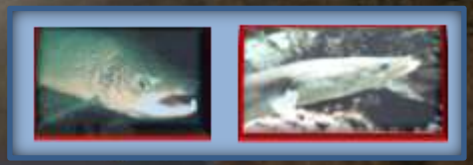
Evaluating fish friendly German hydropower technology on downriver movement of salmon smolt and silver eels

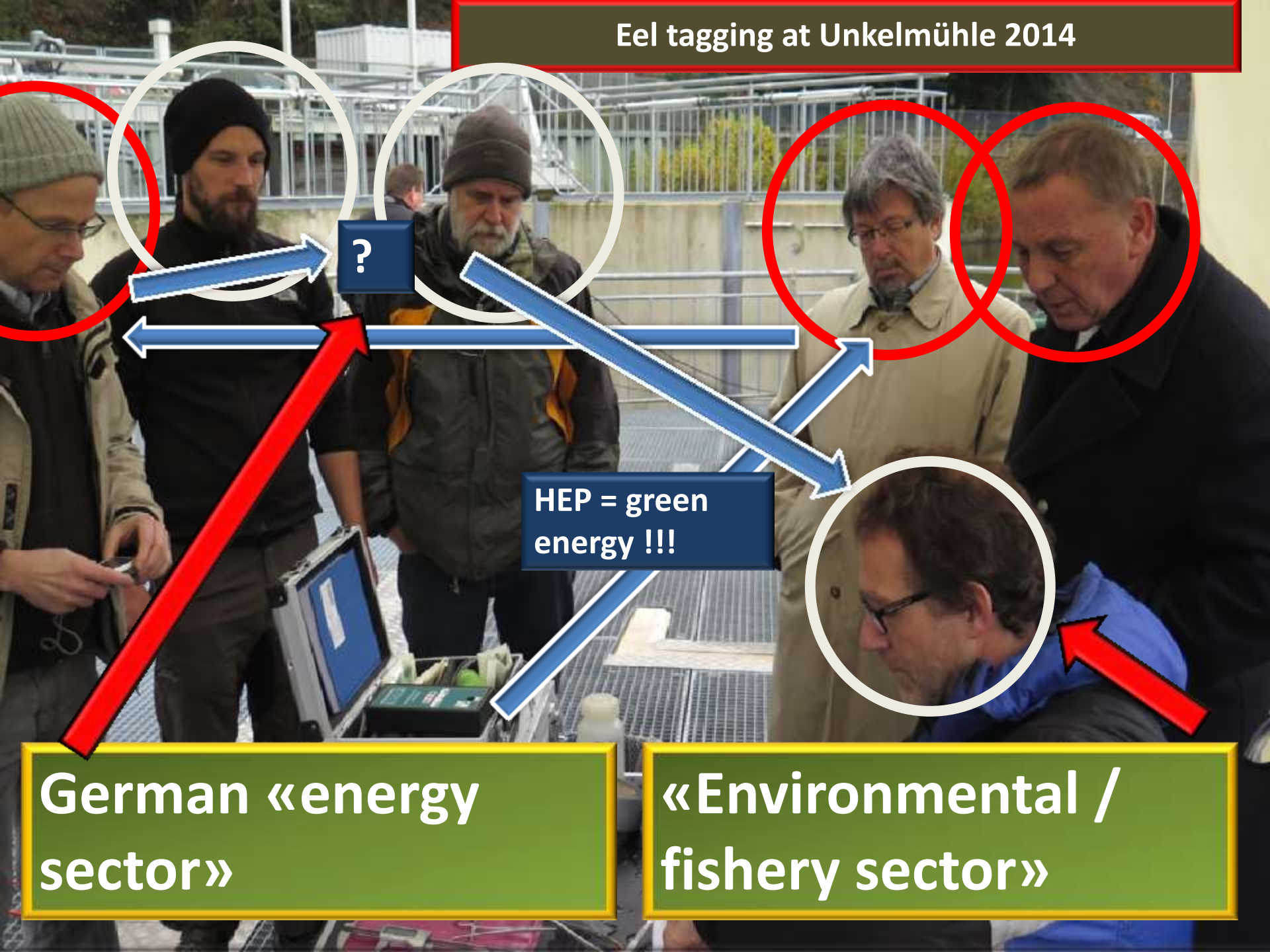


How hard can that be??

Finn Økland, NINA

Project participants:
Maxim Teichert, Univ. of Cologne
Torgeir Havn, NINA, Norway
Eva B. Thorstad, NINA, Norway
Jost Borcherding, Univ. of Cologne
Lisa Heermann, Univ. of Cologne
Sten Are Sæter, NINA, Norway
Ola Diserud, NINA Norway
Richard Headger, NINA Norway
In cooperation with LANUV NRW

Founded by Ministry of Climate Protection, Environment, Agriculture, Conservation and Consumer Protection of the State of North Rhine-Westphalia


Eel tagging at Unkelmühle 2014
?
HEP = green energy !!!
German «energy sector»
«Environmental / fishery sector»

Communication

Trust

Trust = integrity

Norwegian Institute of Nature Research (NINA)

Non profit foundation, 100 % independent.

