EBERHARD KARLS UNIVERSITÄT TÜBINGEN[1]

NiddaMan

What fish have to face

Effects of anthropogenic pollution on fish health in a representative watercourse in a densely populated region of Central Europe

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The *NiddaMan* Project [**Nidda**-**Man**agement]

(Coordinated by Jörg Oehlmann & Ulrike Schulte-Oehlmann, Goethe University Frankfurt)

Being a fairly average European river system, the **Nidda** and its major tributaries Horloff and Usa are characterized by **anthropogenic influences**, including discharges of wastewater treatment plants, diffuse emissions of agricultural chemicals and substance inputs from point sources like factories, rainwater overflow tanks, etc.

The *NiddaMan*-project investigates the consequences of those influences with a set of several tools. This poster places its focus on the **effects on fish** on different levels and exposure situations.

→ **Fish embryo test with Danio rerio (DarT)**
 - developmental toxicity (river water and sediment samples)
 - (sub-)lethal endpoints

→ **Active monitoring**
 - 7 week caging of rainbow trout in the Nidda
 - subacute effects
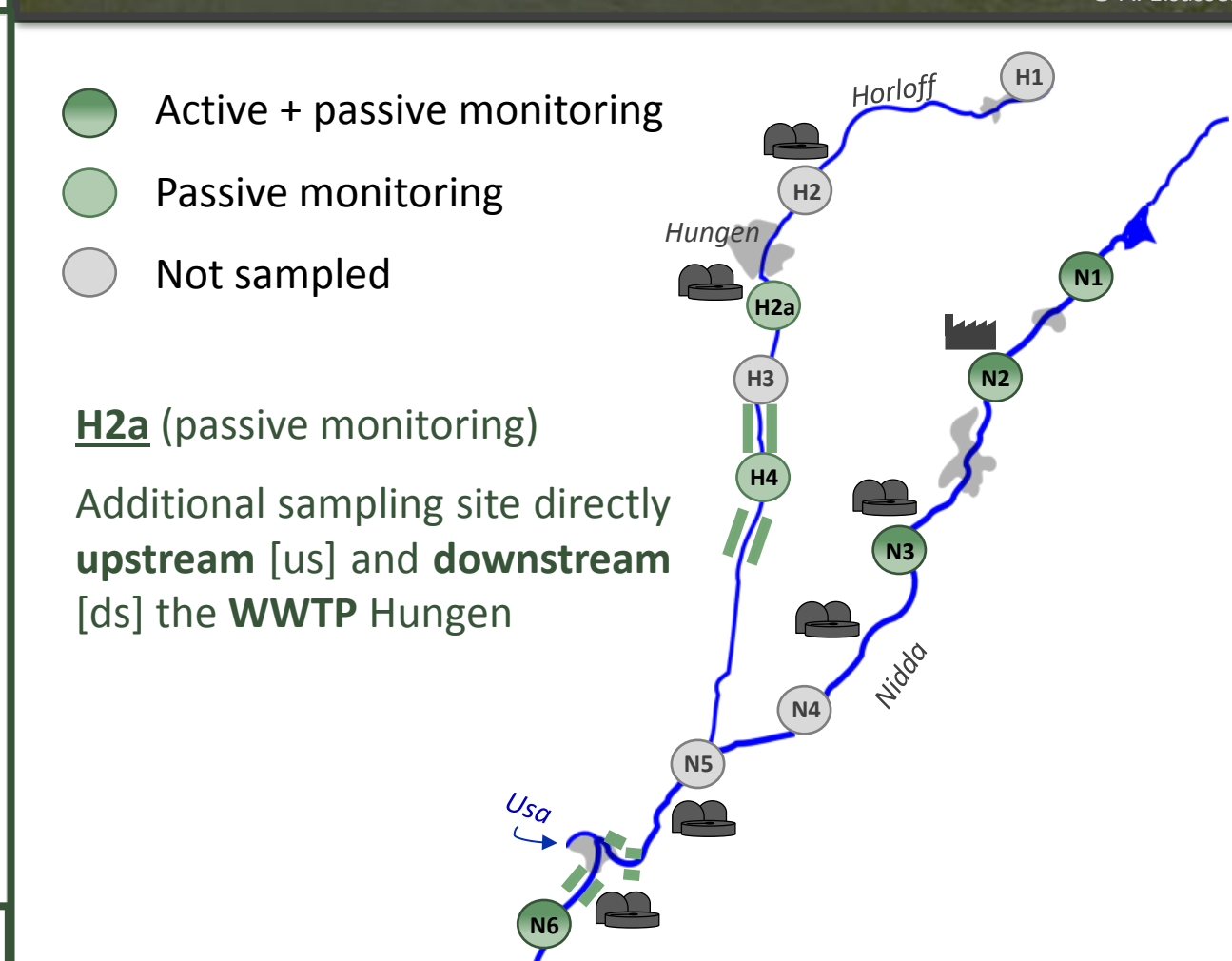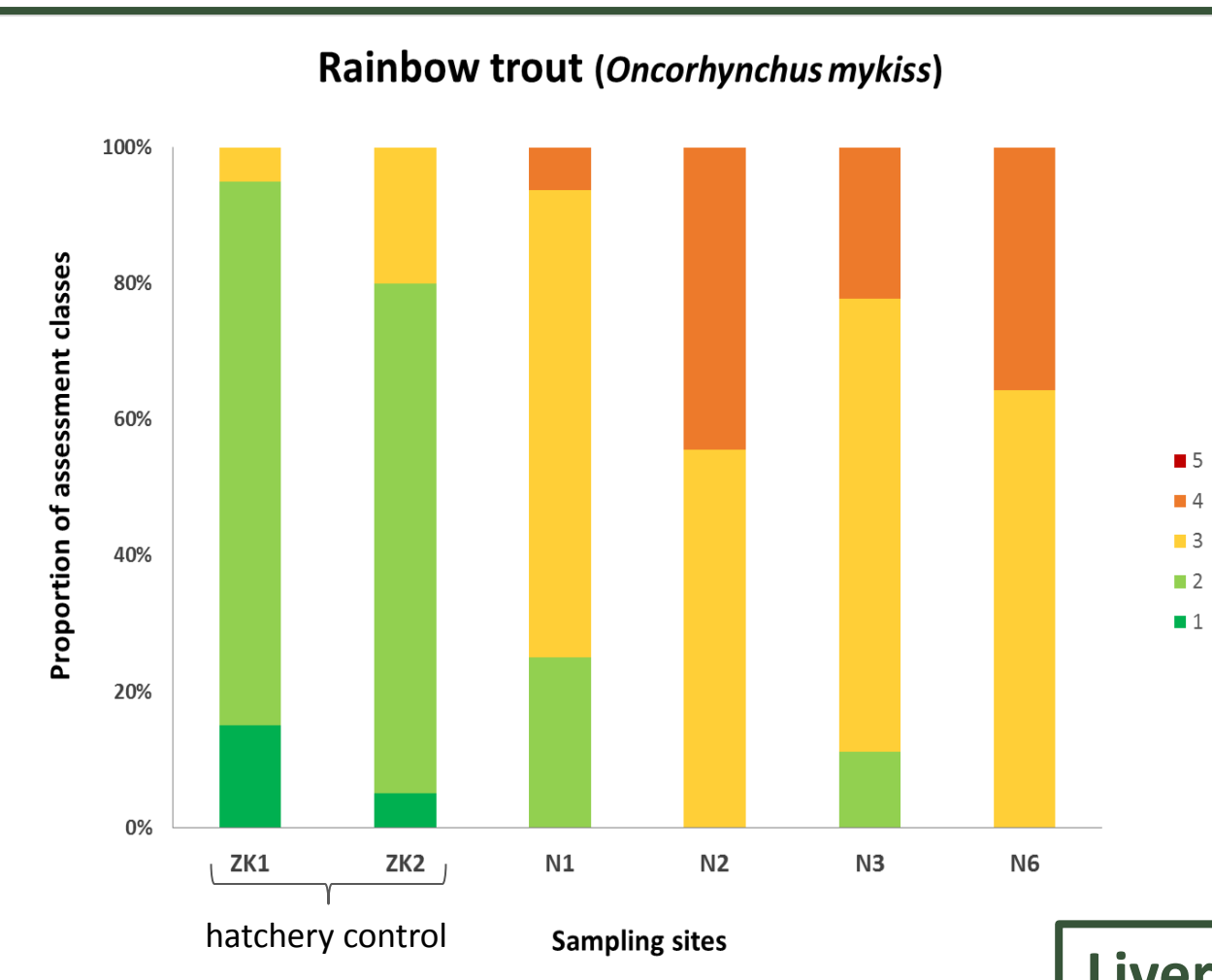 - histopathology, VTG, CyPIA1, micronucleus test

