

The Sound of Rivers

THANKS KLEMENT!



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The Sound of Rivers

Talk Outline

- Sound Plots
- Flume Study
- River Studies
- Summary



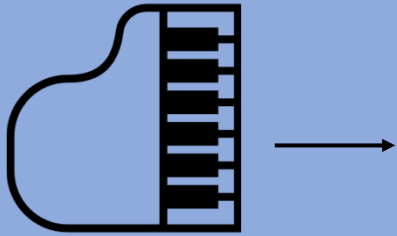
River Sound

Product
of
Turbulence
&
Sediment Particle
Collisions

Dr. Mark Lorang, Chief Science Officer, Freshwater Map, email: mark@freshwatermap.com
Dr. Diego Tonolla, Zurich University of Applied Sciences (ZHAW) Switzerland, email: tono@zhaw.ch

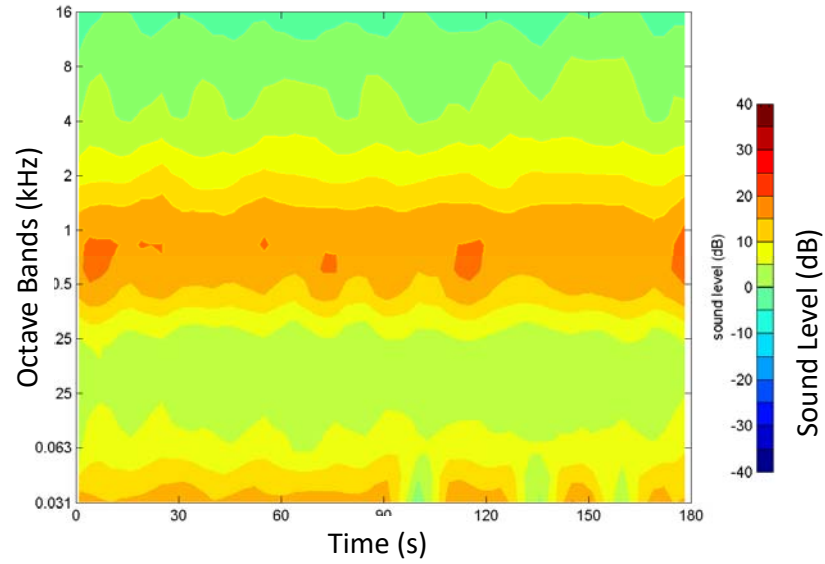


High Sounds

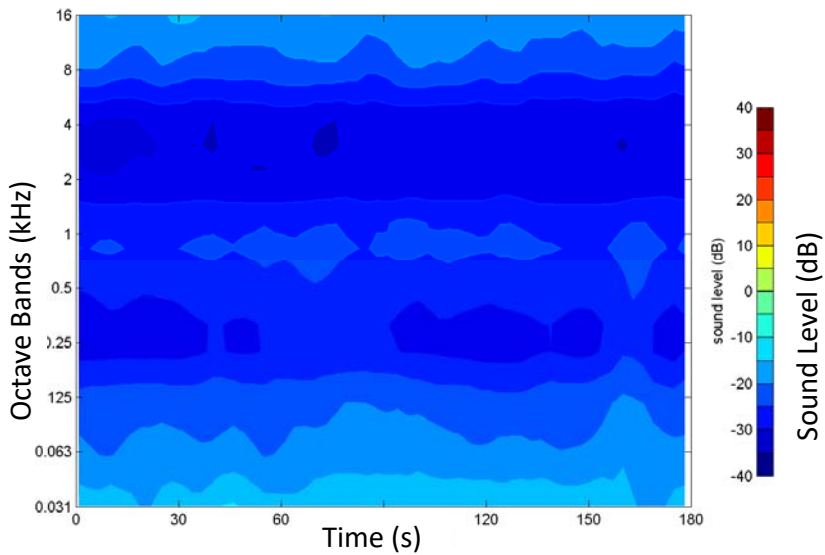


Low Sounds

Colors = Sound Level

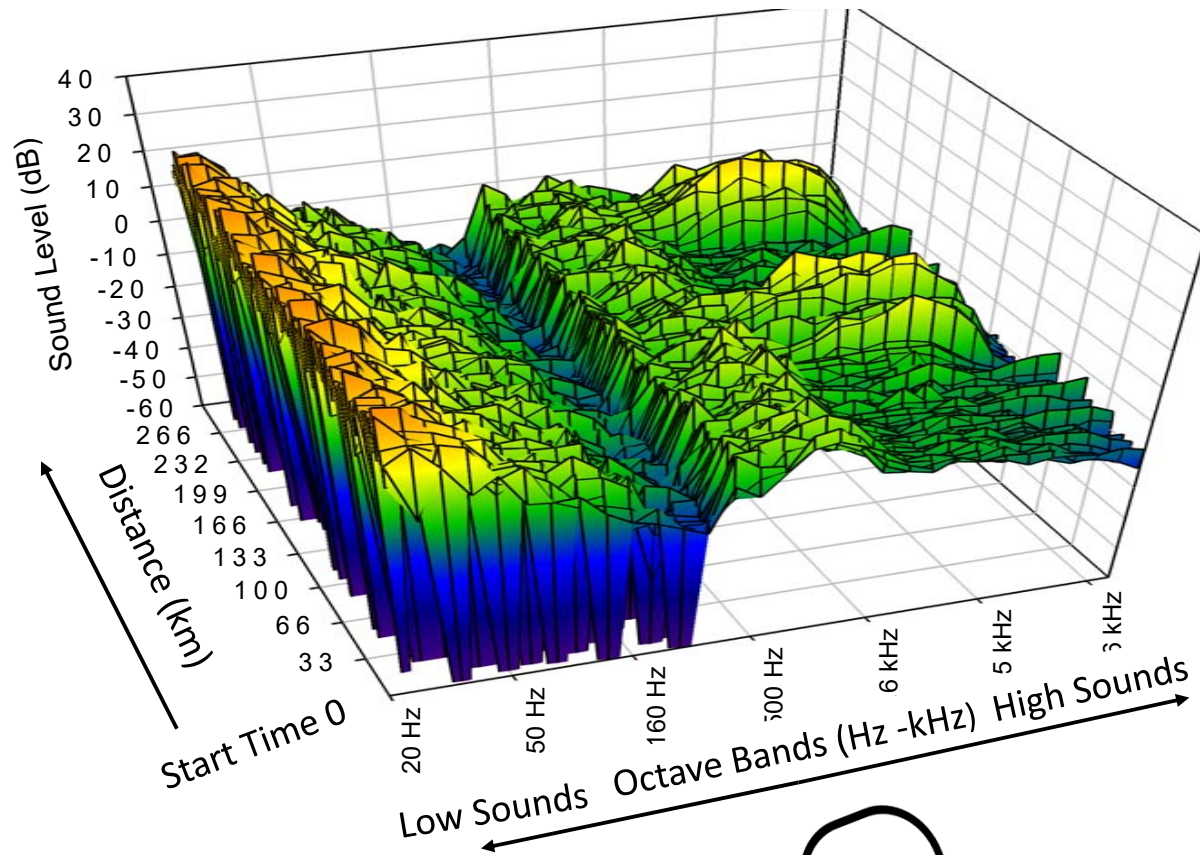


Rattle



Pool

3D Sonogram – (River Reach)



