Behavioural response of downstream migrating European eel (*Anguilla anguilla*) to electric fields under static and flowing conditions

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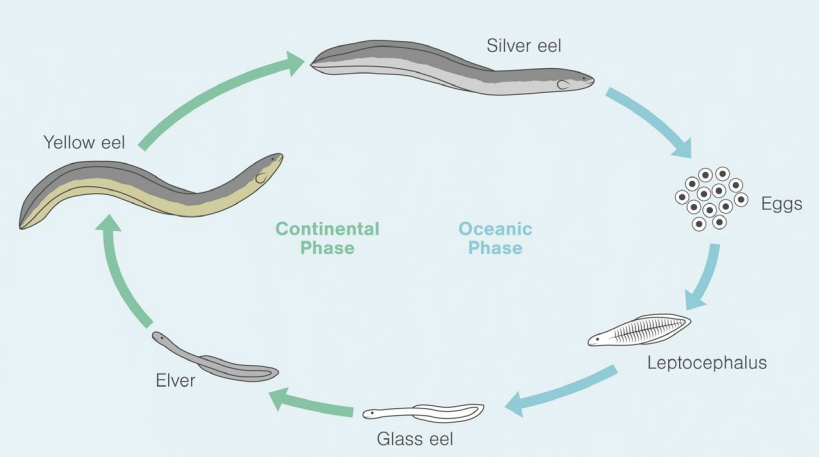
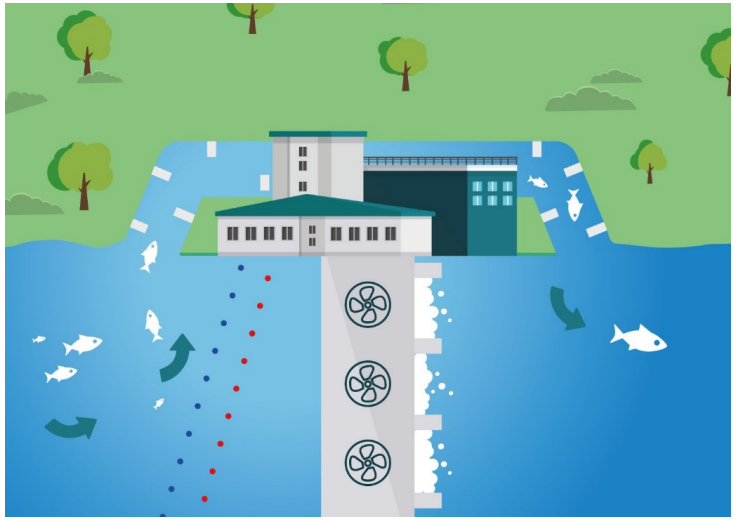
Introduction

- *A. anguilla*
- Critically endangered
- Anthropogenic structures
- Behavioural guidance
- Electric fields





