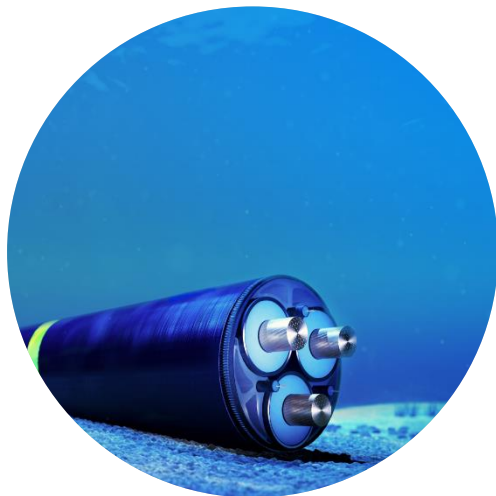


# ElasmoPower: Effects of electromagnetic fields of subsea power cables on benthic elasmobranchs in the Dutch North sea

PhD research Annemiek Hermans

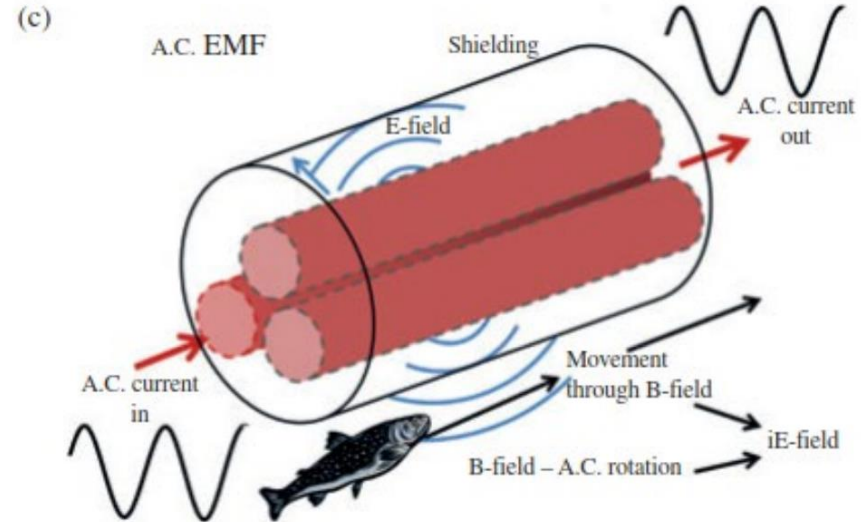
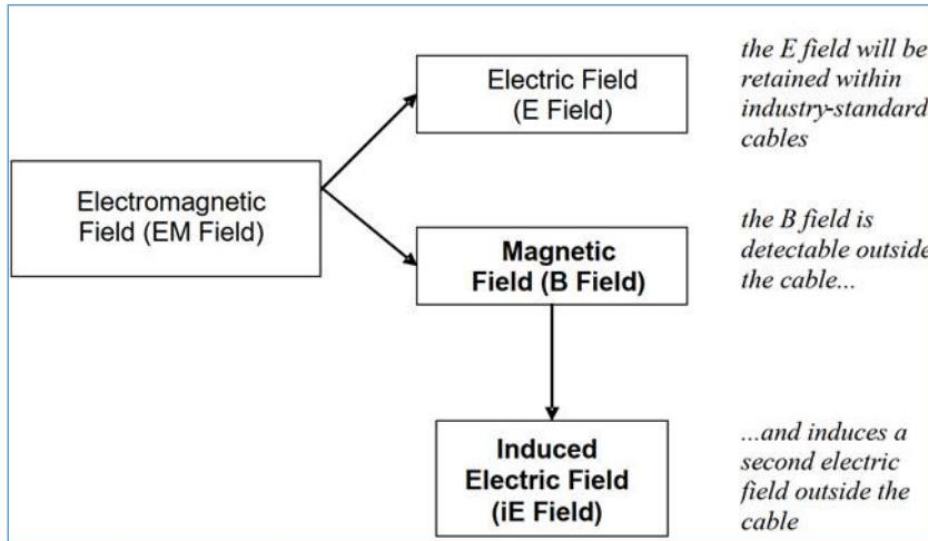
Promotor Tinka Murk, Co-promotors Reindert Nijland (WU) & Erwin Winter (WMR)