Colors & Height of Peak = Sound Level

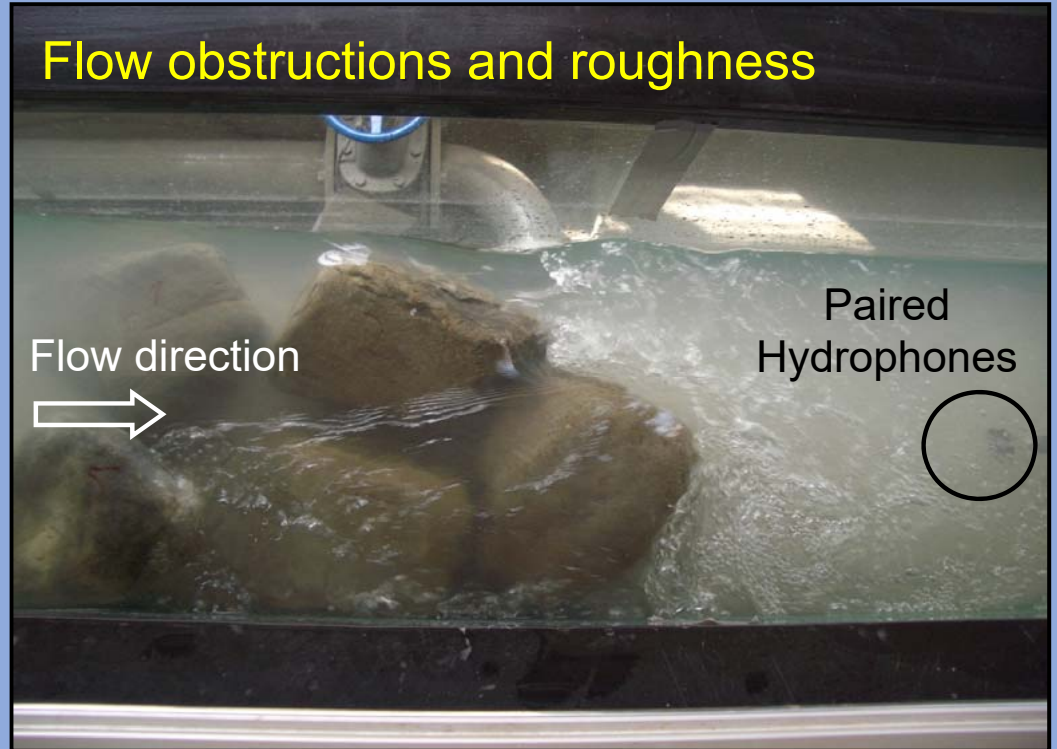


Flume Study

Artificial flume



Flow obstructions and roughness



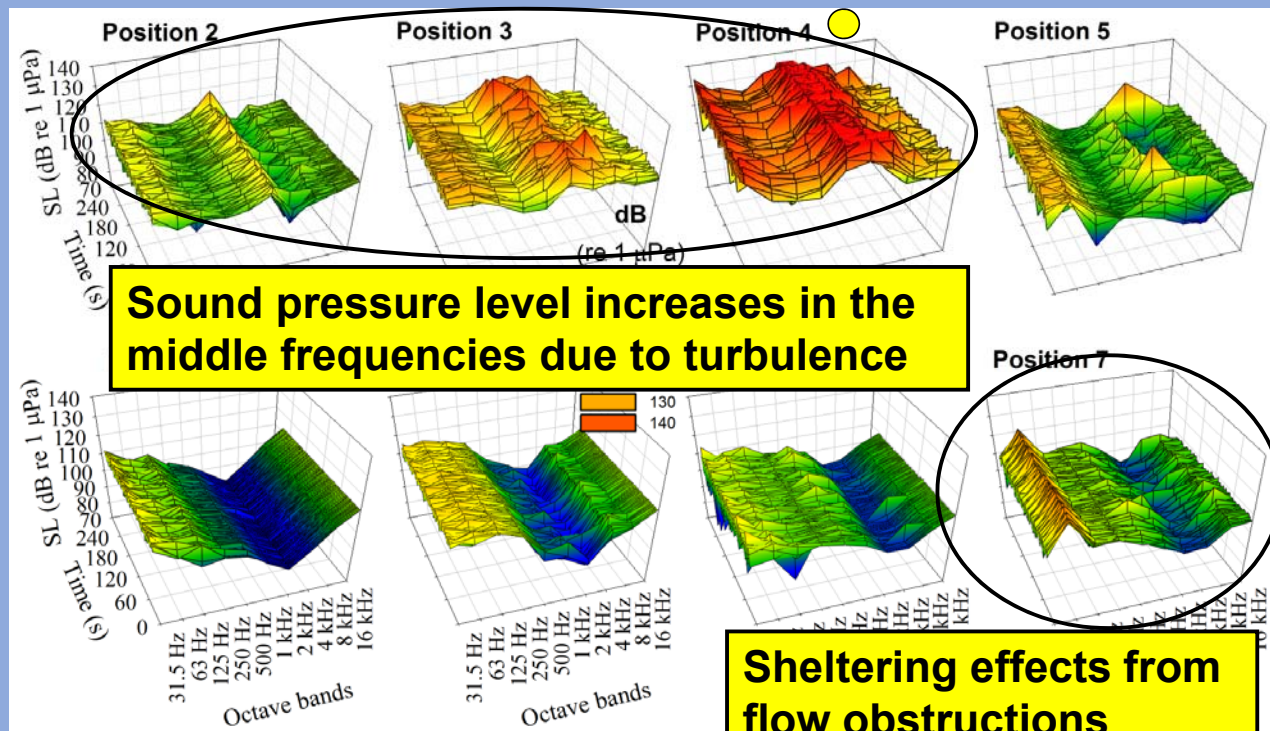
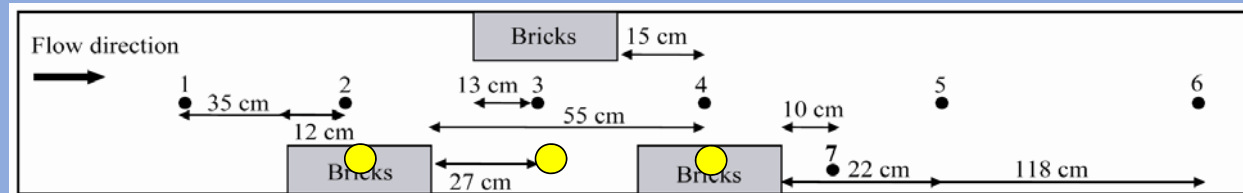
Tonolla et al. 2009. *Aquatic Sciences* 71: 449-462

