Behavioural Responses of *Unio pictorum* and *Anodonta anatina* to Light Availability and their Ecological Importance



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Overview

- Introduction
  - Ecosystem services
  - Water purification
- Factors affecting locomotion
  - Diurnal rhythm
  - Light availability
- Summary
  - Findings and further research
  - Applicability

Diurnal rhythm



Aim - assess locomotion as a factor of light availability

H1: The probability of mussel locomotion during the dark period is significantly higher than the probability during the light period

H2: There is no significant difference between the probability of locomotion among the different time slots during the day

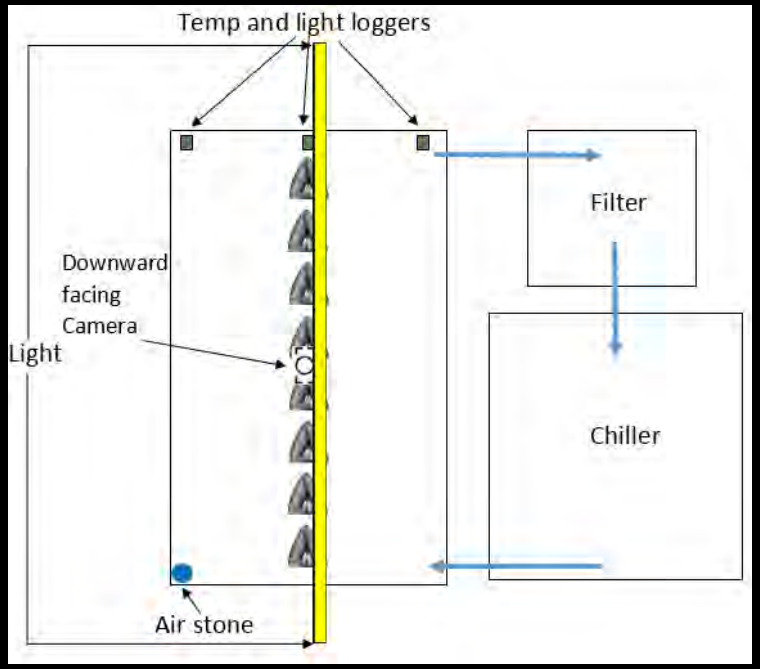
H3: The locomotion distance covered in the dark period is significantly higher than that covered during the light period

Experimental design



Diurnal rhythm – 2-day experiments

- *U. pictorum*
- 60 l tanks, dechlorinated tap water, temp. 19 ± 1 °C
- 0.1 mg AFDW *Chlorella vulgaris* l^{-1} at 06:00, 14:00 and 22:00
- Light on from 06:00 to 22:00
- Vertical photographs were taken before feeding
- Number of locomotion activities and distance covered





Probability theory analysis

	M1 (11)	A1 (2)	E1 (11)	M2 (0)	A2 (0)	E2 (5)
M1 (11)	1	< 0.001	1	< 0.001	< 0.001	< 0.05
A1 (2)	< 0.01	1	< 0.01	< 0.001	< 0.001	> 0.05
E1 (11)	1	< 0.0001	1	< 0.001	< 0.001	< 0.05
M2 (0)	< 0.001	> 0.05	< 0.001	-	-	< 0.01
A2 (0)	< 0.001	> 0.05	< 0.001	-	-	< 0.01
E2 (5)	0.049	0.05	0.049	< 0.001	< 0.001	1

