Politecnico di Torino

XL International School of Hydraulics
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# Aggregation in riverine fish: a review from a fish passage perspective


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RIBES


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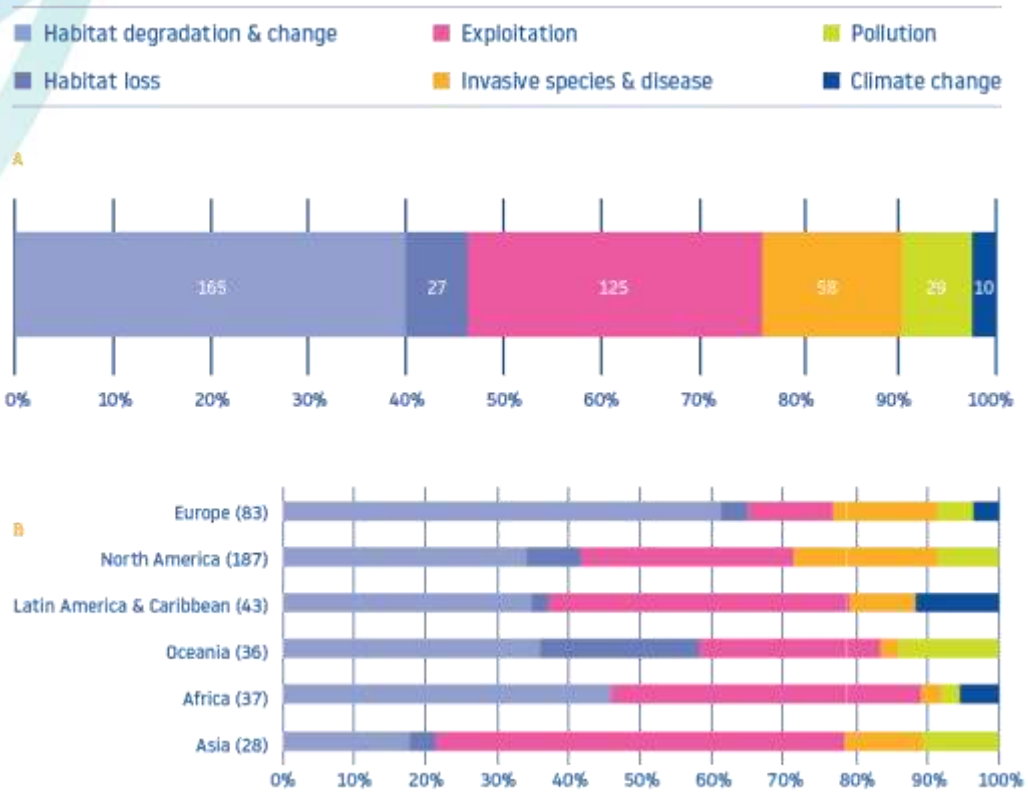
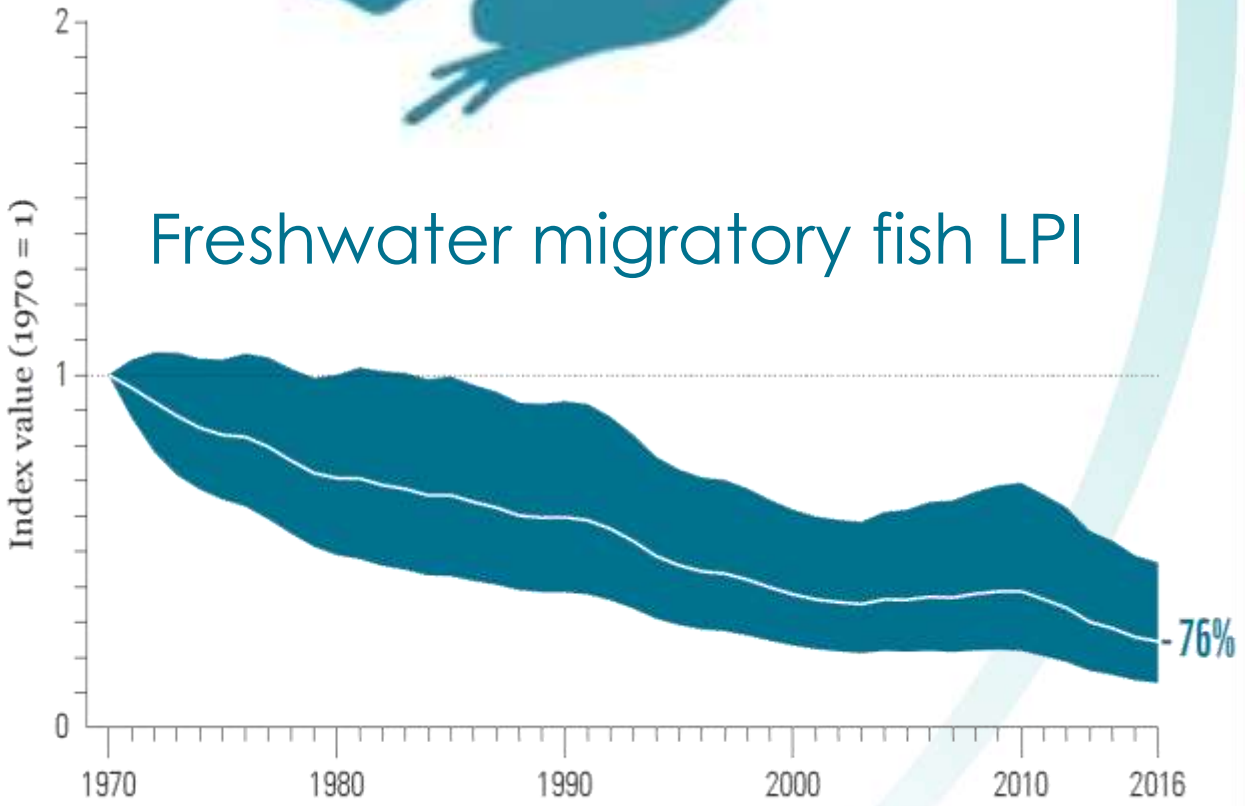
# Biodiversity decline

