

Dec 13th, 1:30 PM - 3:10 PM

# Estuarine fish passes in the northern Netherlands provide contrasting windows of opportunity for migrating fish species

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# Estuarine fish passes in the northern Netherlands provide contrasting windows of opportunity for migrating fish species

Jeroen Huisman<sup>1,2</sup>, Tania Timmer<sup>2</sup>, **Leopold A.J. Nagelkerke<sup>2</sup>**

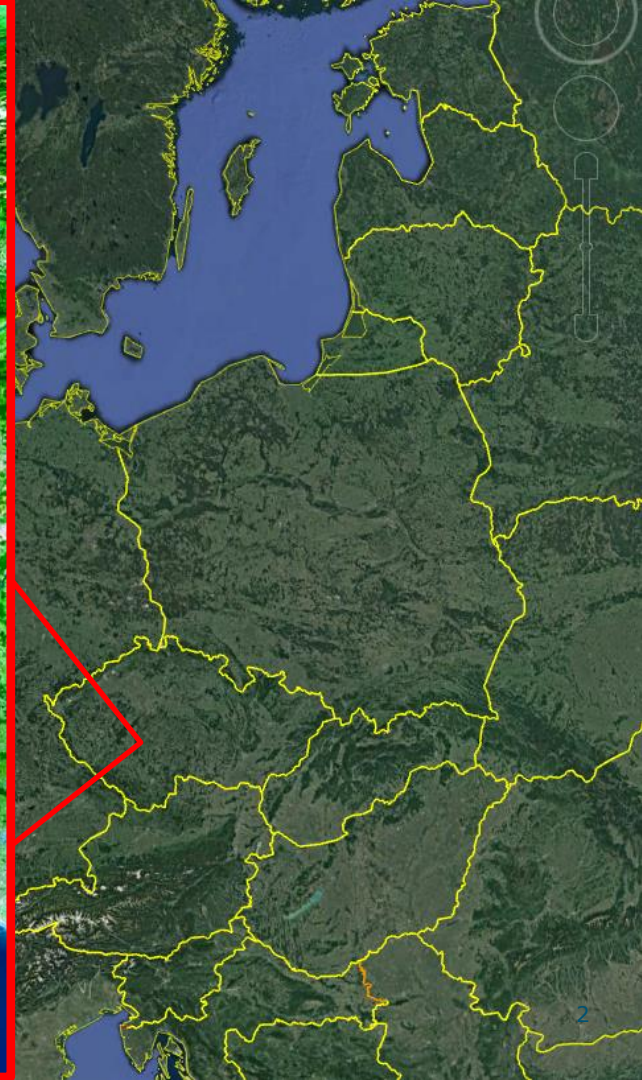
<sup>1</sup> VHL University of Applied Sciences, Leeuwarden, The Netherlands

<sup>2</sup> Wageningen University & Research, Aquaculture & Fisheries Group, Wageningen, The Netherlands

**Fish Passage 2018**, 10-14 December, 2018  
Albury, New South Wales, Australia









# The Wadden Sea and the Delta

...the largest unbroken system of intertidal sand and mud flats in the world.



# Important estuary for western Europe







# Migration bottlenecks & mitigation measures



Spijksterpompen pumping station



# How good are these fish passages?





2018 04 15 02:41:17

IPC

An underwater video showing a school of fish swimming in murky, yellowish-brown water. The fish are dark in color and are moving towards the right side of the frame. The background is a gradient of light blue at the top to a darker, more turbid yellowish-brown at the bottom. The overall scene is dimly lit, typical of an underwater environment.

