Turbidity as a factor for the operation of the Daphnia Toximeter

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What is turbidity?

"Turbidity is a principal physical characteristic of water and is an expression of the optical property that causes light to be scattered and absorbed by particles and molecules rather than transmitted in straight lines through a water sample. It is caused by suspended matter or impurities that interfere with the clarity of the water. These impurities may include clay, silt, finely divided inorganic and organic matter, soluble colored organic compounds, and plankton and other microscopic organisms."

Source: EPA Guidance Manual Turbidity Provisions

What is turbidity?

Compounds which cause turbidity
- clay (< 2µm particle size)
- silt (> 2µm and <63 µm particle size)
- finely divided organic matter
- soluble colored organic compounds
- plankton and other microscopic organisms

What is turbidity?

Turbidity (NTU)

Water Samples:

250   100   50   25   10

water sample

500   50   5

formazine

Pattern of turbidity?

River Elbe around 350 km from spring
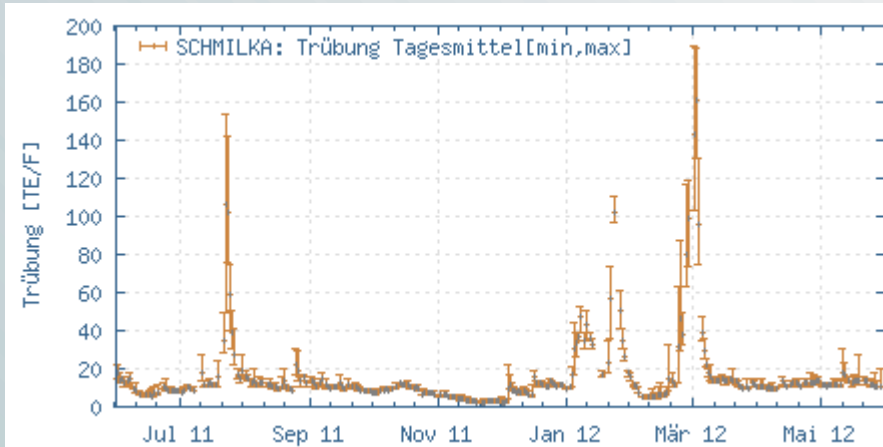
Photo: Elbe near German/Czech border
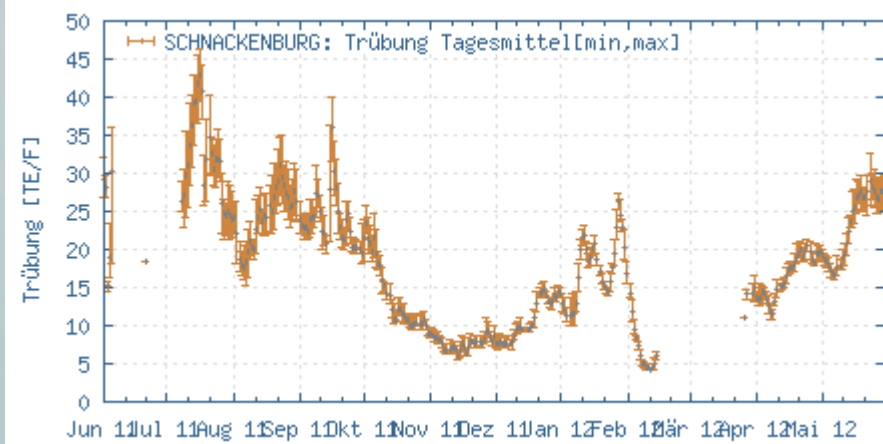
River Elbe around 825 km from spring