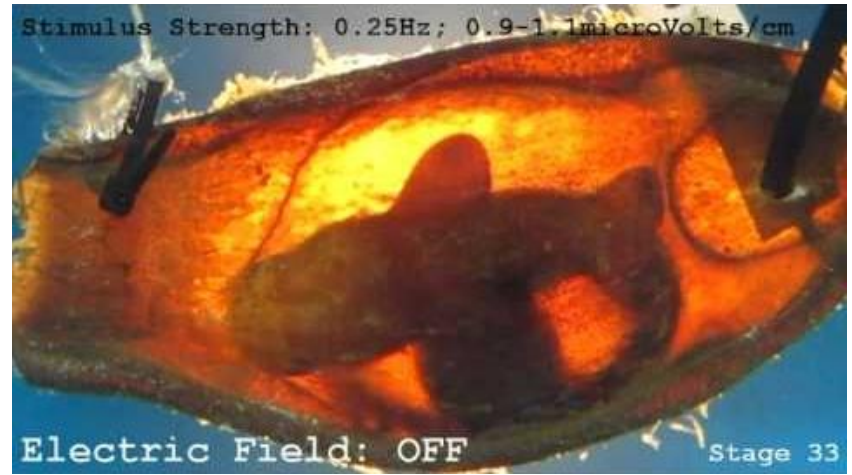
Effects?



