FlatEMF: Laboratory study on behavioural effects of electromagnetic fields on adult flatfish

ST ABBS MARINE STATION

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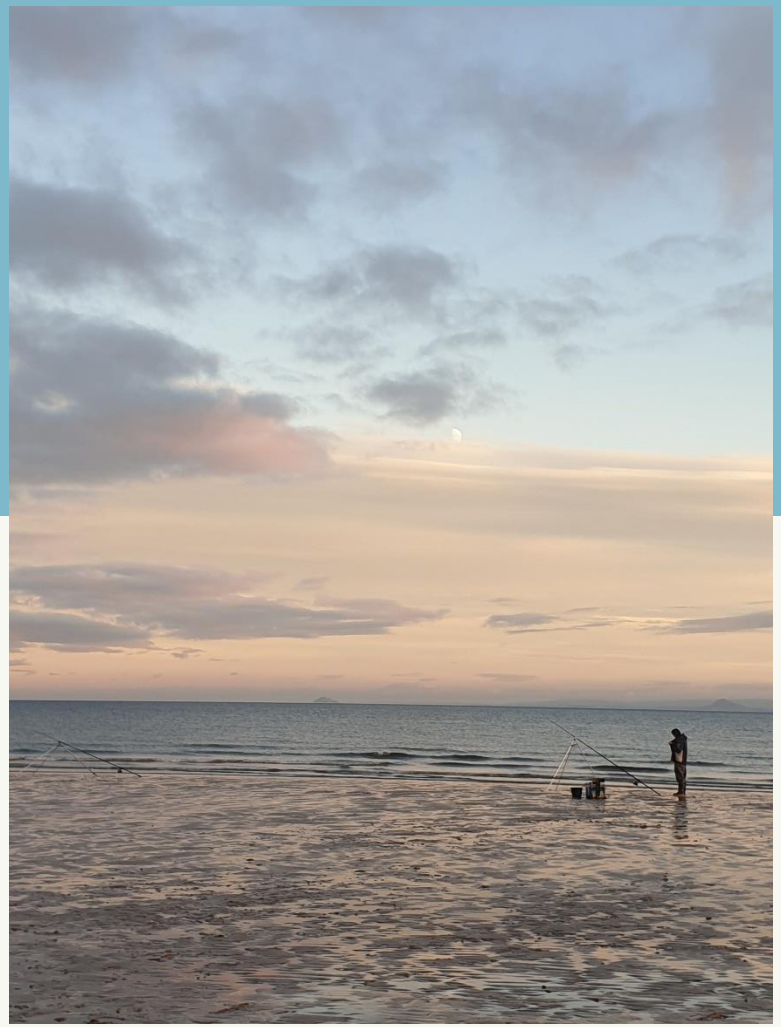
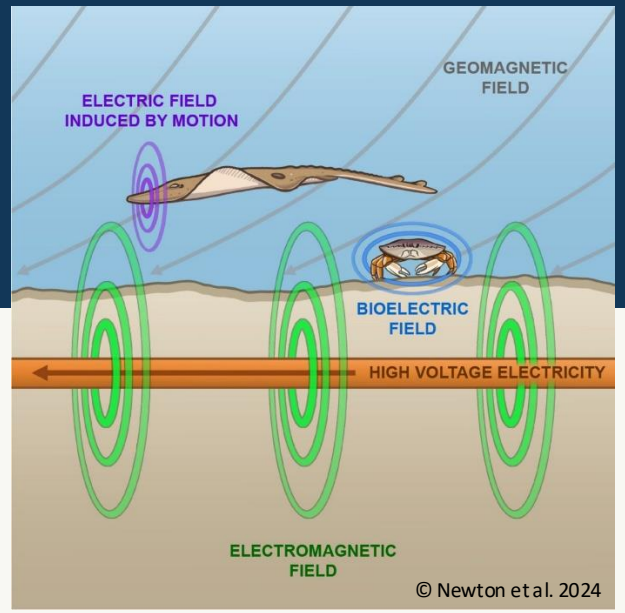
Presentation outline

