

Jun 23rd, 2:45 PM - 3:00 PM

## Session C5: Experiments to Improve Passage Ways for Downstream Migrating Silver Eel

Arne Fjälling

*Swedish University of Agricultural Sciences*

Håkan Wickström

*Swedish University of Agricultural Sciences*

Willem Dekker

*Swedish University of Agricultural Sciences*

Christer Blomqvist

*Swedish University of Agricultural Sciences*

Follow this and additional works at: [https://scholarworks.umass.edu/fishpassage\\_conference](https://scholarworks.umass.edu/fishpassage_conference)



Part of the [Aquaculture and Fisheries Commons](#), and the [Hydraulic Engineering Commons](#)

---

Fjälling, Arne; Wickström, Håkan; Dekker, Willem; and Blomqvist, Christer, "Session C5: Experiments to Improve Passage Ways for Downstream Migrating Silver Eel" (2015). *International Conference on Engineering and Ecohydrology for Fish Passage*. 22.  
[https://scholarworks.umass.edu/fishpassage\\_conference/2015/June23/22](https://scholarworks.umass.edu/fishpassage_conference/2015/June23/22)

This Event is brought to you for free and open access by the Fish Passage Community at UMass Amherst at ScholarWorks@UMass Amherst. It has been accepted for inclusion in International Conference on Engineering and Ecohydrology for Fish Passage by an authorized administrator of ScholarWorks@UMass Amherst. For more information, please contact [scholarworks@library.umass.edu](mailto:scholarworks@library.umass.edu).



# Experiments to improve passage ways for downstream migrating silver eel



Sveriges lantbruksuniversitet  
Swedish University of Agricultural Sciences

Arne Fjälling

Håkan Wickström

Willem Dekker

Christer Blomqvist

# Field experiment

In an earlier pilot experiment, silver eel under heavy stress escaped upstream.

Is an incoming water stream attractive to downstream migrating silver eel facing obstructions?

Are there other behavioral patterns in eel that can be used for increasing passage efficiency/minimizing water spillage?