# The main players



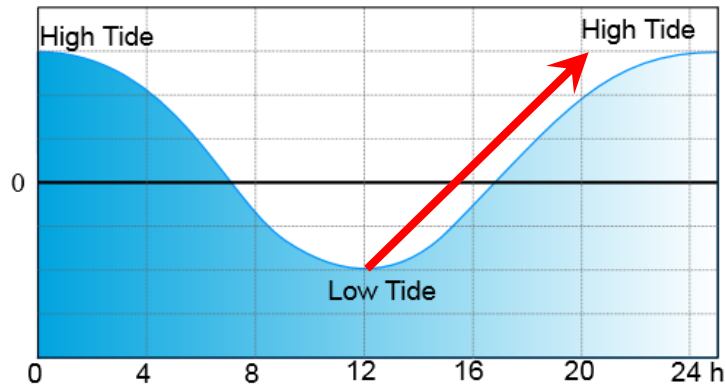
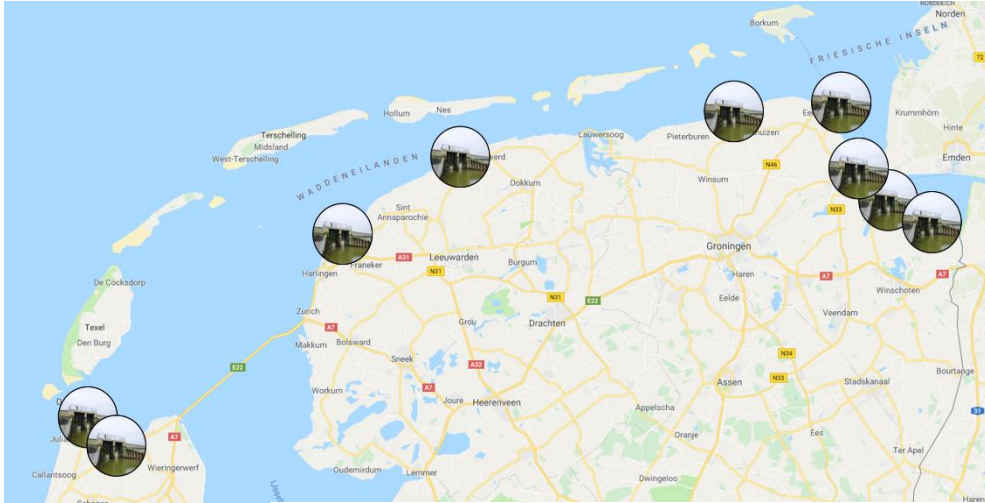
WHAT DRIVES THEIR  
INTERTIDAL MIGRATION?

Three-spined stickleback,  
*Gasterosteus aculeatus*

European eel  
*Anguilla anguilla*



# Methodology

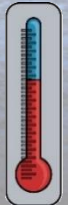
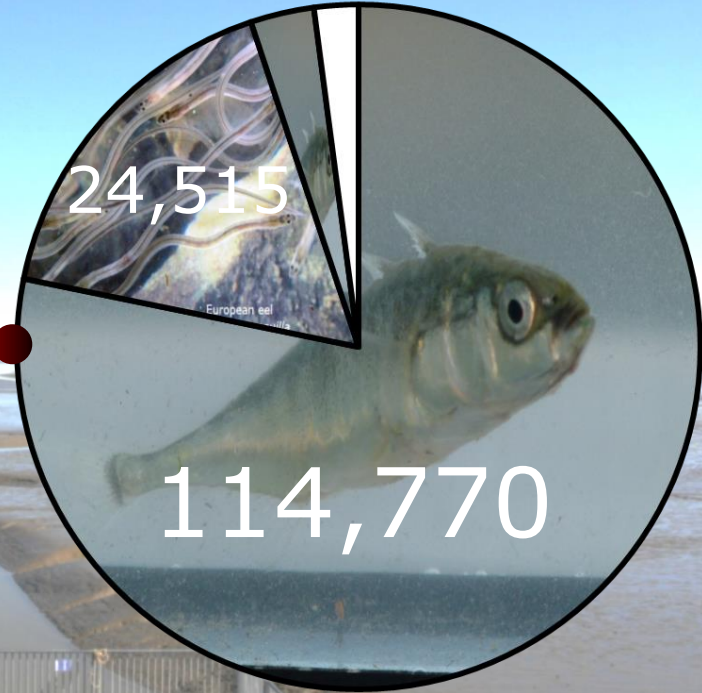