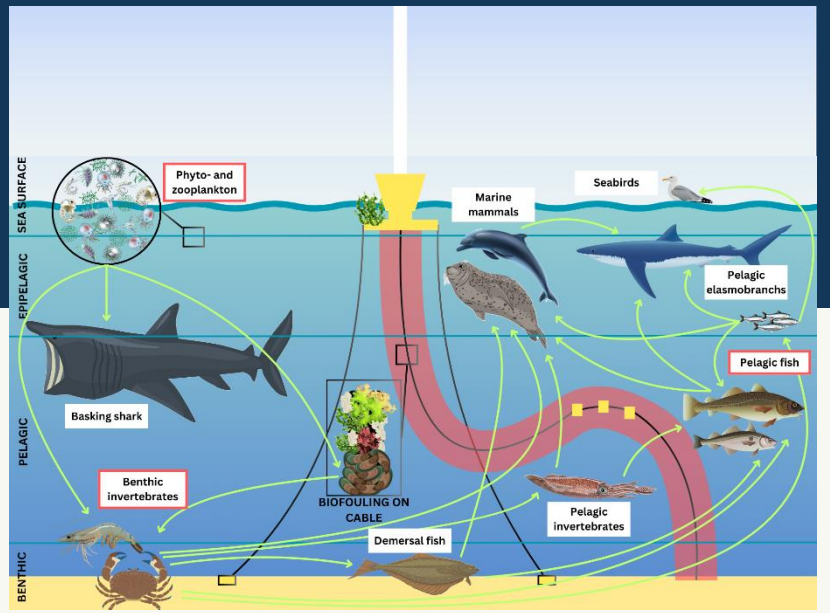
- Background
- Study methods
- Results
- Next steps



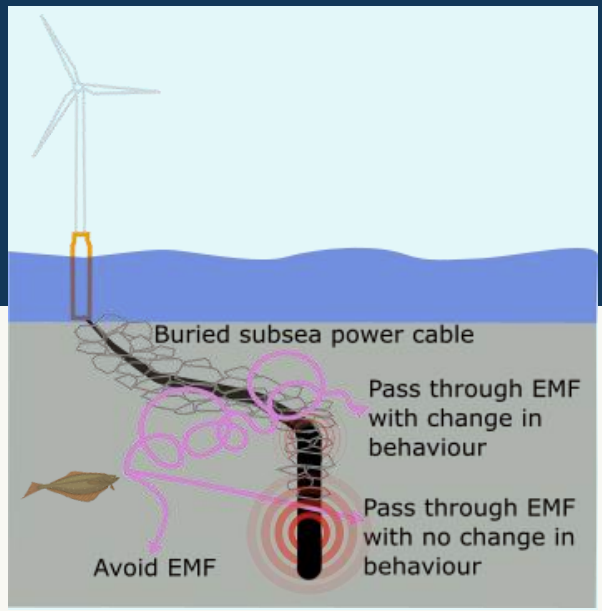
EMF & wildlife



Natural and anthropogenic magnetic and electric fields



Potential ecological effects



Behavioural effects to be investigated

Current windfarm and flatfish research

No changes seen

- No effect on number or length
- No large-scale avoidance to windfarm or attraction to monopiles
- No consistent effect on dietary habits & condition (US)
- Survival of young not affected by EMF

Changes seen

- Some minor or anecdotal size differences
- Increase in biomass
- Shift in diet
- Less likely to cross over cable during nighttime high energy production (EMF unknown)

Other observations

- Recruitment overlap
- Limited research on magnetoreception
- Active over export cable (no analysis)

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Effects of electromagnetic fields on flatfish activity levels

