

# Sub-lethal effects of the water soluble fraction of tunnel wash water on juvenile brown trout (*Salmo trutta*)

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# Overview

- Background
- Aim
- Study design
- Results
- Conclusions



# Tunnel wash water (TWW)

- Tunnels accumulate road related contaminants between washing events
- TWW contain a high concentration of road related contaminants (e.g. metals and PAHs)
- Sedimentation ponds receiving tunnel wash water removes particle bound pollution
  - The removal of dissolved contaminants may be questioned

# Aim

Investigate sub-lethal effects on brown trout exposed to the water soluble fraction of tunnel wash water through a controlled exposure study

# Study design – exposure study

- Semi-static exposure experiment with four treatments

Control x5

Positive control  
x5  
150 µg/L Pb and 1µg/L  
Benzo[a]pyrene

Granfoss  
tunnel wash  
water x5

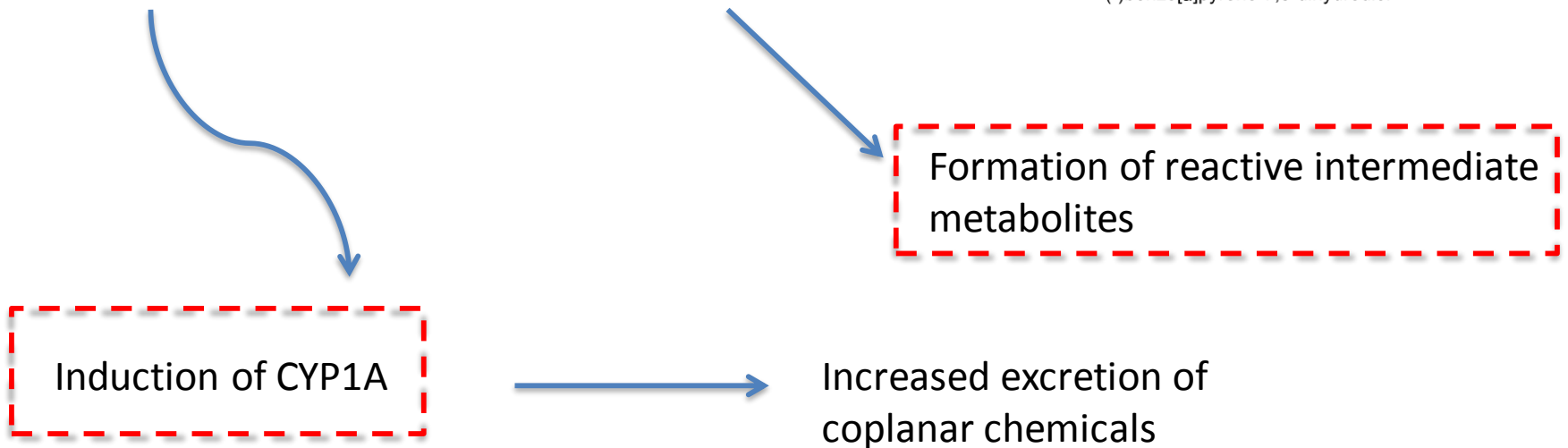
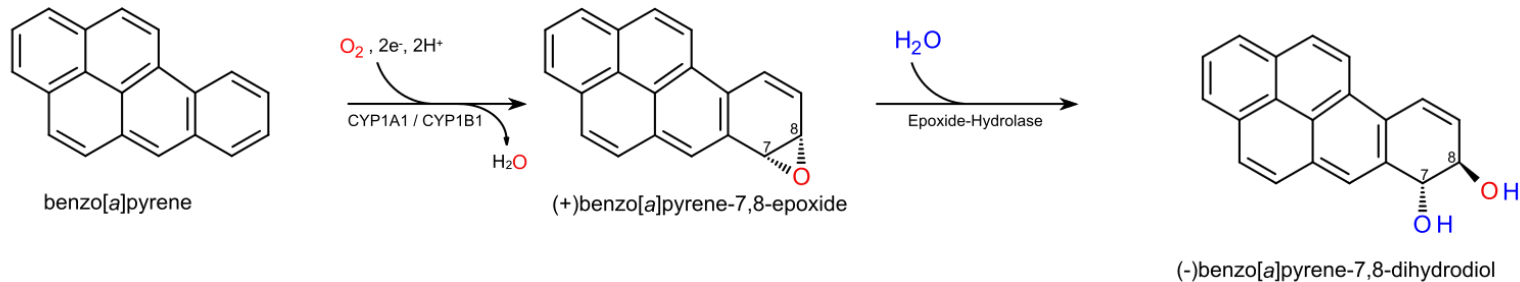
Nordby tunnel  
wash water x5