8 mussels per tank

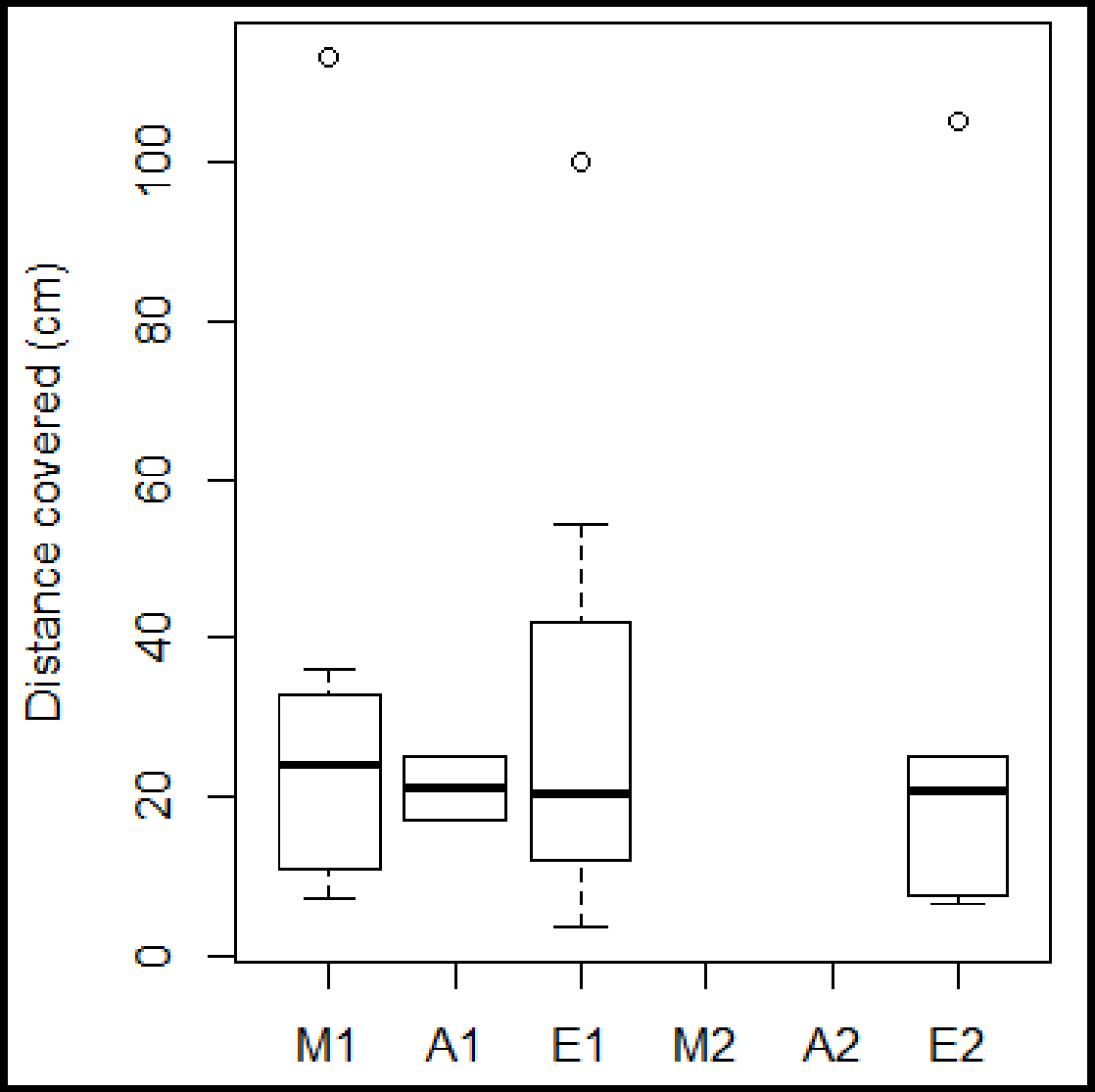
9 tanks

n = 72

M 06:00 am - 02:00 pm
A 02:00 pm - 10:00 pm
E 10:00 pm - 06:00 am

Locomotion probability out of 72

Locomotion distance



GLM analysis

No significant differences with p values > 0.05

Phototaxis



Aim - assess phototaxis as a factor of light availability

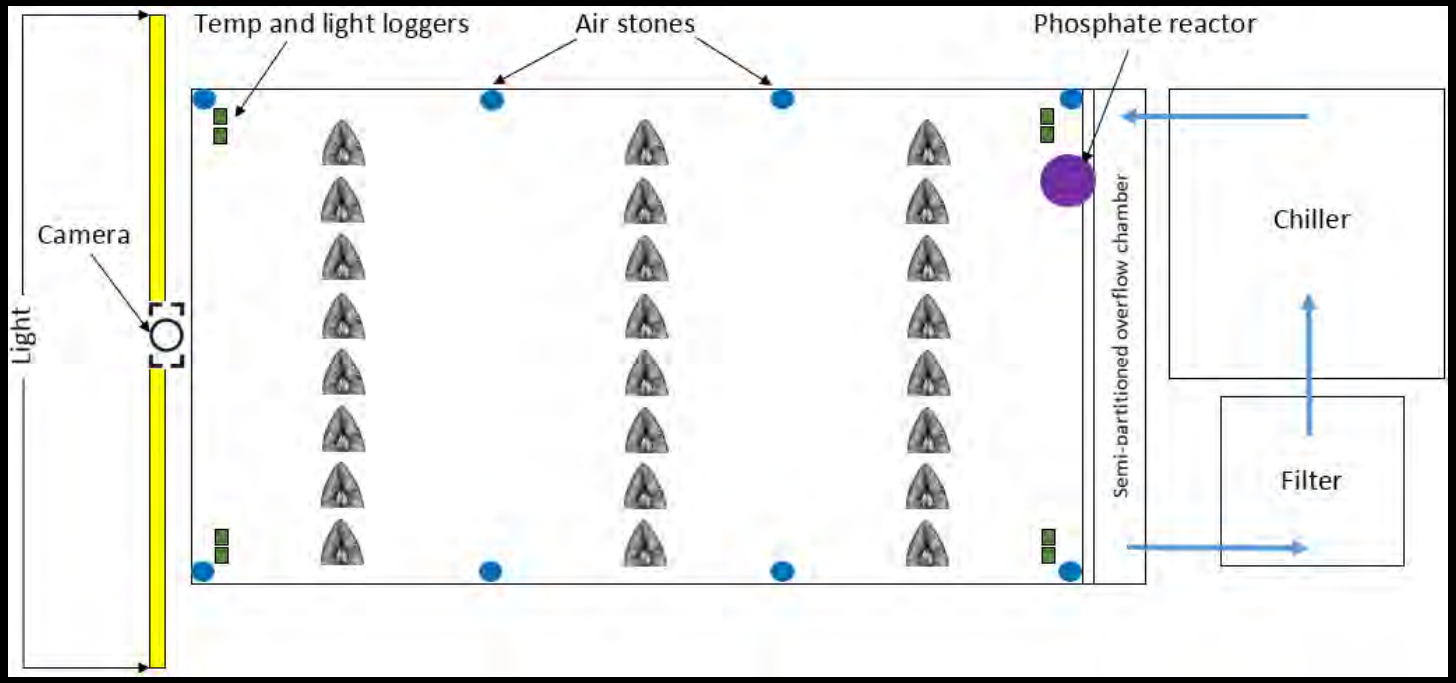
H4: Both *A. anatina* and *U. pictorum* show positive phototaxis which significantly decreases with light intensity

H5: Light intensity is expected to significantly affect the angle of mussels' posterior tip in relation to the light source in both species

Experimental design

Phototaxis – 4-day experiments

- *U. pictorum* and *A. anatina*
- 320 l tank, dechlorinated tap water, phosphate reactor, temp. 19 ± 1 °C
- 0.2 mg AFDW *Chlorella vulgaris* l^{-1} at 13:00 daily
- Vertical (09:00, 13:00 and 17:00) and horizontal time-lapse photography
- Perpendicular distance and angle in relation to the light source