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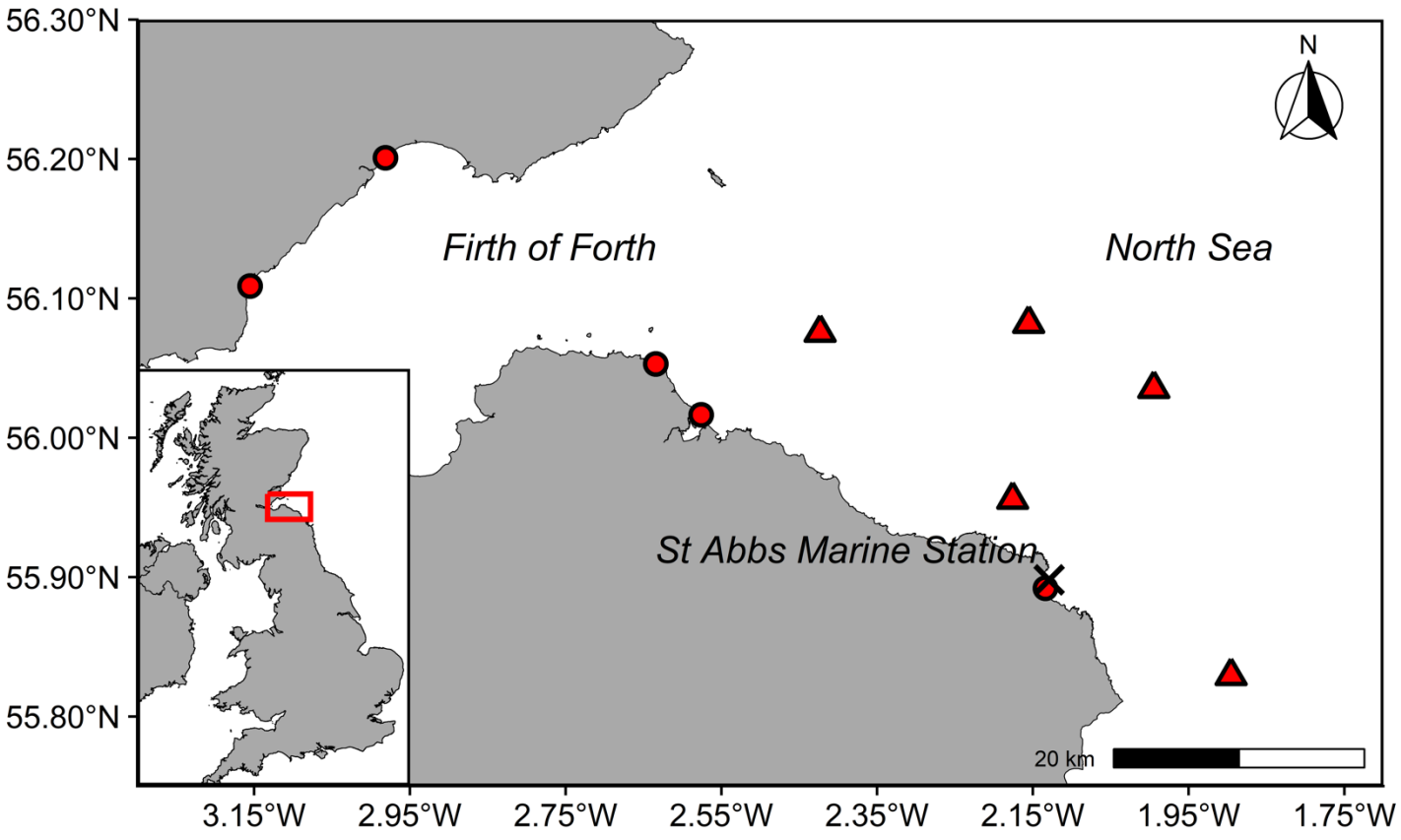
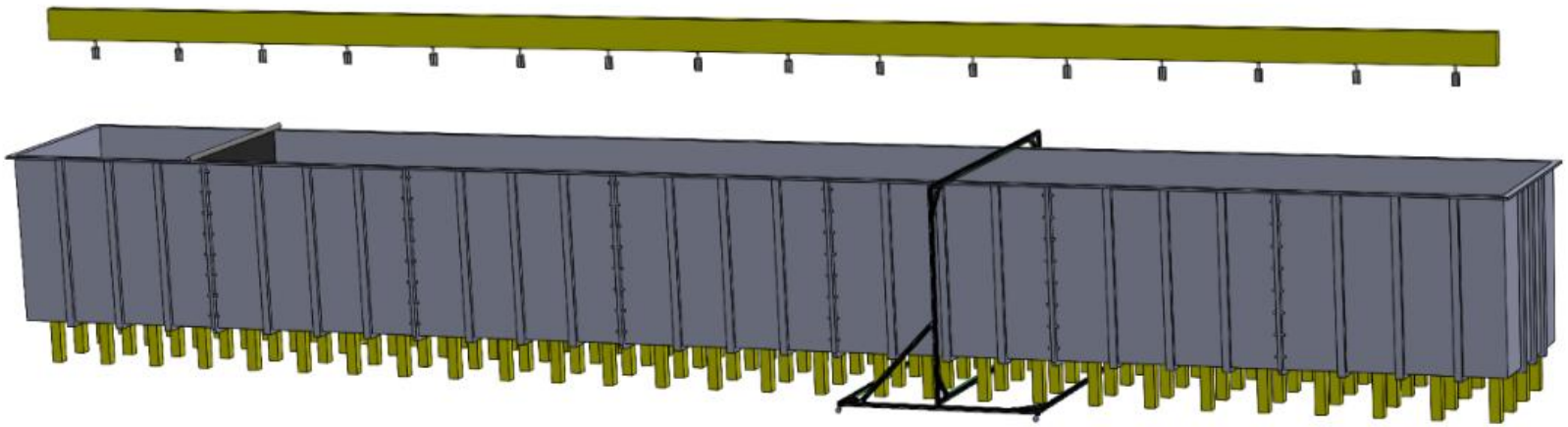
Animal acquisition