- The tunnel washes were conducted without the use of soap
- Water was filtered before used in the experiment

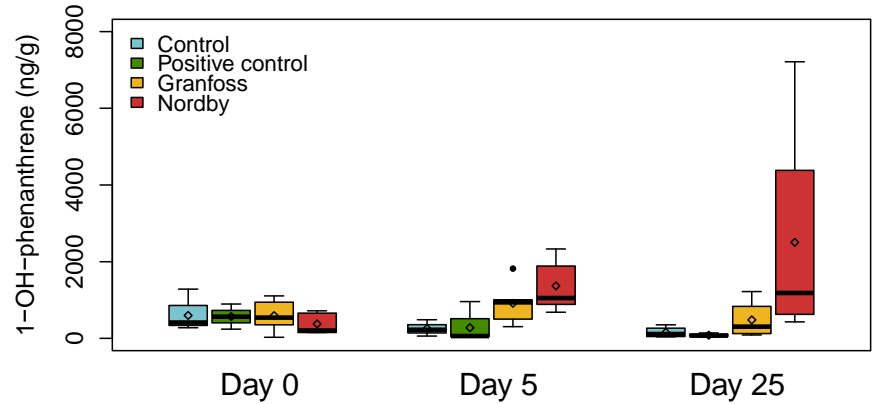
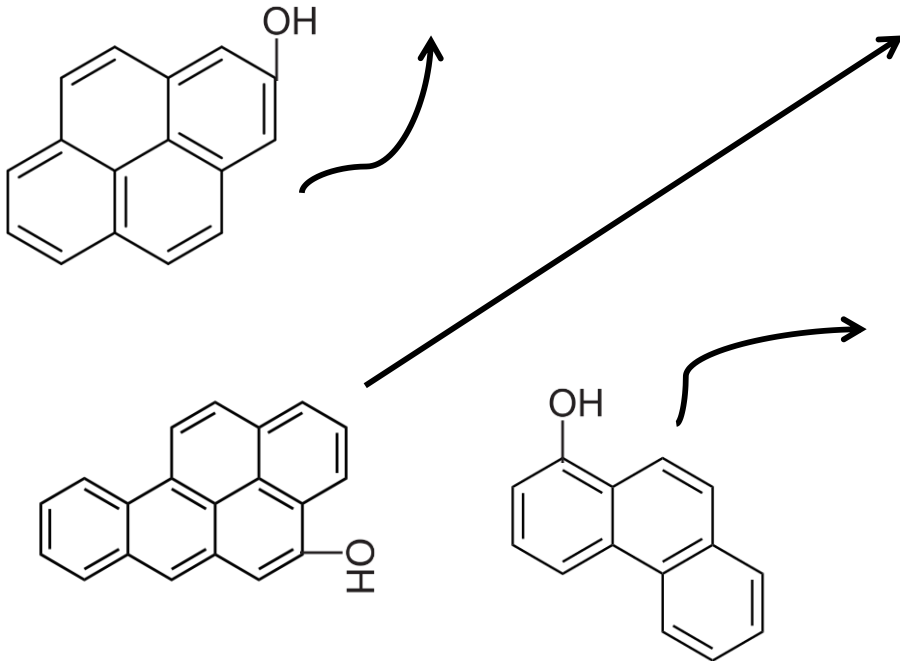
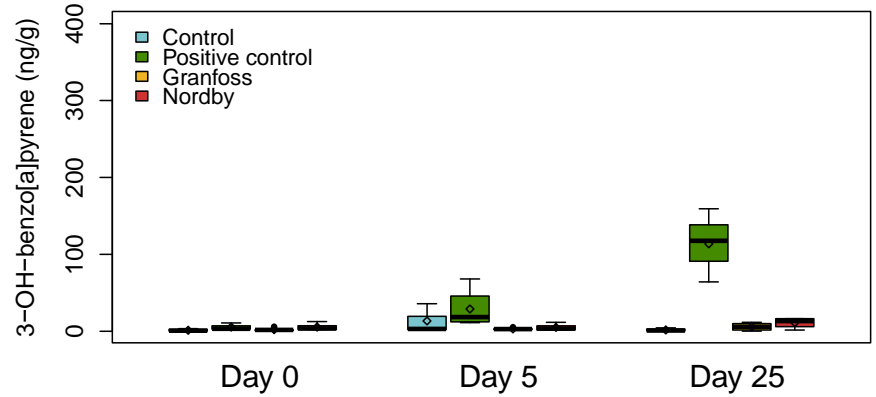
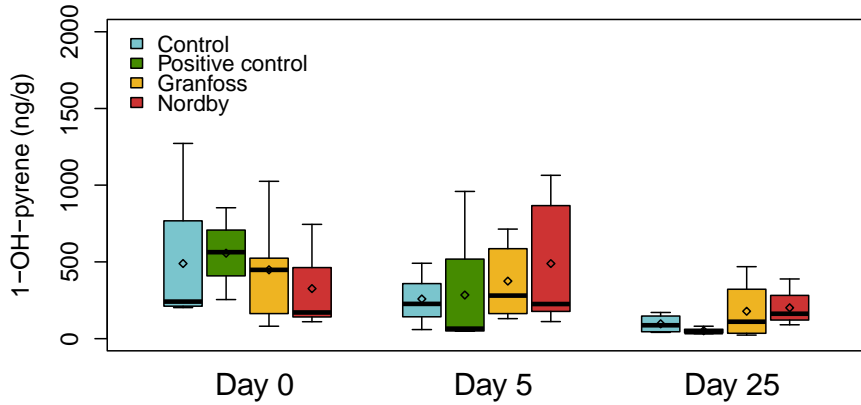