Aims & Objectives

Aim

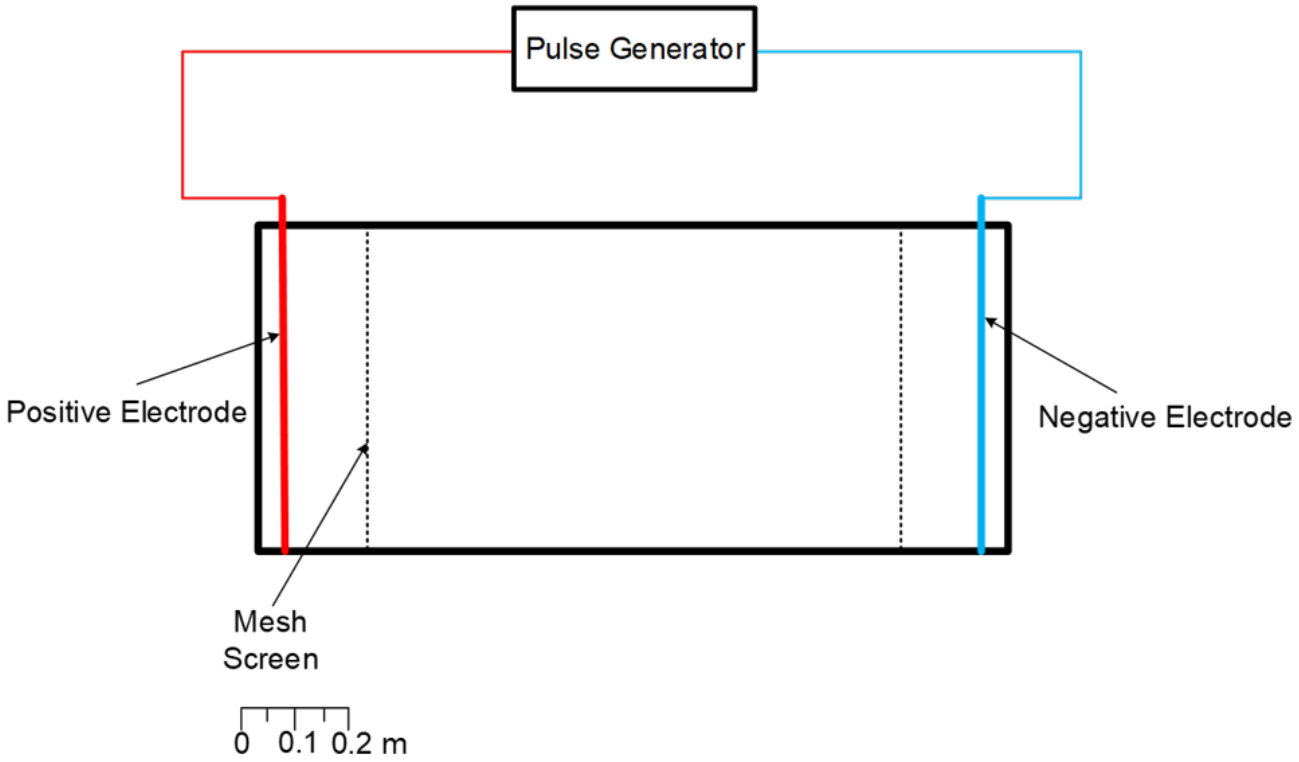
- Explore the viability and potential for utilizing electric fields to deter downstream moving adult eel

Objectives

- Determine field strengths (Vcm^{-1}) at which threshold for three specific physiological responses (*twitch*, *loss of orientation* and *tetany*) were elicited under static water conditions [Experiment 1]
- Examine how behavioural responses vary between two electric field strengths corresponding to the mean field strength for *twitch* and *tetany* [Experiment 2]
- Assess how behavioural responses vary under two water velocities (0.5 and 1.0 ms^{-1}) [Experiment 2]

