

FISHCONSULTING

GmbH

Effects of barriers on fish and outcome of barrier removal in Switzerland



Armin Peter, Dr. FishConsulting GmbH, Hagmattstr. 7, 4600 Olten/Switzerland e-mail: <u>apeter@fishconsulting.ch</u> www.fishconsulting.ch May 4 2021, Dam removal goes Alps 2021 – S.1.3: Effects of barriers on fish populations



Outline

- Fragmentation of rivers in Switzerland
- Effect of barriers
- Need for migration
- Case studies from Switzerland



Fragmentation of rivers in Switzerland

- existence of 100800 artificial barriers > 0.5 m (average free migrating distance is 645 m long)
- several 100000 artificial barriers < 0.5 m
- many tributaries are disconnected



Hydropower • 156 big dams

- > 1'600 power plants
- residual flow:
 - 1'400 water abstractions
 - for hydropower use
- hydropeaking in every forth river







map: Federal Office for the Environment

effects of barriers 4.5.2021 - Armin Peter

Effects of dams

- Changes in water flow and sediment transport
 - Altered flow seasonal inversion of hydroperiod
- Altered thermal and chemical regimes
- Barriers to fish migration and loss of system connectivity
 - Genetic consequences of fragmentation
 - Fish passage at dams
- Community and ecosystem impacts of dams
 - Alteration of fish assemblages

Major impacts from dams

- Water quality including sediments
- Habitat quality
- Flow velocity (slow rivers)
- Migration blockage or retardation
- Alteration of biological communities

Impact on biodiversity and ecosystem function



Potamodromous species





barbel

whitefish

nase



lake resident brown trout

Fish can't fly – but they can jump



in meters	
3.65	Mills 1971
3.3	Reiser & Peacock 1985
1.45	Merwald 1986
> 0.25	Ammann 2006
0.85	Ovidio et al. 2002
0.4	Lucas & Frear 1997
0.27	Holthe et al. 2005
0.4	Lucas et al. 1998
	in meters 3.65 3.3 1.45 > 0.25 0.85 0.4 0.27 0.4

jumping height

Species

FISHCONSULTING

GmbH

Reference



Aare River: Hydropower plant Bannwil downstream migration

Downstream passage at a hydropower plant



effects of barriers 4.5.2021 - Armin Peter

FB



FISHCONSULTING GmbH







effects of barriers 4.5.2021 - Armin Peter







radiotelemetry transmitter







length-frequency histrogram
of barbels
47 individuals tagged in December 2019
10 individuals tagged in April 2019

20 barbels migrated downstream and passed the HP (43 %) 19 used the turbine - 1 used the spillway fishpass was not used as downstream migration corridor!!!!

All barbels migrated down within 28 days, however 70 % within 2 days effects of barbels migrate at night



dam removal in Switzerland Aare River Schönenwerd

Rückbau Ballyschwelle – Aare

Ausgangslage August 2017





removal of a partial dam: Sihlpost-dam, River Sihl Zurich



www.engineering-group.ch

www.damremoval.eu

effects of barriers 4.5.2021 - Armin Peter

Dam removal in Switzerland – Wyna River: block ramp



successfull passage for small-sized fish species (PIT-tagging experiments)

effects of barriers 4.5.2021 - Armin Peter



block ramps with low gradients (2-3 %) are passable for small-sized fishes e.g. bullhead (indicator for weak swimmers)



Binnenkanal - Liechtenstein: Alpine Rhine Valley

effects of



before



effects of barriers 4.5.2021 - Armin

Peter



28.9.2012: + Coregonus sp. total of 19 fish species





Conclusion

- dams and barriers have high impacts on habitat and river connectivity
- dams alter fish assemblages
- functioning migration corridors are needed
- positive reaction of fishes after removal of small dams and barriers
- colonization depends on nearby species pools



FISHCONSULTING GmbH