# CYP1A

- Major enzyme conducting phase I metabolism (“detoxification-process”) of coplanar chemicals

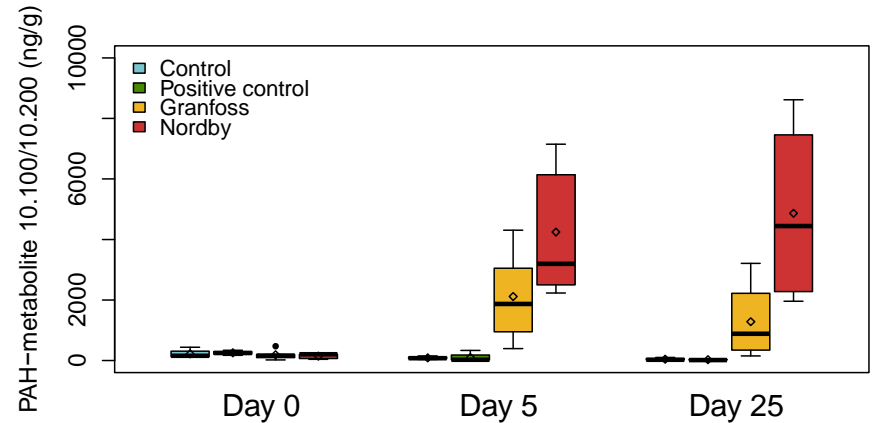
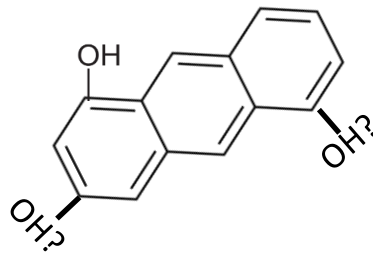
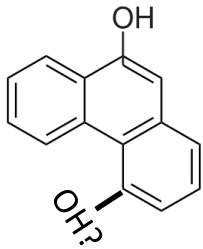
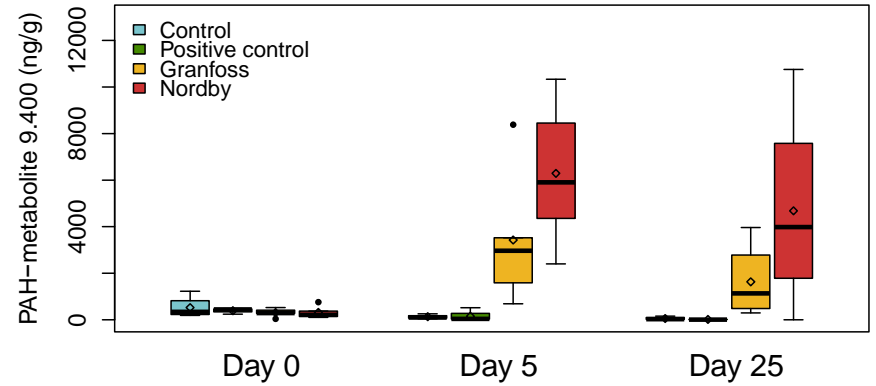
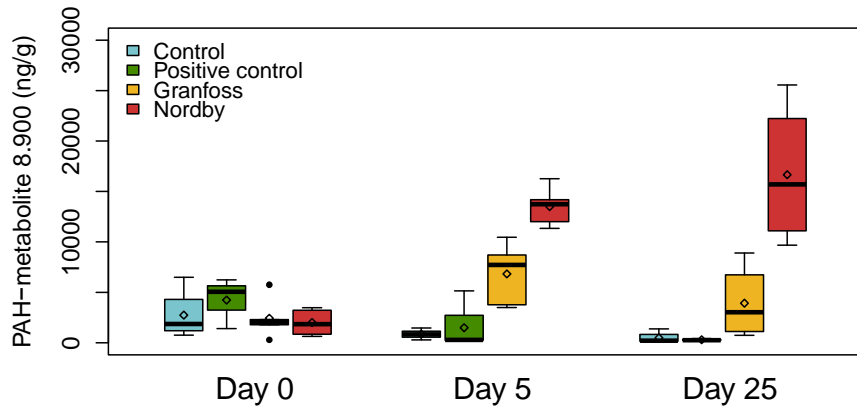