→ **Passive monitoring**
 - 2 electro fishing events at Nidda and Horloff
 - chronic effects
 - histopathology, CyPIA1, micronucleus test

Ecological status

- **Very good** [0 significant differences]
- **Good** [1-3 significant differences]
- **Moderate** [4-6 significant differences]
- **Poor** [7-9 significant differences]
- **Very poor** [≥ 10 significant differences]

4 class-I-WWTPs (1000 p.e. max.) → **unsatisfying** purification **efficiencies**

60 hpf
© M. Schweizer

DarT

Wastewater treatment plant
Paper factory
Mineral spa
Renaturation
Sampling sites

Frankfurt am Main   Main

Ecological status evaluation based on the fish embryo test with *Danio rerio* (DarT).

The data set consists of **four sampling events** between July 2015 and July 2016. For each sampling site and event **three runs** were conducted.
Significant **differences** relate to the **control** and are regarded as significant if at least two out of three runs show statistically significant values in the respective categories (mortality, hatching rate, heart rate, developmental delays, malformations).

Bottom line

→ **DarT, active** and **passive monitoring** show conspicuous results for **N2**.
 → likely influence of **paper factory**

→ **Sediment bound** fish (loach, gudgeon) show **severer effects** than trout and chub.
 → **fits DarT** results (no effects with water only)

→ Active/passive monitoring results for **N6** are not reflected in DarT.
 → pollution possibly less sediment bound