2014

# Methodology

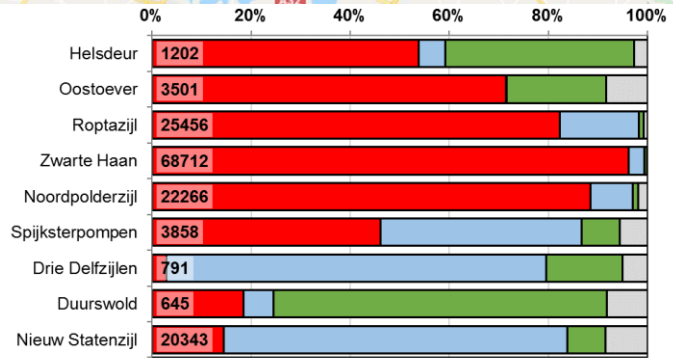
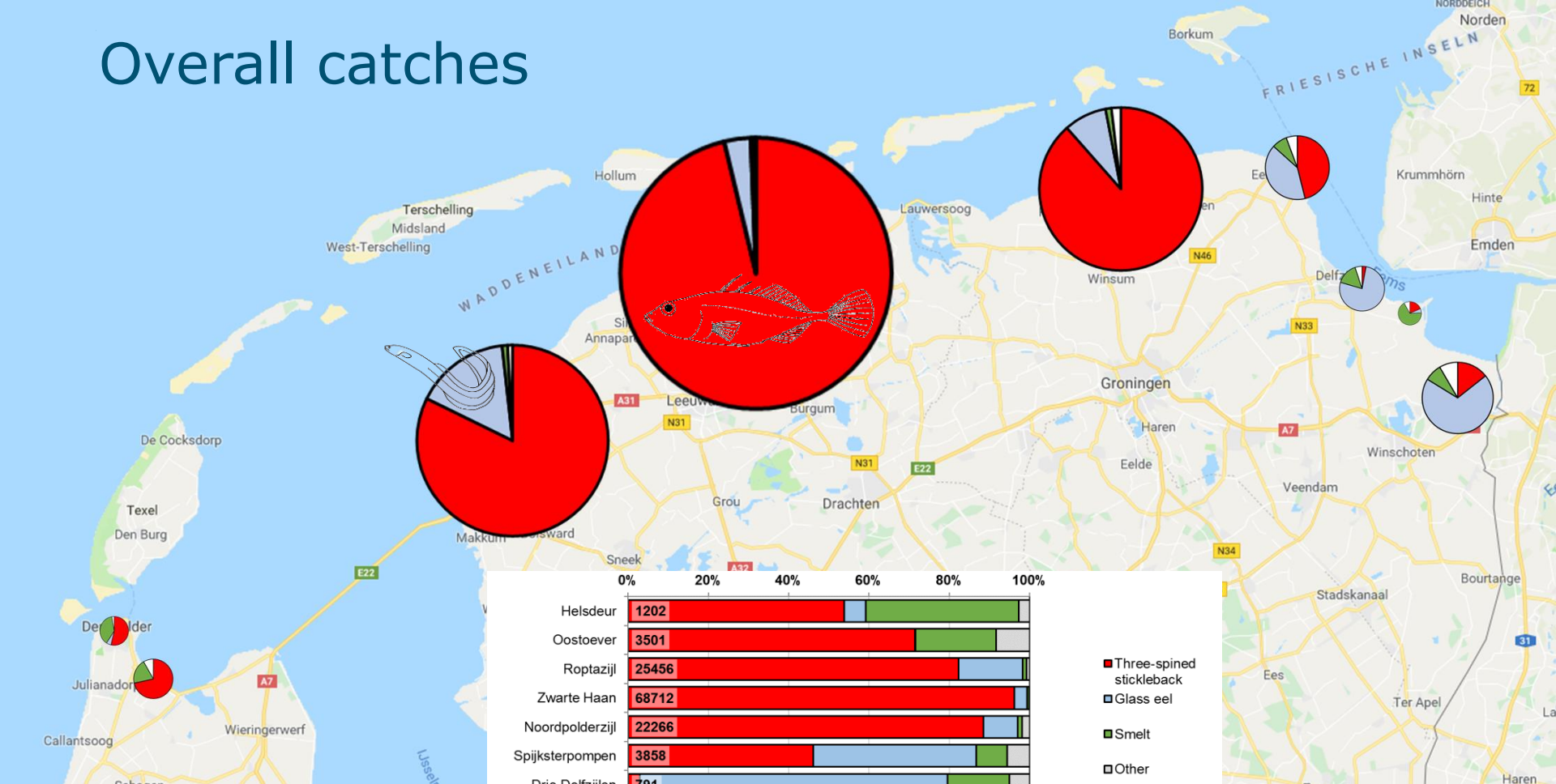
168  
sample  
days