# PAH-metabolites



n= 3-5

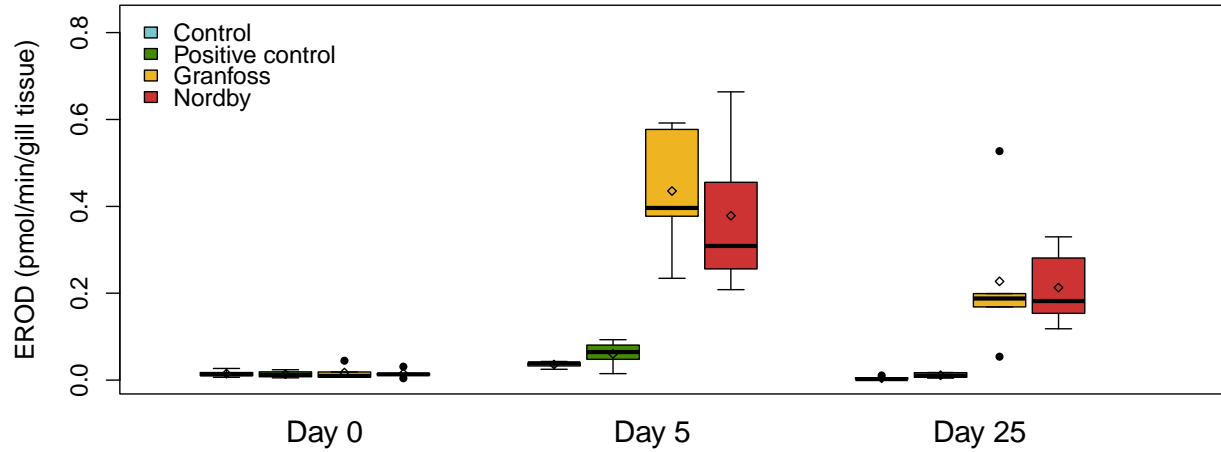
# OH-phenanthrenes/anthracenes



n= 3-5

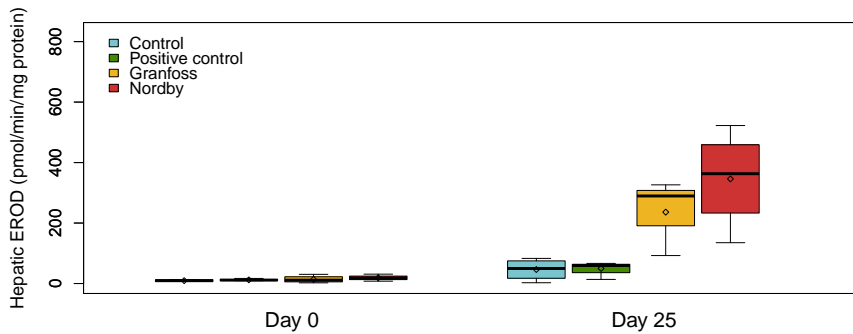


# CYP1A

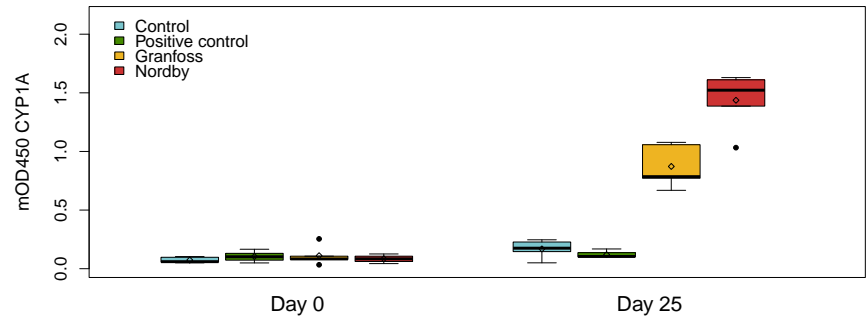


Activity in gills

Activity in liver