Methods

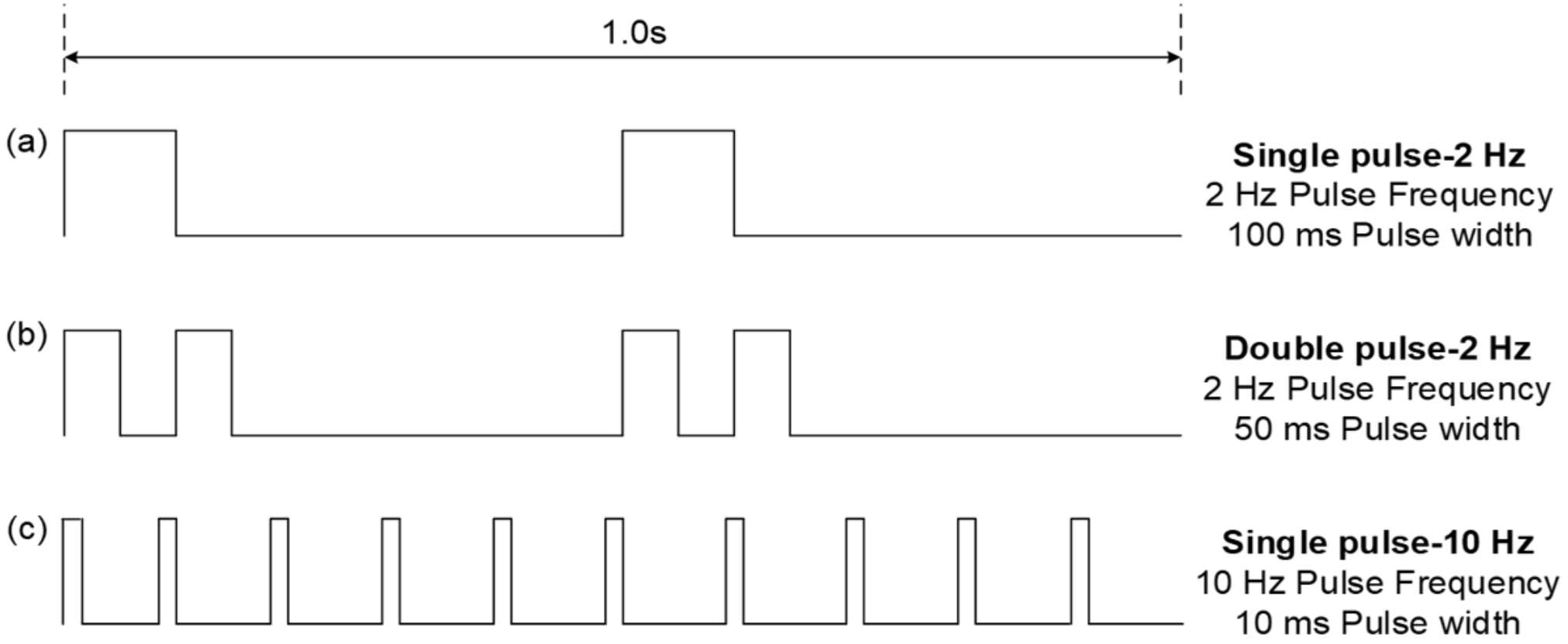
Experimental set-up



Experimental Procedure

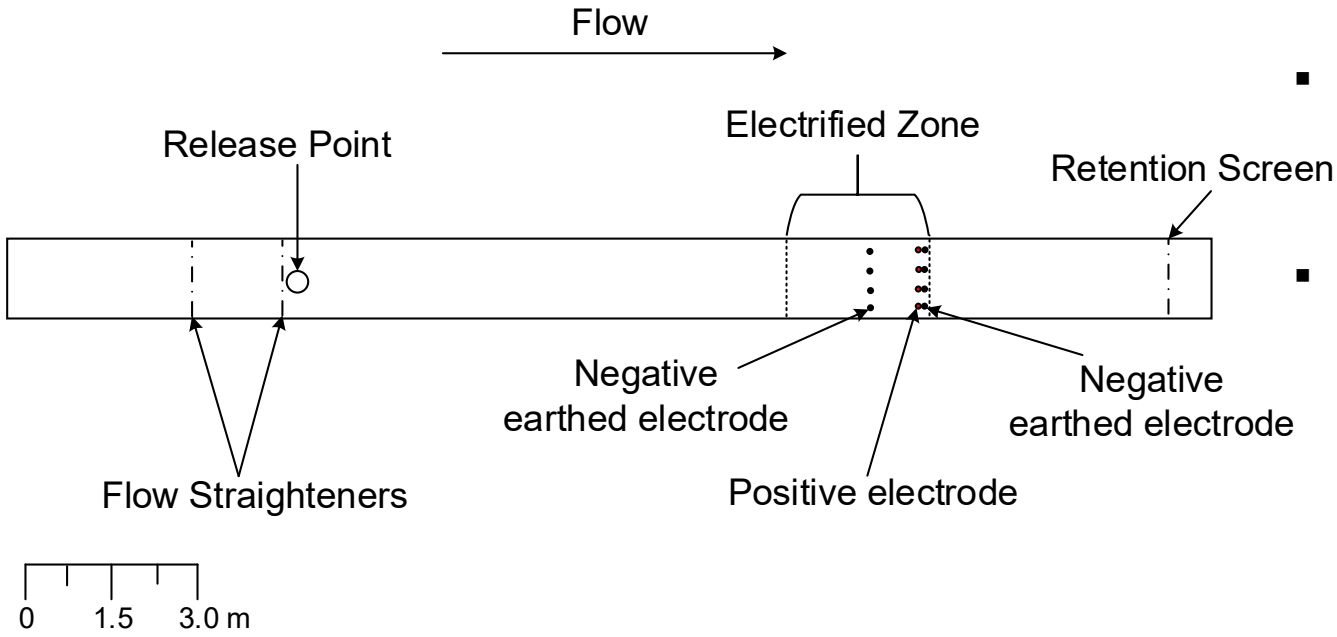
- 0.05 Vcm^{-1} increments
- Behaviours
  - *Twitch*
  - *Loss of Orientation*
  - *Tetany*

