

Comments on Dissolved Oxygen and Biochemical Oxygen Demand

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Take Home Message



Associated Press (2008)

A coat of algae?
(At least we are not
there yet)
But algae aren't all

Key Points

- DO measured in a place reflects biotic and abiotic processes that occur upstream of the location where it is measured
- BOD as a measurement is an abstraction
- Biochemical processes that affect DO are controlled by many things that may or may not be regulated. Not addressing these linkages may shortchange stakeholders.

What is BOD?

Depends how it is measured.

BOD₅

- biochemical oxygen demand in a bottle incubated at 25 C in dark for 5 days
- includes organic matter oxidation AND inorganic matter oxidation

- nitrogenous oxygen demand
- autotrophic bacteria
- heterotrophs can outcompete nitrifiers for NH_4^+

C-BOD

- carbonaceous oxygen demand

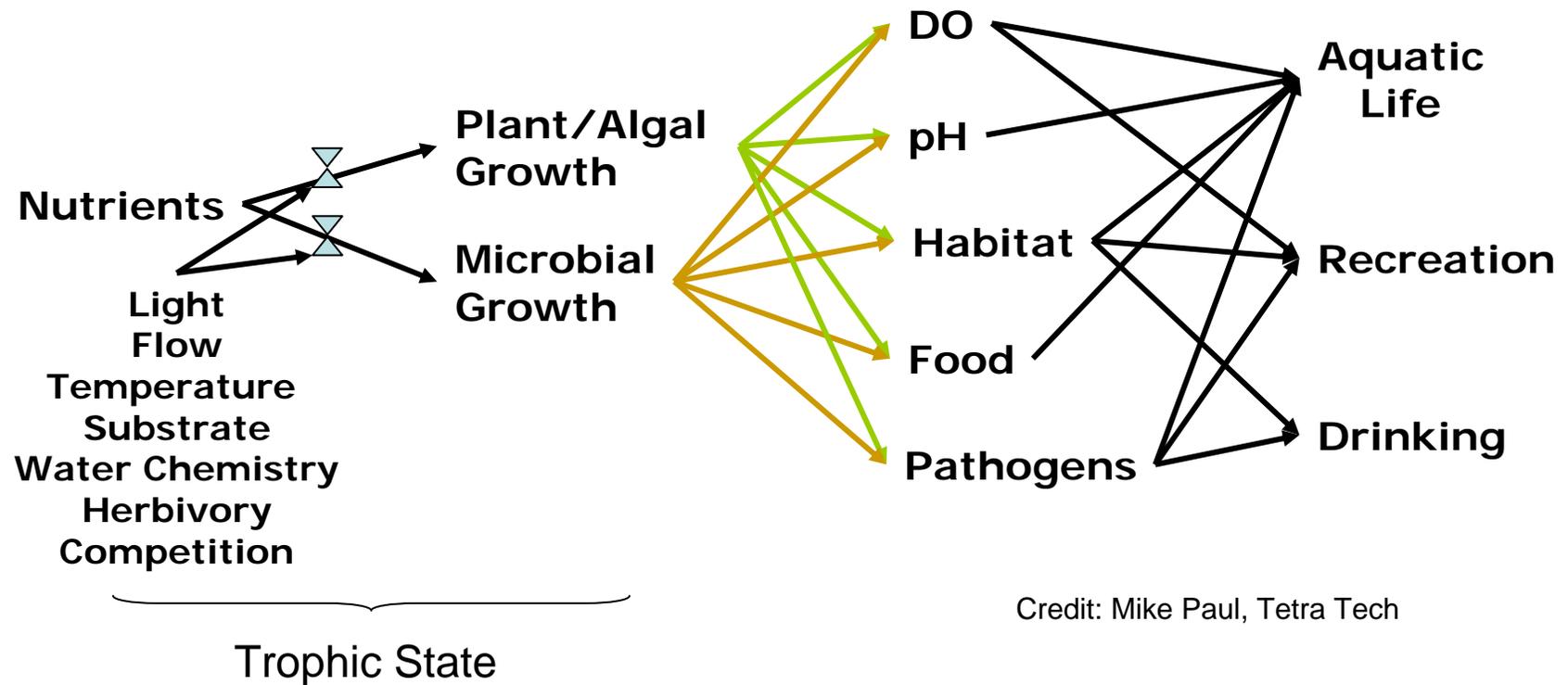


Comments Specific to Chapter 4

- Assumption is that $BOD = C$ “available” (under lab conditions) - not clear that is true as presented.
- If $BOD = C$ then $C =$ respiration/decomposition isolates water column so there are “bottle effects.” Should express BOD as decay rate rather than concentration regardless.
- VSS does not represent labile C and so linkage to DO is not clear.
- Diurnal data might be informative to evaluate controls on dissolved oxygen BUT DO measured in a specific location integrates processes far upstream.
- Considering DO in isolation of other factors such as temperature and nutrients make “linkage” difficult.