## TERRESTRIAL


## MARINE

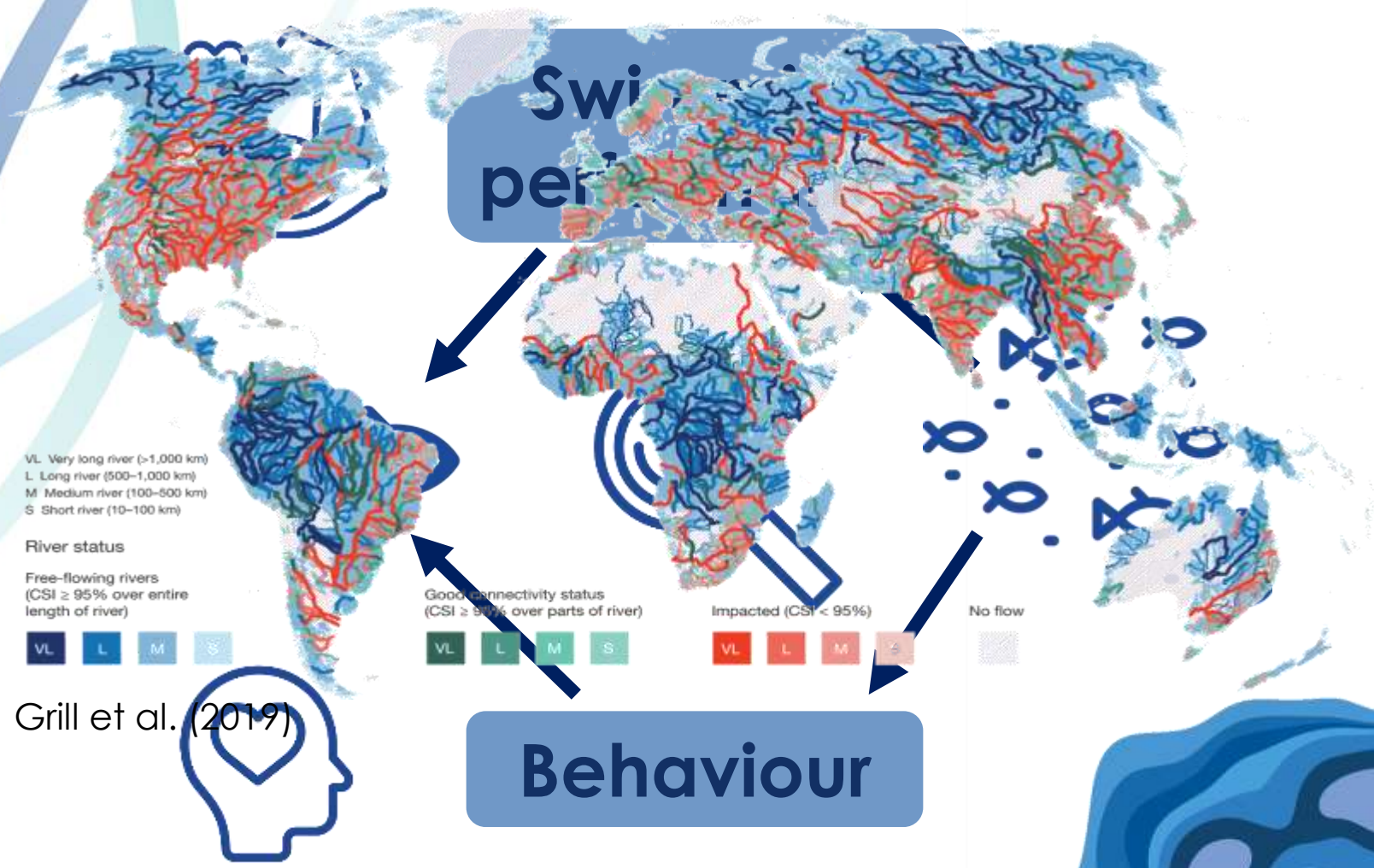

## FRESHWATER

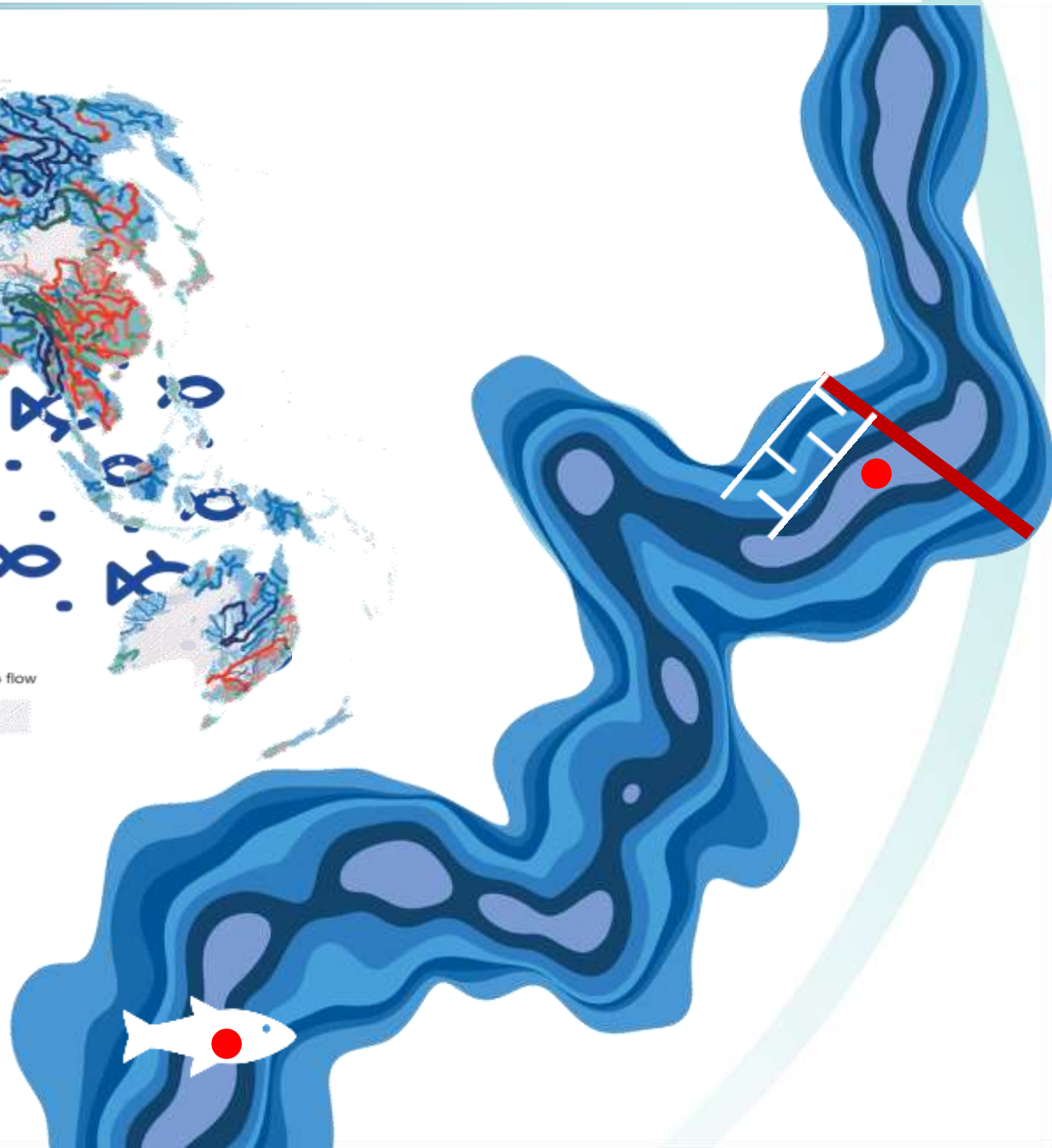




Source: WWF Living Planet Report 2022

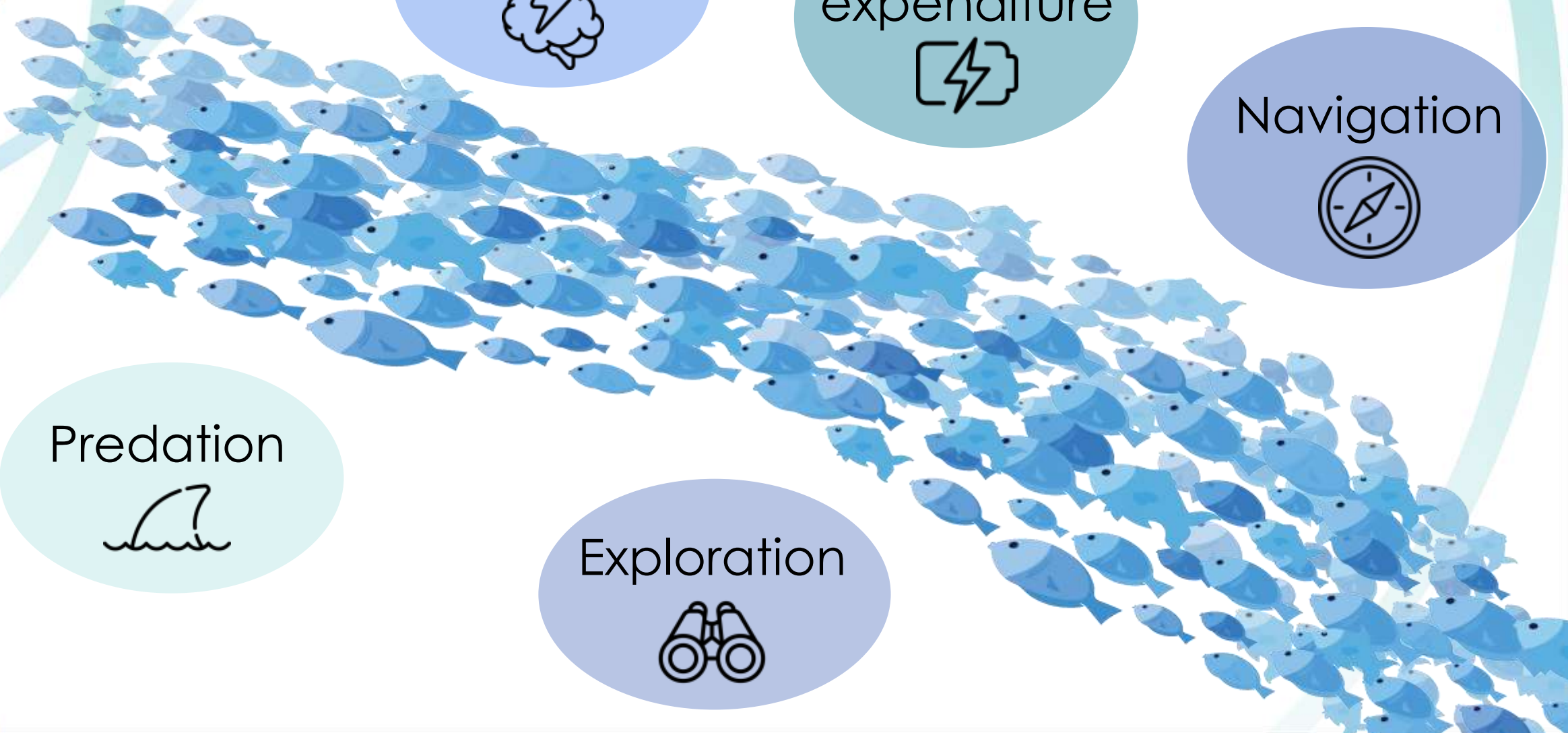
# Fish migration and river barriers




Grill et al. (2019)

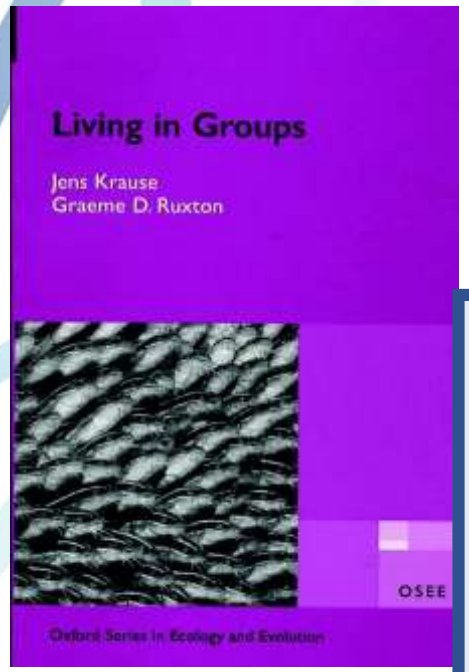


# Aggregation in fish passage



# Collective behaviour in riverine fish

RIBES




PROCEEDINGS B

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Research

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Collective navigation can facilitate passage through human-made barriers by homeward migrating Pacific salmon

Connie Okasaki[1,2], Matthew L. Keefer[3], Peter A. H. Westley[4] and Andrew M. Berdahl[1,2]

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[4]Department of Fisheries, University of Alaska Fairbanks, Fairbanks, AK 99775, USA

Most of research in STILL WATER!!!

Review

Collective animal navigation and migratory culture: from theoretical models to empirical evidence

Andrew M. Berdahl[1,2,†], Albert B. Kao[3,†], Andrea Flack[4,5], Peter A. H. Westley[6], Edward A. Codling[7], Iain D. Couzin[5,8,9], Anthony I. Dell[10,11] and Dora Biro[12]

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One contribution of 16 to a theme issue 'Collective movement ecology'.

Contents lists available at ScienceDirect

Animal Behaviour

journal homepage: www.elsevier.com/locate/anbehav

Collective behaviour of fish in the presence and absence of flow

Jasper de Bie [a, *], Costantino Manes [b], Paul S. Kemp [a]

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Inferring the structure and dynamics of interactions in schooling fish

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Edited* by Simon A. Levin, Princeton University, Princeton, NJ, and approved June 28, 2011 (received for review May 12, 2011)