- European flounder (*Platichthys flesus*)
- European plaice *(Pleuronectes platessa)*



Key infrastructure

- GRP building low magnetic field interference
- 275 m² aquarium
- Raw seawater supply (20,000 L/h)
- Semi-clear roof & ventilated walls
- Specialist EMF magnetic field generators



EMF generation

Alternating Current (maximum ca. 15 µT RMS)

Direct Current (maximum ca. 21 µT)

	10	9.5	9	8.5	8	7.5	7	6.5	6	5.5	5	4.5	4	3.5	3	2.5	2	1.5	1	0.5	0	-0.5	-1	-1.5	-2	-2.5	-3	-3.5	-4	-4.5	-5
-0.5	NA	NA	0	NA	NA	NA	NA	NA	0.1	NA	NA	NA	NA	NA	0.6	1.1	1.9	4.2	10.3	13.5	15.0	13.3	11.3	5.1	2.1	1.1	0.6	NA	NA	NA	NA
0	NA	NA	0	NA	NA	NA	NA	NA	0.1	NA	NA	NA	NA	NA	0.7	1.1	2.0	4.6	10.8	13.2	14.4	13.0	11.5	4.9	2.2	1.1	0.7	NA	NA	NA	NA
0.5	NA	NA	0	NA	NA	NA	NA	NA	0.1	NA	NA	NA	NA	NA	0.6	1.1	2.0	4.4	10.5	13.3	15.0	13.1	11.3	4.9	2.1	1.1	0.6	NA	NA	NA	NA

distance from center of EMF in meters

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

distnace from back wall

AC

	10	9.5	9	8.5	8	7.5	7	6.5	6	5.5	5	4.5	4	3.5	3	2.5	2	1.5	1	0.5	0	-0.5	-1	-1.5	-2	-2.5	-3	-3.5	-4	-4.5	-5
-0.5	NA	NA	0.5	NA	NA	NA	NA	NA	0.55	NA	NA	NA	NA	NA	1.85	2.05	3.7	7.5	15.8	18	16.6	17.4	16.8	7.25	3.6	1.8	1.05	NA	NA	NA	NA
0	NA	NA	0.55	NA	NA	NA	NA	NA	0.8	NA	NA	NA	NA	NA	1.8	1.8	3.75	6.9	16.1	18.6	16	19.6	17.2	7.3	3.6	1.55	1.05	NA	NA	NA	NA
0.5	NA	NA	0.5	NA	NA	NA	NA	NA	0.65	NA	NA	NA	NA	NA	1.8	2.05	3.35	7.5	15.8	18.1	16.4	17.4	16.1	8.15	4	1.75	1.25	NA	NA	NA	NA