Flume Study Results

TAKE HOME VALUE

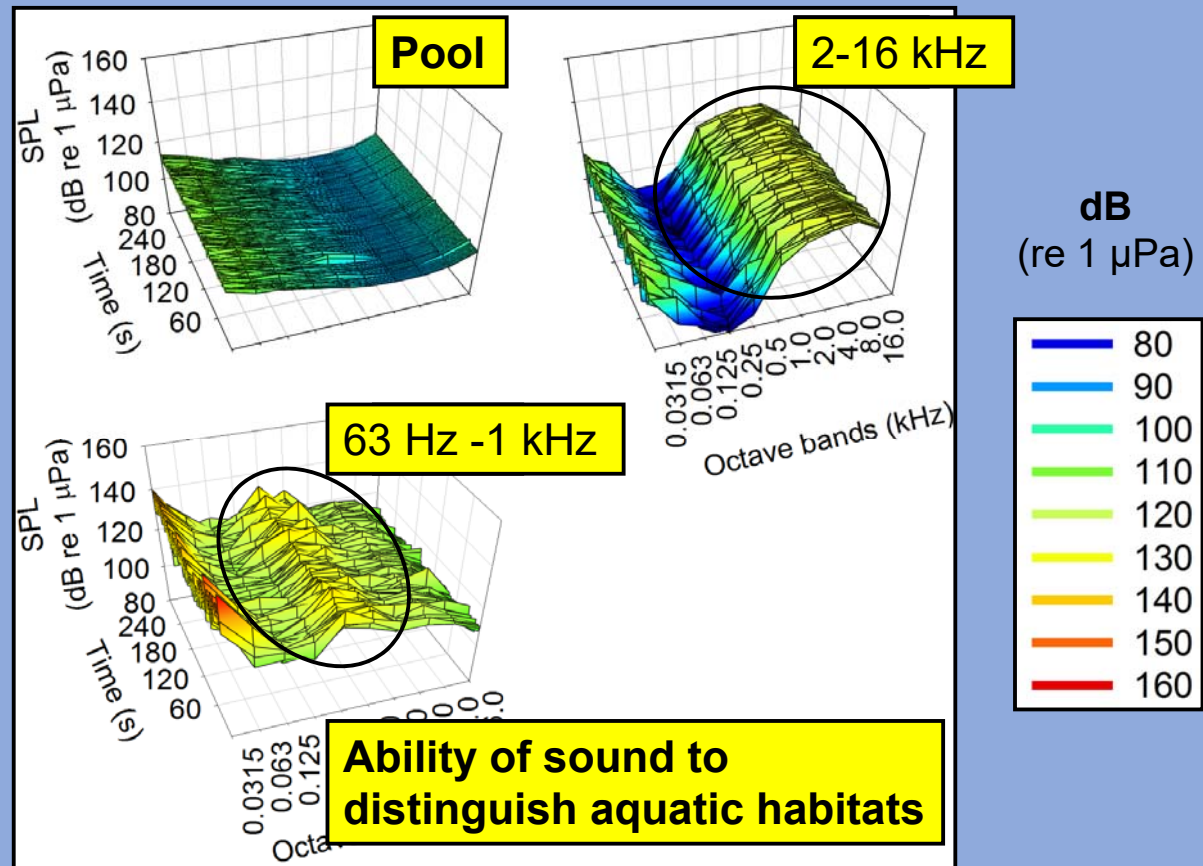
Not white noise!