# Collective behaviour in moving waters

***How does hydrodynamics (velocity and turbulence) affect collective behaviour???***


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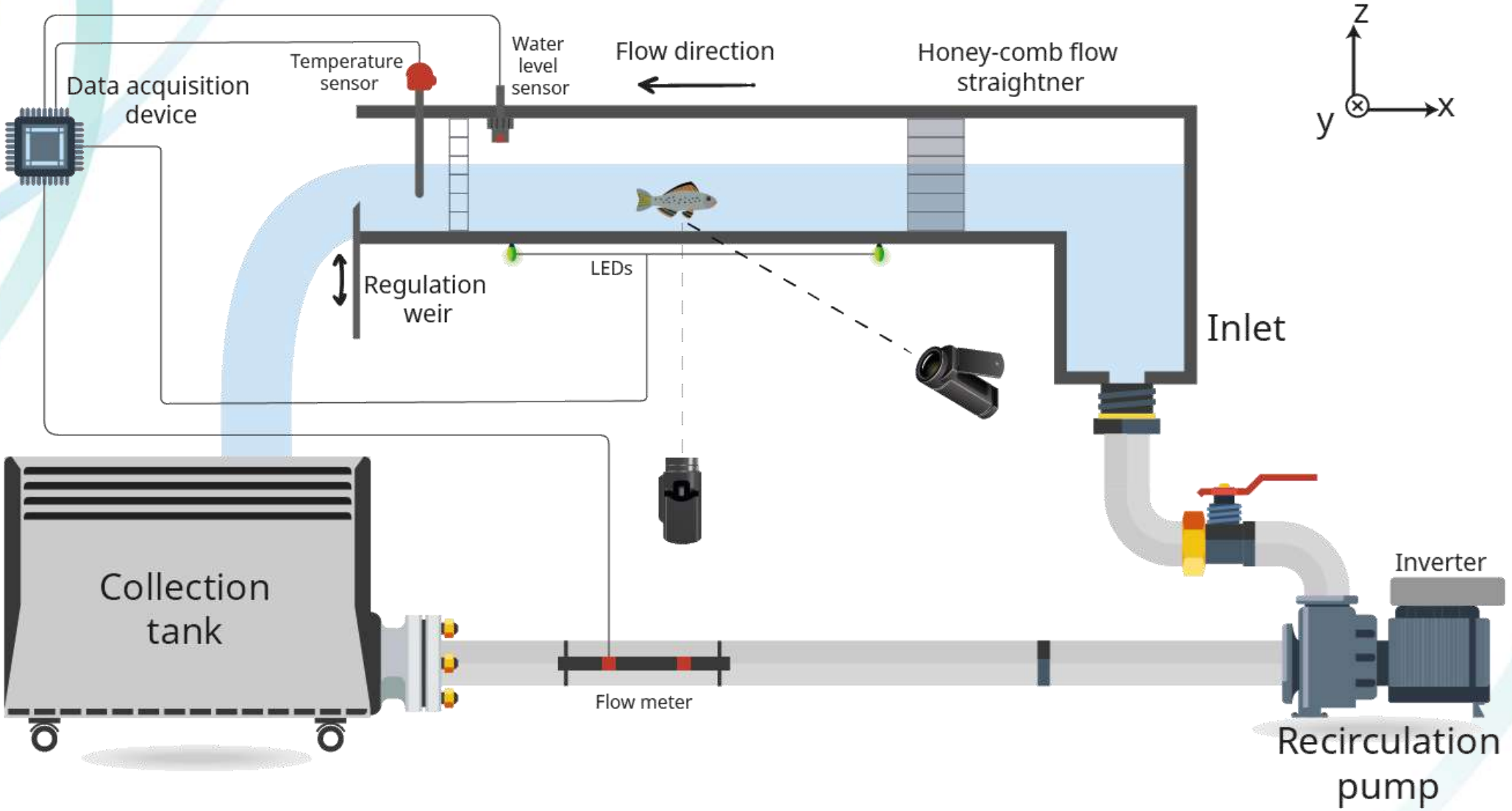
1859