Photo: Elbe near Schnackenburg

Datasource: http://undine.bafg.de

Pattern of turbidity?
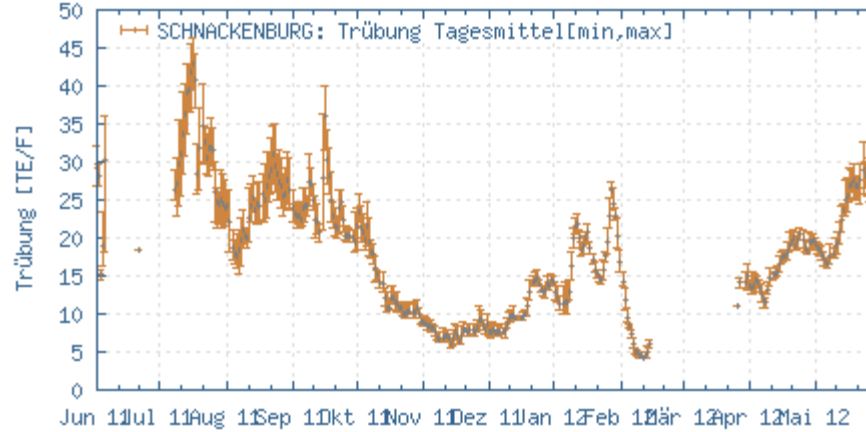
River Elbe around 825 km from spring

River Elbe around 1000 km from spring tidal zone

Photo: Elbe near Schnackenburg
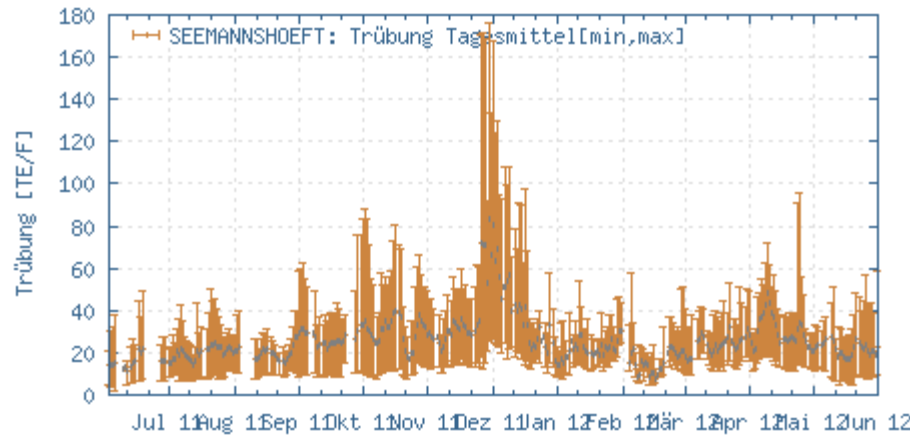
Photo: Measuring Station at the Elbe in Hamburg

Source: http://undine.bafg.de

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Pattern of turbidity?

**River impression
from China**

**high turbidity,
lot of organic particles**

What is the impact of turbidity on a DTOX?