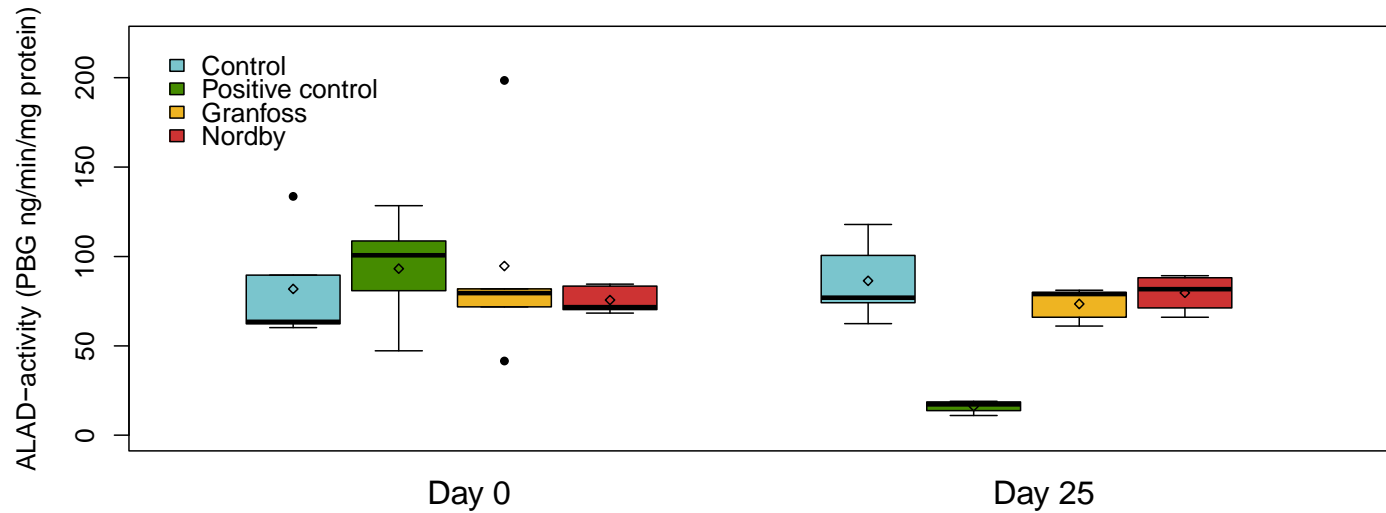


Concentration in liver



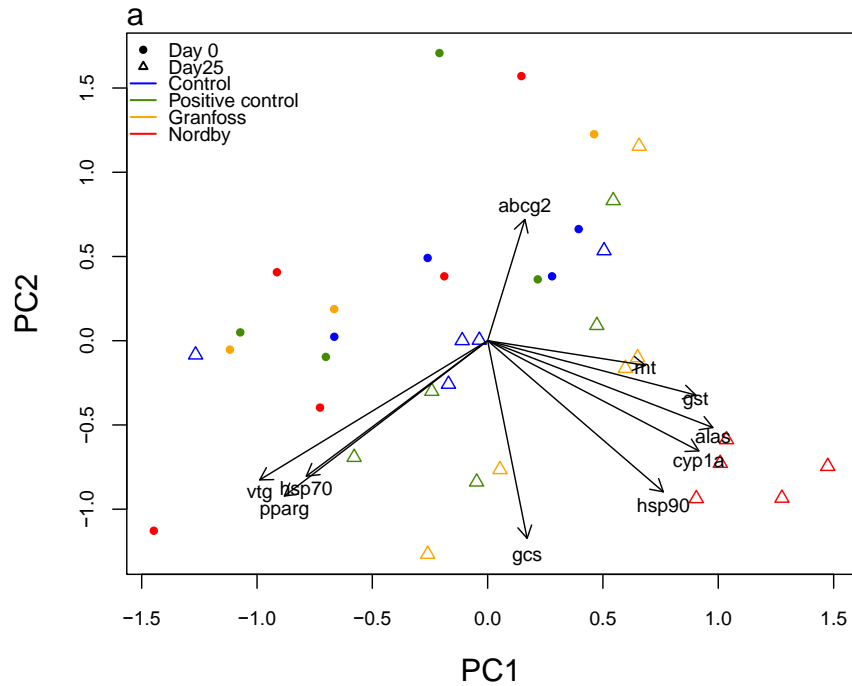
# ALA-D activity

- Activity of the enzyme  $\delta$ -aminolevulinic acid dehydratase
- Catalyse the second step in prophyrin and heme biosynthetic pathway