# Experimental set-up



# Fish detection and tracking

RIBES

Deep Learning

Video

Image annotation

Training

Testing

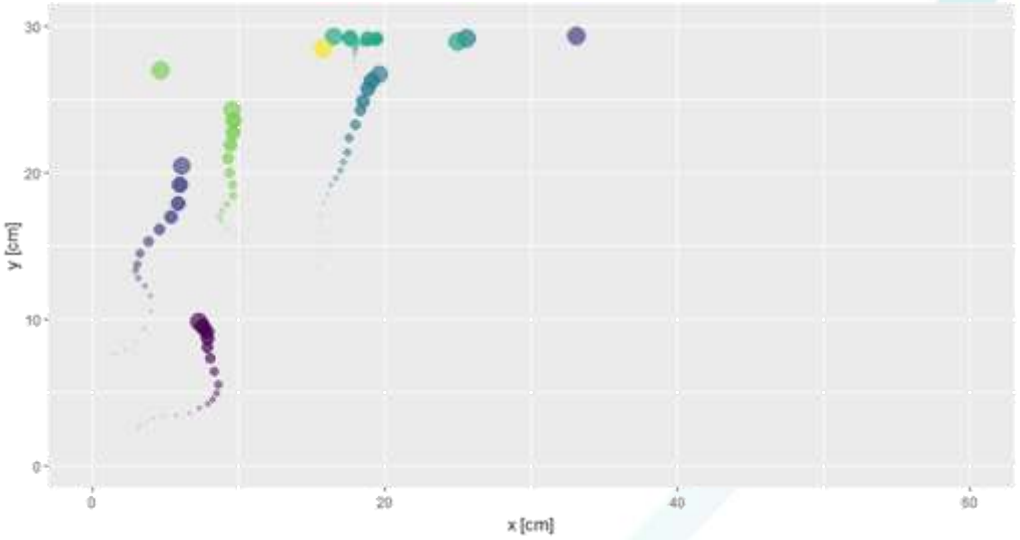
Detection data

Kalman filtering

ID recognition

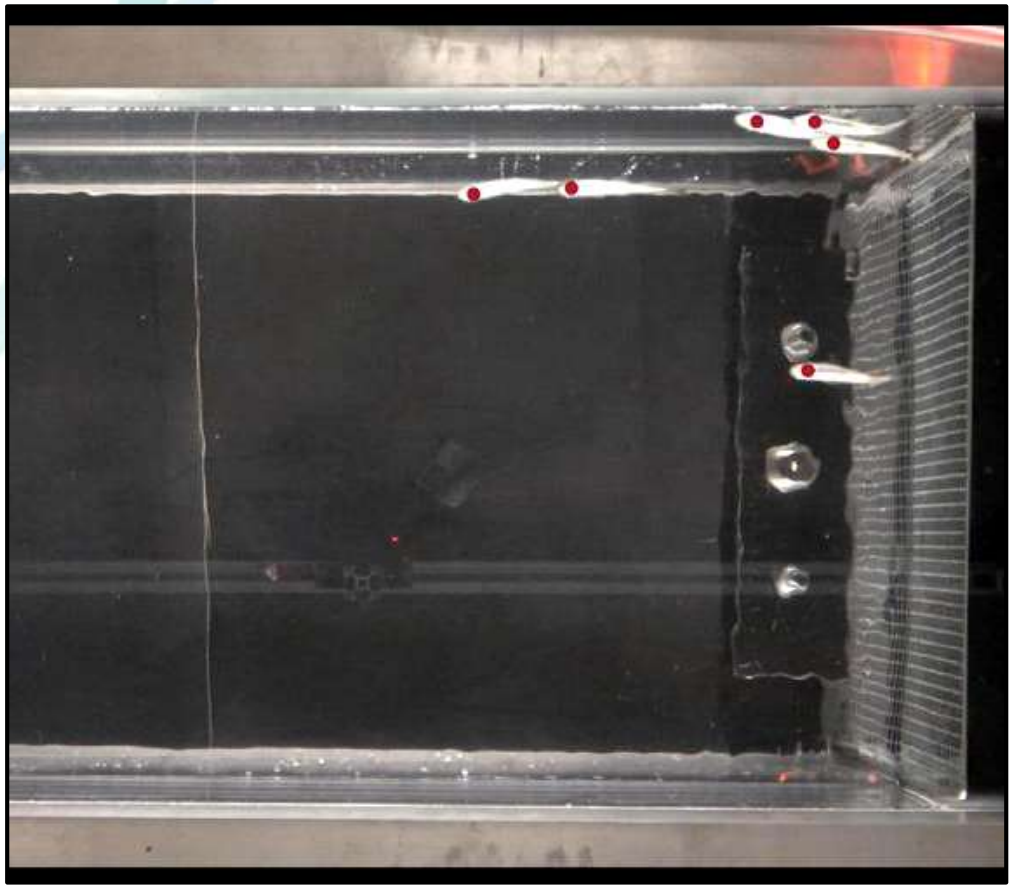
Smoothing

Fish trajectories