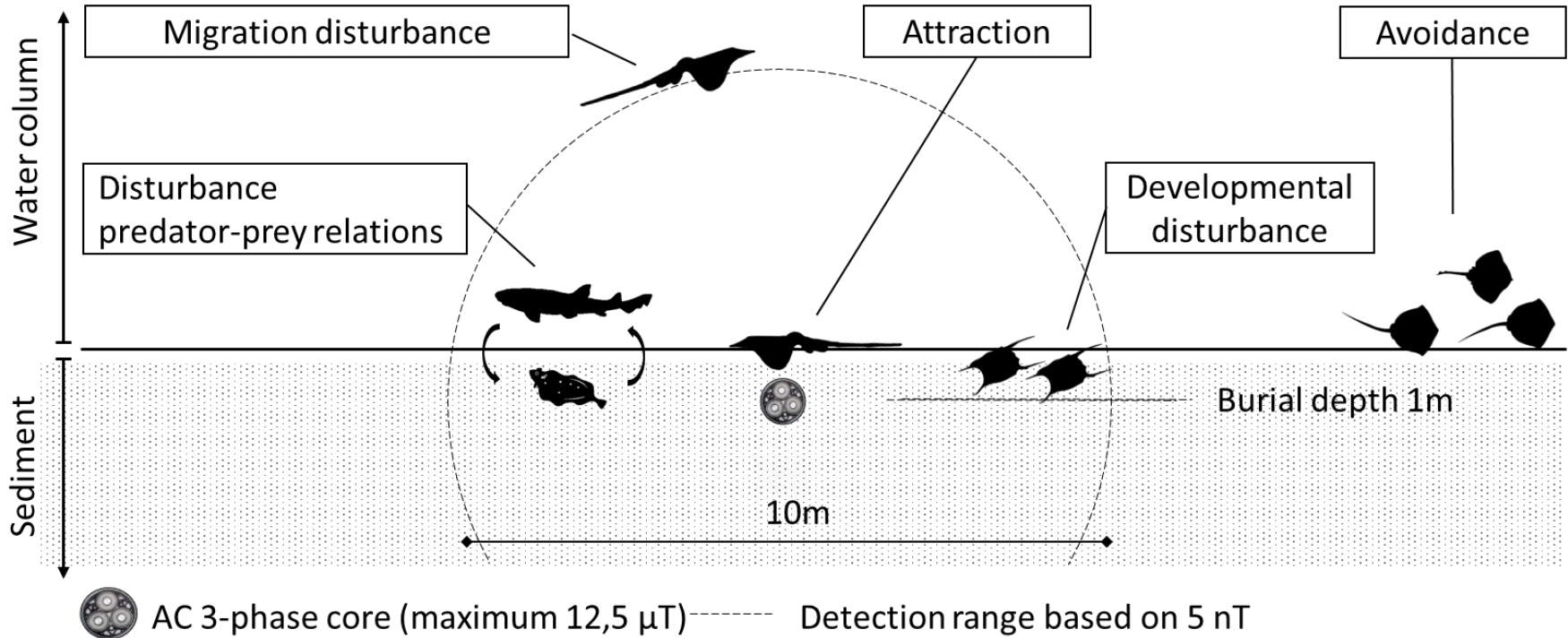
# Electromagnetic fields



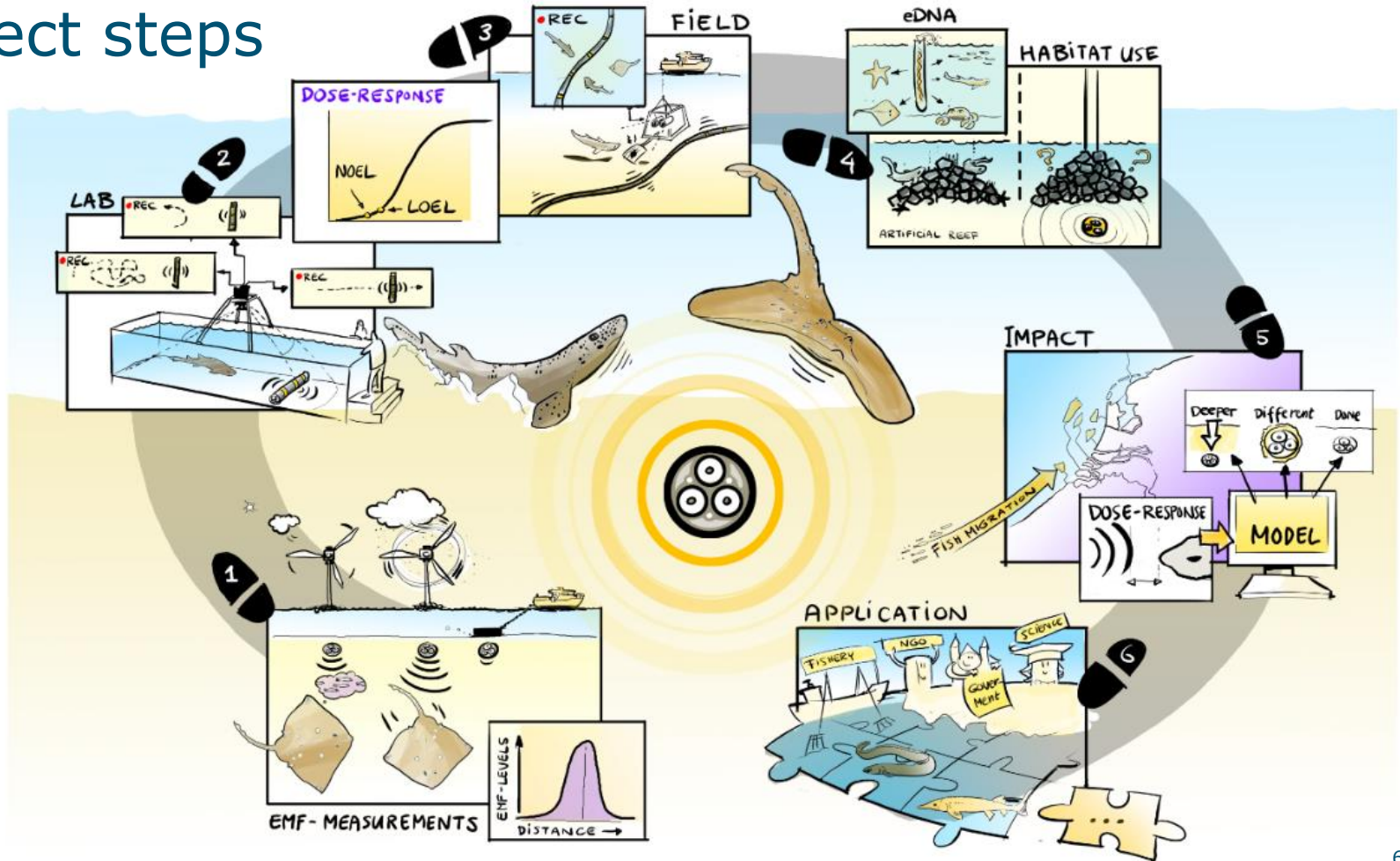
# Different responses



# Reason for concern?



# Project steps



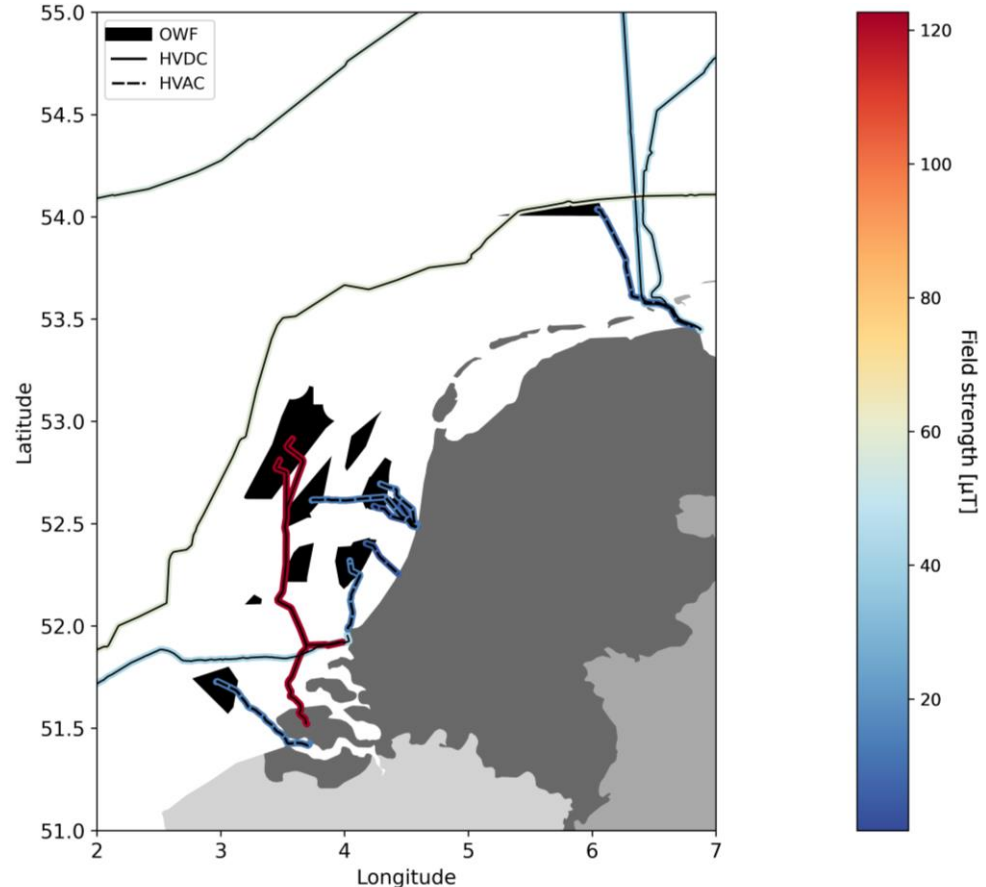
# Data collection complete

Long term EMF monitoring station export cable Borssele



# Model results magneto-scape

- ☛ Included input from cable owners
- ☛ Different scenario's
- ☛ 5% of Dutch North Sea



