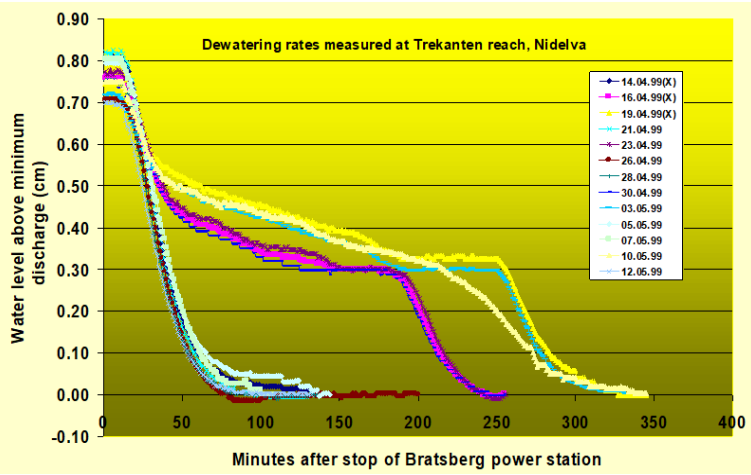
Hydropeaking impacts

Rapid changes in power **production** by hydropower plants as a consequence of varying electricity generation and **demand** on the electricity market.

- EFFEKT project: Focus on stranding of salmon and trout
- CEDREN EnviPEAK: Focus on other effects on fish and the aquatic ecosystem
- COSH Tool
- FIThydro: Hydropeaking Tool
- Link to flexibility in hydropower
- Ideas for collaboration

EFFEKT project

- The stranding risk varies with time of the year and part of the day. Dewatering in winter at daytime worst.
- Cold water, coarse substrate and high velocities resulted in high stranding rates.
- Gentle dewatering (<10-13 cm/hour) reduced stranding drastically, but did not eliminate stranding of 0+ brown trout.
- Gentle drops in discharge are particularly important after long stable flow periods, and in rivers with much cover.
- About 40 per cent of the fish did never strand after repeated rapid dewatering episodes.
- Daily flow fluctuations without reduction in wet perimeter, do not seem to cause stress for juvenile fih.
- Fish wait until the very last before they move!



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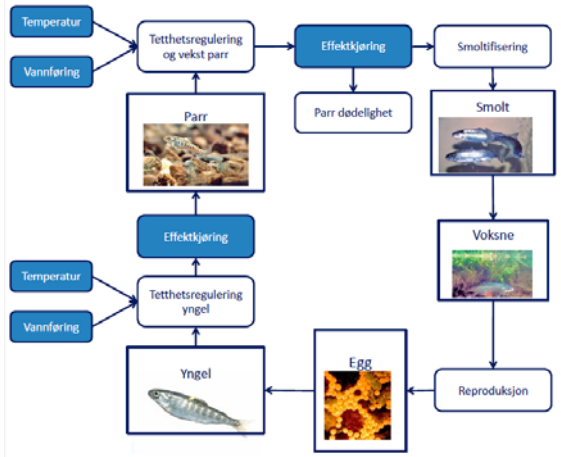
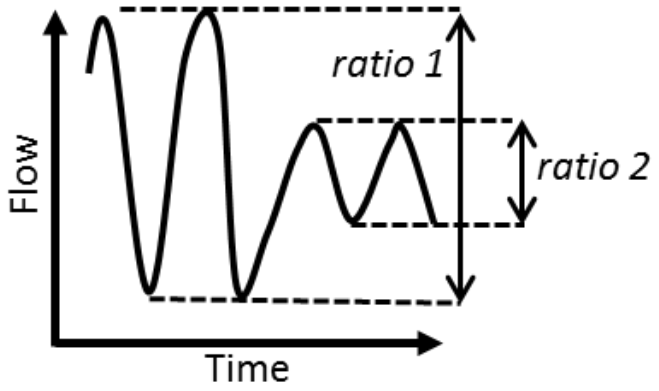
CEDREN EnviPEAK

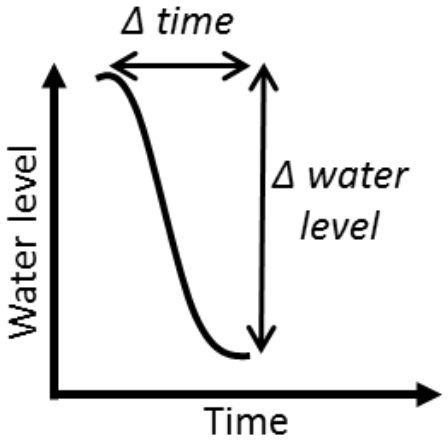
- Linking models for power production with peaking, hydrology, hydraulics, habitat and fish populations
- Impacts on physical processes: Substrate, hyporheic zone, water temperature, ice
- Impacts on invertebrate, mammals, birds and people
- Survivors of stranding in winter had significant less body mass – no effect in summer
- Relatively small effects on fish when stranding is avoided in strong fish populations
- Tools for analyzing flow variations and peaking impacts
- Mitigation measures to reduce impacts from peaking