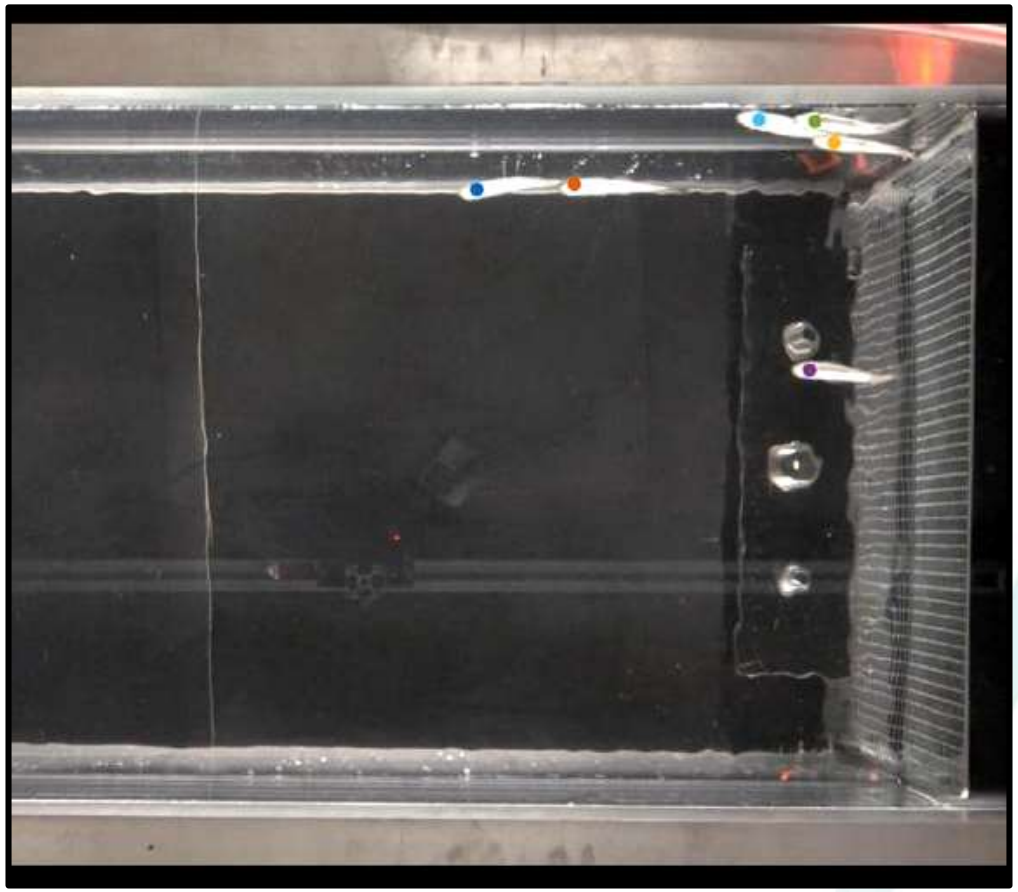


# Tracking examples

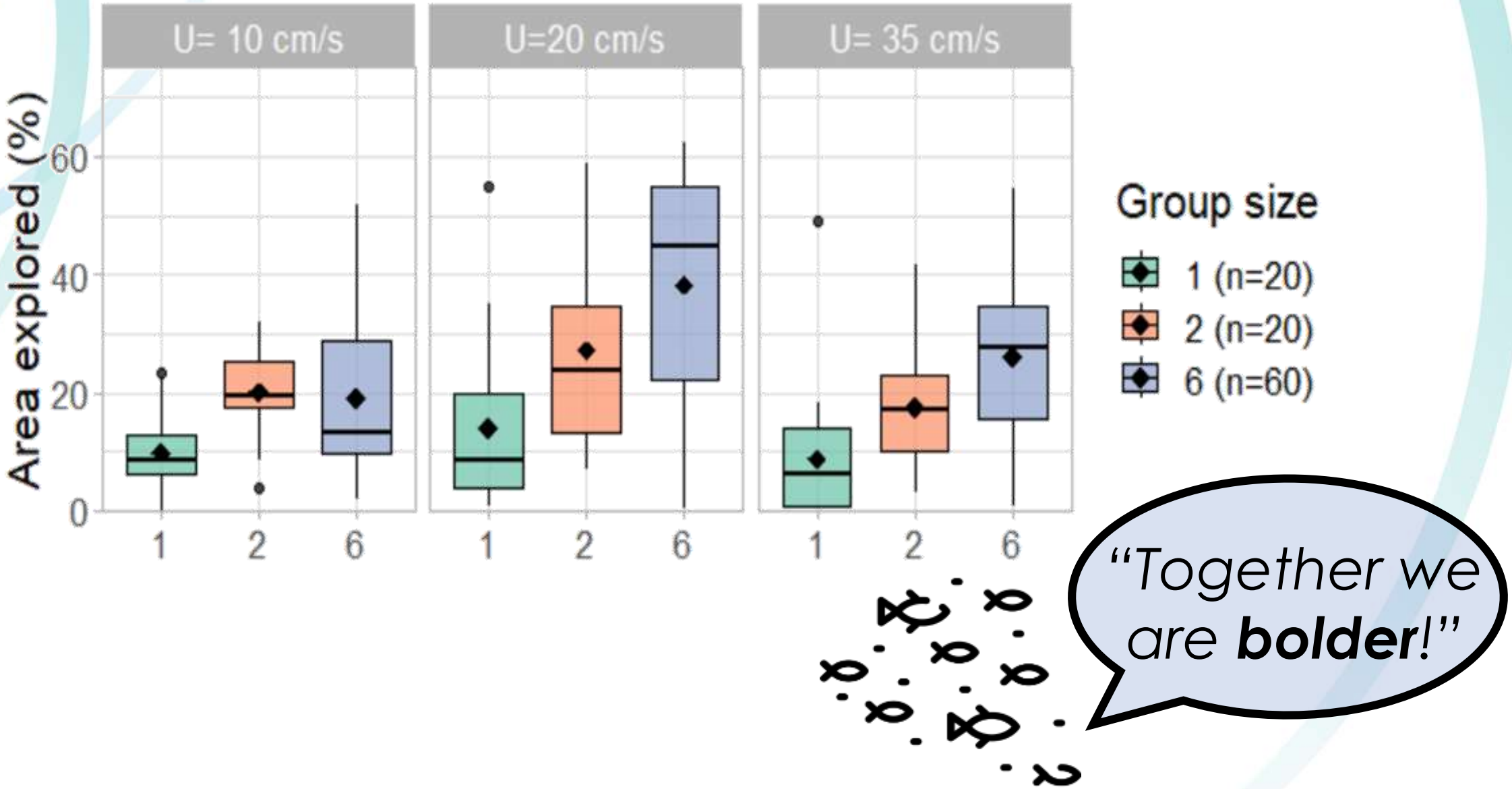
## AI detections



## Tracking outputs

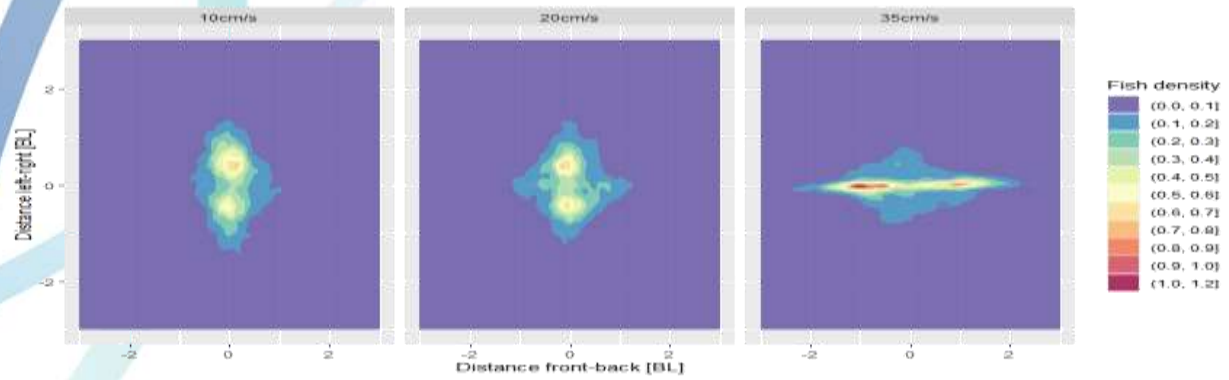


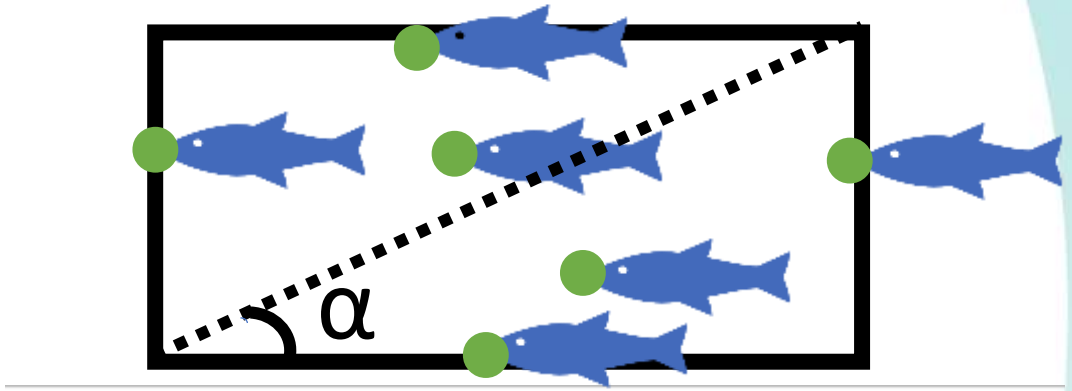
# Aggregation and velocity on exploration

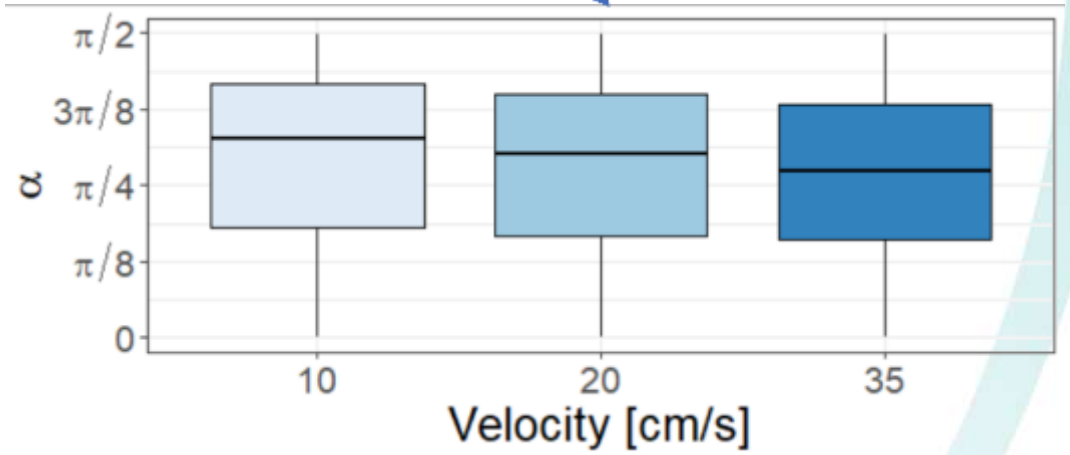