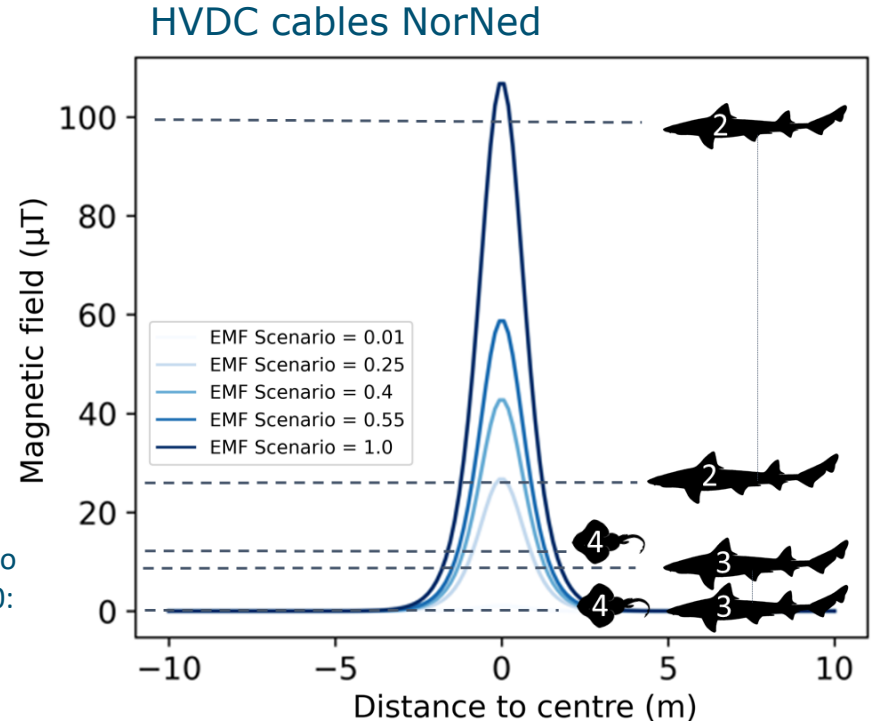
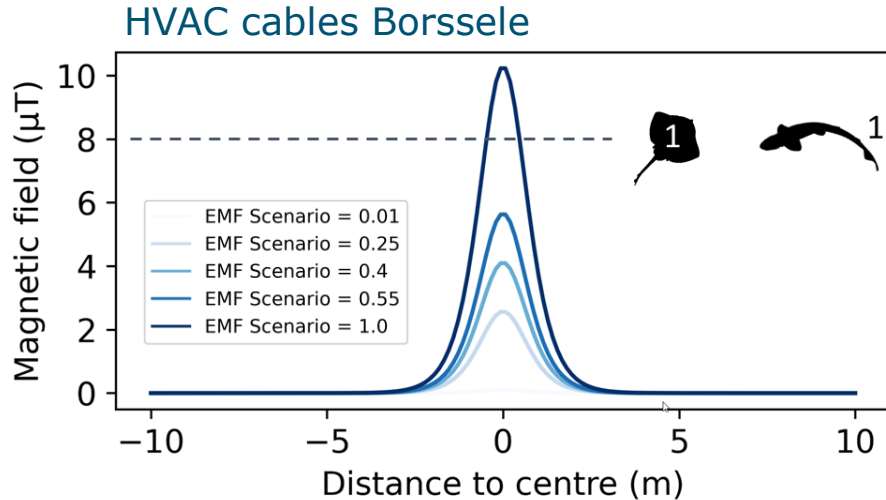
Hermans et al. 2023 *in prep*



# Risk characterization

## Overlap magnetic field & elasmobranch sensory range

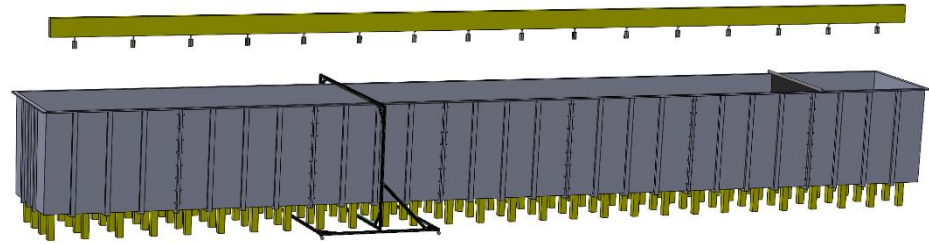
Note difference in power systems and axis!



Hermans et al *in prep* [1] Gill et al. 2009: 8  $\mu\text{T}$  [2] Meyer et al. 2005: 25 to 100  $\mu\text{T}$  [3] Anderson et al. 2007: 0.03 to 8.00  $\mu\text{T}$  [4] Hutchison et al 2020: 0.3, 4.0 and 14  $\mu\text{T}$  (deviations from geomagnetic field)

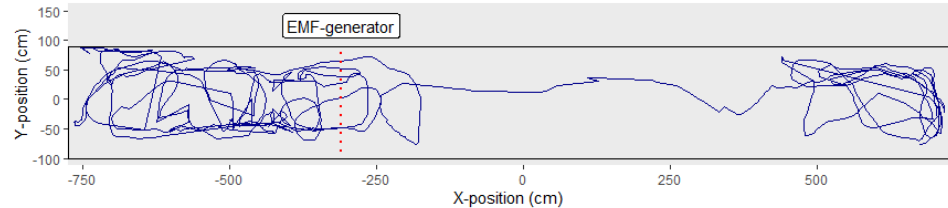
# Behavioral experiments – St Abbs Marine Station