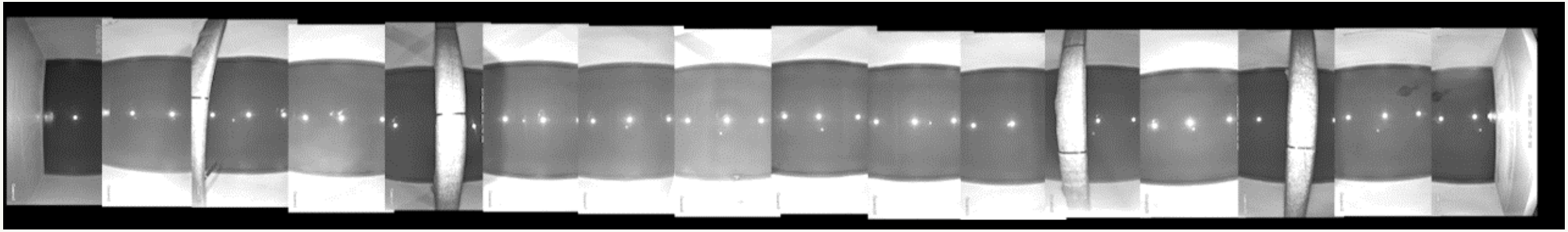
distance from center of EMF in meters

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

distance from back wall

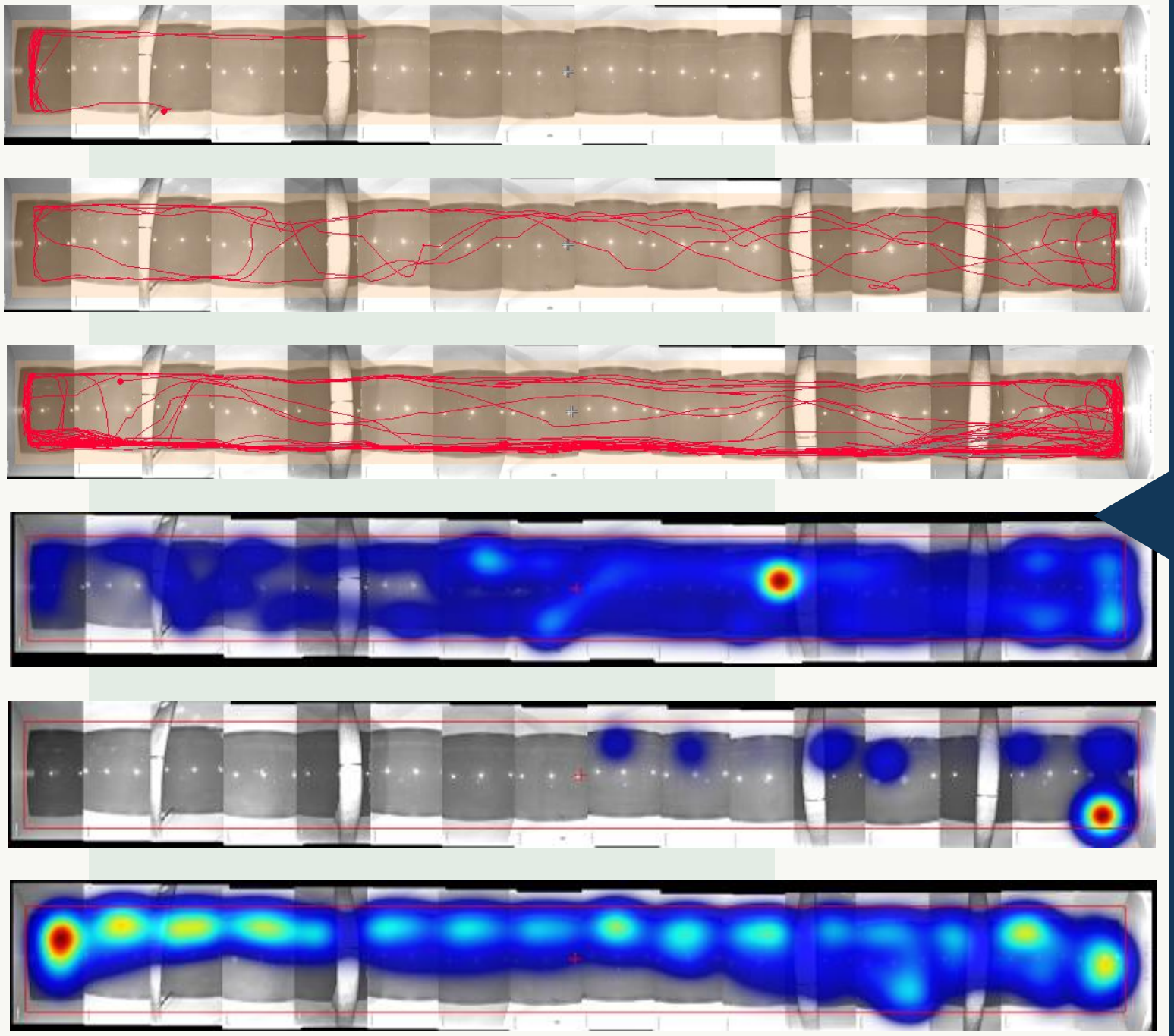
DC

CCTV recordings of behaviour



Parameters measured

- Occurrences in EMF
- Inside vs outside EMF
- Whole tank
- Time spent moving
- Time spent changing direction
- Movement per hour
- Fish length, tank temperature, etc