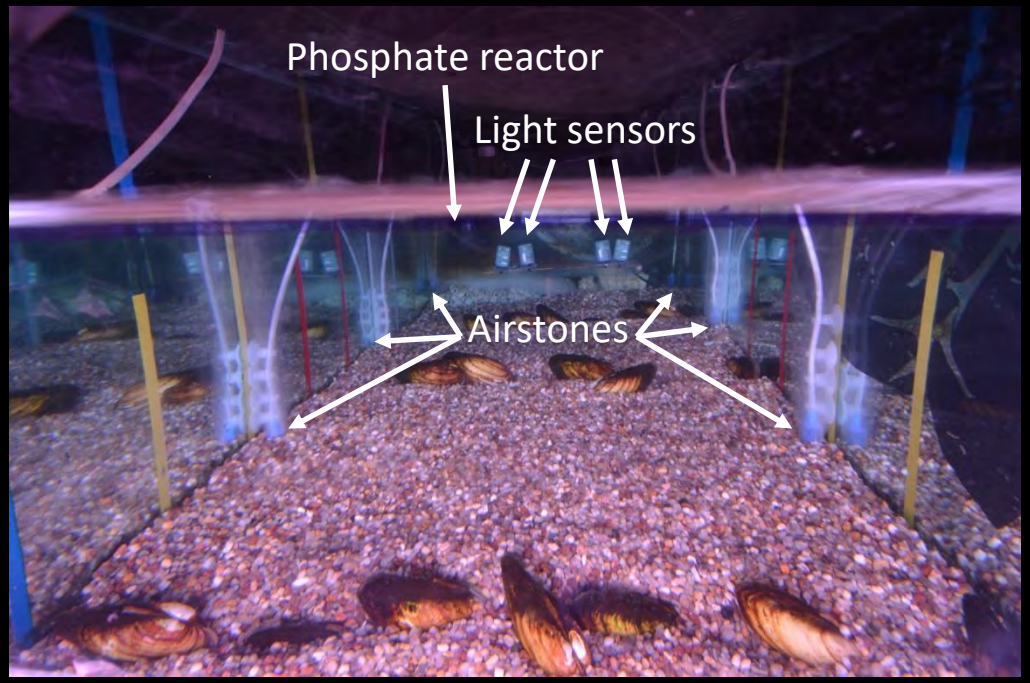


Experimental design



Phototaxis – 4-day experiments

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- 320 l tank, dechlorinated tap water, phosphate reactor, temp. 19 ± 1 °C
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- Vertical (09:00, 13:00 and 17:00) and horizontal time-lapse photography
- Perpendicular distance and angle in relation to the light source