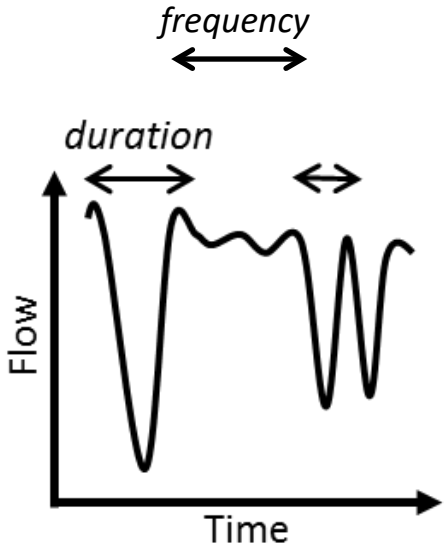
COSH Tool



Ratio



Rate of change



Duration
Frequency

COSH Tool is a software from SINTEF to analyse peaking flows and water levels

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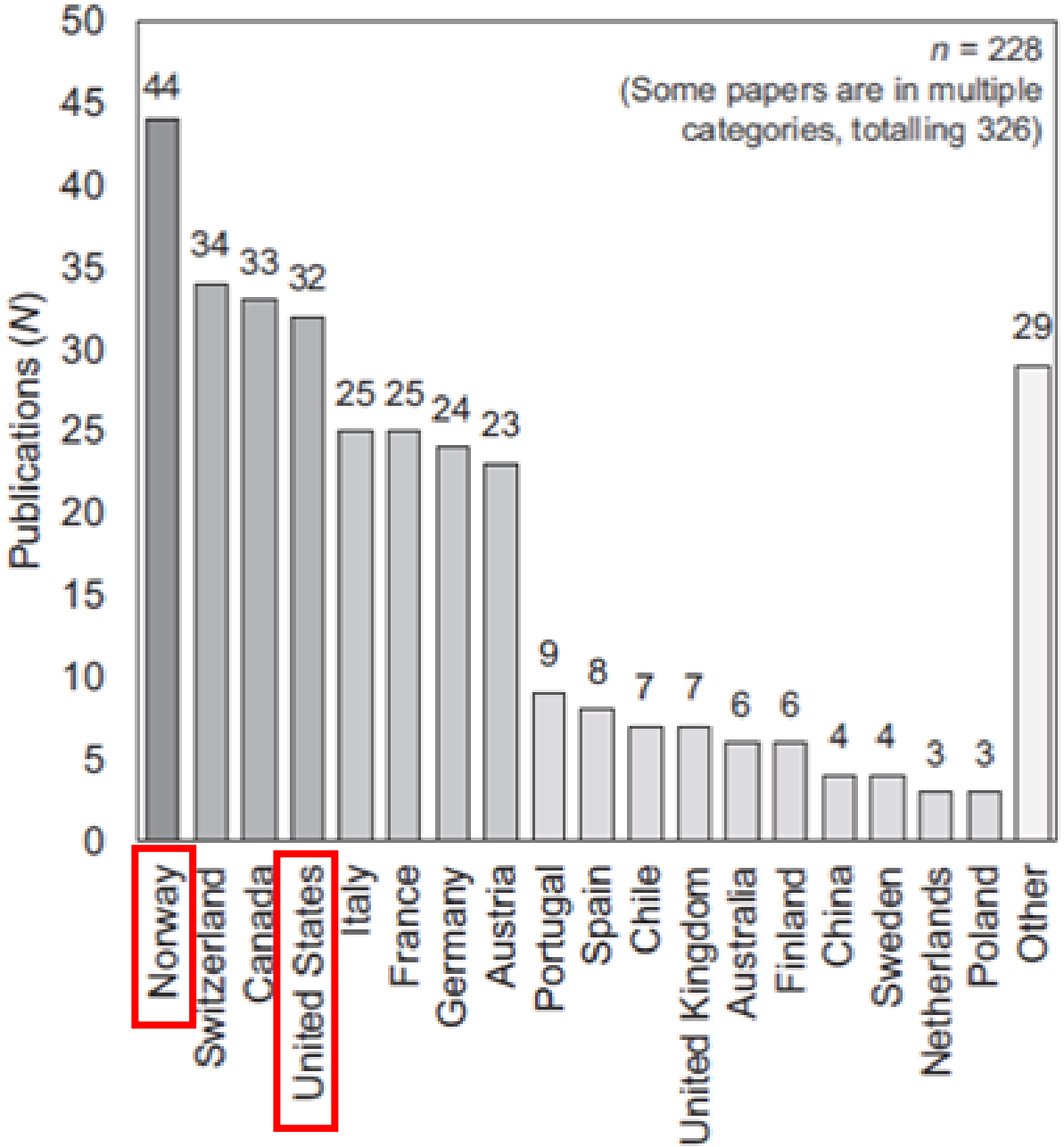

Number of papers in the literature on hydropeaking impacts (Moreiro et al 2019)

Fig. 1. Number of papers found in the Scopus database using the keywords "hydropeaking" and "hydro peaking", sorted by country/territory of author affiliation (the literature search includes results until September 2018 based on Title-Abstract-Keywords). "Other" includes: Belgium, Brazil, New Zealand, South Korea, Cyprus, Czech Republic, Denmark, Estonia, Greece, Hong Kong, Iceland, Japan, Croatia, Malaysia, Slovenia, Taiwan, and undefined.

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FIThydro Hydropeaking Tool

Salmon, grayling, barbel

Starting point: Regulated river without peaking

Vulnerability

- How vulnerable is the fish populaton to the additional impact of hydropeaking

- How strong is the additional effect of peaking operations compared to hydropower production without peaking?

Effects

Support for decisions:

Vulnerability	Hydropeaking effects: Very large 21-32	Large 15-20	Moderate 10-14	Small 4-9
High 16-21				
Moderate 10-15				
Low 4-9				

Combinations of hydropeaking effects and vulnerability for total impact assessment

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Ideas for collaboration – impacts of hydropeaking

- Hydropeaking network
- What are the needs for flexibility? – see the IEA Hydro White Paper
- How can hydropower provide?
- What are the impacts on the aquatic ecosystem?
- What are the most pressing topics to study more?
- Stranding and non-lethal effects on salmonids – well studied
  Impacts on other fish species and other species
- Mitigation measures
- List of tools