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
3D Sonogram – (River Reach)

Colors & Height of Peak = Sound Level
Flume Study Results

TAKE HOME VALUE

Not white noise!

Where you place the hydrophones is important.

Sound pressure level increases in the middle frequencies due to turbulence

Sheltering effects from flow obstructions

Early Field Observations

Ability of sound to distinguish aquatic habitats

Tonolla et al. 2010. Hydrological Processes 24: 3146-3156
Early Field Observations

Tagliamento River Italy: Riffle

Colliding Pebbles

Sound Level (dB)

Flow Direction

Octave Bands (Hz -kHz)
Go With The Flow

Hydrophones

Acoustic Doppler Profiler
Very High Repeatability (Flood Conditions)

Day 1 am
Day 1 pm
Day 2 am
Day 2 pm

White Bars = Obstacles

= Eddy Sound Sheltering

Octave Bands (kHz)

Distance (km)
Some Gravel Transport

Exposed Groin

Intermediate Flow

Mobile Bed Everywhere

Flood Flow

Gravel Pebbles

River Sounds and Fish Hearing

Low sound level in the middle frequencies
This coincides with the sensitive hearing range of many fishes

Loud sound level in the high frequencies

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

Kootenai River, Idaho Below Libby Dam

Mid-Channel Transect

Backwater effect from Kootenay Lake

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?