clay (< 2μm particle size)   pass filters; deposits in chamber

silt (> 2μm and <63 μm particle size)   retained in DTOX II; can block filters

finely divided organic matter   can clog filters; can feed Daphnia

soluble colored organic compounds   low impact

and plankton and other microscopic organisms   can severely clog filters, can feed Daphnia
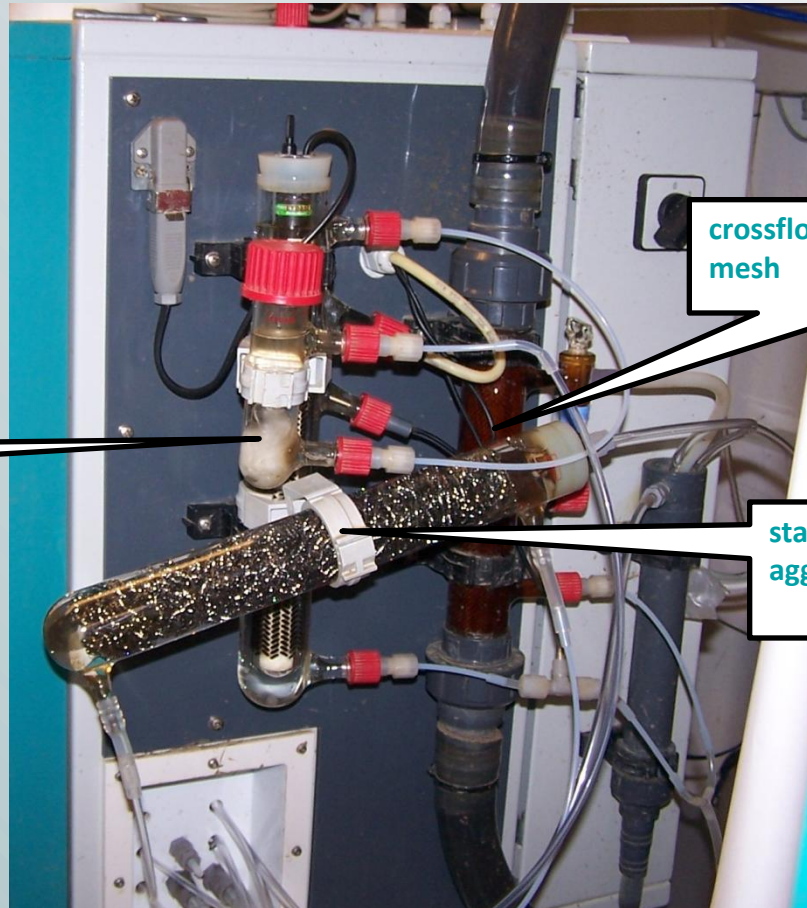
What particles can Daphnia eat?

- all types of organic particles

- largest particle size: 25 µ ?

- smallest particle size: 0.5 µm
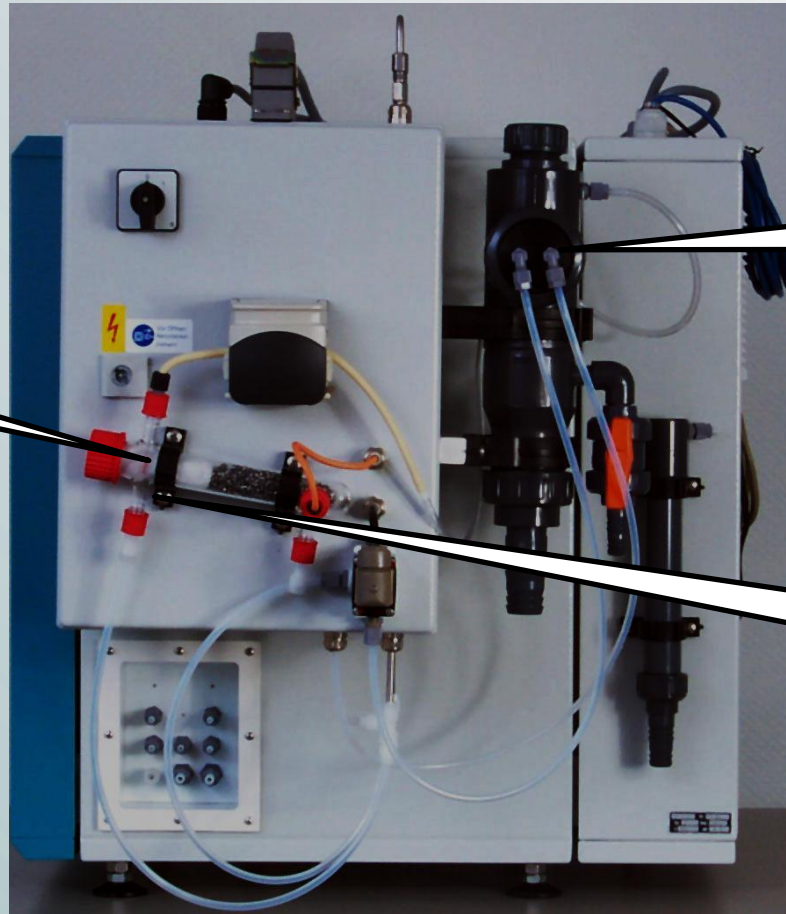
Reduction of turbidity in an older DTox I (custom)