Oh What a Tangled Web

Linkages among designated use, DO and biochemical processes

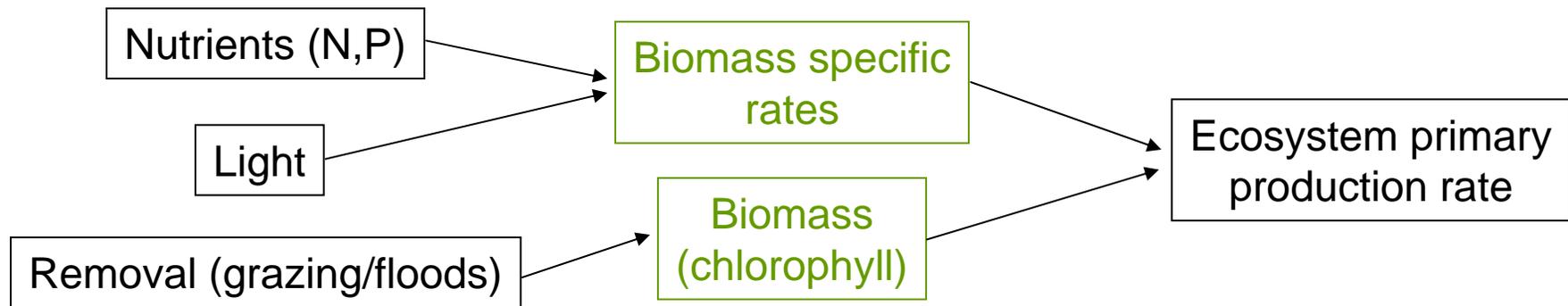


Trophic State in Streams

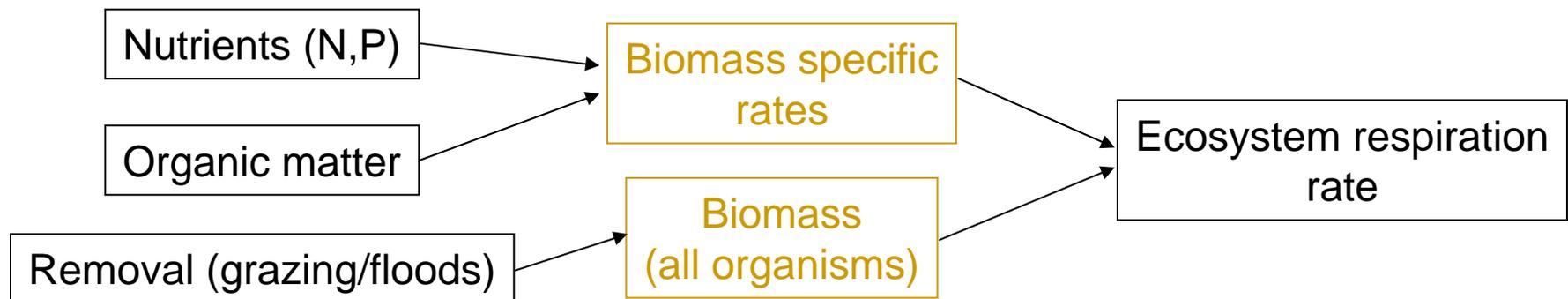
- Trophic state often characterized by chlorophyll; but production depends on biomass AND activity.
- Heterotrophic state not often considered. Driven by organic matter supply.
- Both autotrophic and heterotrophic states affected by temperature AND nutrients.