Methods


1.0s
(a)
Single pulse-2 Hz
2 Hz Pulse Frequency
100 ms Pulse width
(b)
Double pulse-2 Hz
2 Hz Pulse Frequency
50 ms Pulse width
(c)
Single pulse-10 Hz
10 Hz Pulse Frequency
10 ms Pulse width

Methods

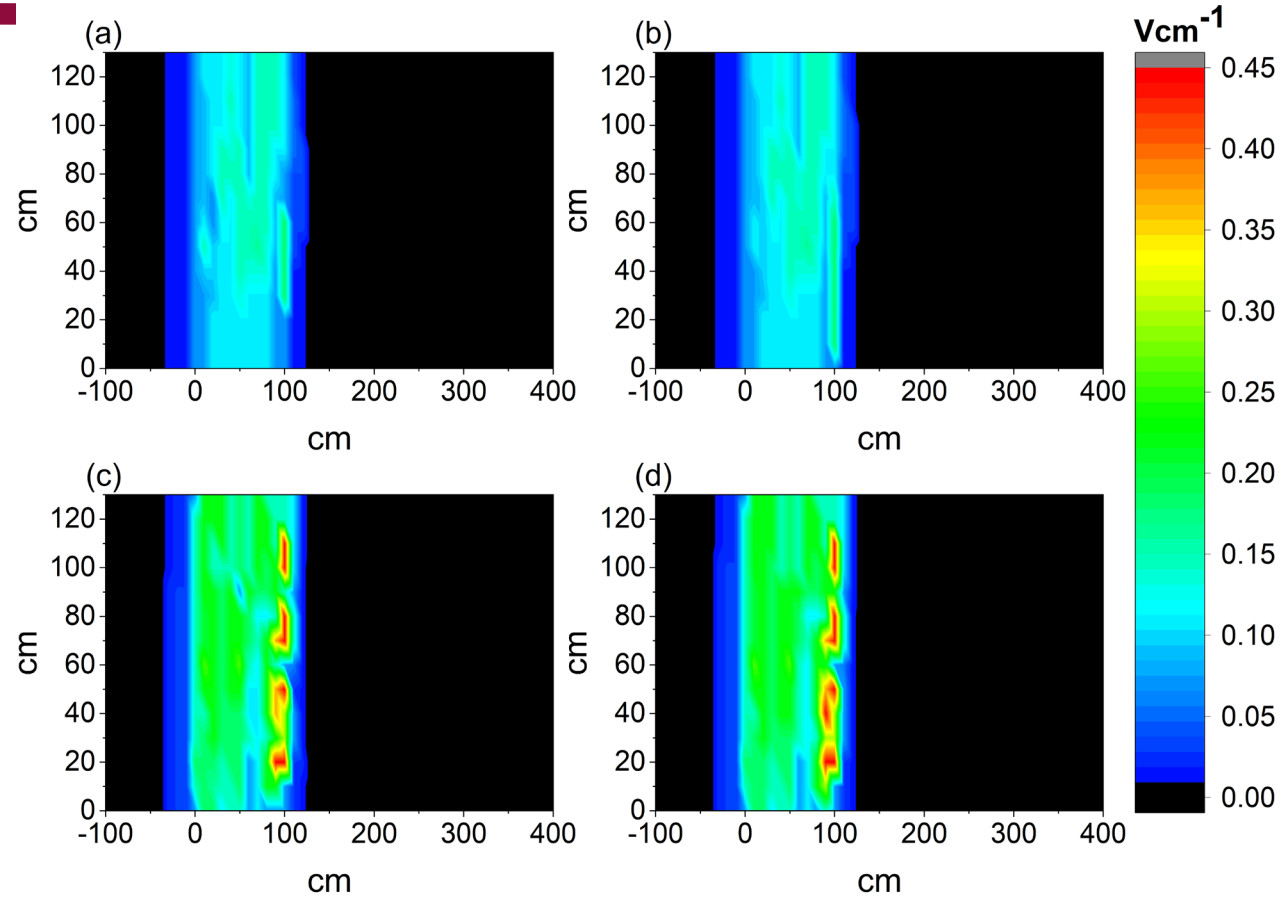
