REGULATED RIVERS RESEARCH PROGRAMME 2011-2016

www.rktl.fi/english/fish/regulated_rivers/



"FISHWAYS & NETWORKING"



European Union European Regional Development Fund IEA – Implementing Agreement for Hydropower Technologies and Programmes Teppo Vehanen Finnish Game and Fisheries Research Institute FGFRI

Content of the presentation

- 1. Status of migratory fish species in Finland
- 2. Finland's National Fish Passage Strategy
 - Main themes
 - Priority sites

3. Regulated Rivers Research Programme 2011-2016

- Content and organisation
- Course of action



Baltic salmon - past and present

- Atlantic salmon in the Baltic Sea
 - Vulnerable
- Anadromous whitefish
 - Endangered
- Sea trout
 - Critically endangered
- Eel
 - Endangered
- Landlocked Atlantic salmon
 - Critically endangered
- Brown trout (southern)
 - Threatened
- River lamprey
 - Threatened

Migratory fish species are in trouble!





Why? – for multiple reasons

- High fishing pressure
- Dredging (flood control, timber floating)
- •Land use (e.g. agriculture, peat mining)
- •Water quality problems (diffuse loading, industrial)
- etc., but

Most of Finnish rivers are regulated or otherwise heavily modified

- In total, c. 159 000 km rivers in Finland
- Pristine/near pristine 10%
 - ≥50 km river stretch without dam in upstream
- Activities
 - Hydroelectric powerplants
 - Long- and short-term regulation
 - Dams



But there is some light in the window

- Number of upstream migrating spawners has been increasing
- Effect of new fishing regulations?
- Environmental improvements?



Date



FINLAND'S NATIONAL FISH PASSAGE STRATEGY

- Prepared by the Ministry of Agriculture and Forestry
- Contributes to the implementation of the Finnish Governmental Programme 2011-2015.
- Follows the first 3 periods of the water management plans (2010–2027).
- **OBJECTIVES**
- The focus of actions will be transferred from fish stocking to maintaining and restoring the natural reproductive cycle of fish.
- VISION
- Viable migratory fish stocks breed in the wild, ensuring the preservation of biodiversity and allowing sustainable fishing.



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Strategy themes

- 1. Multiple objective analysis and prioritisation of fishway sites
- 2. Increasing co-operation (incl. funding issues)
- 3. Targeting the stocking obligation to supporting the natural life cycle of fish
- 4. Consideration of the migration and reproduction of fish in developing regulating practices
- 5. Developing fishing regulation to ensure the migration of fish
- 6. Increasing research and monitoring
- 7. Implementation of other measures to revive and protect the migratory fish stocks
- Concrete measures and responsible organizations in each theme





PRIORITY SITES FOR FISHWAYS

- 55 dams in 20 rivers
- Based on suggestions from regional fishery authorities
- Assessment based on

✓ ...

- ✓ natural stocks available
- ✓ endangerment status
- ✓ habitats available
- Baltic salmon, sea trout, landlocked salmon, brown trout



REGULATED RIVERS RESEARCH PROGRAMME



Conducted in 2011-2016 Fish Stocking Research Programme 2006-2012









Elinkeino-, liikenne- ja ympäristökeskus

METSÄHALLITUS





Euroopan unioni Euroopan aluekehitysrahasto



CONTENTS ?

Multidisciplinary information for comprehensive decision making

COMPREHENISIVE RESEARCH AND CO-OPERATION

LIFE CYCLE STAGE OF SALMONID FISH	PROBLEMS	SOLUTIONS	PARTNERS	RESEARCH
ASCENDING POPULATION	- MIGRATORY BARRIERS - FLOW REGULATION - OVERFISHING	+ FISHWAYS + FLOW ADJUSTMENT + FISHING RESTRICTION + STOCKING	 MINISTRY OF AGRICULTURE AND FORESTRY CENTRE FOR ECONOMIC DEVELOPMENT, TRANSPORT AND FOR THE ENVIRONMENT WATER POWER COMPANIES FISHERMEN ORGANIZATIONS, ASSOCIATIONS TOURISM BUSINESS LAND OWNERS FINNISH FOREST AND PARK SERVICE AGRICULTURE, FORESTRY, PEAT MINING 	DOMESTIC COOPERATION - FGFRI - FINNISH ENVIRONMENTAL ADNINISTRATION - FINNISH FOREST RESEARCH INSTITUTE - UNIVERSITIES INTERNATIONAL COOPERATION - SWEDEN - NORWAY - RUSSIA - CANADA - USA
SPAWNING FISH	- LACK OF SPAWNING FISH	+ FISH MOVEMENT ABOVE DAMS + STOCKING + RIVER RESTORATION		
EGGS	- POOR QUALITY OF WATER	+ WATER POLLUTION CONTROL		
JUVENILES	- SHORTAGE OF NURSERY AREAS	+ RIVER RESTORATION + FLOW ADJUSTMENT		
SMOLTS	- PREDATION - MIGRATORY BARRIERS	+ PREDATOR REMOVAL + FISH LOUVERS		