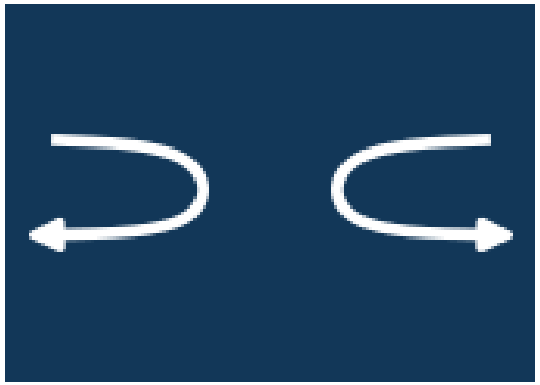


Automated tracking

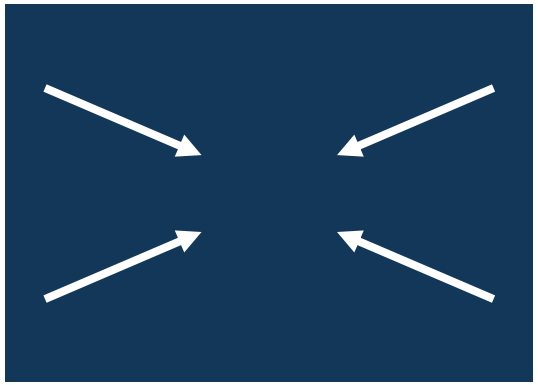
Plaice pilot study

- No significant differences but small sample size
  - Number of occurrences in EMF
  - Time in EMF
  - Portion of time changing direction
  - Time spent moving
- All plaice entered EMF