Experimental Set-Up



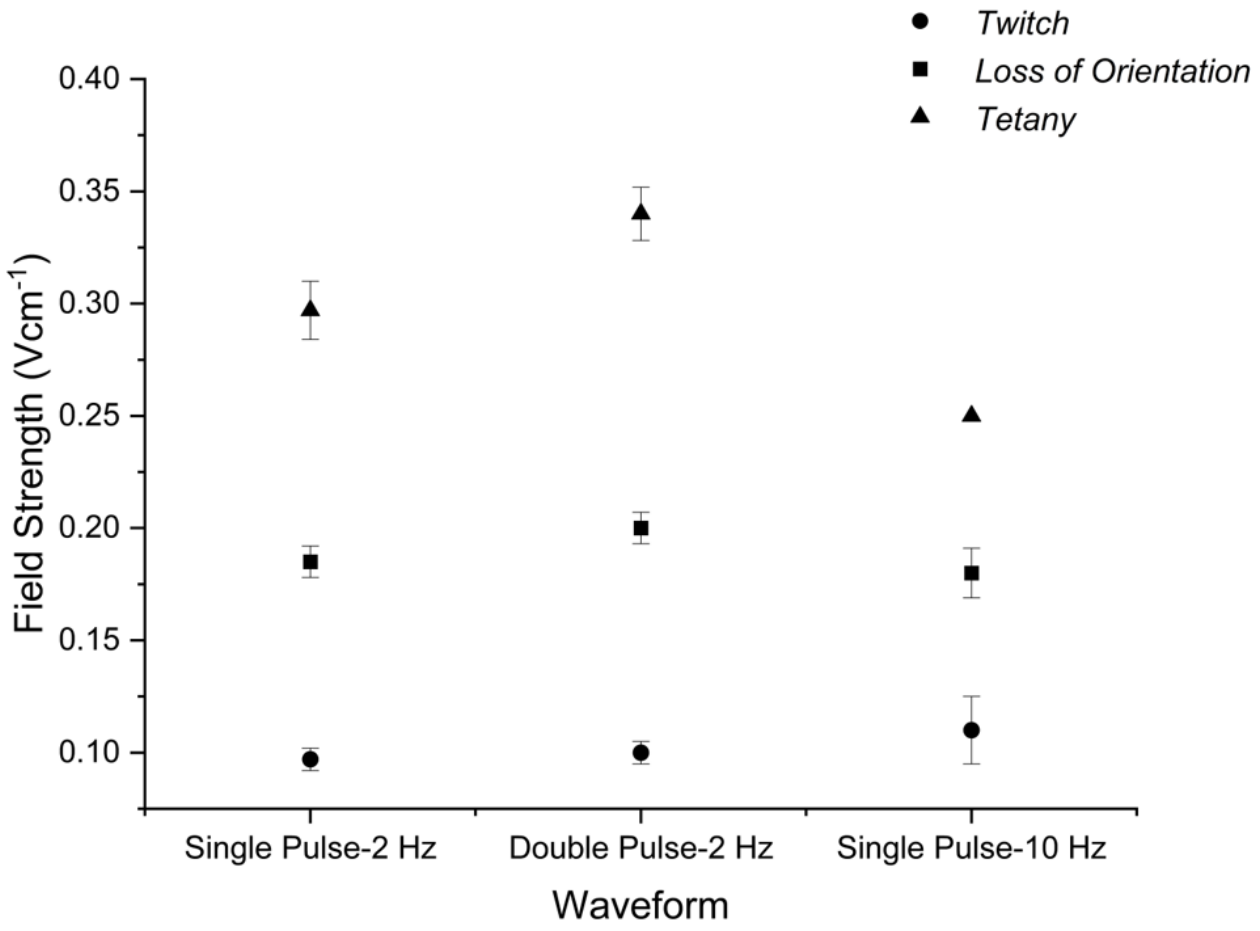
Experimental Procedure

- Two electric field strengths
  - ≈ 0.15 Vcm^{-1} (Mean *Twitch*)
  - ≈ 0.3 Vcm^{-1} (Mean *Tetany*)
- Two water velocities
  - 0.5 ms^{-1} (Low)
  - 1.0 ms^{-1} (High)