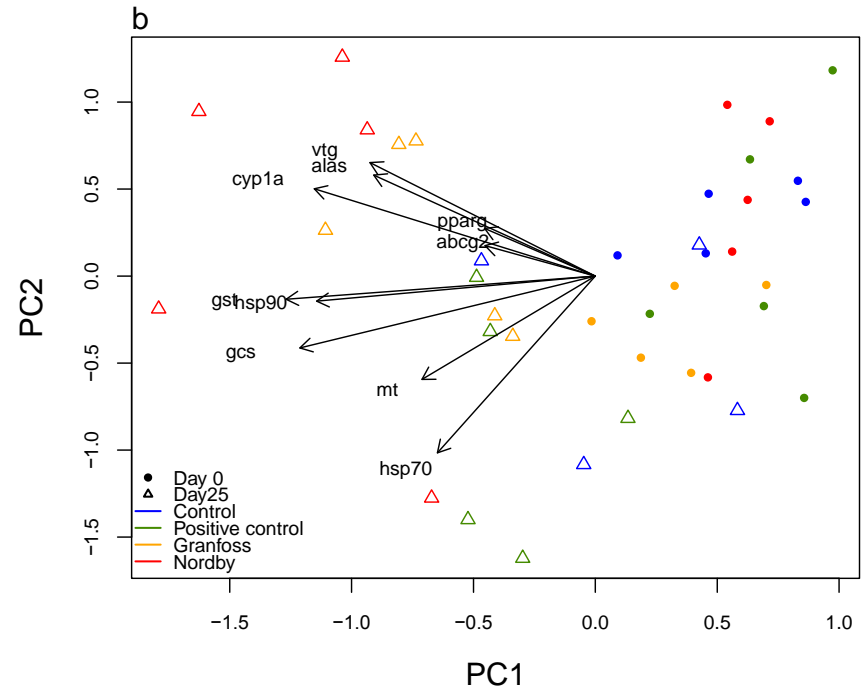


# Other biomarkers - gene expression

## Gill

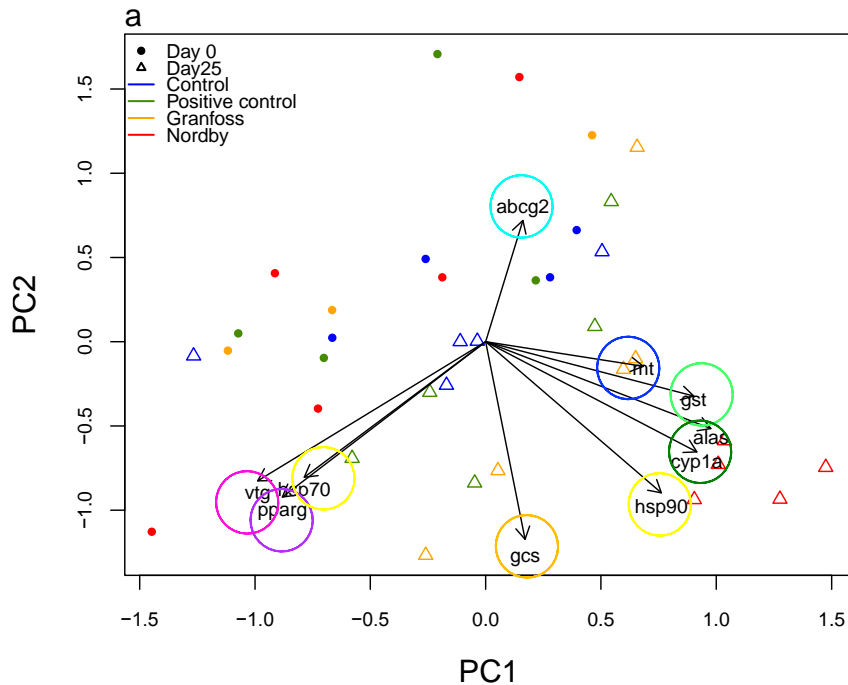


## Liver



# Gene expression

Gill



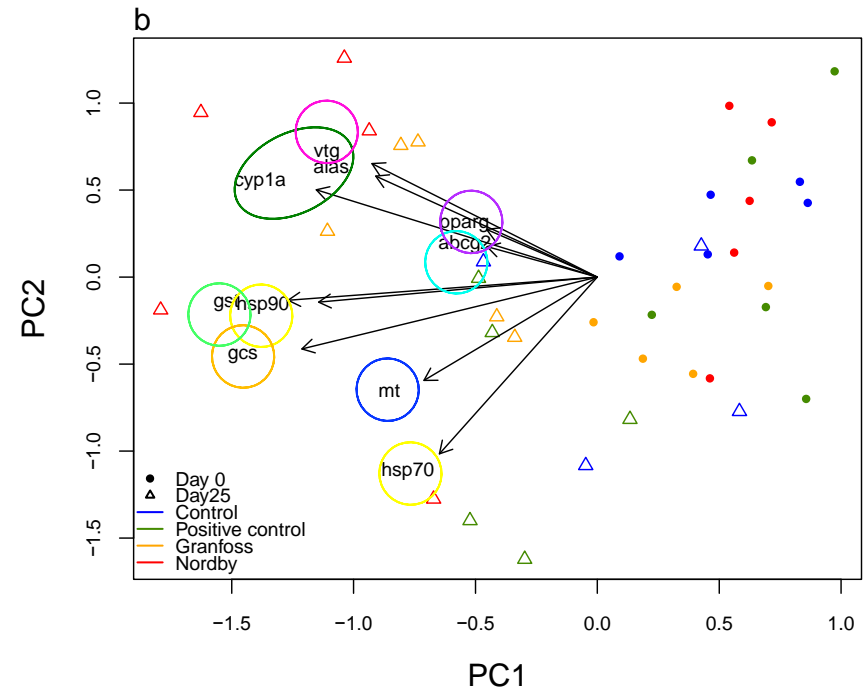
CYP1A (phase I metabolism) and ALAS (heme synthesis)

Gluthathion S-transferase (phase II metabolism)

Vitellogenin (endocrine effects)

ABC transporter (transport out of cells)