# Current and future research

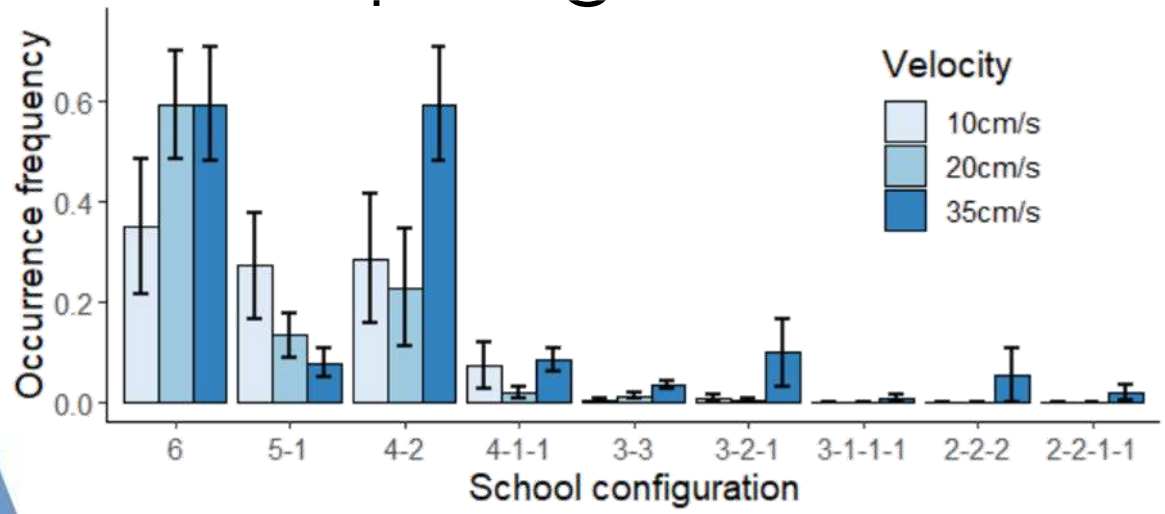
## Schooling strategies




## Group fragmentation




**… and more to come!**

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# Thanks for your attention!

# QUESTIONS ?

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