Experimental setups (passages) in a low head dam

river



Norway

Finland

Sweden

Field experiment

Aquarium experiment

Field experiment

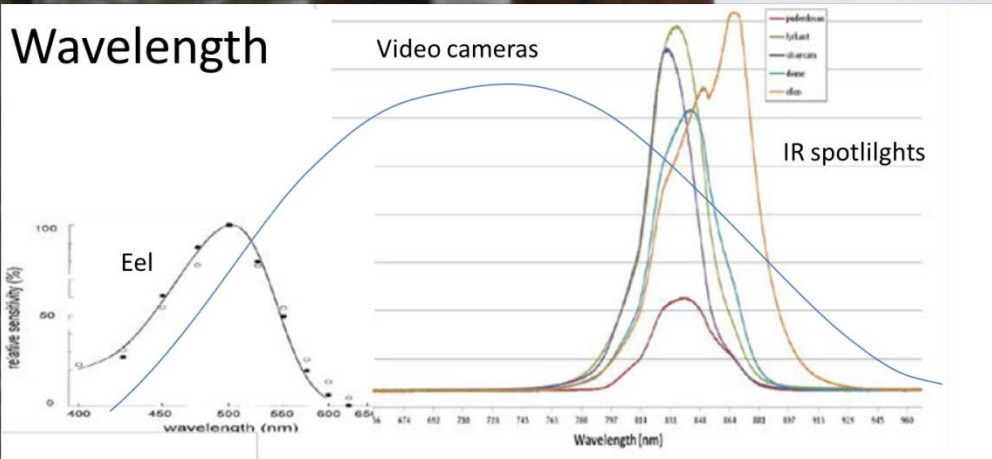
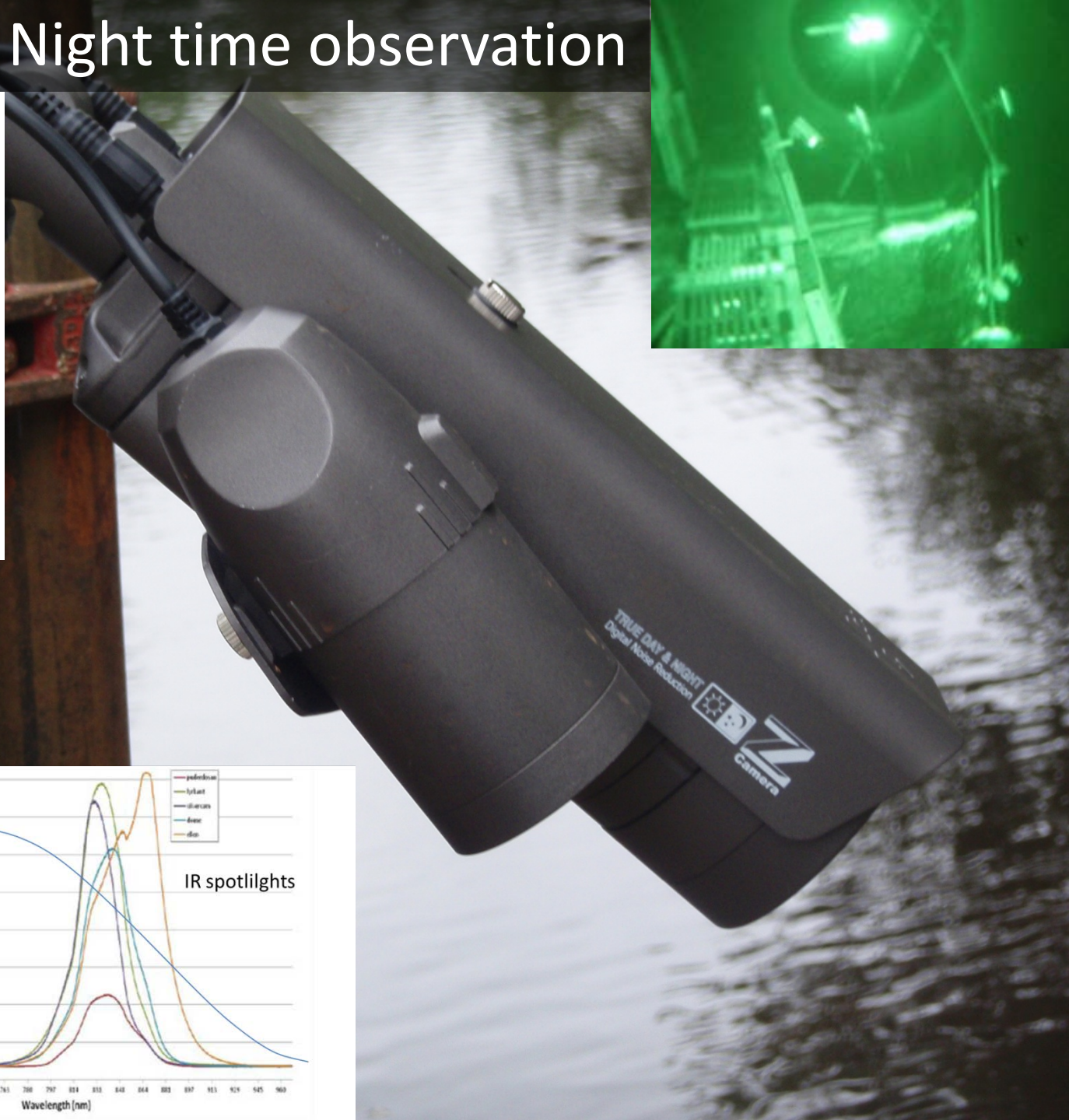


# Night time observation

Experiments were made during darkness.

Video recordings were used for documentation.

The IR spotlights were not detectable for eel (or for people!) but functional for cameras.



# Plain opening, 20 l/s

A plain opening in the dam with moderate downstream flow was used as control.

Four eel were observed near the opening, two of them passed downstream.





# Dead end

A dead end opening in the dam.

No eel were observed near this opening or entering it.



# Small inflow (5 l/s) and water spray

A small water flow into the dam.

No eel were observed near this opening or entering it.

The flow was deemed too insignificant to base conclusions on.





# Large inflow, 150 l/s

A significant water stream into the dam.

25 eel were observed, no one entered.

A few eel explored the plume from 1-2 m distance, then turned away.

It was concluded that an incoming water stream is not attractive to (only lightly) stressed silver eel seeking a passage.





## Bypass, 20 l/s

A bypass with a moderate downstream water flow.

55 eel were observed near this opening and four passed downstream.