4,558  
samples

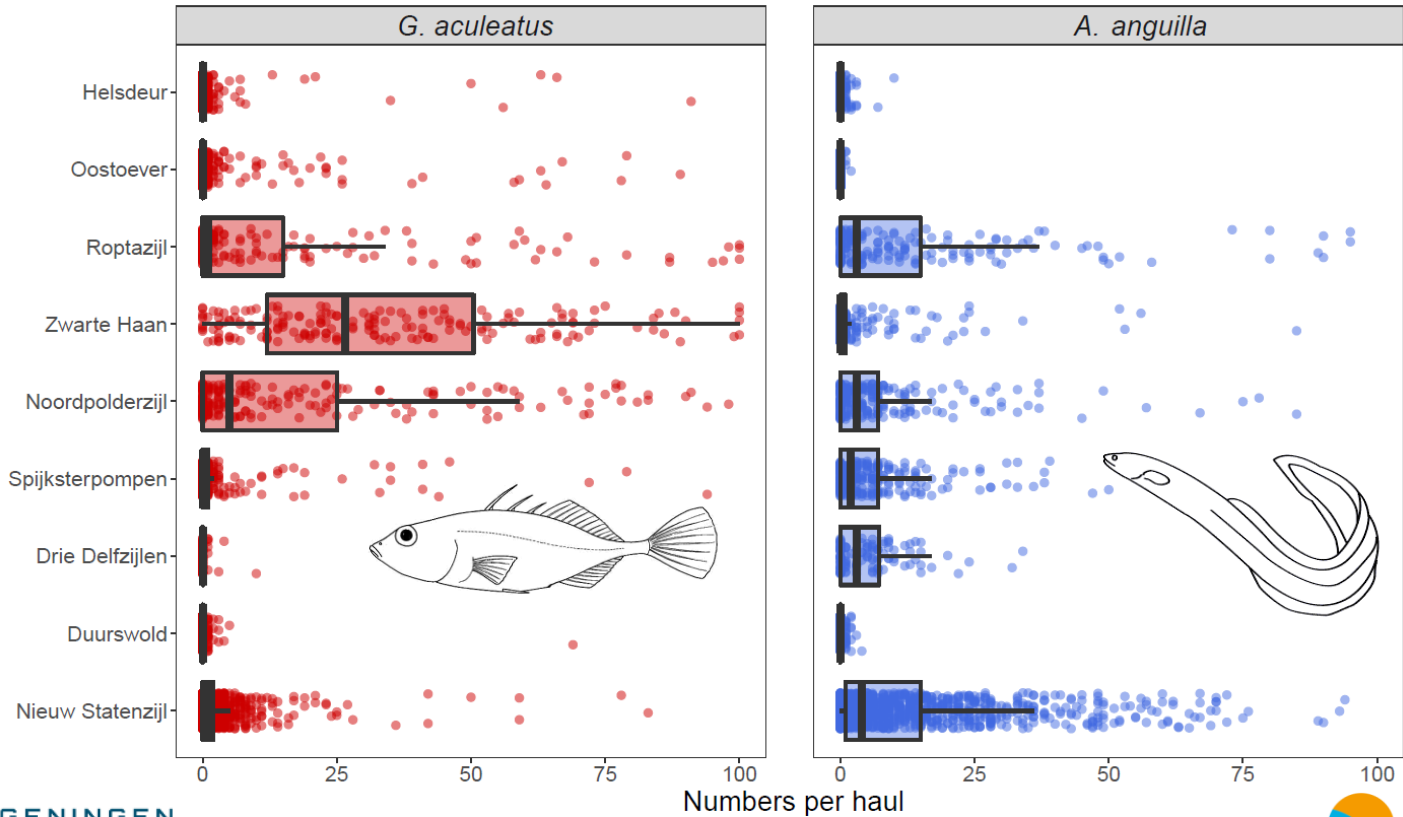




# Overall catches