crossflow filter with 50µ mesh

glass fibres for filtration

stainless steel wool trapping larger aggregated particles

Daphnia Toximter I, later version

automatic backflush filter with 20µ mesh
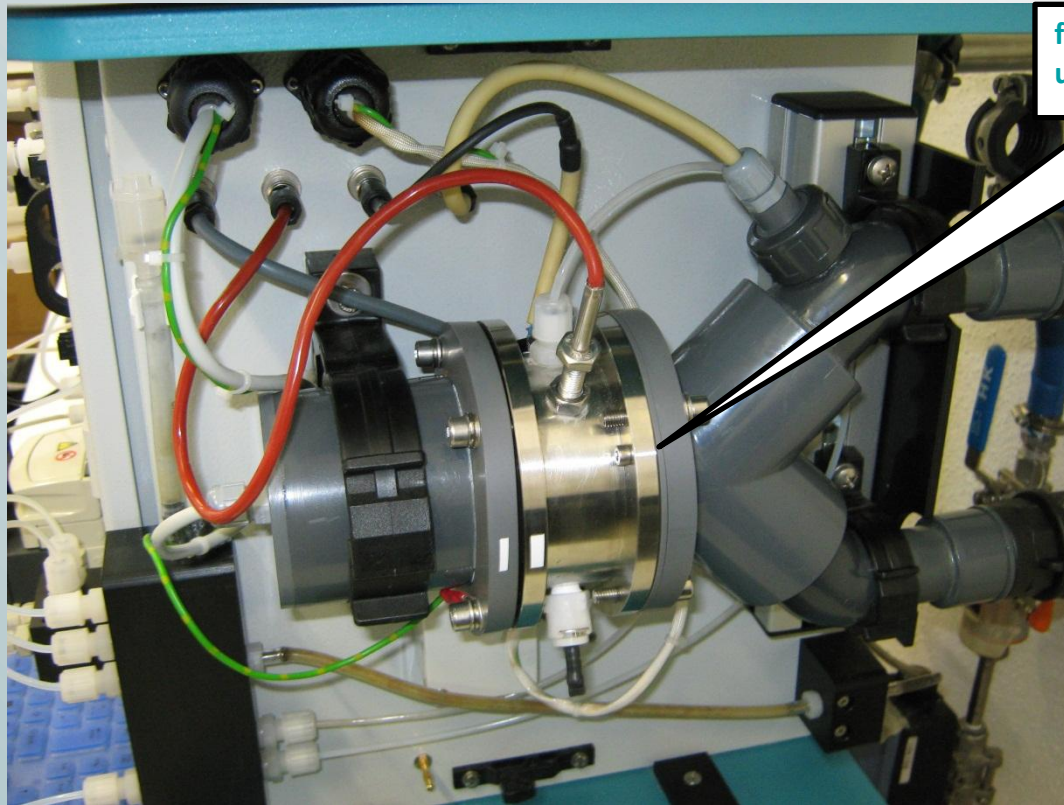
glass fibres for filtration