Vertical images



U. pictorum start
16 July 18



U. pictorum end
20 July 18



A. anatina start
24 July 18

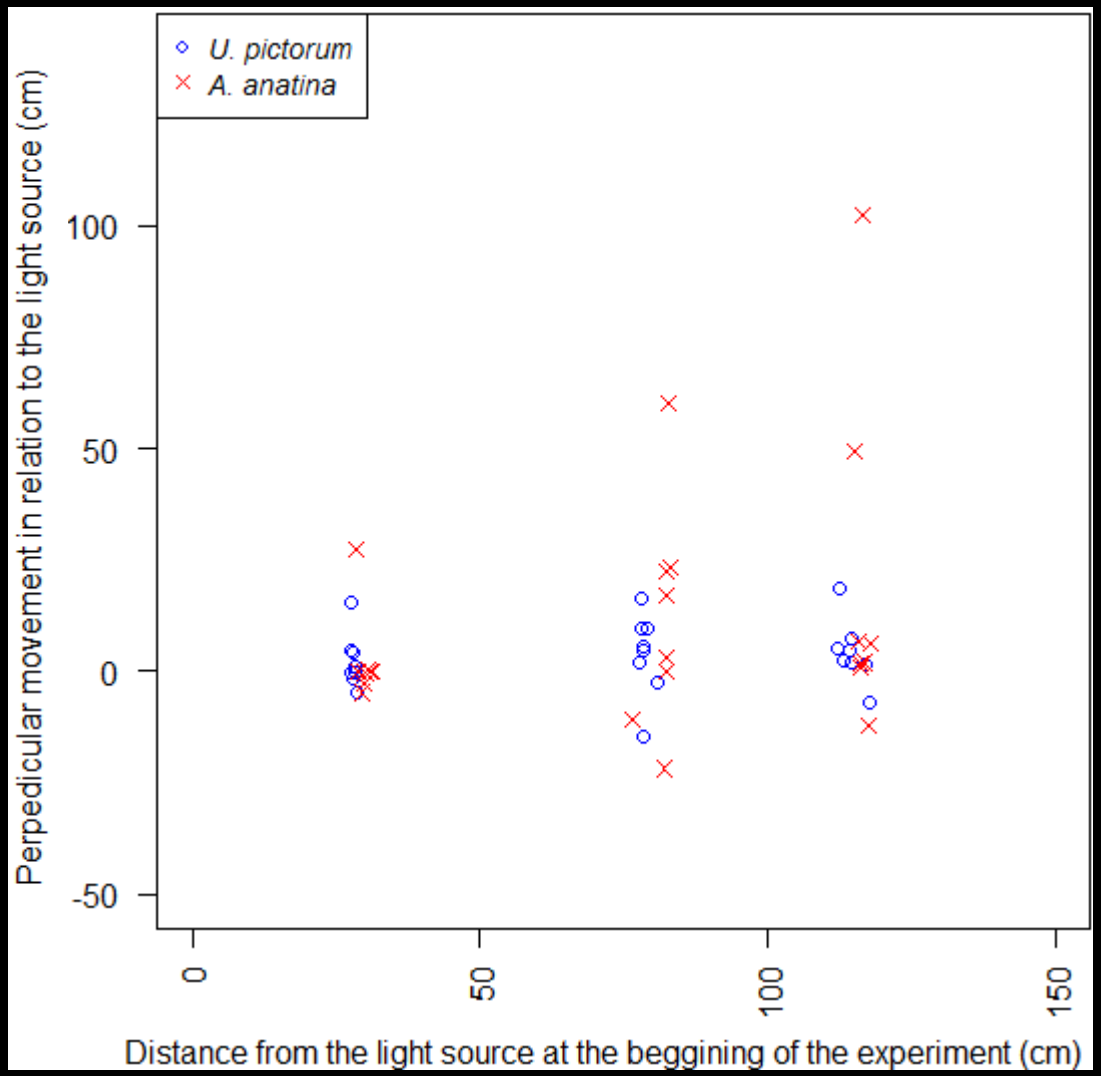


A. anatina end
28 July 18



Locomotion and light intensity



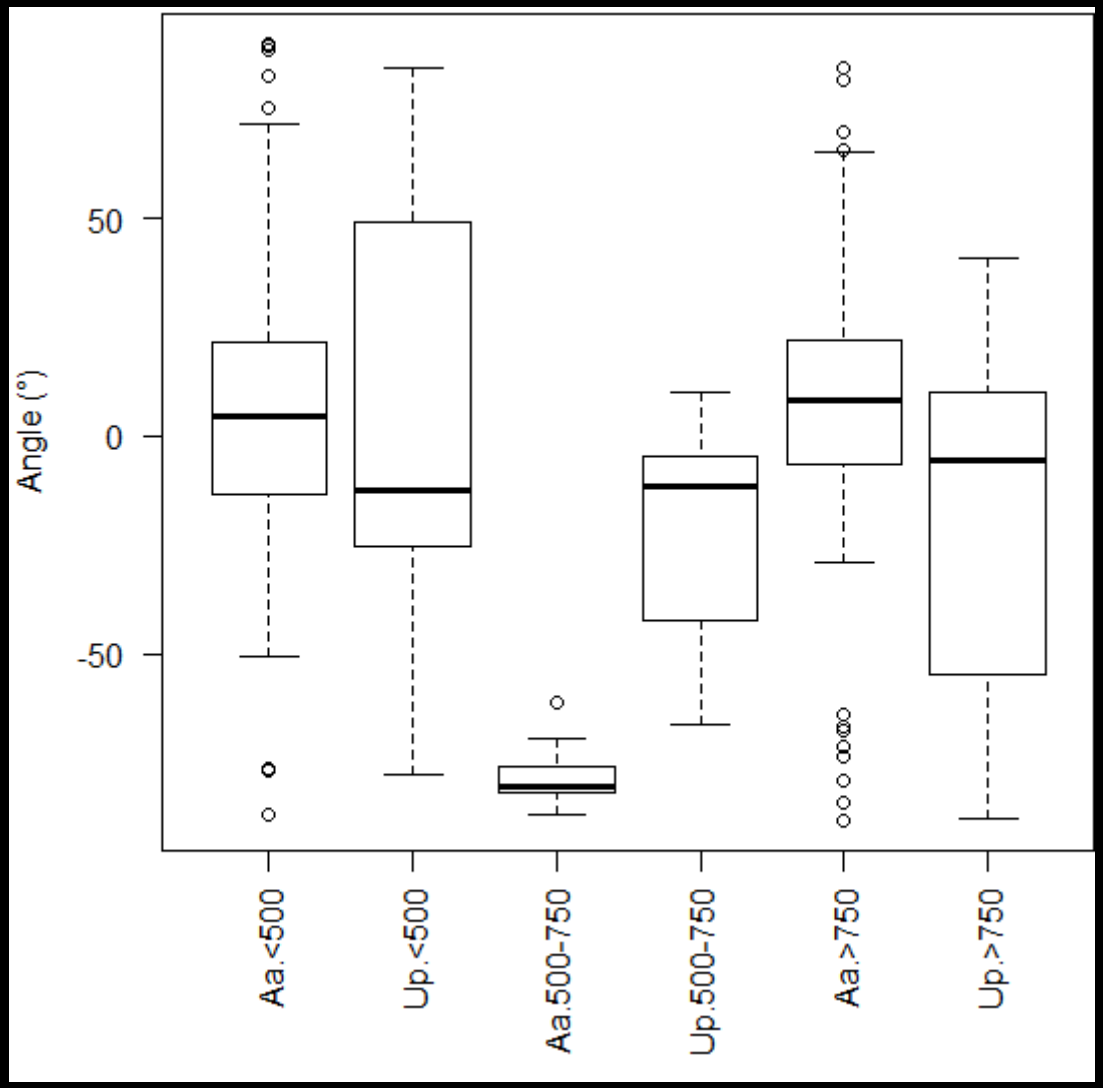


Group	Distance (cm)	Light intensity (lux)
High (HI)	29.0	1085
Intermediate (II)	80.2	437
Low (LI)	115.4	232

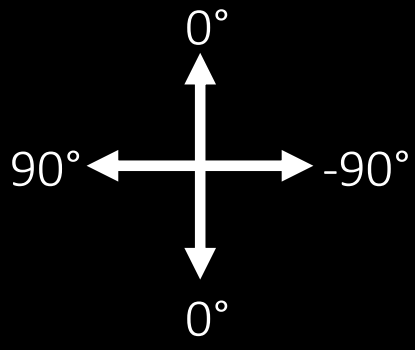
Species	Group	Mean (cm)	SD (cm)
Aa	HI	2.5	10.2
Aa	II	11.7	25.2
Aa	LI	19.6	38.0
Up	HI	2.3	6.1
Up	II	3.8	9.3
Up	LI	4.4	7.2