experiment

river

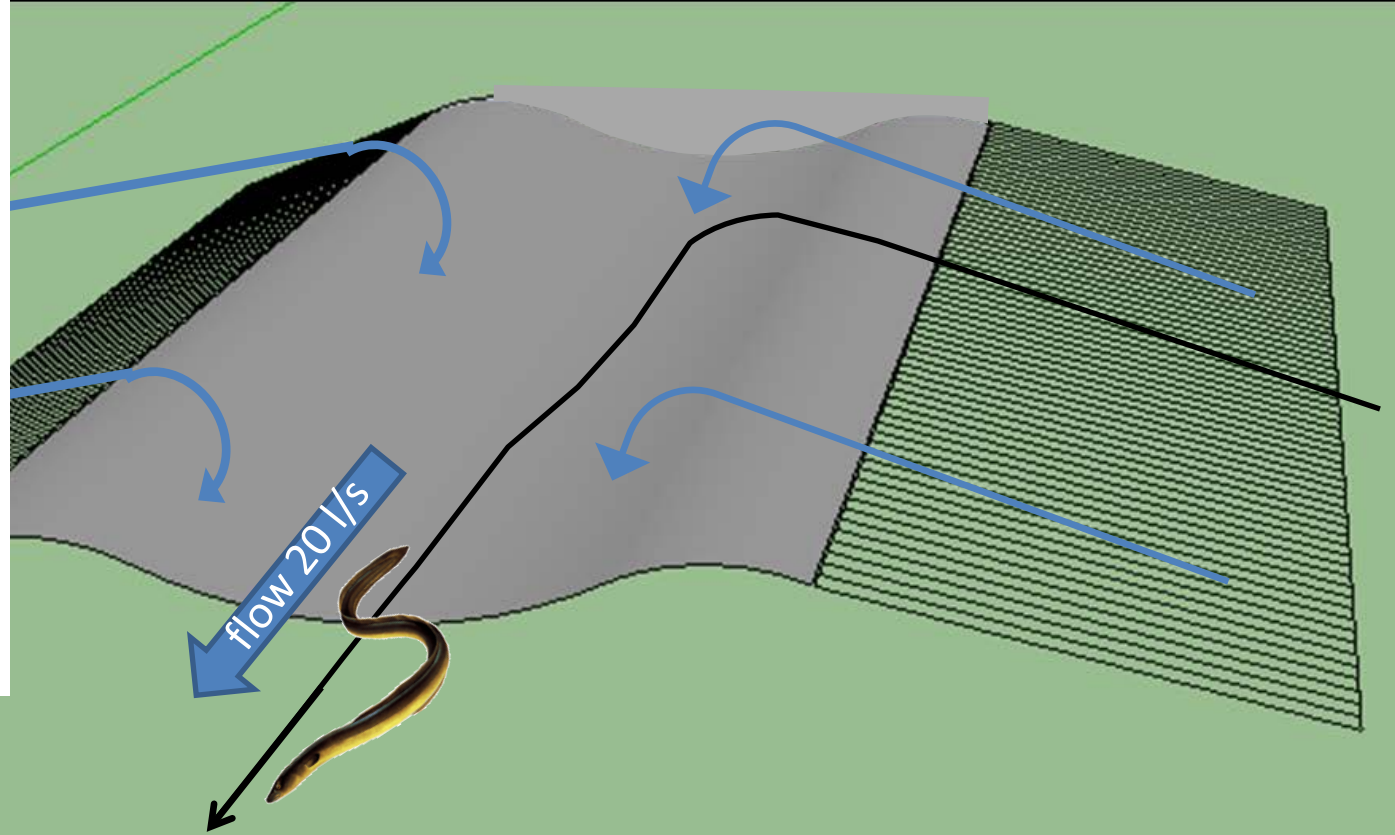


# M-chute, principle

An M-formed chute extending upstream of a plain opening.

The idea was to skim off eel and guide them towards the opening in the dam. Thus minimizing water spillage.

The water flow was controlled by shallow ridges at the sides.





76 eel were observed in contact with the chute and two passed downstream.

Eels generally hesitated to pass over the shallow (0,2 m) ridges. Instead they turned upstream.

M-Chute, 20 l/s

10.05.2013 23:53:32 02



↑  
Typical fright  
reaction in this  
experiment



# U-Chute, 20 l/s

A U-formed chute extending upstream of a plain opening.

The basic idea was the same as in the M-chute, but water flow was now controlled by narrow slots in the vertical sides.

There were slots only on one side of the chute.



experiment



# U-Chute, 20 l/s

23.04.2014 03:38:59

74 eel were observed in contact with the chute and 11 passed downstream.

Passages were quick.



Quick passages!

# Summing up field experiments

Time	Experiment	Water flow (l/s)	Silver eel interacting/near	Silver eel passing	Conclusion
Fall 2012	Plain opening	20	4	2	control
	Small inflow	5	0	0	no attraction, N/A
	Dead end	0	0	0	no attraction
Spring 2013	Significant inflow	150	25	0	no attraction
	M-chute	20	76	2	aversive reaction
Spring 2014	U-chute	20	74	11	increase vs control!
	Bypass	20	55	4	like control