Where you place the hydrophones is important.



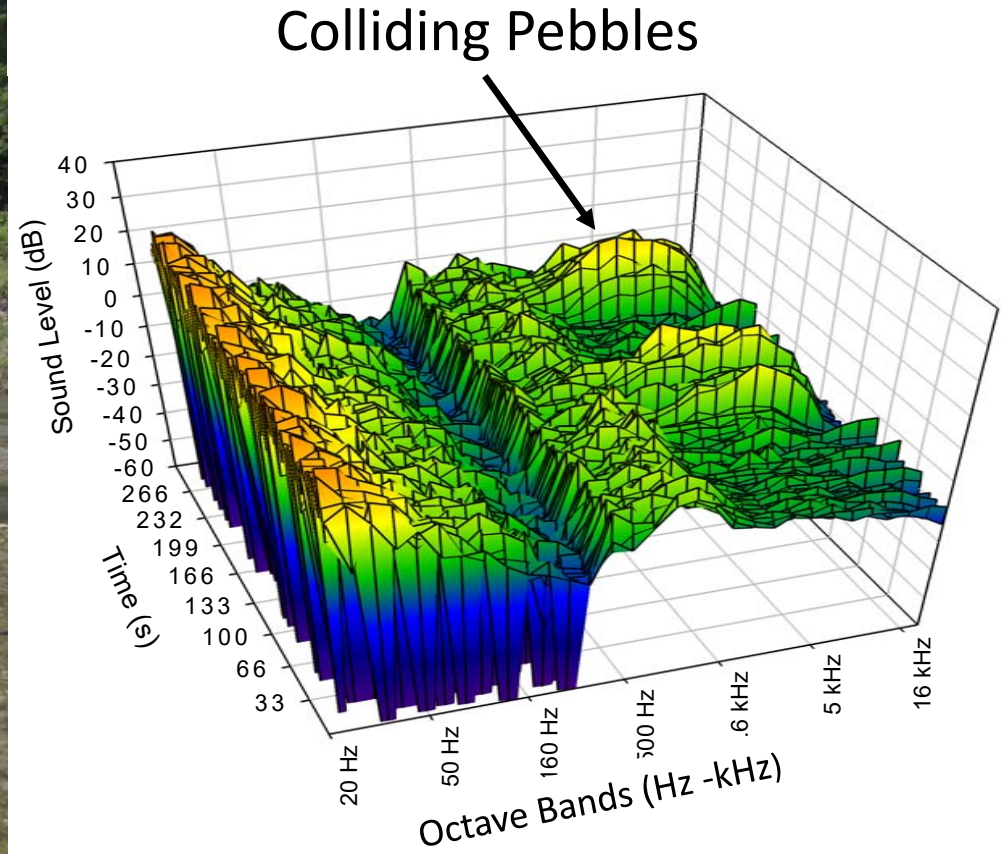
Tonolla et al. 2009. *Aquatic Sciences* 71: 449-462