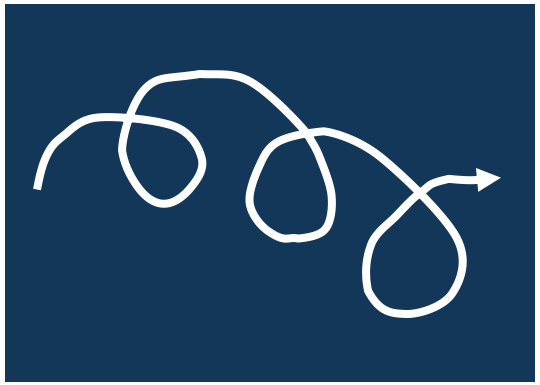
Flounder



No avoidance

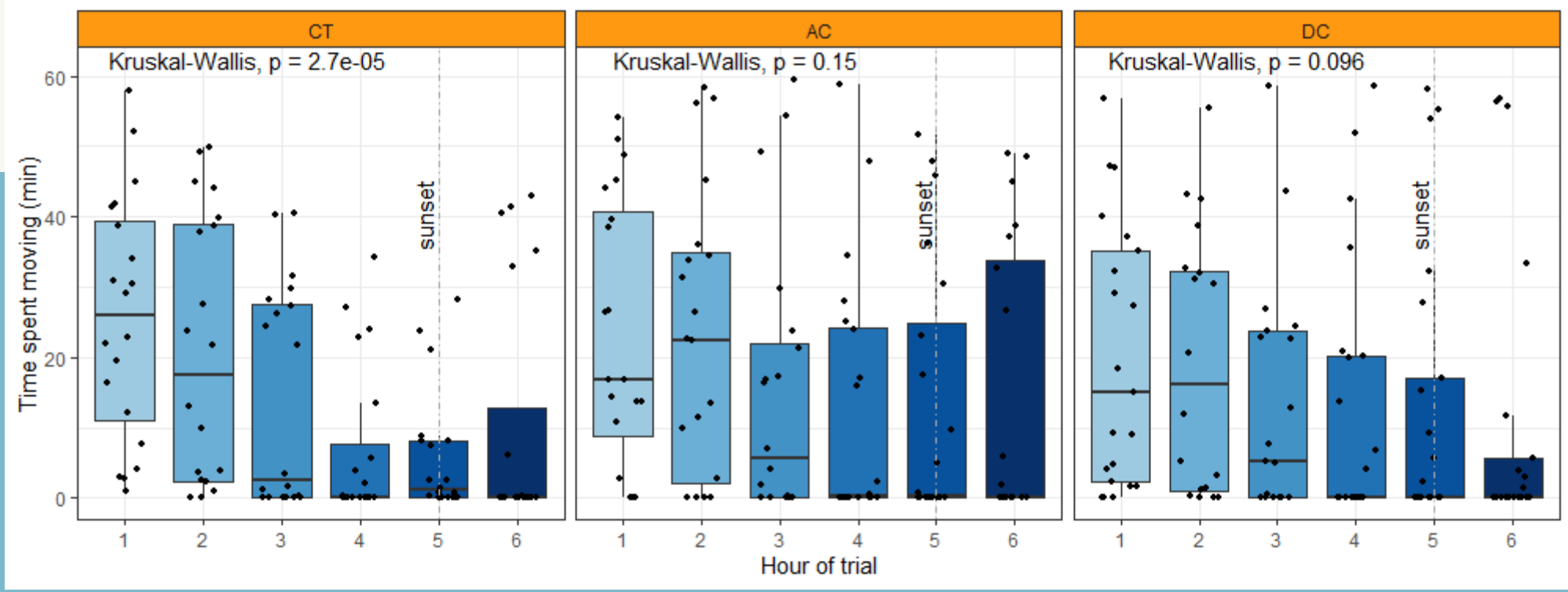


No attraction

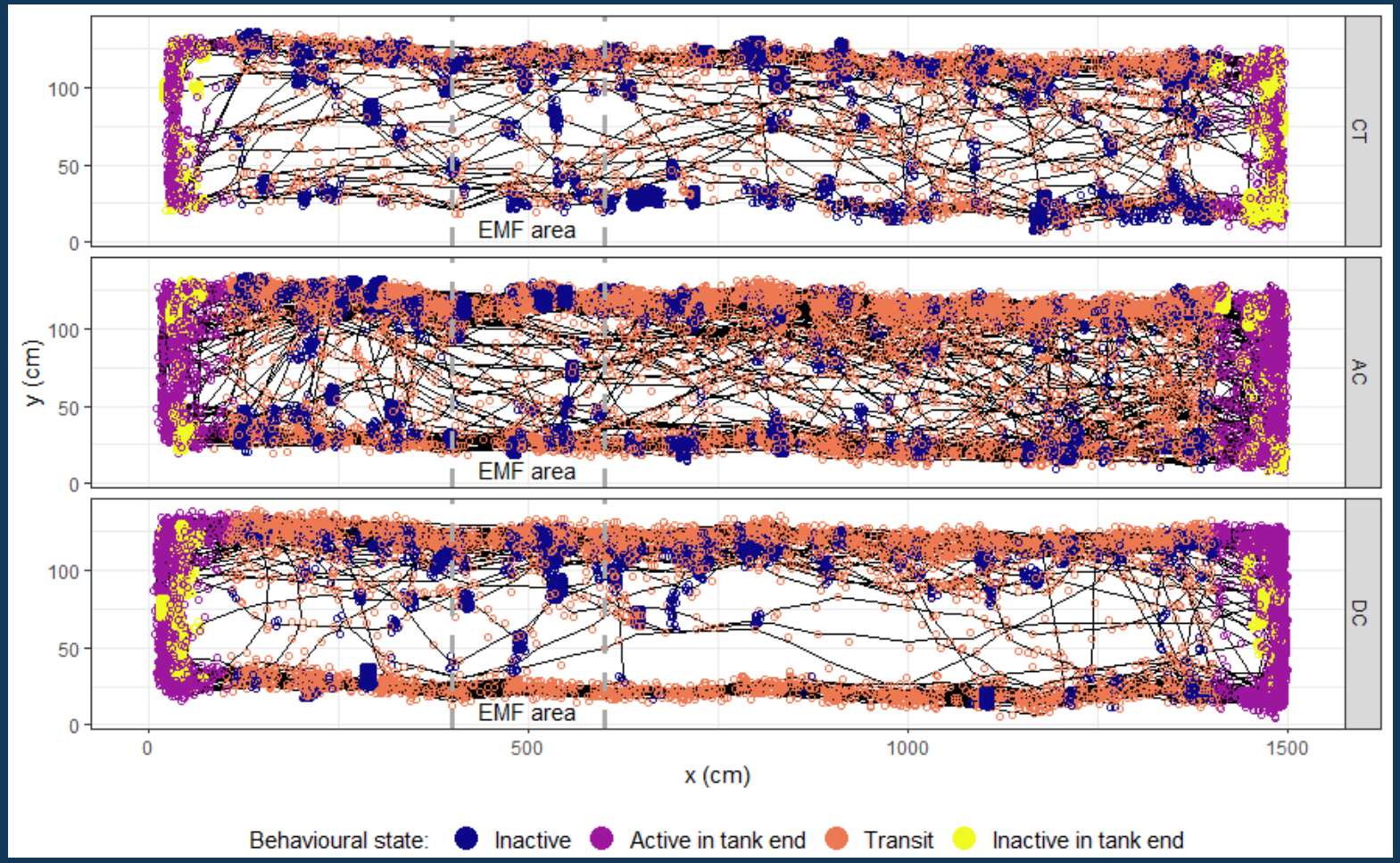


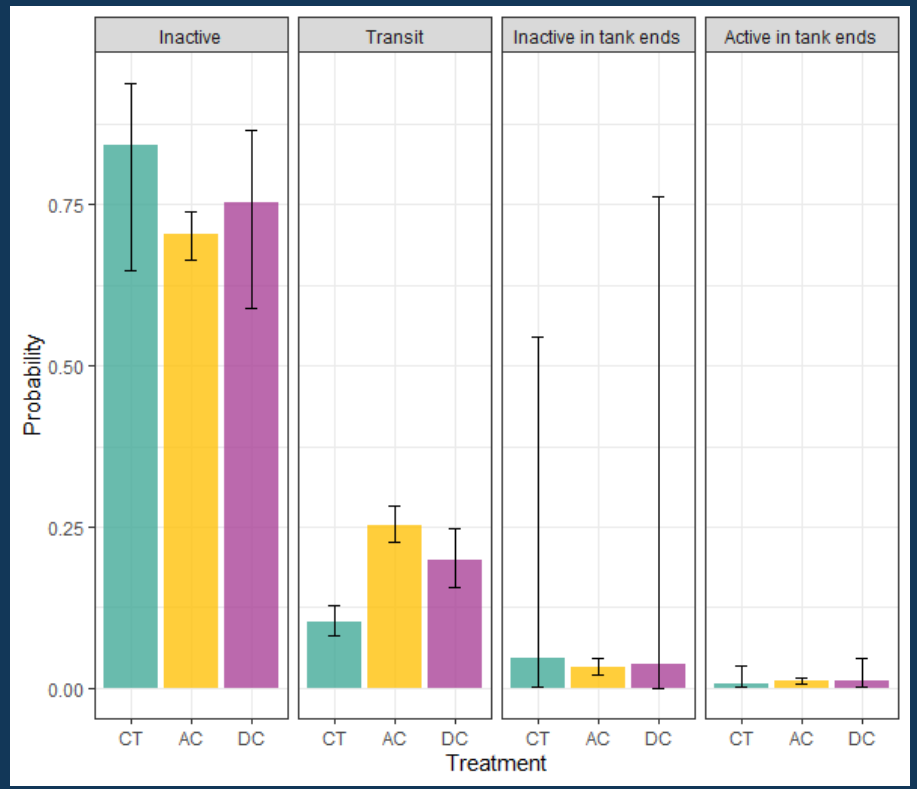
No change in movement

Hourly activity levels



Sunset


CT
AC
DC
EMF area
y (cm)
x (cm)
0
500
1000
1500
Behavioural state:
Inactive
Active in tank end
Transit