Active monitoring

Histopathology classification

- class 1: control state
- class 2: intermediate
- class 3: reaction
- class 4: intermediate
- class 5: destruction
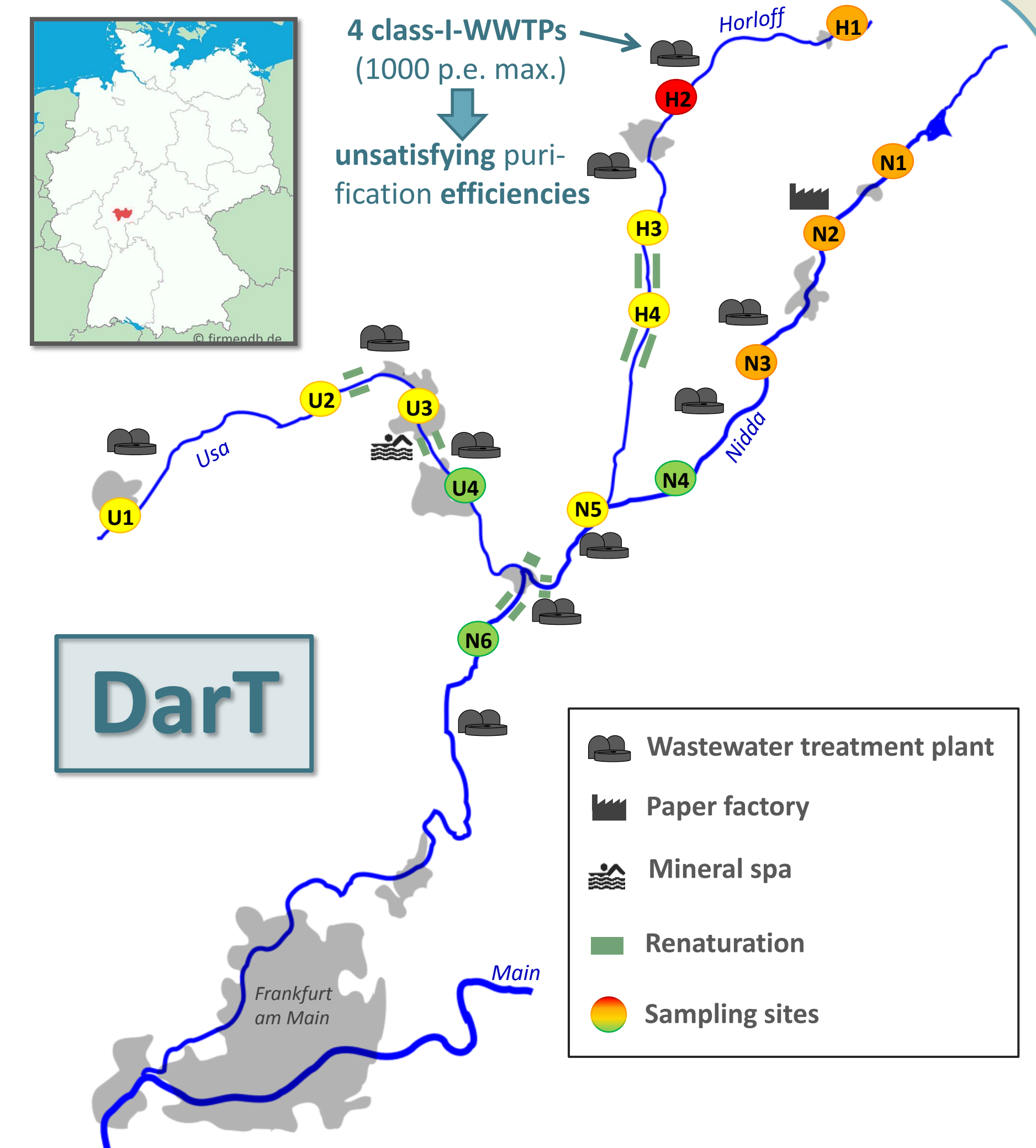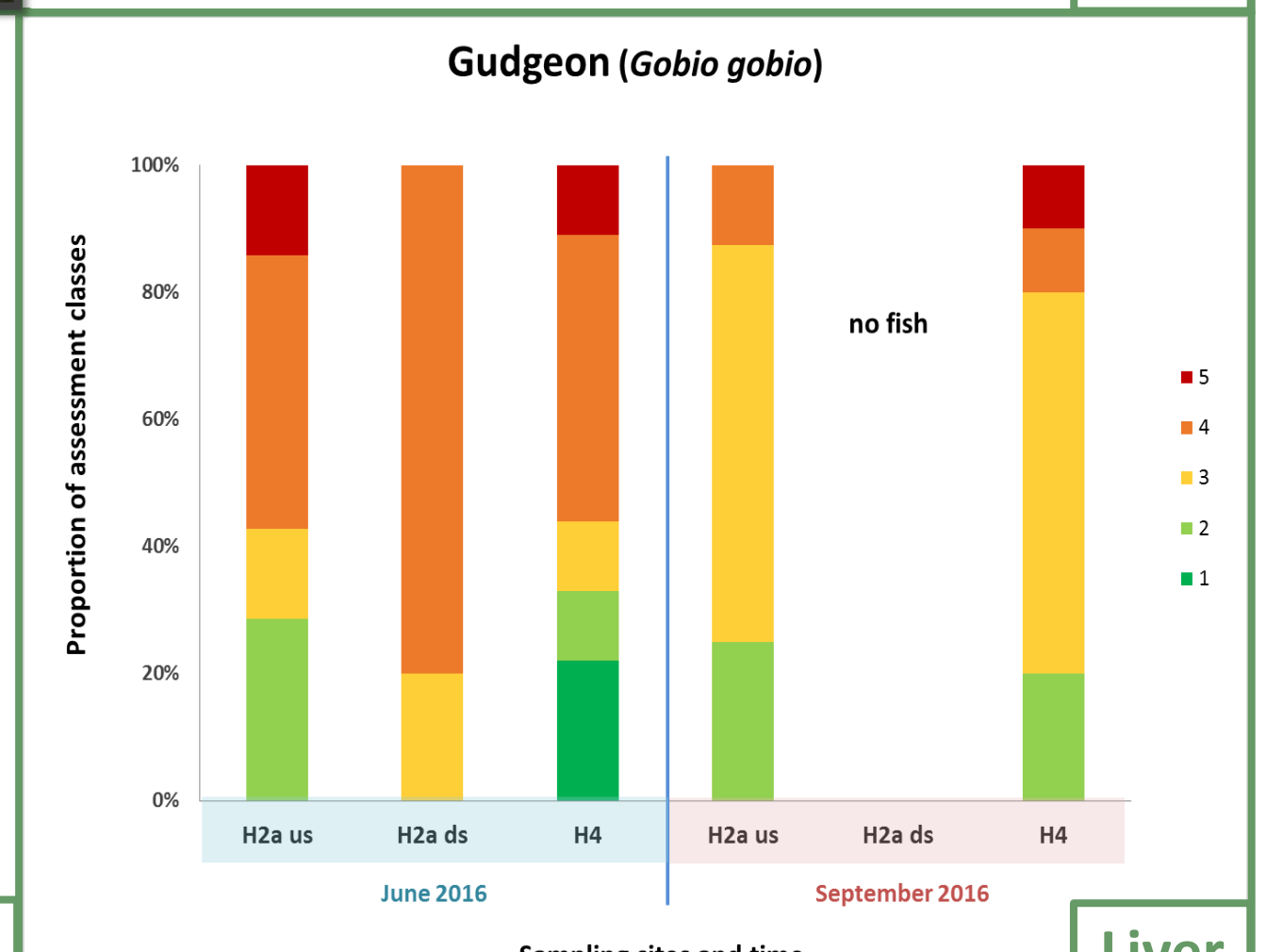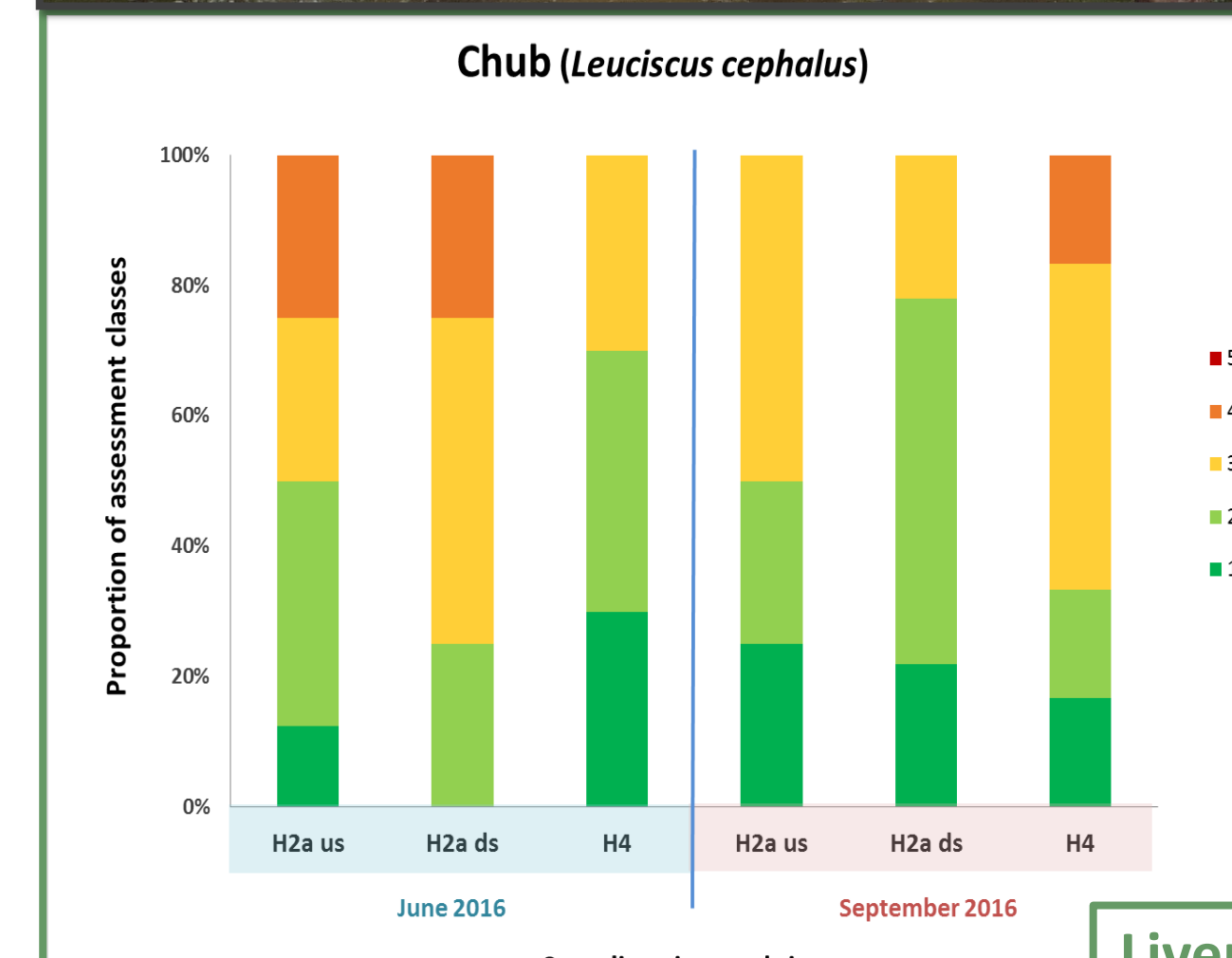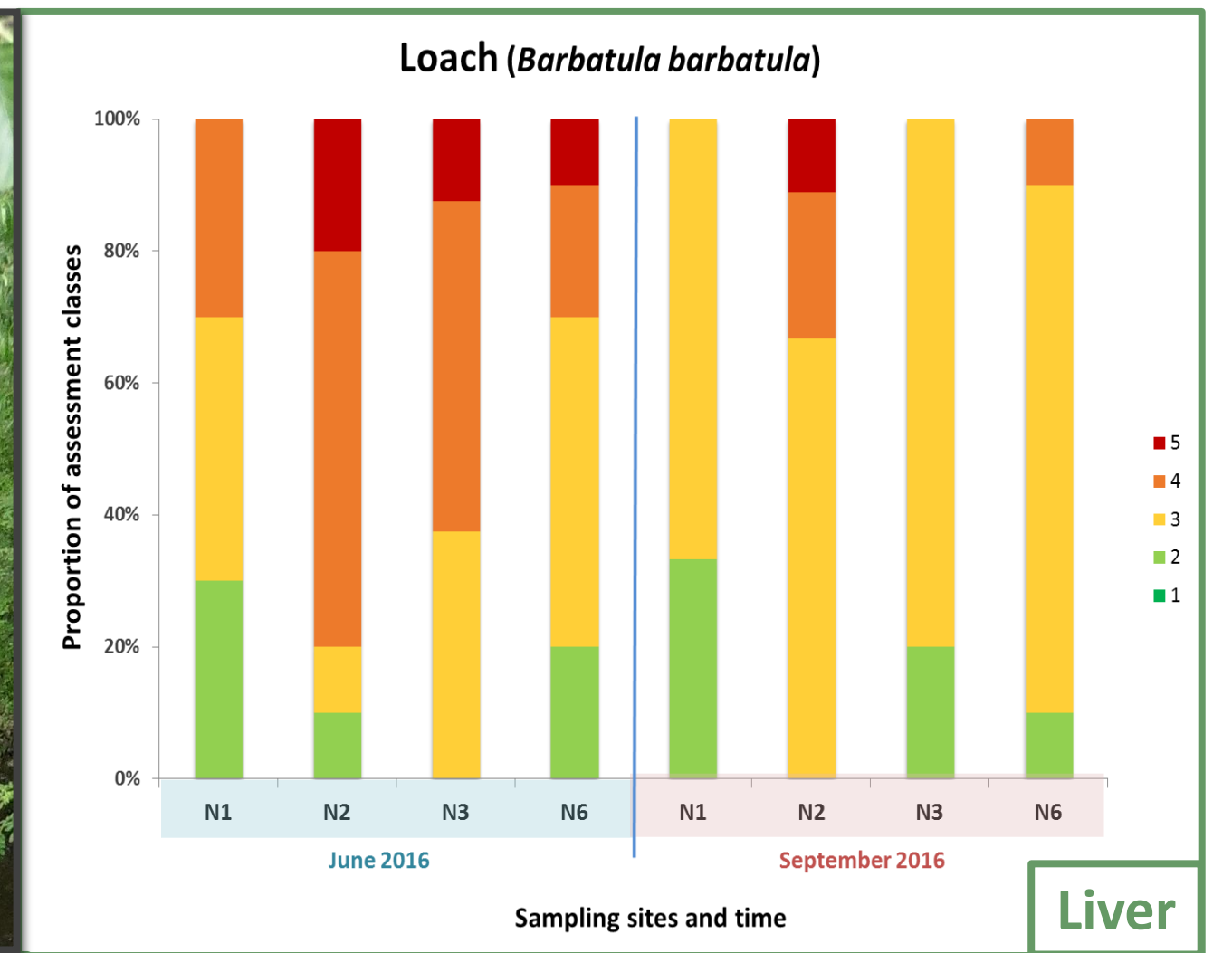
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Rainbow trout (*Oncorhynchus mykiss*)