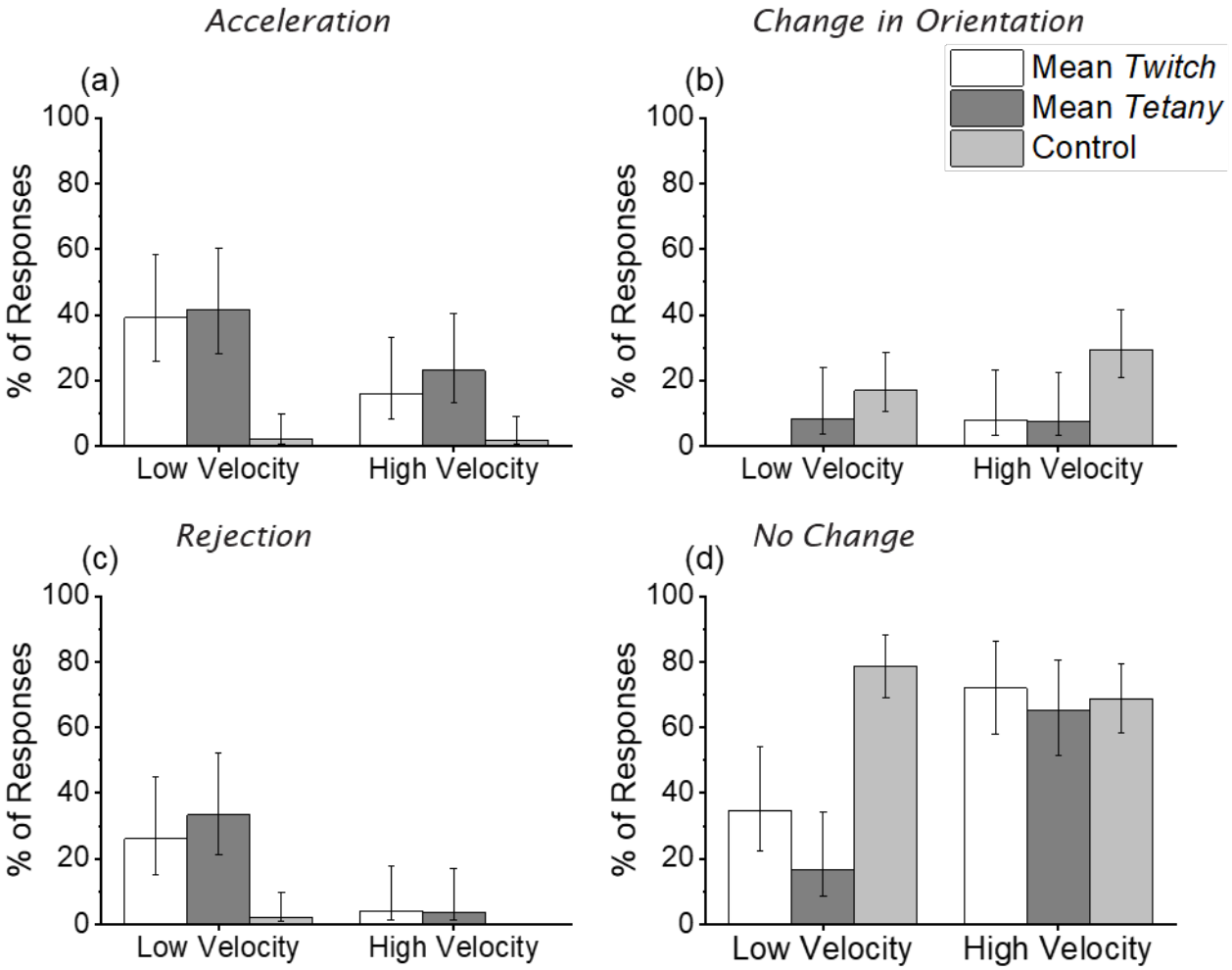
Methods


(a)
(b)
(c)
(d)
cm
cm
Vcm-1
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
120
100
80
60
40
20
0
-100
0
100
200
300
400