Trophic State in Streams

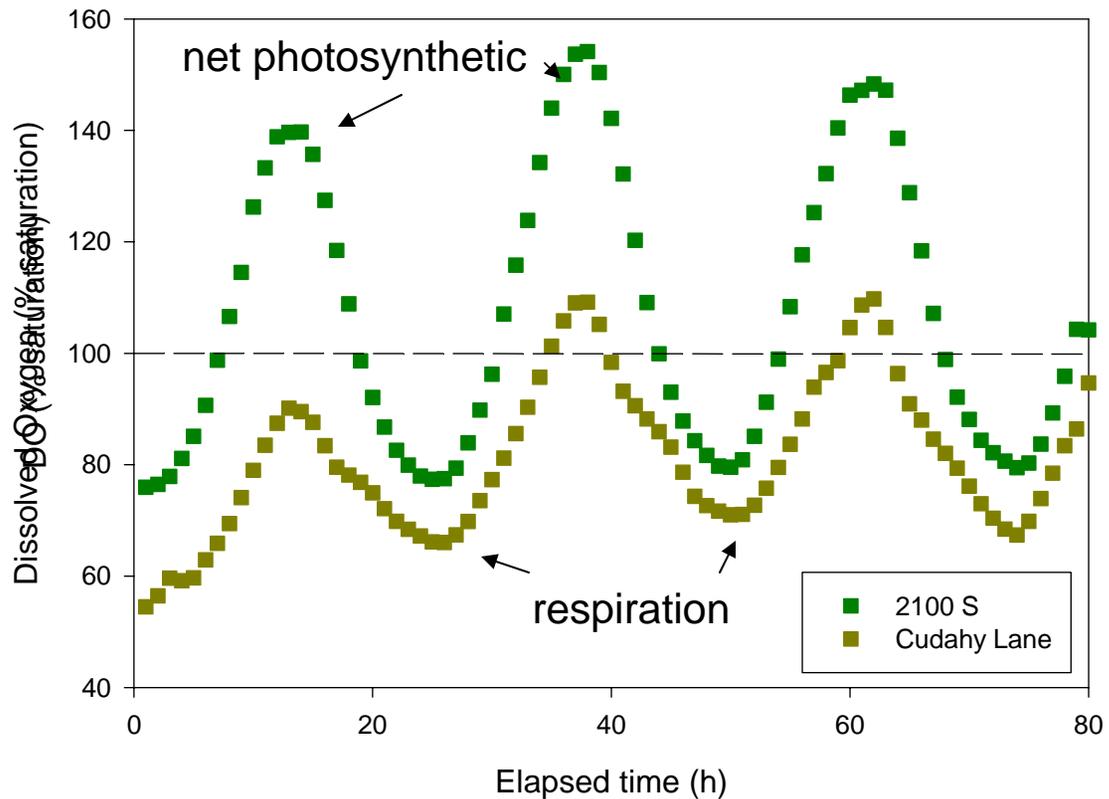
Autotrophic State



Heterotrophic State



Linking Trophic State to DO



2100 S is net **autotrophic**
 $P > R$

Cudahy Lane is net
heterotrophic $P < R$

Either Cudahy Lane has
less autotrophic activity,
more heterotrophic activity
or both.

Jordan River data, August 2006, courtesy of E. Duffin
data plotted after Dodds 2007 TREE