hatchery control   Sampling sites
ZK1 ZK2 N1 N2 N3 N6
Liver

Active + passive monitoring
Passive monitoring
Not sampled

Horloff H1 H2 Hungen H2a H3 H4 N1 N2 N3 N4 N5 N6 Usa Nidda

H2a (passive monitoring)
Additional sampling site directly **upstream** [us] and **downstream** [ds] the **WWTP** Hungen

→ **At N2 and N6 livers of rainbow trout show severe effects**
 - N2: likely effect of potential paper factory discharges
 - N6: fish face complete load of WWTPs, paper factory, tributaries, etc.

Passive monitoring

Loach (*Barbatula barbatula*)
N1 N2 N3 N6 N1 N2 N3 N6
June 2016   September 2016
Sampling sites and time
Liver

Chub (*Leuciscus cephalus*)
H2a us H2a ds H4 H2a us H2a ds H4
June 2016   September 2016
Sampling sites and time
Liver

Gudgeon (*Gobio gobio*)
no fish
H2a us H2a ds H4 H2a us H2a ds H4
June 2016   September 2016
Sampling sites and time
Liver

→ **Feral fish in a worse health state in June compared to September**
 - end of spawning season → energy storages depleted → less stress resistant
 - heavy rainfall → more suspended matter / run-off → more pollution