Liver



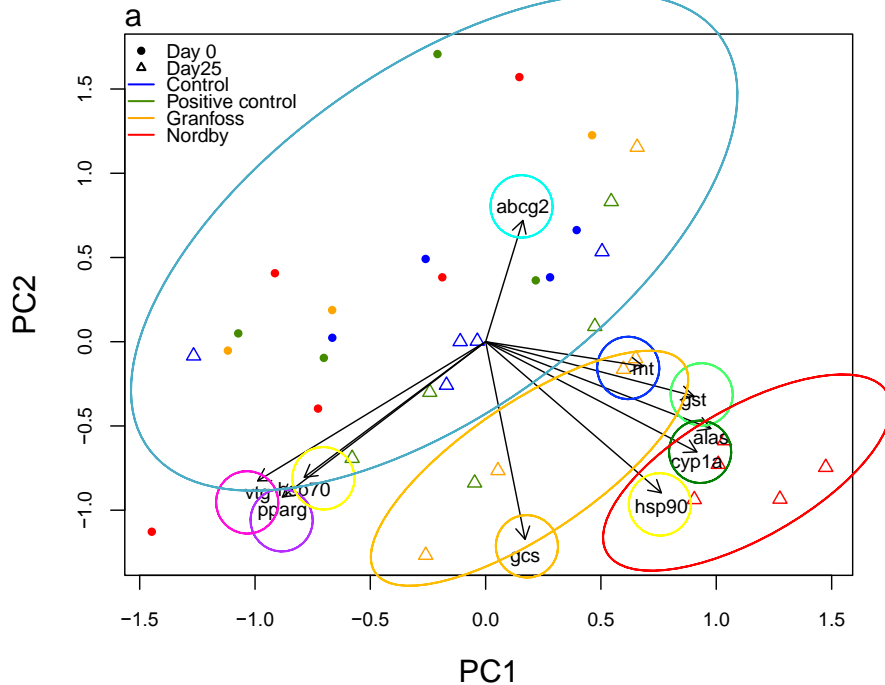
Peroxisome proliferater activated receptor (lipid metabolism)

Methallotionin and Gammagluthamyl cysteine synthethase(ligase) (antioxidant defences)

Heat shock proteins (stress)

# Gene expression

Gill



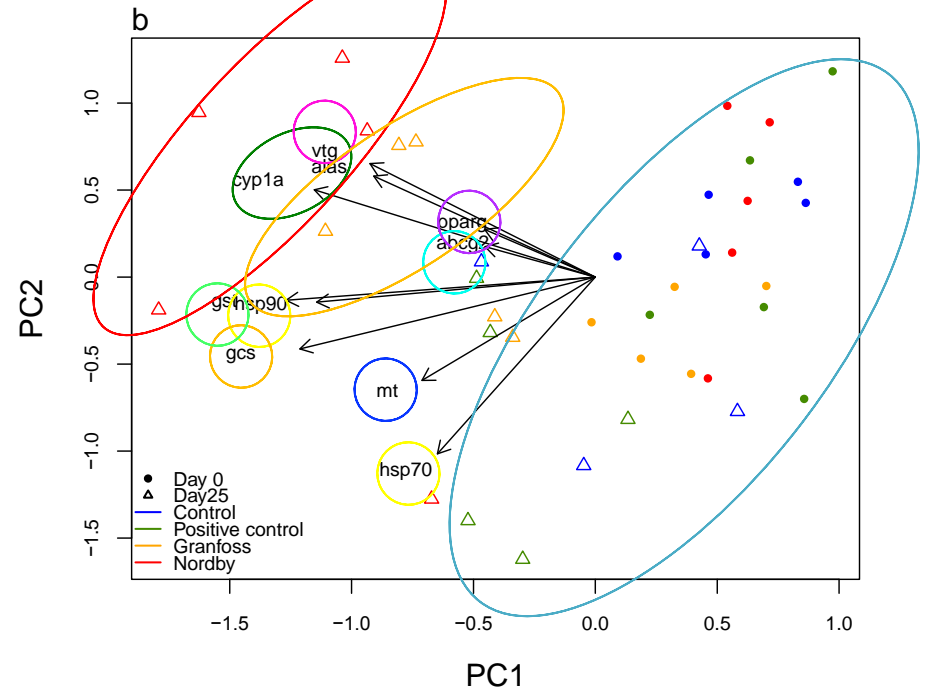
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Peroxisome proliferator activated receptor (lipid metabolism)

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# Conclusions

- TWW exposed trout:
  - Have accumulated PAH-metabolites in bile
  - Have increased activity, concentration and gene expression of CYP1A
  - Does not show signs of lead poisoning
  - Have increased gene expression for several of the genes investigated in both gills and liver



# Thank you for the attention!

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