Model tank, thanks to Peet Hovenkamp



Movement of shark during experiment

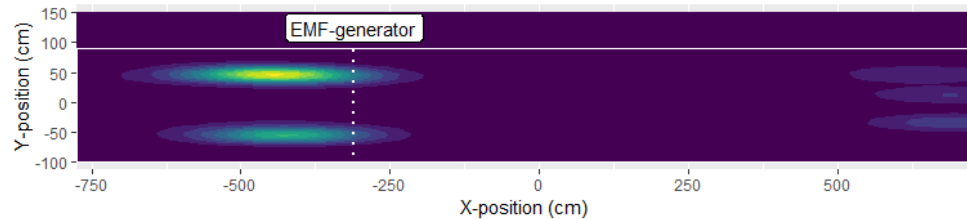
Shark ID: SCA026 Treatment: AC



Movement track, thanks to Robbert Spooler

Movement of shark during experiment

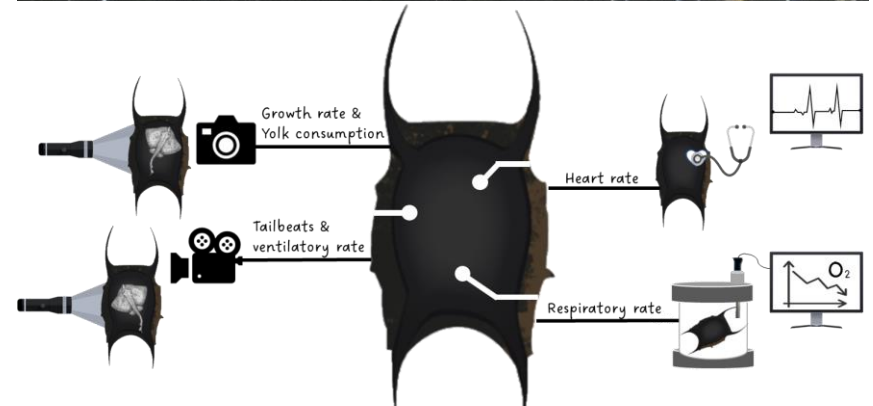
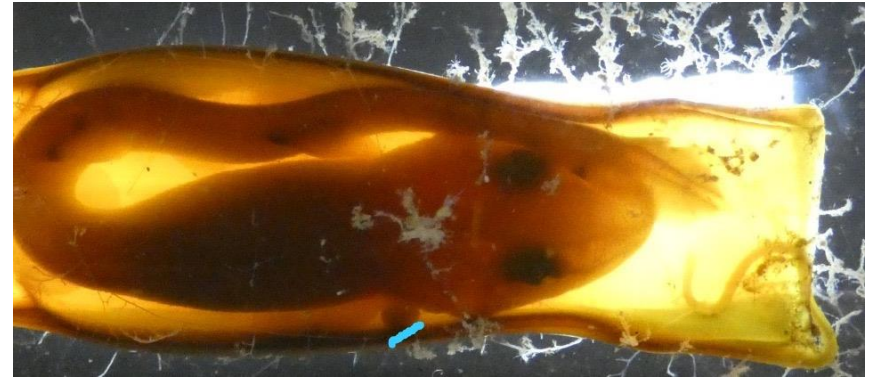
Shark ID: SCA026 Treatment: AC



Movement heat map, thanks to Robbert Spooler

# EMF & embryogenesis

- Overlap nursery grounds
- Development Embryogenesis
- Sensory range dose-response relationships
- Traditional techniques & innovative sensors



Hermans et al. 2022, poster conference, thanks to Maxime Weber

# A lot more to be done!

- Baited camera field study
- Population genetic using egg cases
- Agent based modelling
- Overview Hutchison et al 2021 →



\* Consider in relation to population fecundity and mortality to determine any significance of impact

From Hutchison et al. (2021). Receptor related present and desired knowledge base. - doi: 10.1038/s41598-020-60793-x 12

# Consortium – Public Private Partnership funding NWO