> MULTIDISCIPLINARITY IN RESEARCH PROGRAMME



Different combinations of biological, technical and socioeconomical studies



RESEARCH SERVICES AVAILABLE

TOPICS

- Biological studies
- Socioeconomical explorations
- Multicriteria assessment for decision making

STRENGTHS

- Wide domestical & international co-operation
- Staff with technical knowhow and experience
- Modern technology (radio telemetry, PIT, Didson, Simsonar)
- Existing equipment



Optimal location of the fishway entrance?

- Radio-telemetry (FGFRI)
 - Fish behavior in power station tailraces
- 2D- and 3D-discharge models (Markku Lahti/Fortum)
 - Prevailing discharge and turbulence conditions



- Can we find general behavioral patterns of fish in tailrace areas during different conditions ?
- Can this data tell us where to locate fishway entrances or at least where not to locate them?
- How to use fishways and possible additional fishway discharges?





- Long-term telemetry data available (several months)
- Migration behaviour, migration end-points, resting areas, timing of migrations, back and forth movements, etc.
- Modelling the fish behaviour in relation to power station use



Simulation of fishway discharge in relation to power plant discharges



- Possible to model different discharge situations (fishway and turbines)
- Modelling of fish (discharge) guiding options (Kluber ym. ISE2012)



Connectivity problems in downstream smolt migration



Can smolts survive trough multiple power plants?

- River Iijoki, 5 power plants at the lowermost 54 km
 - Radio-tagging of salmon smolts
 - Migration behavior and survival in natural and regulated river sections
 - Turbine mortality and predation
 - Hatchery fish + semi-wild fish







Results II



- 2.6 % of hatchery smolts migrated trough 5 power plants (n=39)
- Direct turbine mortality 0.0-16.7%
- High and variable mortality at reservoirs
 - e.g. 22.6 % and 42.6 % in a reservoir of 18 km in 2010-2011



Conclusions

- Significant problems during the downstream migration of smolts
 - Survival trough multiple power plants is extremely low
 - Migration motivation trough power plants is weak
 - Power plants are significant obstacles for smolts
 - Direct turbine mortality is reasonably low
- Restoration of salmon populations is highly dependent on securing the downstream migration of smolts
 - Upstream fishways are not enough
 - Guiding devices may be needed for fast and successful by-pass of smolts at power plants



Raasakka

Turbine intake can be located very deep, >10 m !



Population modelling

- Life-cycle model
 50 years
- Assumptions
 - Fishways and downstream guiding "fences" built
 - -Juvenile stocking 1-12 y
 - The age size distribution of salmon stock is "constant"
- Adjustable parameters
 - Fishing mortality
 - Open sea-, coastal- and river fisheries
 - Egg to smolt survival (habitat restoration)
 - Smolt survival (riverine)



The River lijoki and Kemijoki scenarios (5 dams)







The River Kymijoki scenario (1 dam)



Population modelling_conclusions

- Restoring migratory fish stocks in regulated rivers is possible
- The number of dams is a crucial issue
 - 1-2 dams is OK
 - ≥ 3 dams makes the restoration very challenging...
- A full scale support pallet is needed e.g. in Rivers Ii- and Kemi
 - Long-term support
 - Strong fisheries regulation
 - Partially natural stocks achievable
- The River Kymijoki is one of the most promising river for salmon stock re-building at the moment



AINUTLAATUINEN TILAISUUS JOKA TARJOAA TIETOA JA TEKNIIKKAA KALOJEN KULKUYHTEYKSIEN PALAUTTAMISEEN







 \star tutkimuslaitos sekä Suomen ympäristökeskus esittävät: \star **KALAMARKKINAT 2014**



vesitutkimus Oy