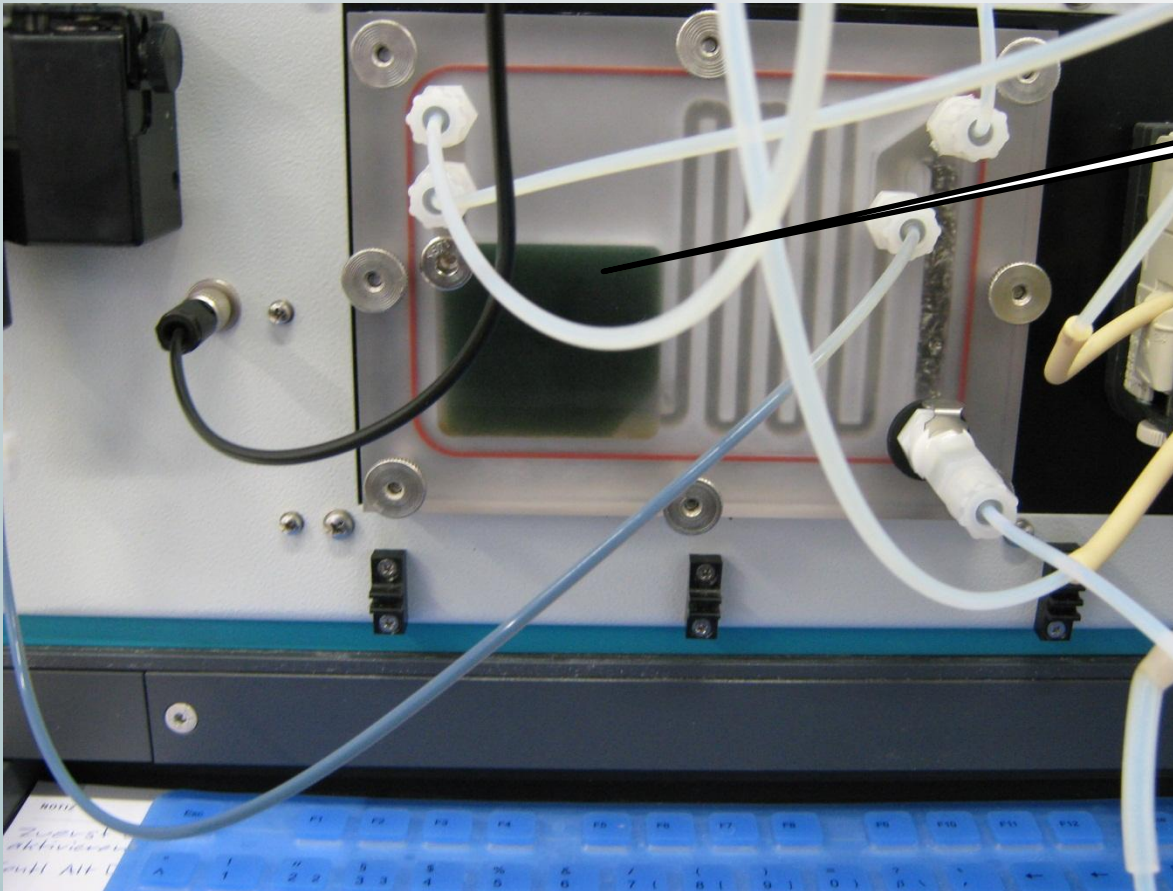stainless steel wool trapping larger aggregated particles; degassing

The DaphTox II (filter system, lateral view)

filter with 2µ mesh with ultrasonic cleaning

The DaphTox II (filter system, front view)