Inactive in tank end

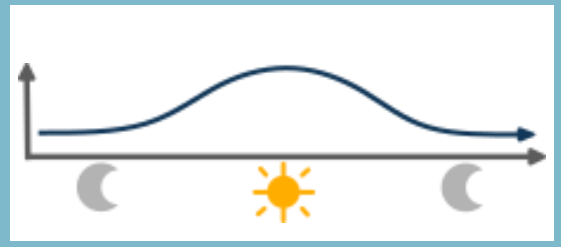

Inactive
Transit
Inactive in tank ends
Active in tank ends
Probability
0.00
0.25
0.50
0.75
CT
AC
DC
Treatment

Next steps

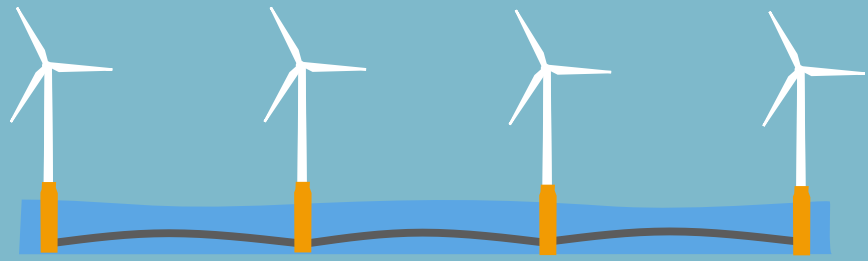
Possible physiological cause(s)

Melatonin

Full 24-hour cycle



In the field



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