Early Field Observations



Early Field Observations

Tagliamento River Italy: Riffle



Go With The Flow

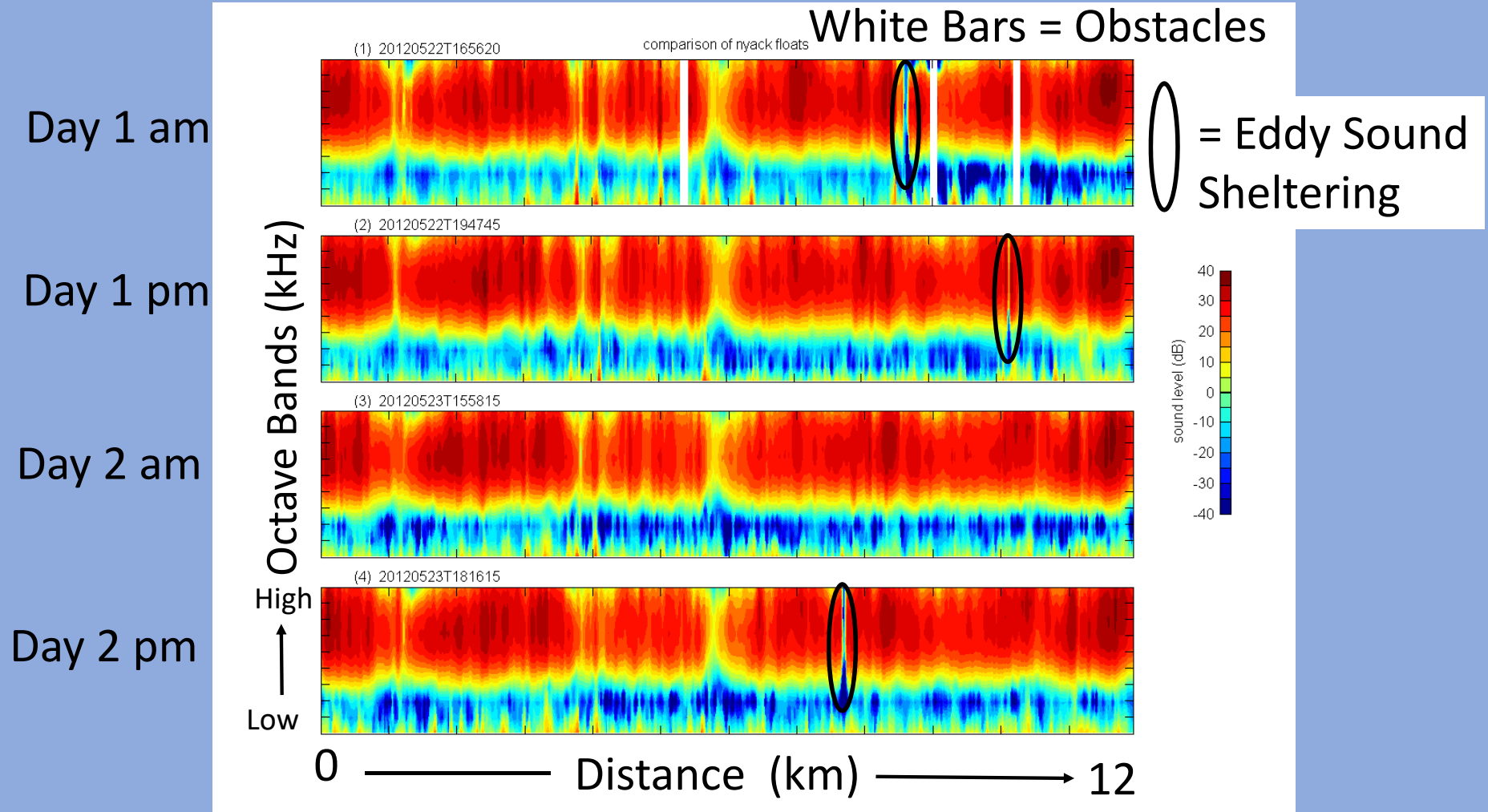


Acoustic Doppler Profiler