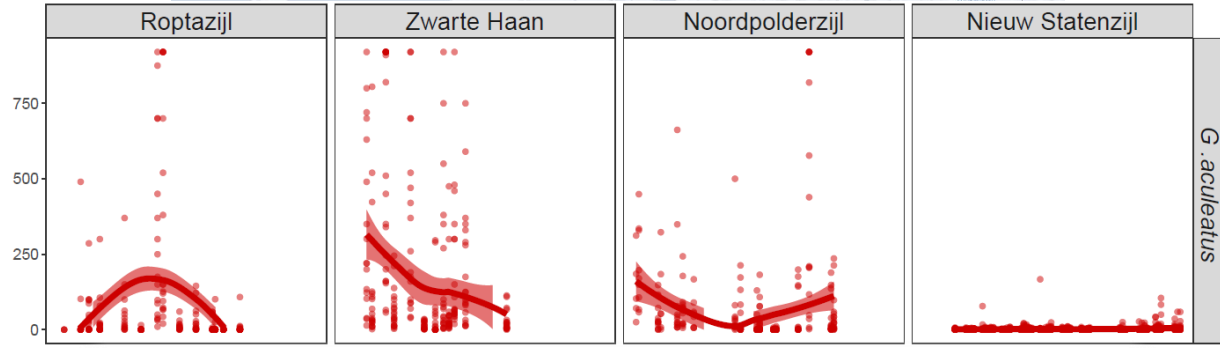
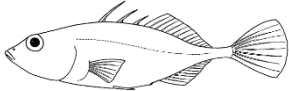