Angle in relation to the light source



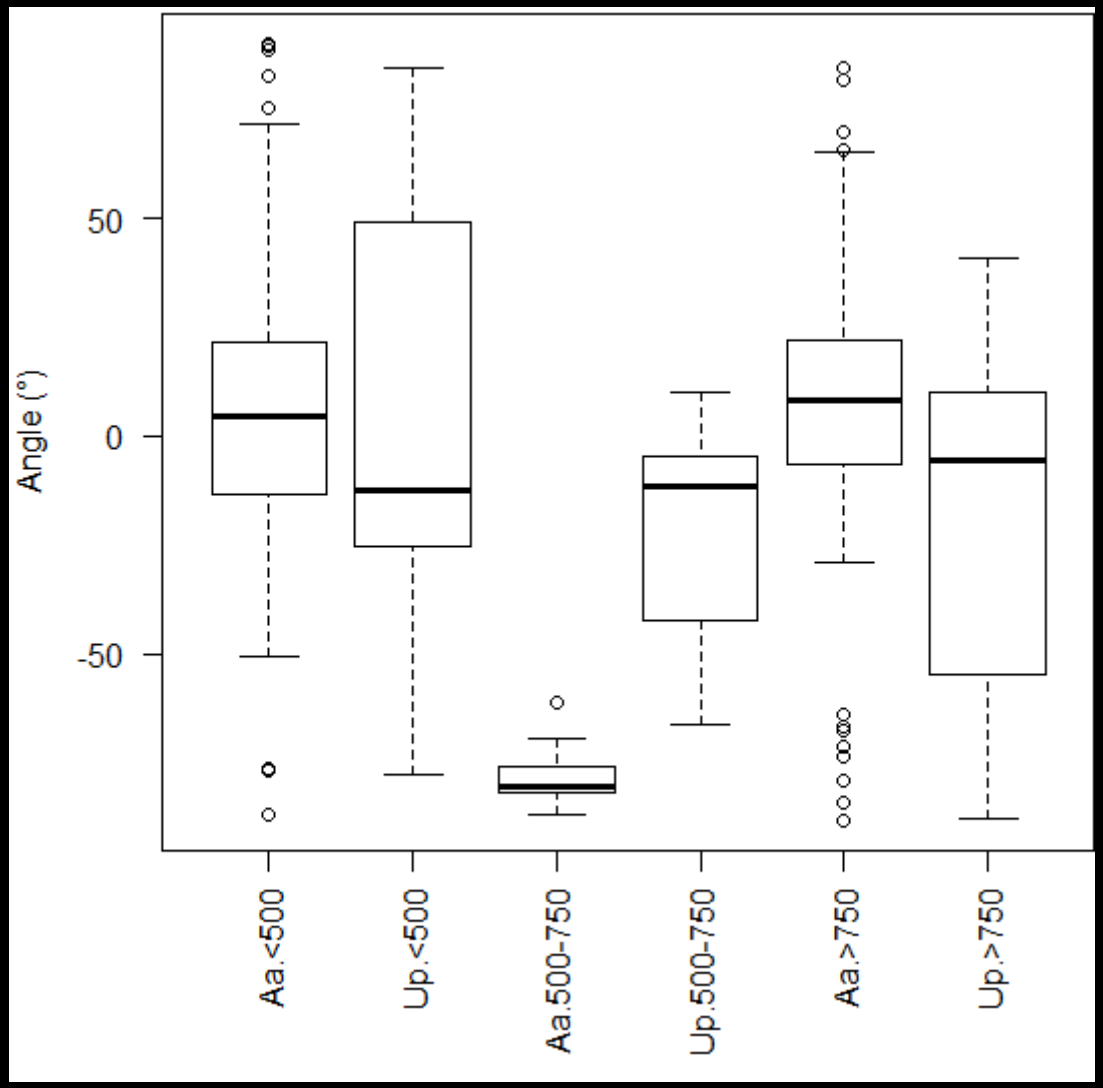


Lux
< 500 lux
500 - 750 lux
> 750 lux

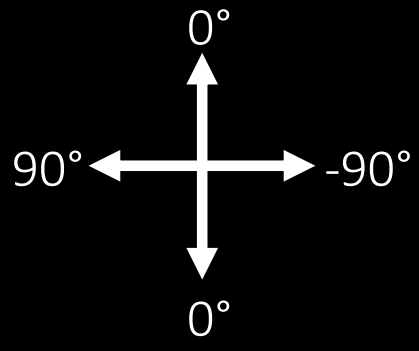


Angle in relation to the light source





Lux
< 500 lux
500 - 750 lux
> 750 lux



A. anatina	p-value: 0.006		
	<500	500-750	>750
<500	1	-	-
500-750	< 0.01	1	-
>750	> 0.05	< 0.01	1

U. pictorum	p-value: 0.516		
	<500	500-750	>750
<500	1	-	-
500-750	> 0.05	1	-
>750	> 0.05	> 0.05	1

Applicability - Reintroductions



- Bioremediation potential - water purification

i) Sediment mixing, bioturbation and nutrient release vs Biodeposition and biostabilation

ii) Model the processes

- Social and environmental impacts

- Conservation

i) Species specific light niche could affect reintroductions' success

ii) Light availability could be considered as a factor in monitoring programmes - cost effectiveness

Thank you for your time