Trust = quality

Evaluation of biology, medicine and health research in Norway (2011)

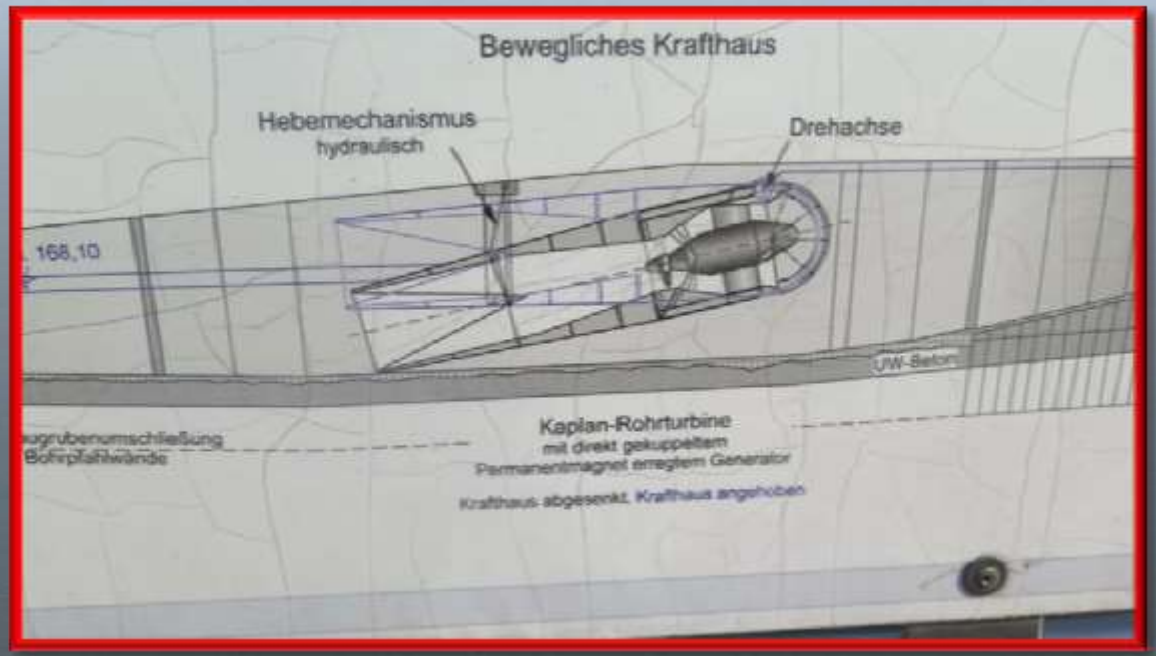
- **Commissioned by the Norwegian Research Council**
- **Panel 1: Botany, Zoology and Ecology-related Disciplines**
- Page 82-86:
- **Norwegian Institute for Nature Research (NINA)**

Department of Aquatic Ecology

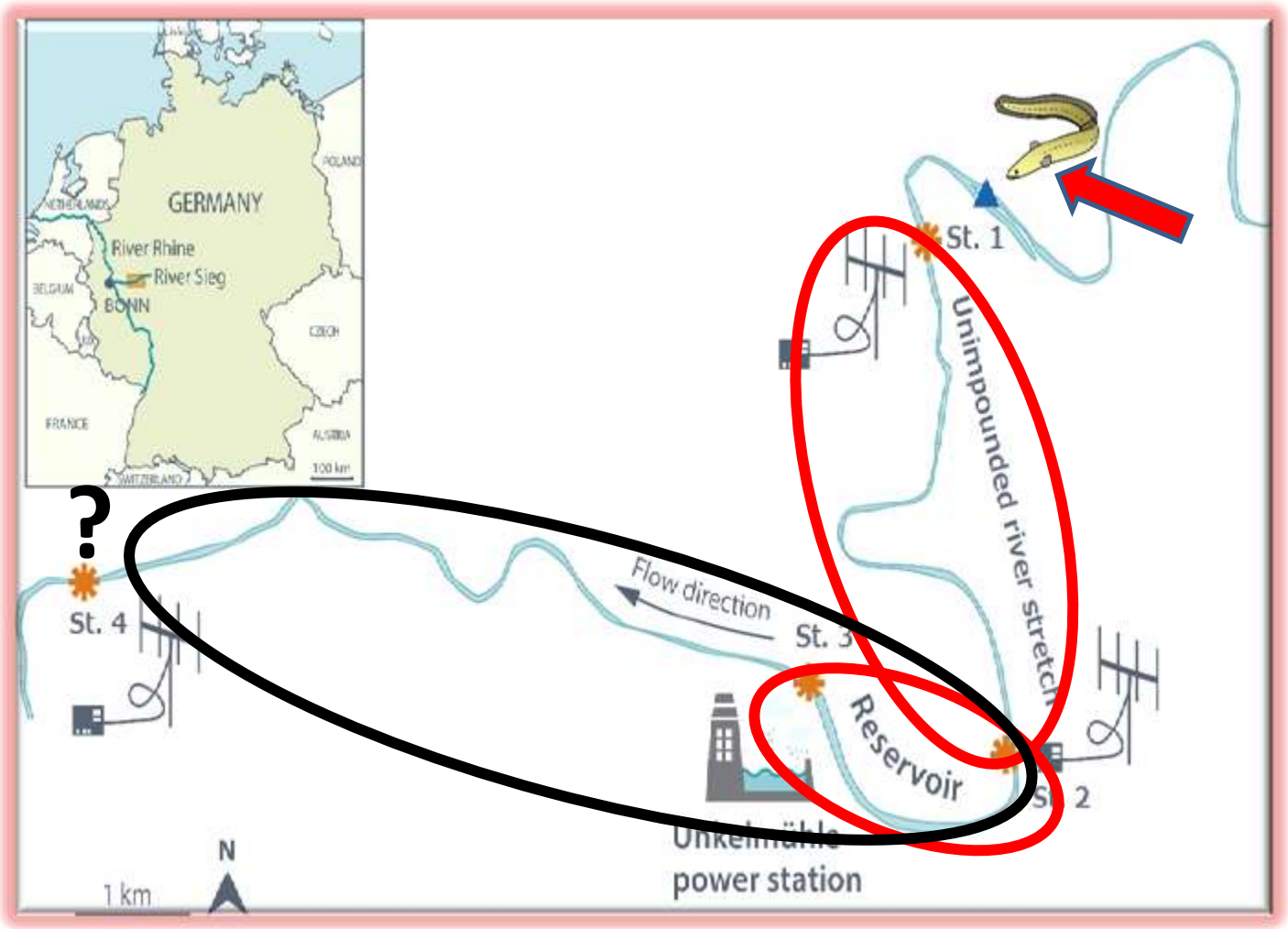
Grading of scientific quality: Very Good