Hydrophones

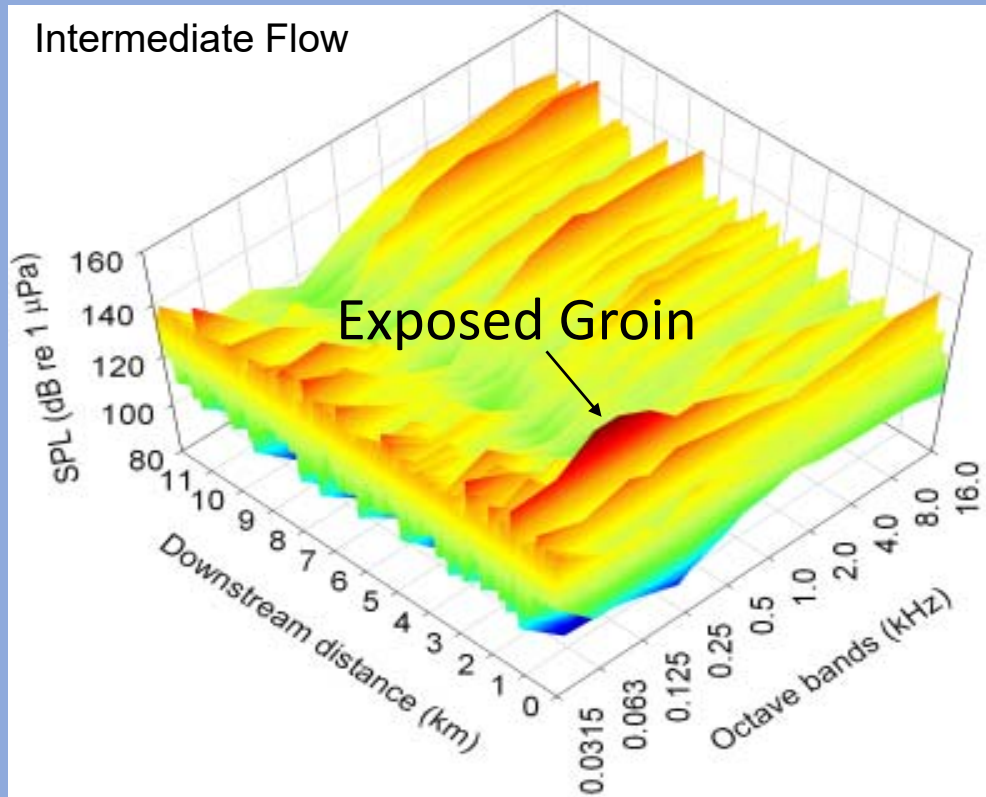


Photo: Tom Gonser

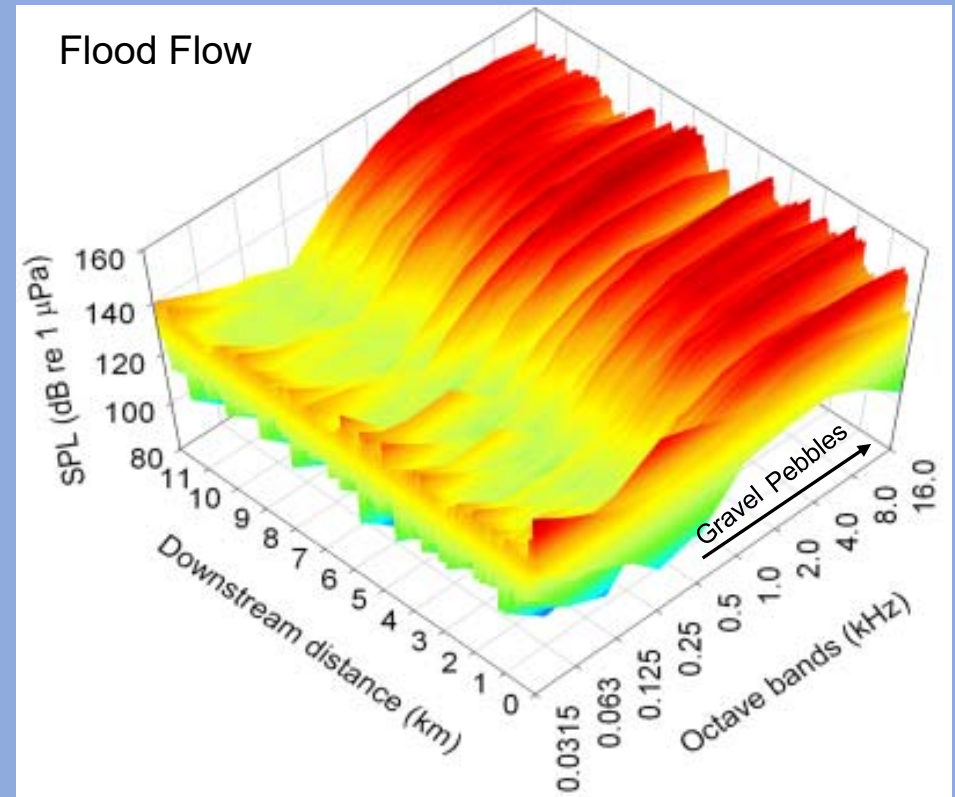
Very High Repeatability (Flood Conditions)