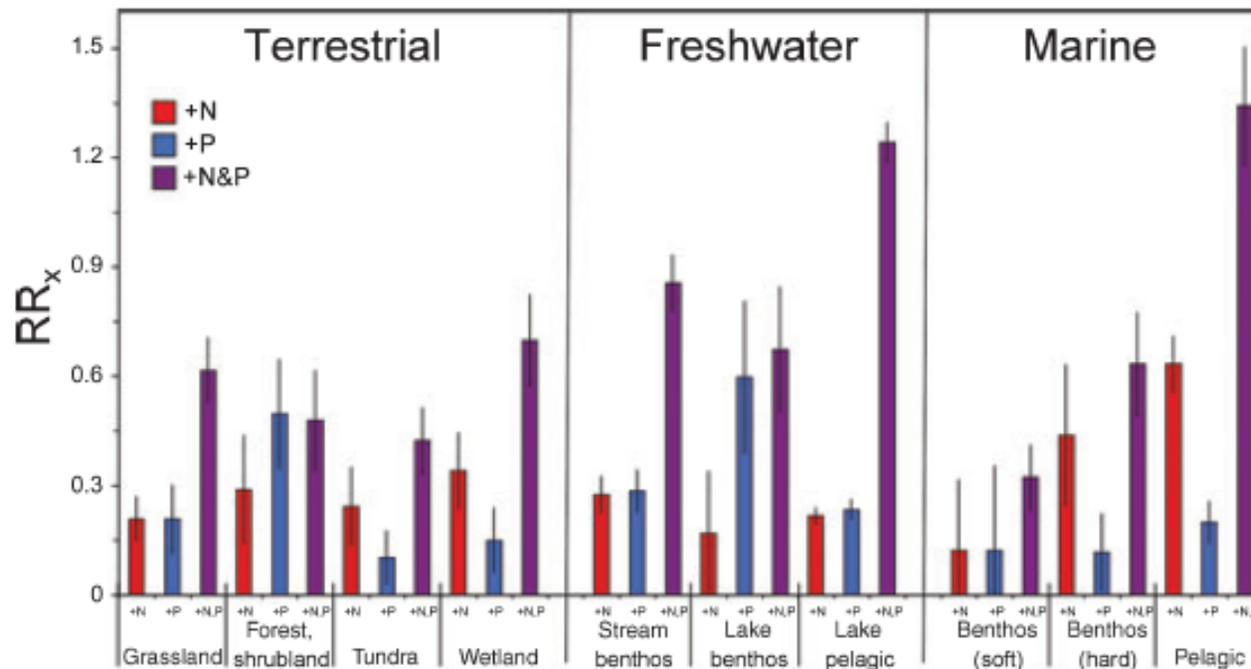
Linking Trophic State to DO

Primary production = light + nutrients

Respiration = organic matter + nutrients

Linking Trophic State to Nutrients

Autotrophic State

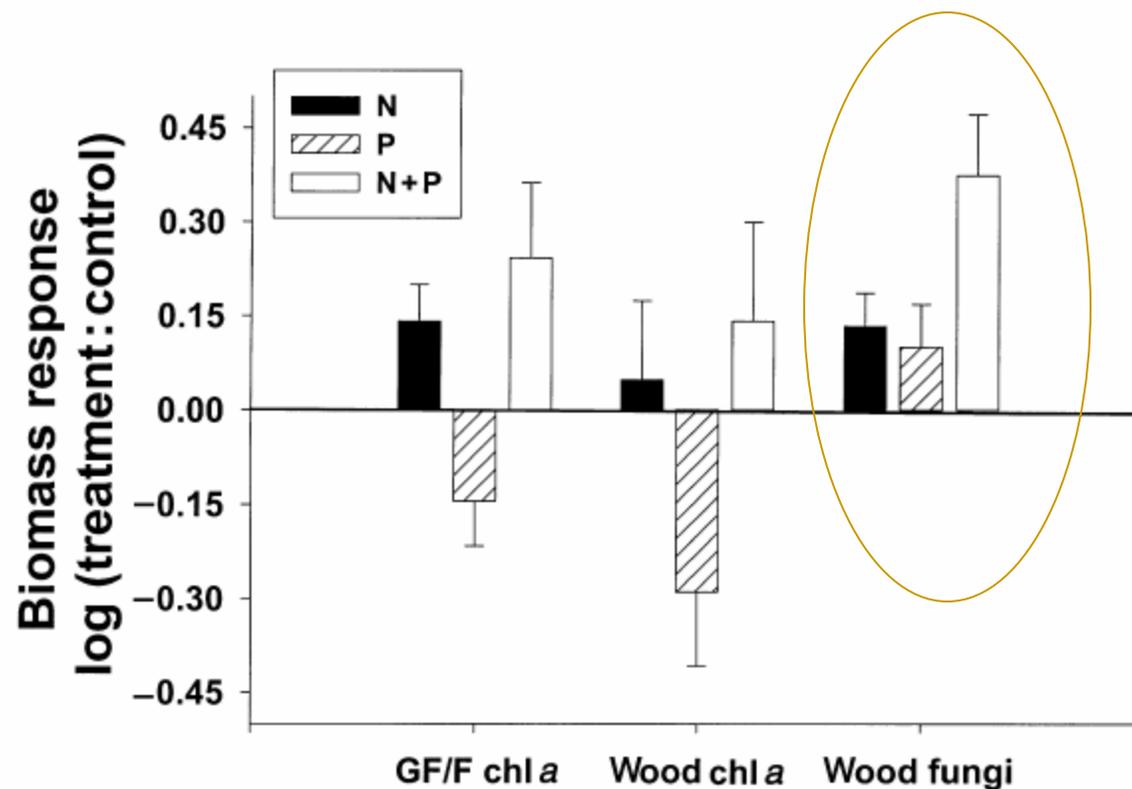


Data from analysis of 200-500 studies of biomass increase and/or production show greatest responses to N+P addition