- *General evaluation & recommendations*
- The department has many strengths. **Research involving fish telemetry is excellent** and research on interactions between aquaculture and wild fishes is internationally relevant. Applications of SNP chips are quite useful for understanding the response of stocks to interactions between aquaculture and fishing. Staff have successfully used the national infrastructure for research. Publication week and internal research competitions are innovative ways to address the lack of time available to draft manuscripts for submission to peer-reviewed journals.

Fish friendly technology?



Project design for recording loss associated with Unkelmuhle power station



Control stretch

Impounded Stretch –

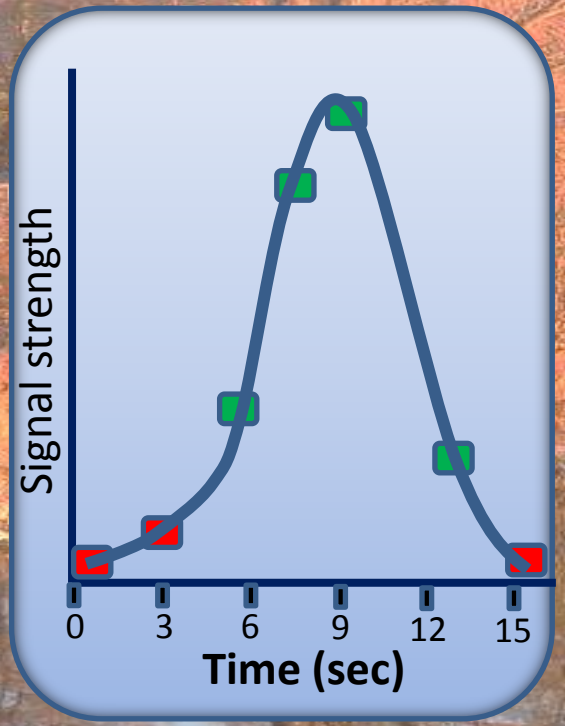
a) Reservoir
b) Power station

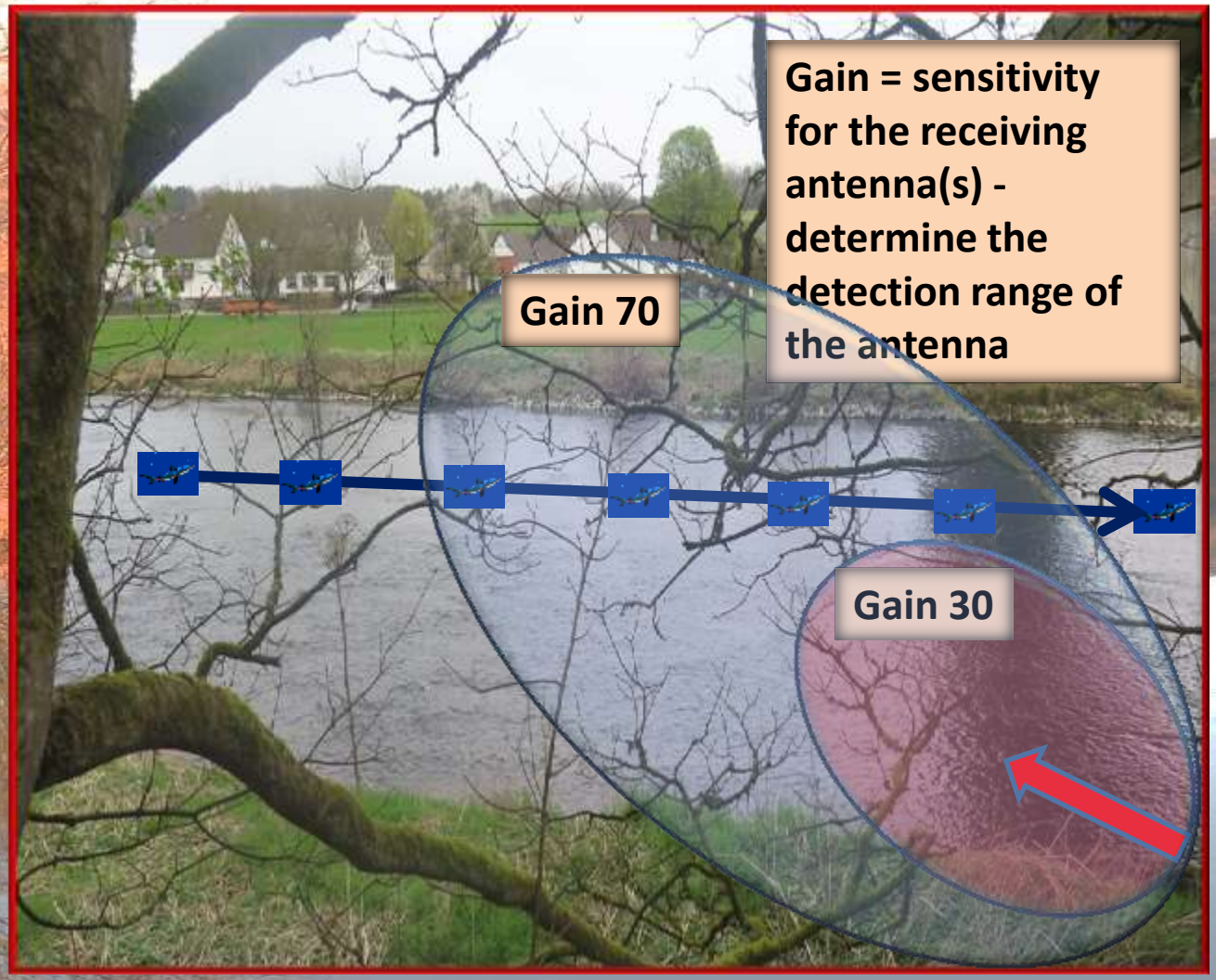
Total area effected

a) Reservoir
b) Power station
c) Tail race and below, covering dead fish drift

Trust in technology

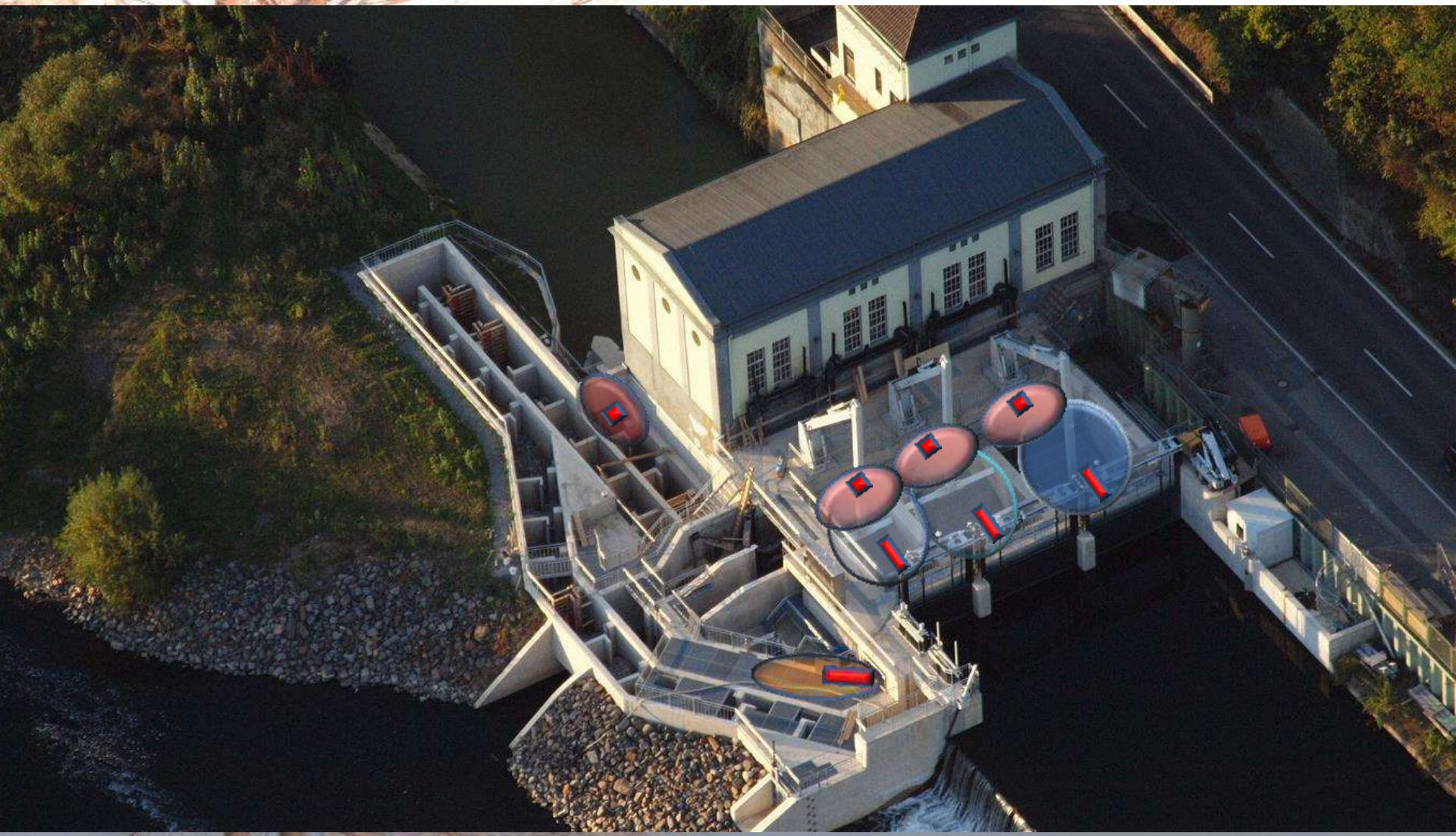
Tuning a single antenna station 1 and 2