Some Gravel Transport

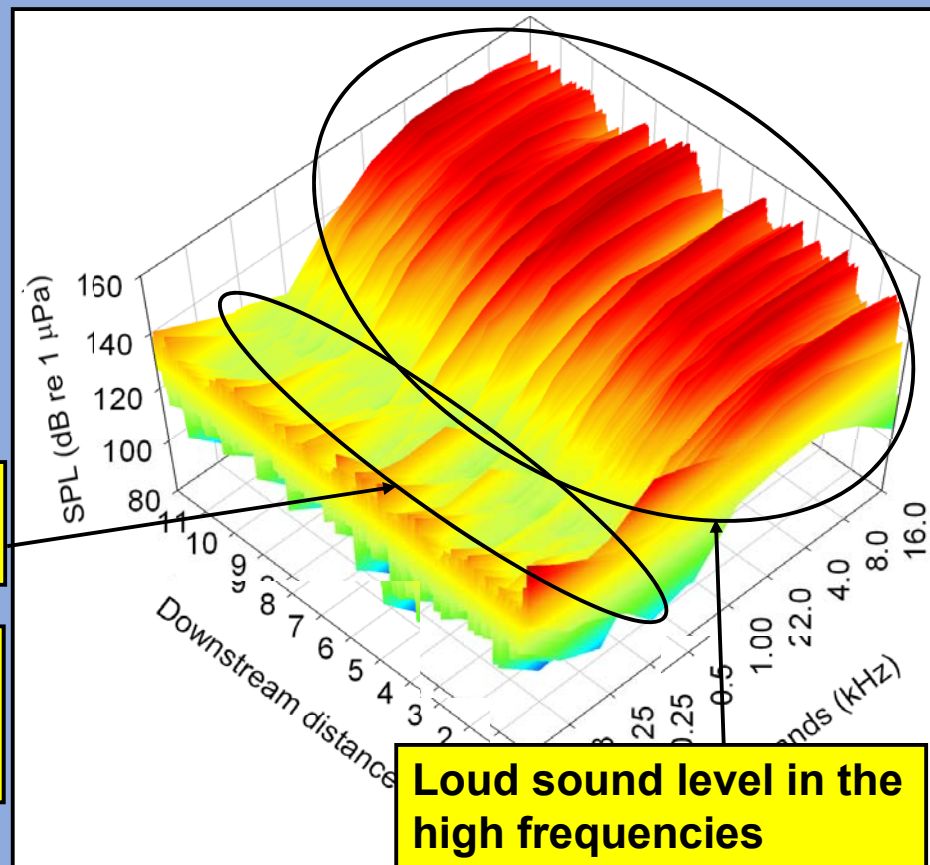


Mobile Bed Everywhere



Tonolla et al. 2011. *Limnology and Oceanography* 56: 2319-2333

River Sounds and Fish Hearing



Up to 160 dB (= 134 dB in the air)

Gravel Transport During a Flood is Very Loud!

Some fish species can detect sound at frequencies up to 180 kHz

Loud sound level in the high frequencies

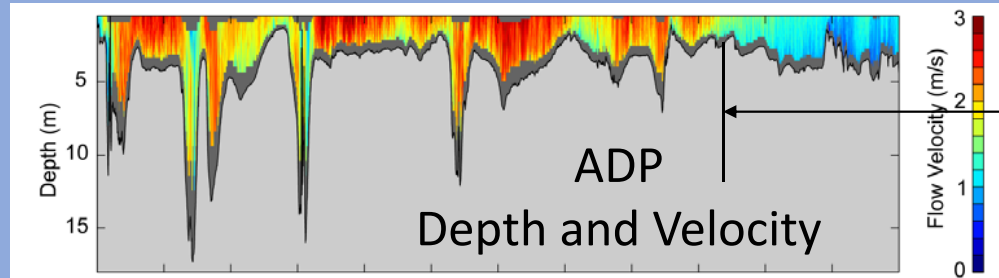
Low sound level in the middle frequencies

This coincides with the sensitive hearing range of many fishes

Tonolla et al. 2011. *Limnology and Oceanography* 56: 2319-2333

Kootenai River, Idaho Below Libby Dam

Mid-Channel Transect



Lorang, M.S. and D Tonolla (2014) ***Special Issue: Fundamental and Applied Limnology: Frontiers in real time ecohydrology.***

SUMMARY

- Where you put your hydrophone in a river is important.
- Not white noise everywhere, very distinct soundscapes per habitat.
- Floating down a river is a quick and easy way to measure soundscape and it is very repeatable.
- Because soundscape measurement is repeatable and can uniquely identify aquatic habitats it could be useful in monitoring restoration activity or habitat change relative to a change in flow and at large scales
- Soundscape measurement is an economical way to monitor flushing flows from dams aimed at sediment transport targets.

Questions?

