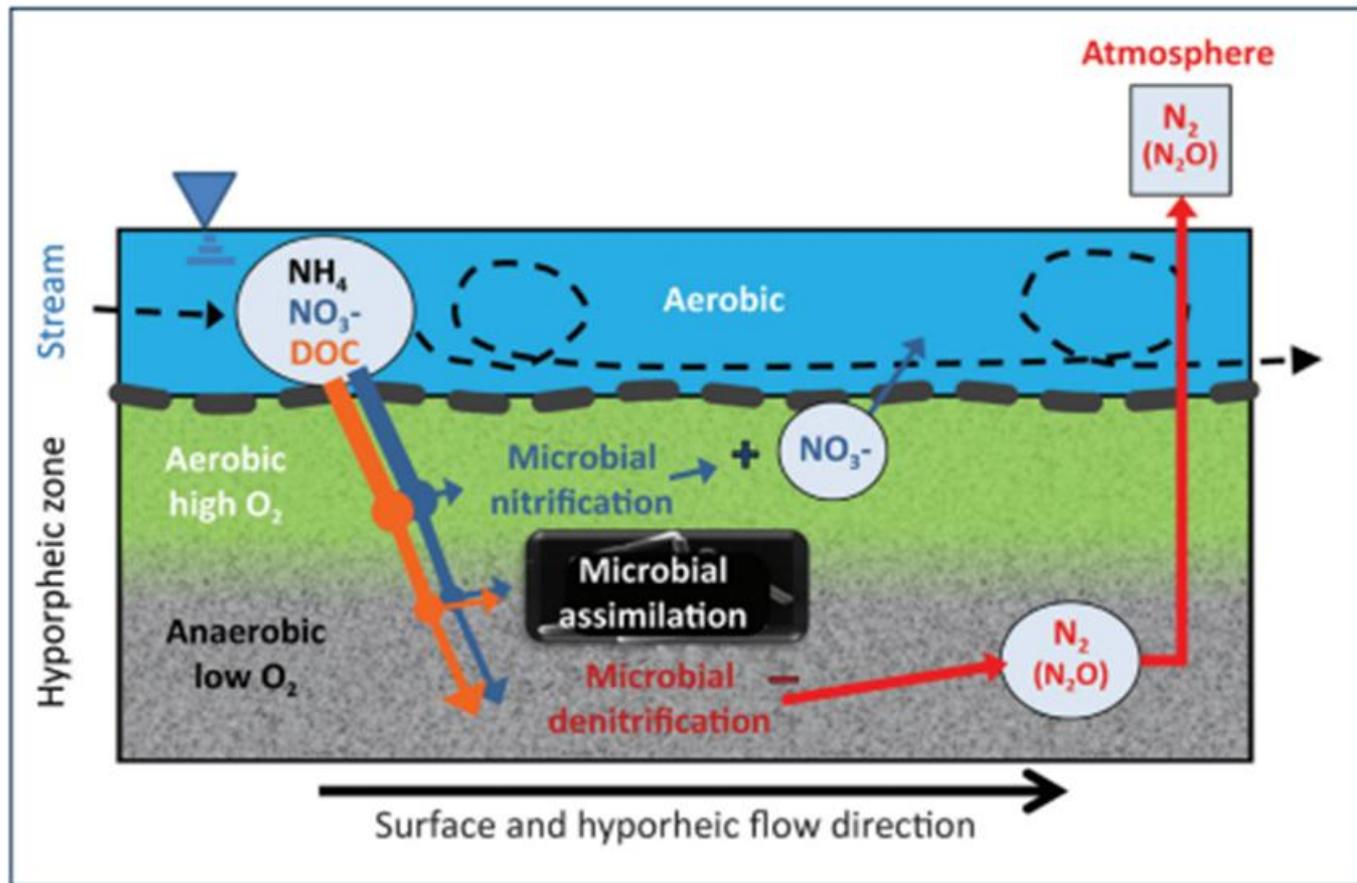


Sabater et al. 2016

I diversi componenti del biofilm (alghe e batteri, come i principali) sono incorporati in una matrice di espolisaccaridi (EPS), sono recettori di elementi inorganici e organici e rimangono soggetti alle influenze dei diversi fattori ambientali.

*Frei, S., Piehl, S., Gilfedder, B.S. et al. Occurrence of microplastics in the hyporheic zone of rivers. Sci Rep 9, 15256 (2019).*

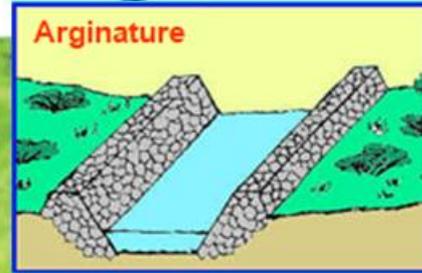
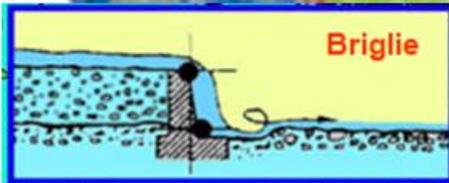
# Dinamiche dell'azoto nei sedimenti





L i p o  
z o n a  
a i c a

# L'autodepurazione: come distruggerla



Water table

Groundwater flow

Hyporheic zone

4

la zona iporreica