# Overall catches





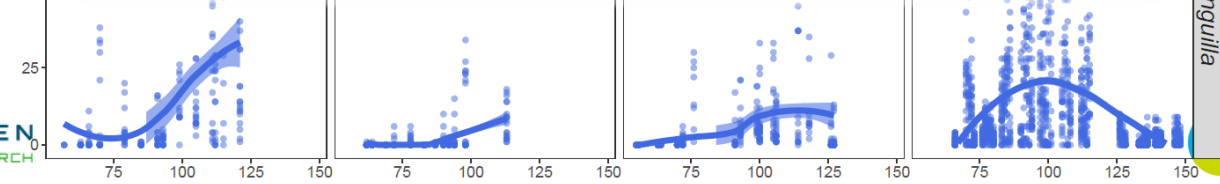
# Seasonal development



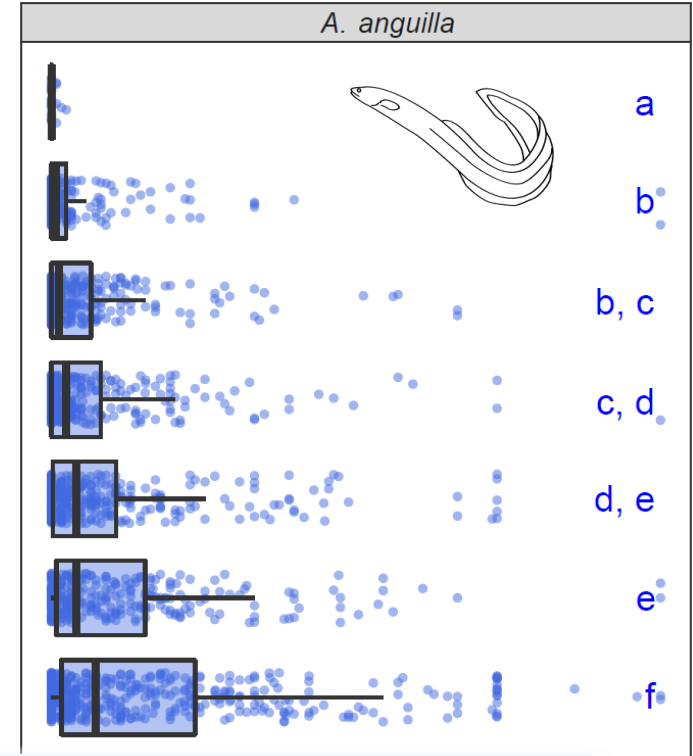
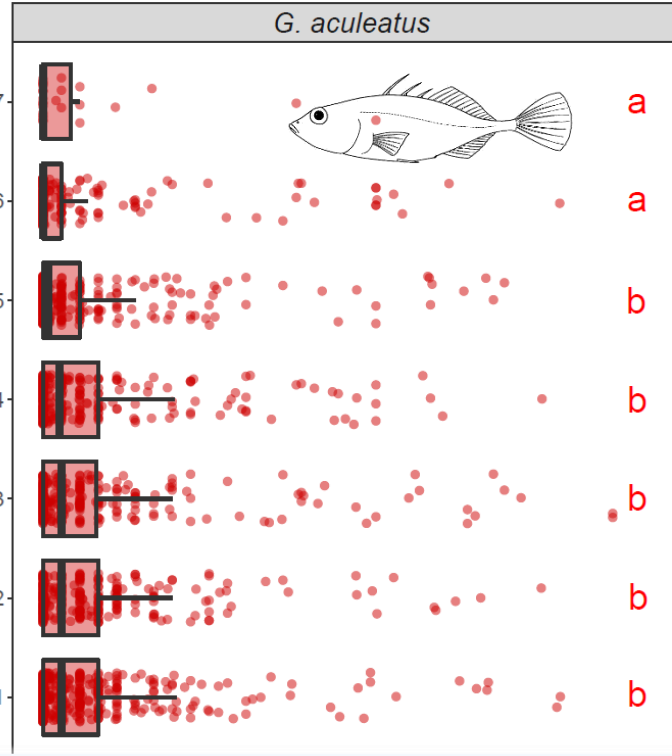
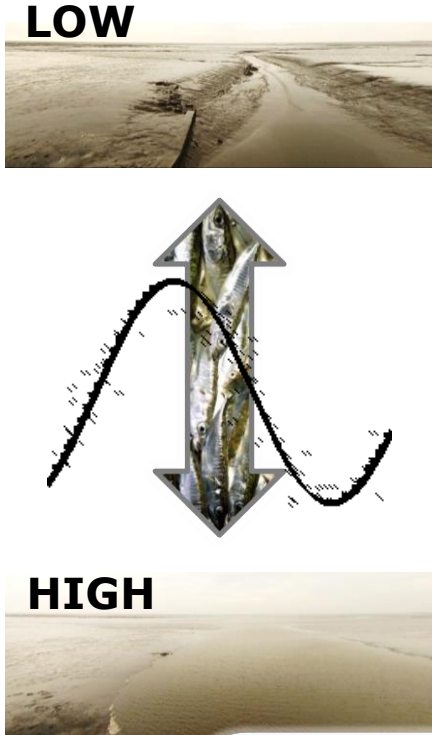
*G. aculeatus*