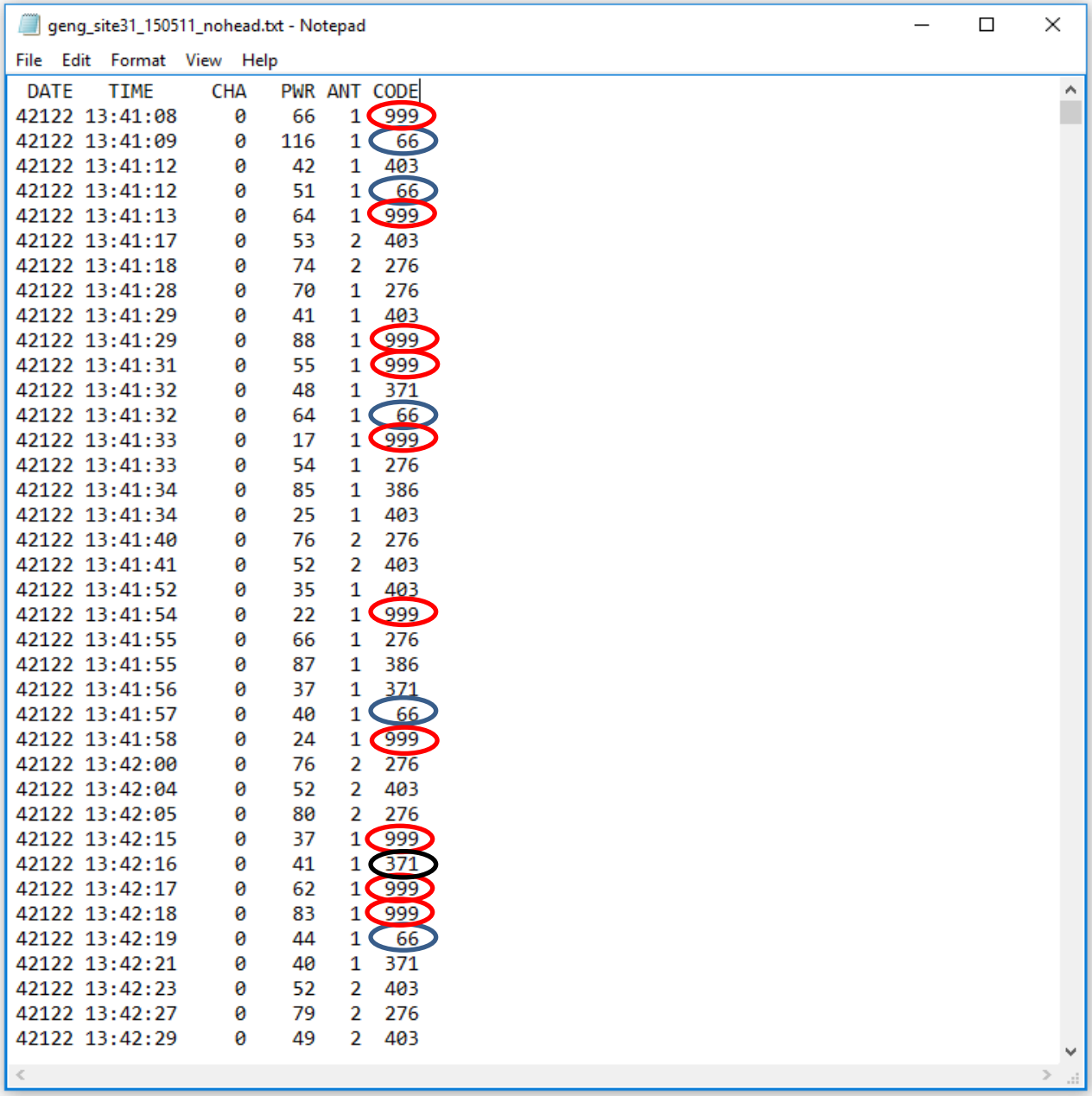


Unkelmühle Powerstation

Recording migratory routes



Raw data recorded, millions of data

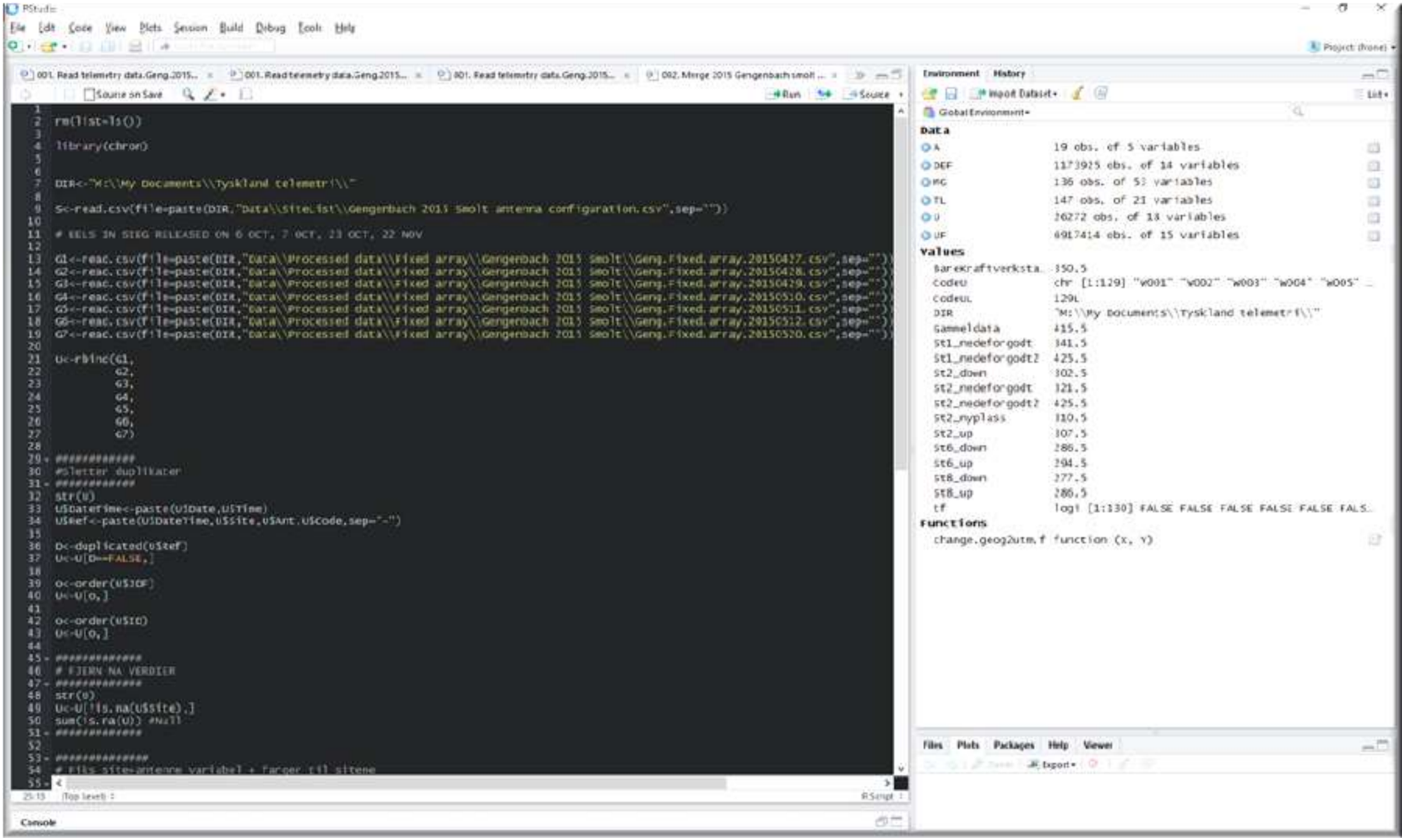


Valid codes

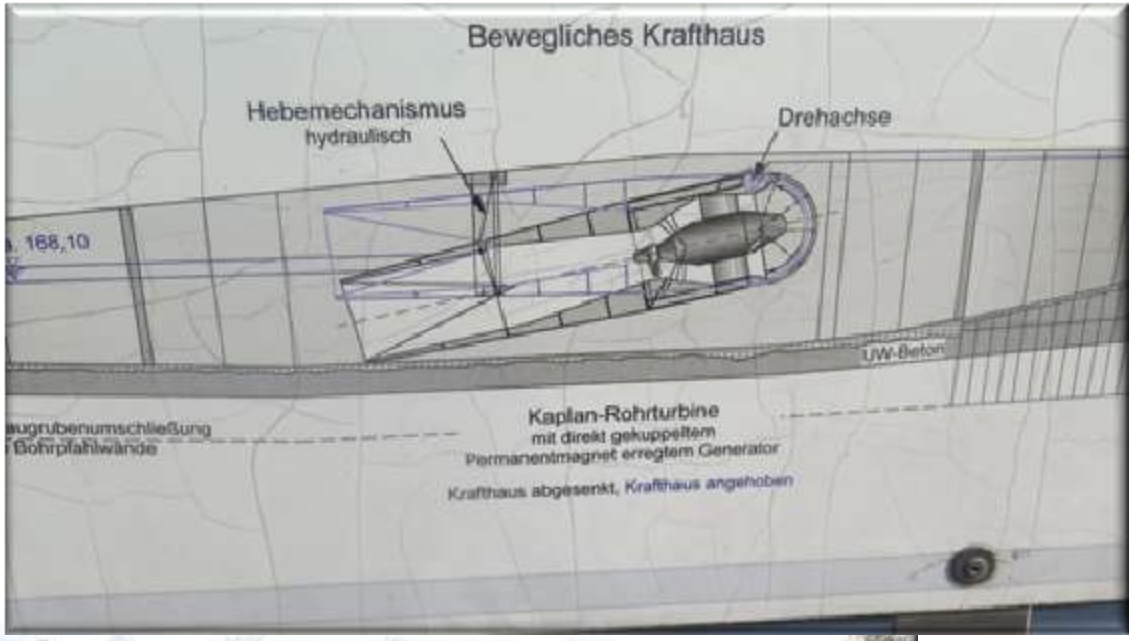
Code collisions

False codes

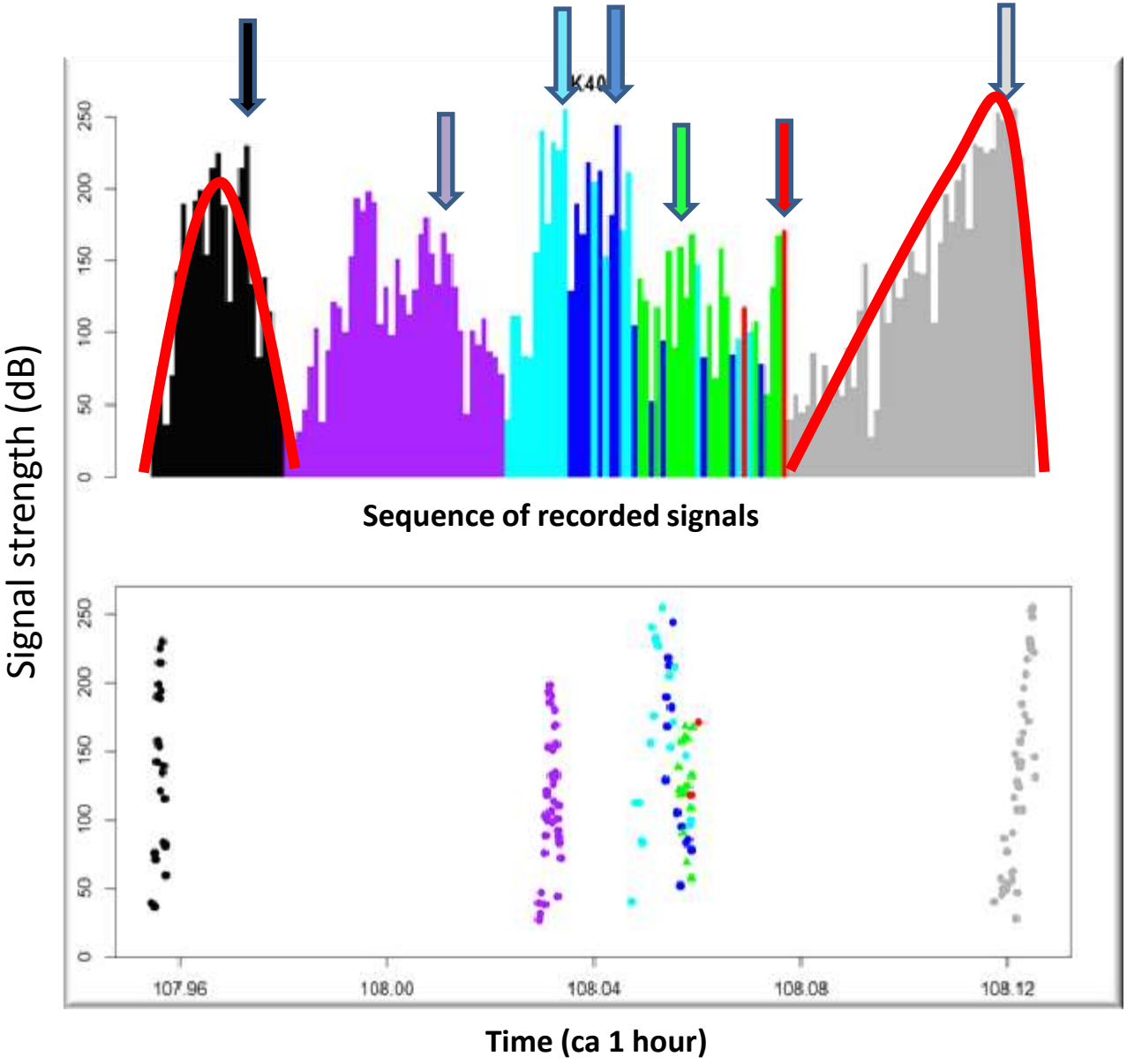
R-script developed for each site and location