aquarium filter

The Daphnia Toximeter I filters, Dutch usermods

1µ prefilter

The Daphnia Toximeter I filters, Dutch usermods

1μ prefilter

**Standing time:
1-3 weeks**

The Daphnia Toximeter I filters, Swiss usermods - no filter

The DaphTox II filters, Brazilian usermods

sedimentation chamber

75µ prefilter cartridge
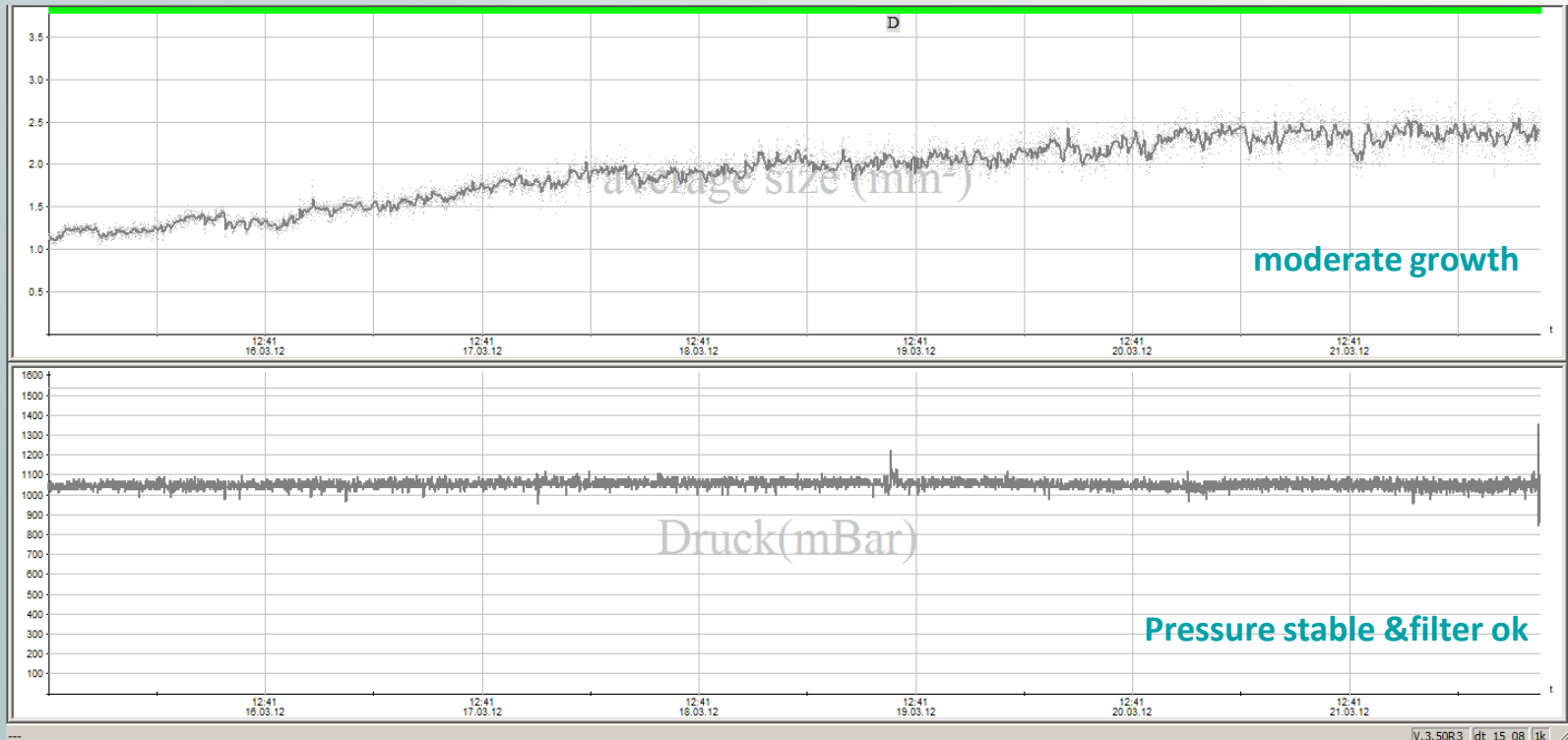+ 50µ prefilter cartridge