Elser et al. 2007 Ecology Letters

Linking Trophic State to Nutrients

Heterotrophic State



Data from analysis of 10 biomes show fungi respond to N+P addition

Nutrients and Aquatic Ecosystems

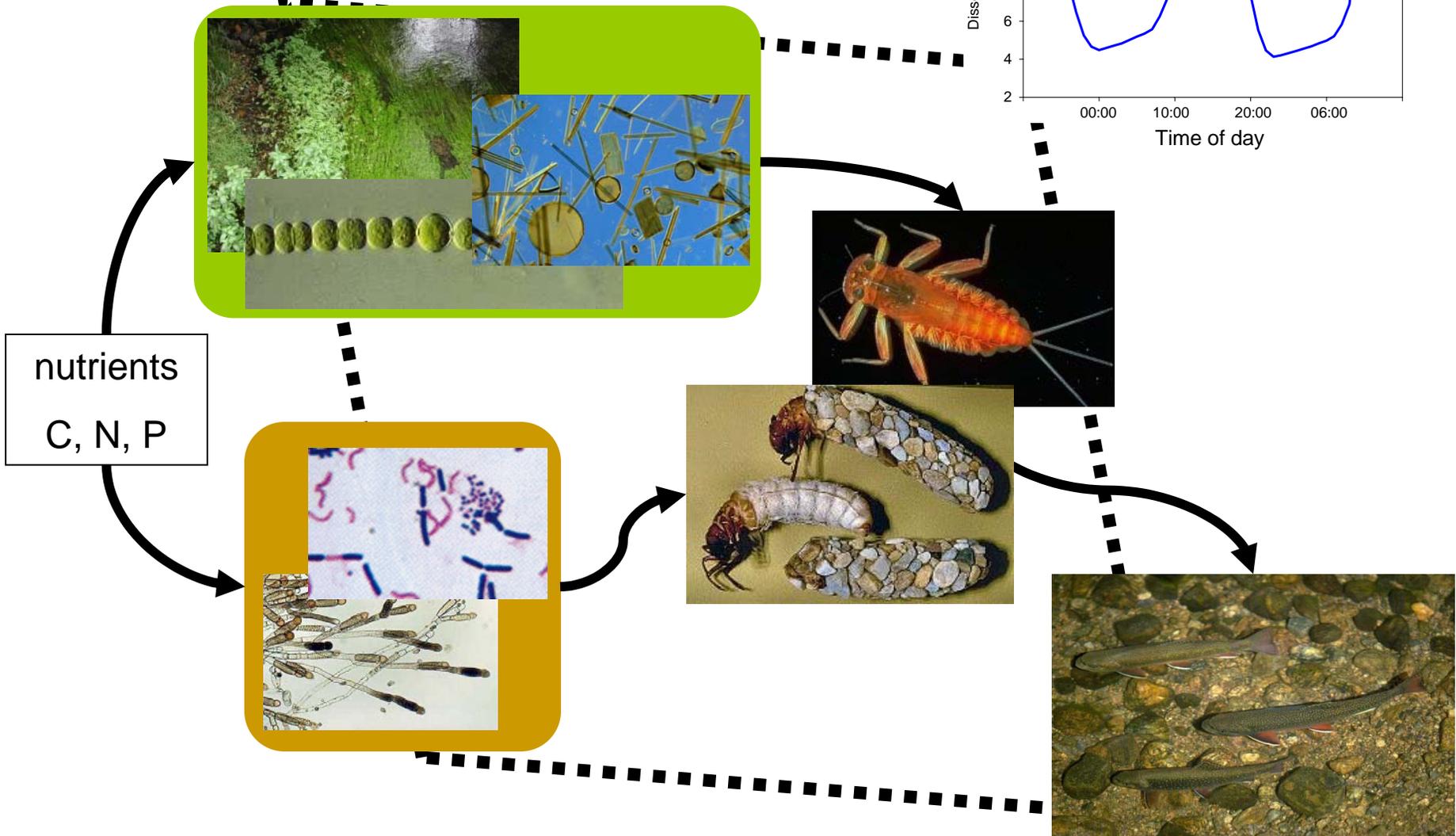
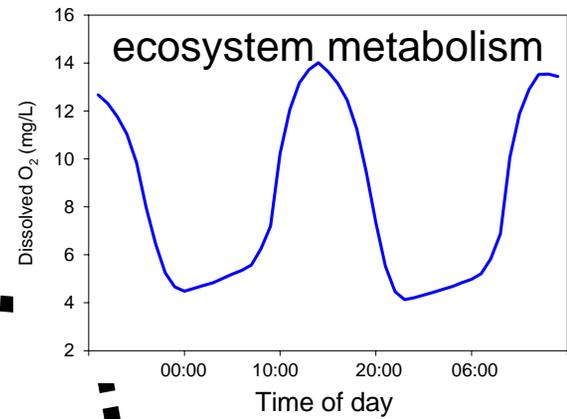


photo sources: National Geographic, NABS, Microbe zoo

New Data/Directions

- New Data: NBOD vs. not; organic matter standing stocks and fluxes; turbidity
- Old Data: Express BOD and K_a kinetically; analyze the diurnal record and relate to potential drivers
- How do other factors (nutrients, temperature...) play in to all this?