Gengenbach, Kinzig



Surviving migratory smolt

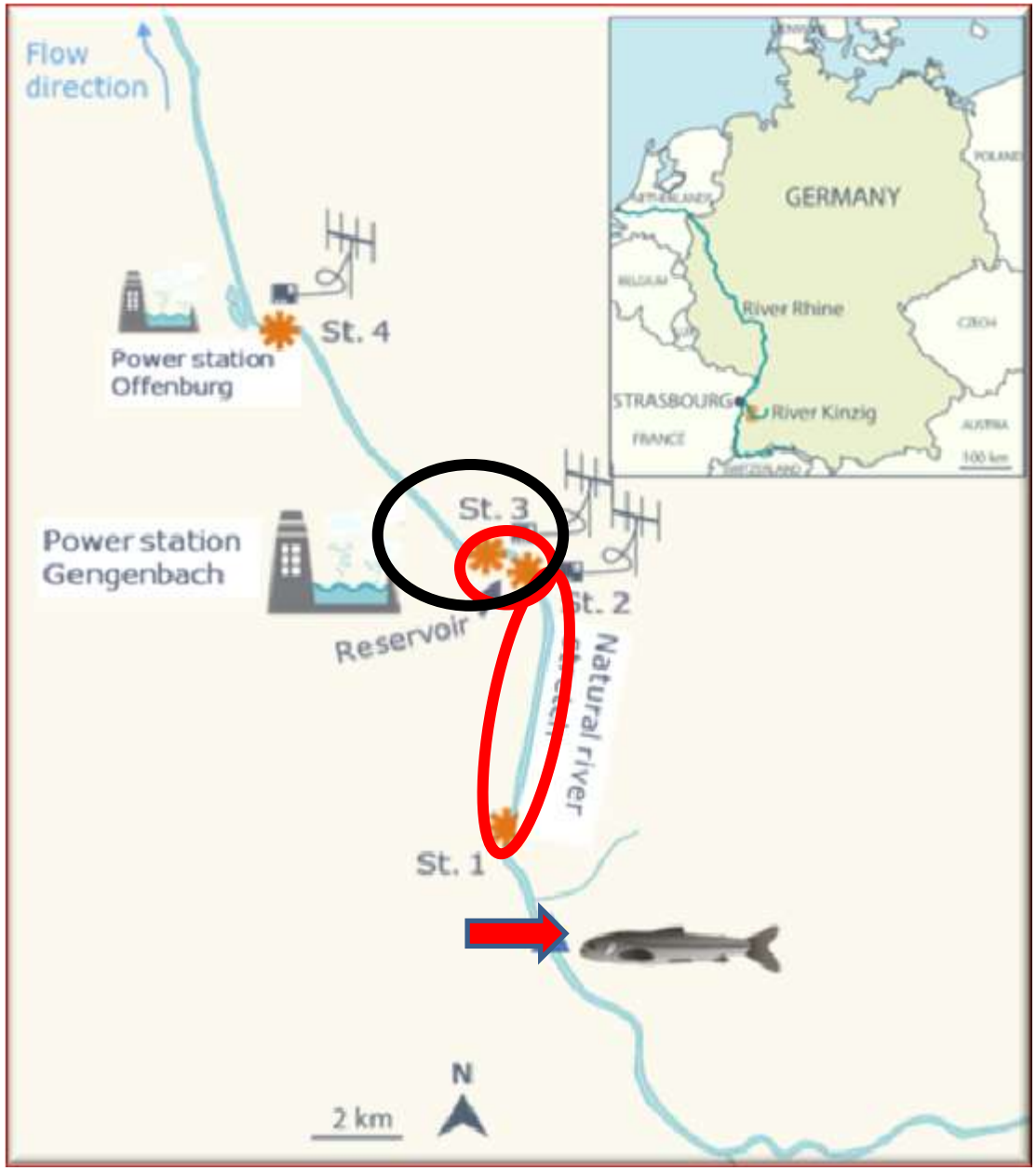


- Site 1
- Site 2
- Site 3, antenna 311
- Site 3, antenna 312
- Site 3, antenna 313
- Site 3, antenna 321
- Site 3, antenna 322
- Site 4