River near Sao Paulo

Standing time: **½ day!**

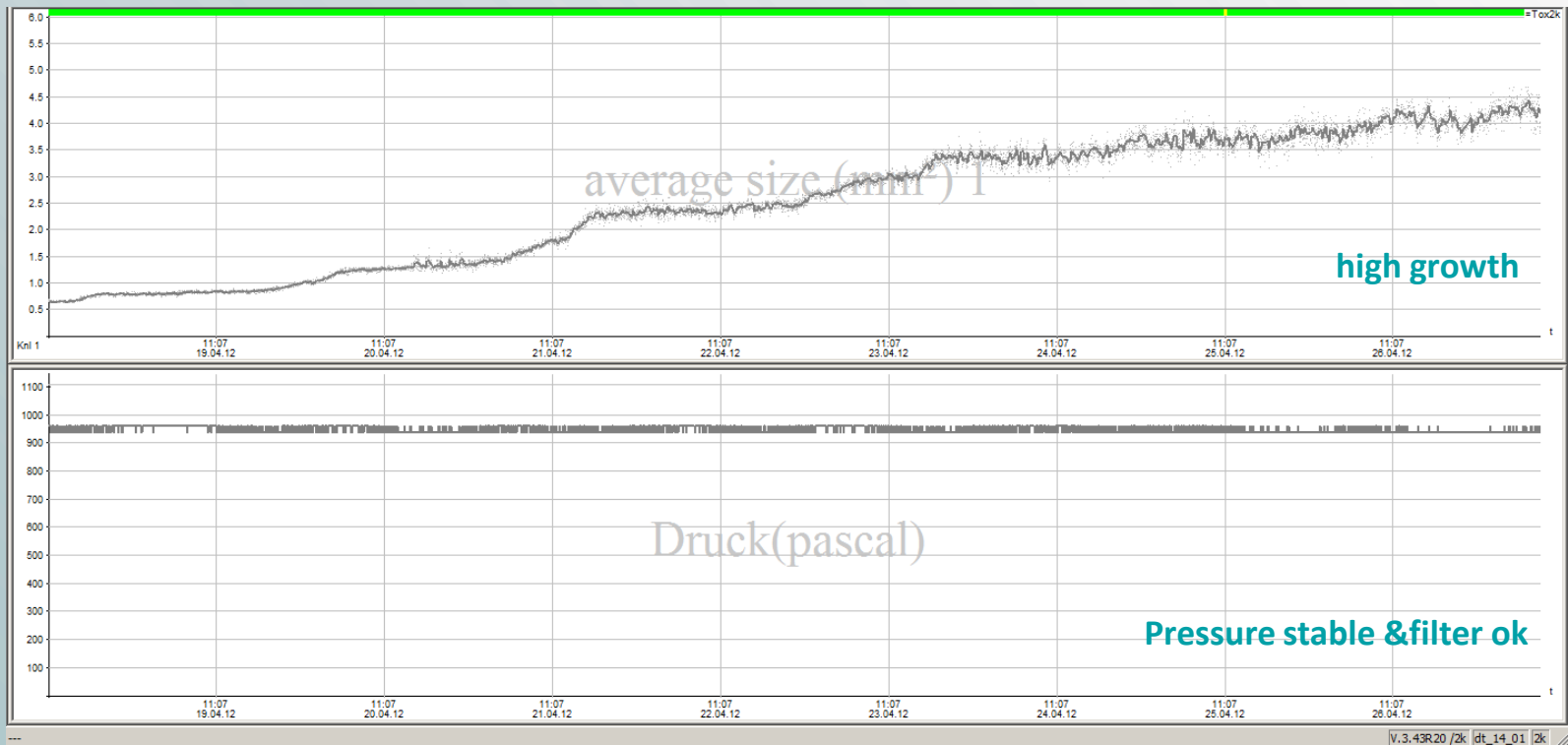# Filtration vs. food in DaphTox II (well balanced)