GLASS EEL IS MORE PREDICTABLE

*A. anguilla*

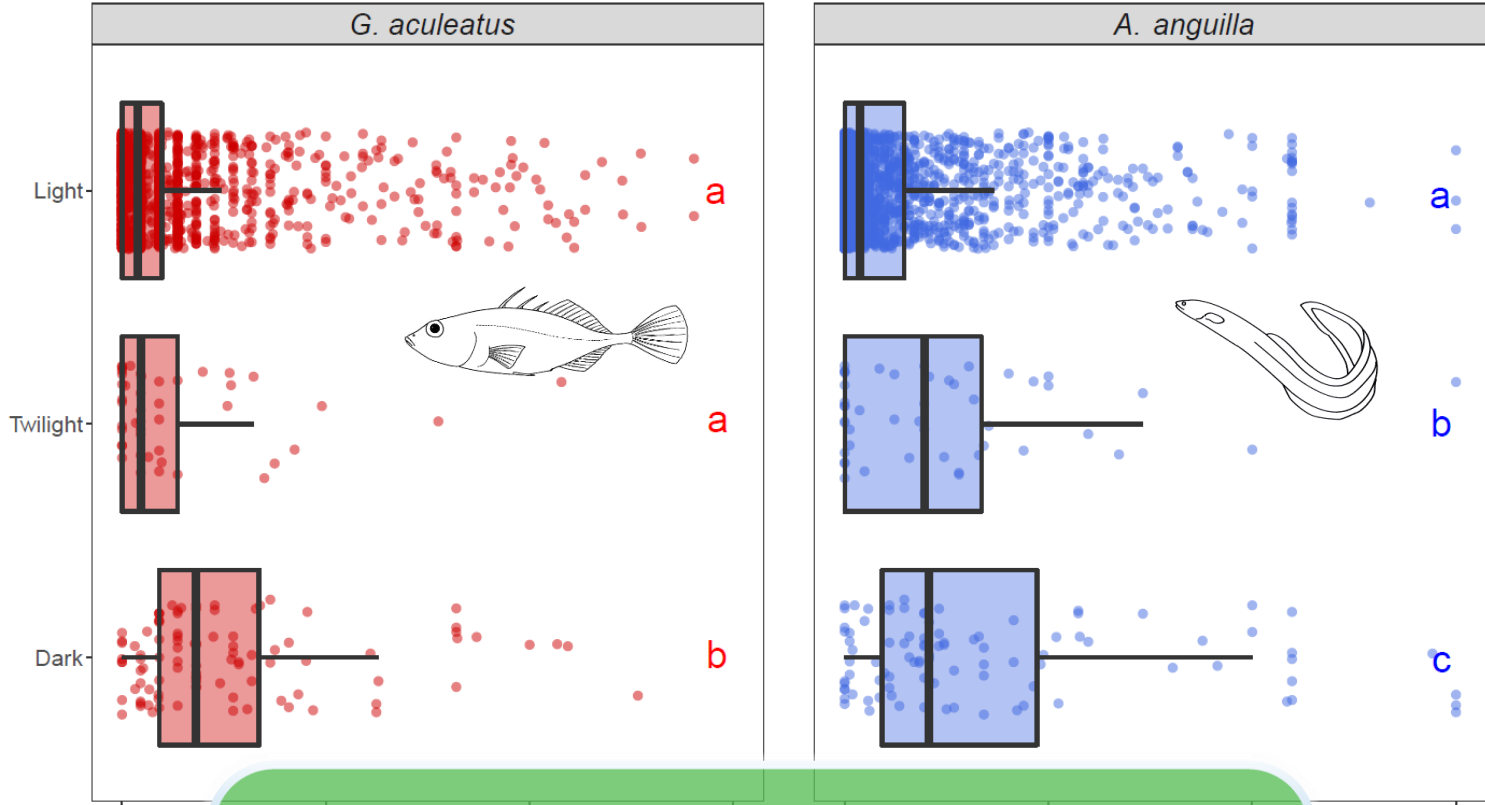


# Tidal phase



Standardised numbers per haul

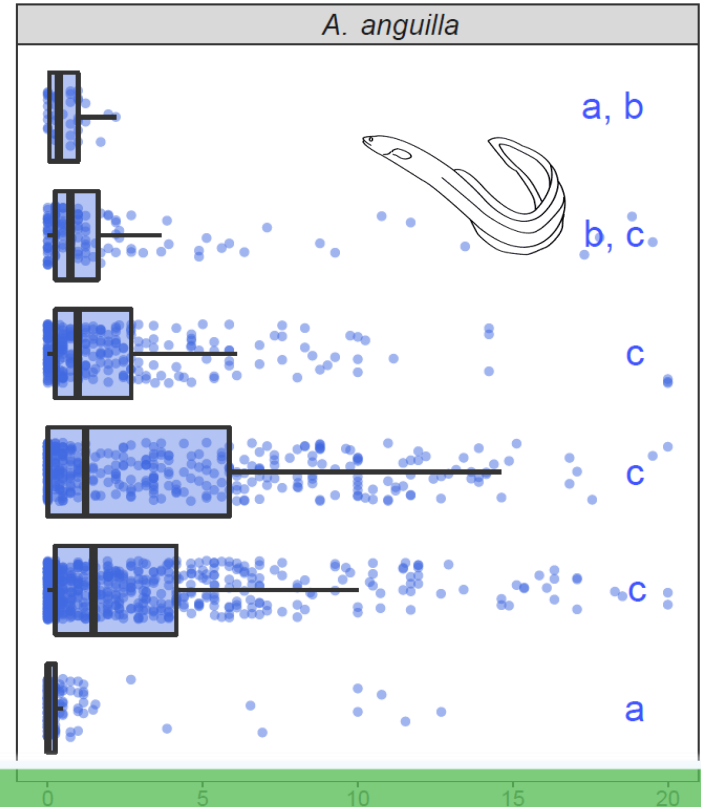
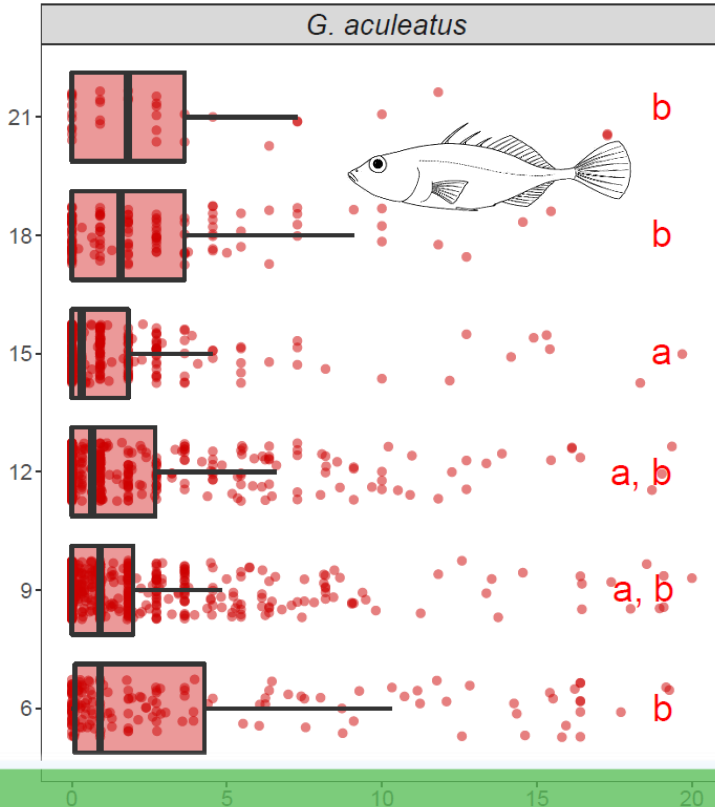
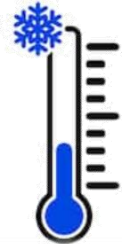
# Day phase



**BOTH SPECIES LIKE THE DARK**



# Water temperature



MOST GLASS EEL AT INTERMEDIATE TEMPERATURES

# Match-mismatch



WINDOWS OF OPPORTUNITY DIFFER BETWEEN SPECIES

ENGINEERS AND BIOLOGISTS SHOULD TALK MORE

*Glass eel*

*Stickleback*



Thank you for your attention!

Many thanks to:

All the VHL students that  
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Ben, Bram, Florian, Izaak, Nico,  
Peter, Pieter-Wytze, Reinder & Tim



><> ruim baan voor  
<>< **vissen**