Site 1, entrance to unimpounded stretch
Site 2, entrance to reservoir
Antenna 311, entrance to power station
Antenna 312, entrance to turbine intake and fish way
Antenna 313, covering tailrace area across river
Antenna 321, covering tailrace area only
Antenna 322, covering fish way only
Site 4, next power station

Site 4

Project design for recording loss associated with Gengenbach power station



Control stretch

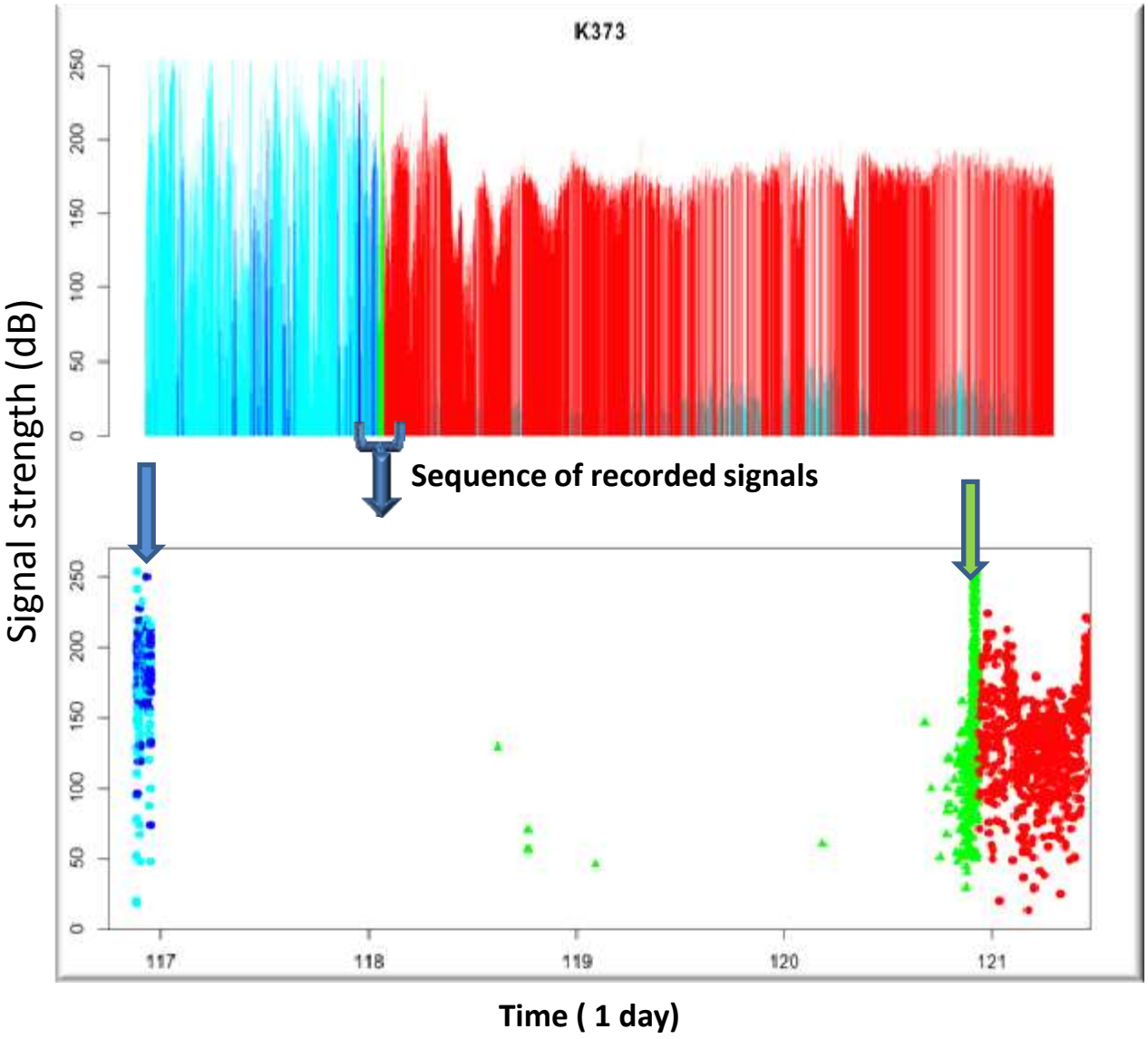
Impounded Stretch –

a) Reservoir
b) Power station

Total area effected

a) Reservoir
b) Power station
c) Tail race and below, covering dead fish drift

Zoom på
373



- Site 1
- Site 2
- Site 3, antenna 311
- Site 3, antenna 312
- Site 3, antenna 313
- Site 3, antenna 321
- Site 3, antenna 322
- Site 4

Site 1, entrance to unimpounded stretch
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Antenna 313, covering tailrace area across river
Antenna 321, covering tailrace area only
Antenna 322, covering fish way only
Site 4, next power station

- **How hard can that be??**

1. **The technical solution we decided to use worked very well**
2. **The data analyses must be a combination of R scripts and manual interpretation**
3. **The fact that dead fish do drift in combination with fish being predated and removed can make reliable loss estimates impossible, 2 eel sites.**
4. **Different mathematic models was needed for all 3 power stations to estimate smolt losses**
5. **Communicating results to all stakeholders sometime with conflicting interests can be demanding but is now working well.**

- **Very hard indeed**

Thank you