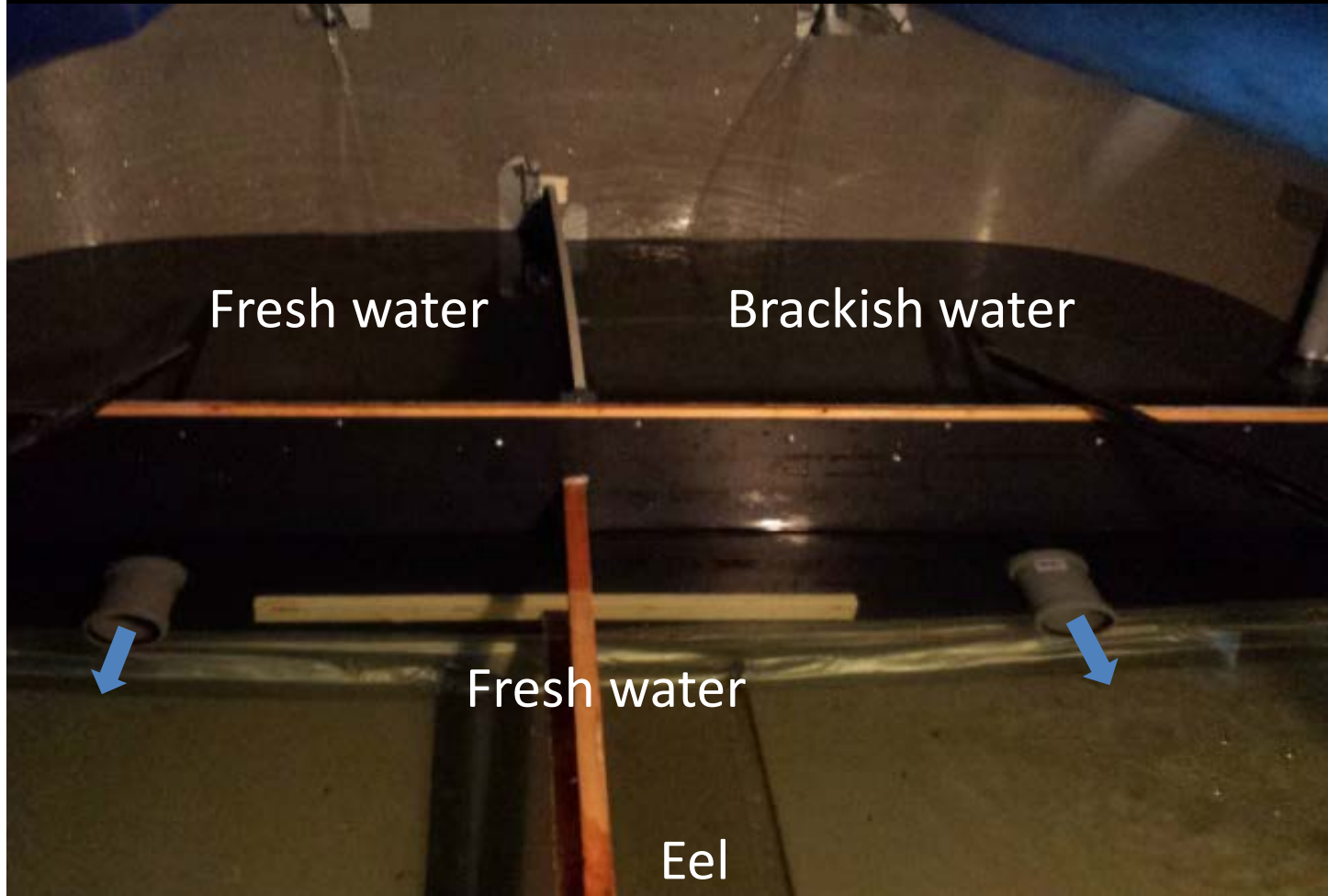
# Eel and brackish water

Due to lack of rain, and administrative constraints, field experiments were cut.

An aquarium experiment was made instead.

This tested if silver eel on their way to the sea were attracted to saline water.

21 eel entered into the compartment with brackish water and 8 into the compartment with fresh water.



# Silver eel behavior in experiments

- Numbers correlated to water flow
- Not attracted to incoming water flow, unless severely stressed
- Shunned shallow ridges
- Swimming freely through narrow vertical slots
- Minimized water spillage per eel conceivable
- Attracted to mildly saline water



A photograph of a dirt path with a long shadow cast across it. The path is made of brown earth and small stones, with patches of green grass and dry leaves. The shadow is dark and elongated, stretching from the top left towards the bottom right. The background shows a grassy slope with some rocks.

Thank You

# Acknowledgements

This study was financed by the R&D part of "Krafttag Ål", a program funded by Swedish Agency for Marine and Water Management, Vattenfall Vattenkraft AB, E.ON Vattenkraft Sverige AB, Fortum Generation AB, Sollefteåforsen AB, Statkraft Sverige AB, Tekniska Verken i Linköping AB, Holmen Energi AB and Karlstad Energi AB.