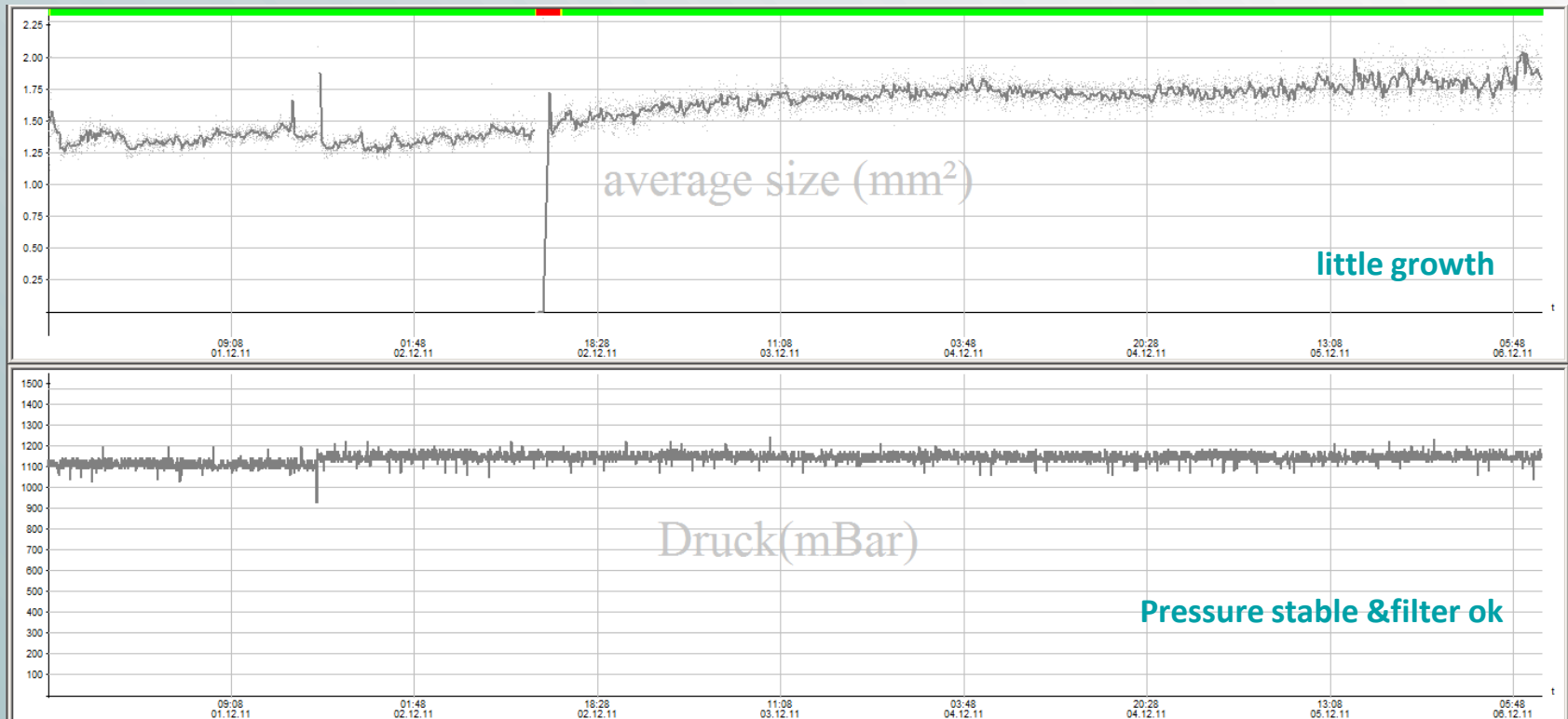**moderate growth**

Pressure stable &filter ok

Filtration vs. food in DaphTox II (moderately balanced)

average size (mm²) T

high growth

Druck(pascal)

Pressure stable &filter ok

Filtration vs. food at DTOX II (pooly balanced)

The significance of turbidity for the Daphnia Toximeter

1. Turbidity situation is an individual factor at different locations

2. At different locations the removal of turbidity has been adapted by internal and/or external measures

3. The measured turbidity values do not always give a clue to the real impact on the performance of the Daphnia Toximeter, since they neither define the amount of food nor define the tendency of clogging in the given filter system

4. Even with the strongest filtration at 2µm in the DaphTox II, the main food source for Daphnia in the toximeter is food supplied by the filtered sample water (river water)

5. It is beneficial for the operation to adjust the amount of food added to the water situation

Many thanks for
your attention