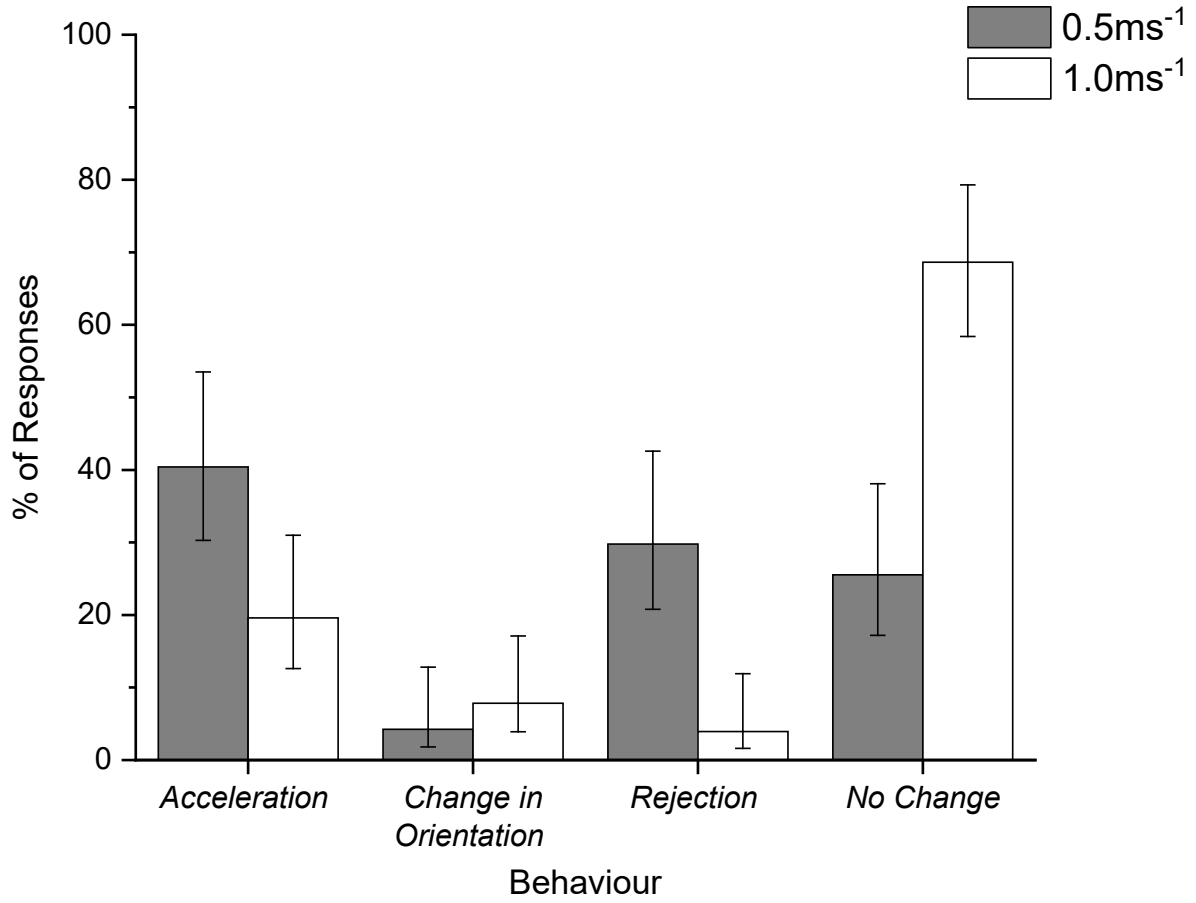
Results (1)


Twitch
Loss of Orientation
Tetany
0.40
0.35
0.30
0.25
0.20
0.15
0.10
Field Strength (Vcm-1)
Single Pulse-2 Hz
Double Pulse-2 Hz
Single Pulse-10 Hz
Waveform

Results (2)


Acceleration
(a)
% of Responses
100
80
60
40
20
0
Low Velocity
High Velocity
Change in Orientation
(b)
Mean Twitch
Mean Tetany
Control
Rejection
(c)
No Change
(d)

Results (3)


0.5ms-1
1.0ms-1
100
80
60
40
20
0
% of Responses
Acceleration
Change in Orientation
Rejection
No Change
Behaviour

Summary & Future Work

- Distinct thresholds for key physiological behaviours
- Slight differences in thresholds for *tetany* across waveforms
- Less avoidance behaviour seen under high water velocity
- Future work
  - Different life stages e.g upstream migrating juveniles
  - Orientation of electrodes

Thank you

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Questions ?

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