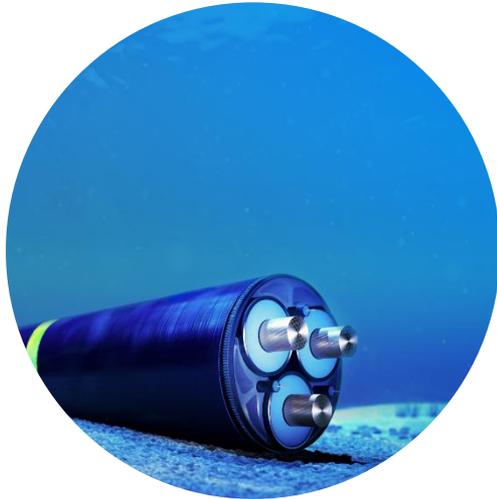


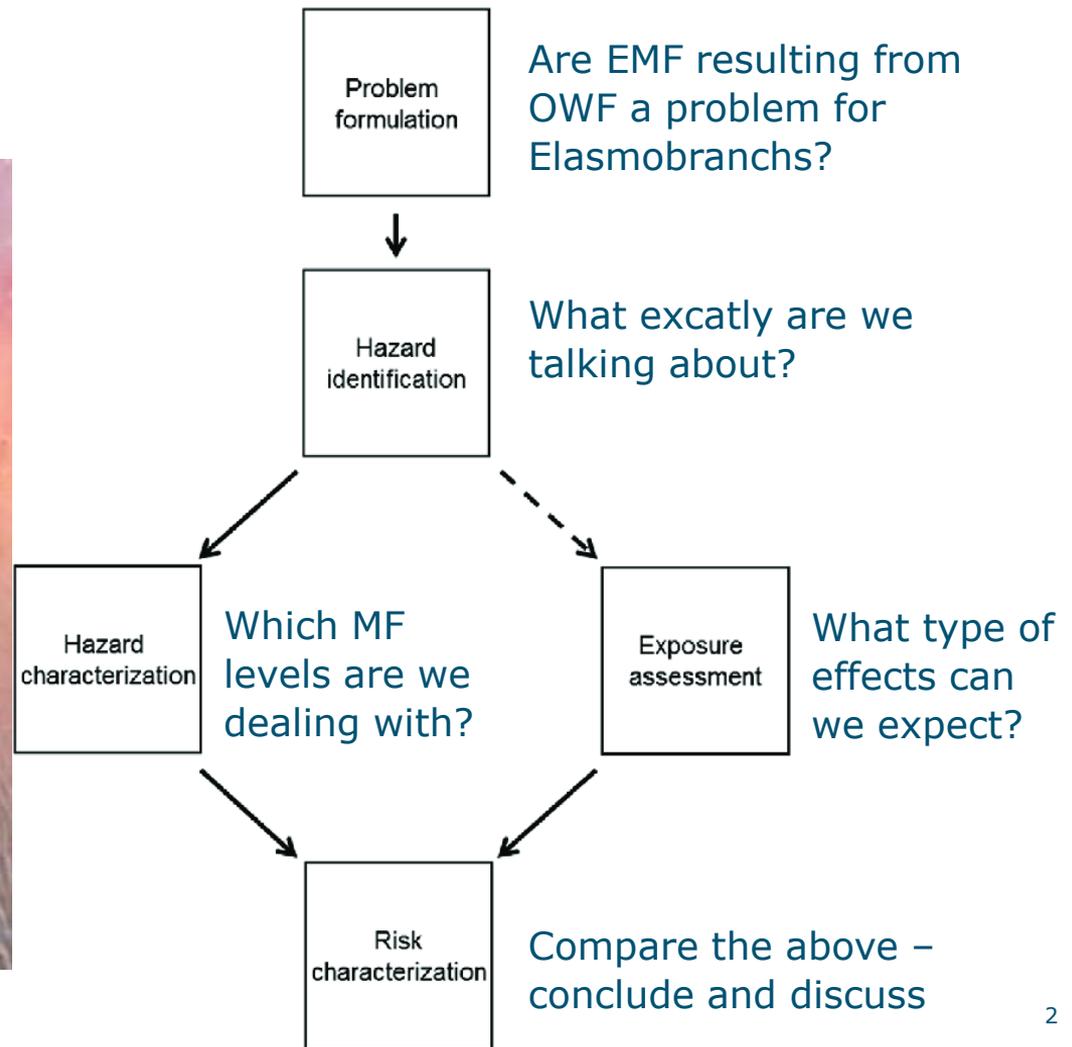
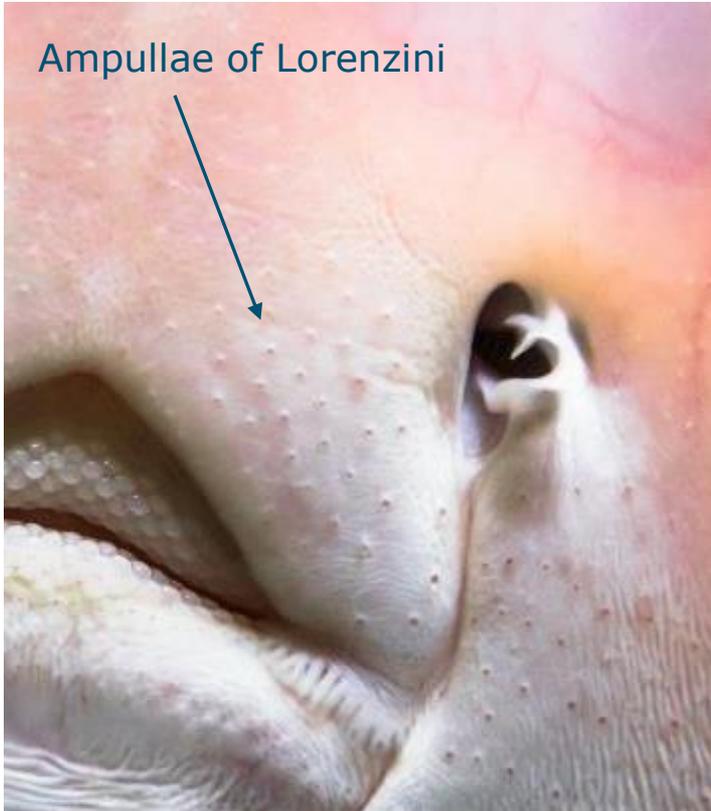
Magnetoscope

The current state of the natural and anthropogenic magnetic fields of the Dutch Continental Shelf and associated risk for Elasmobranchs

Annemiek Hermans - Elasmopower

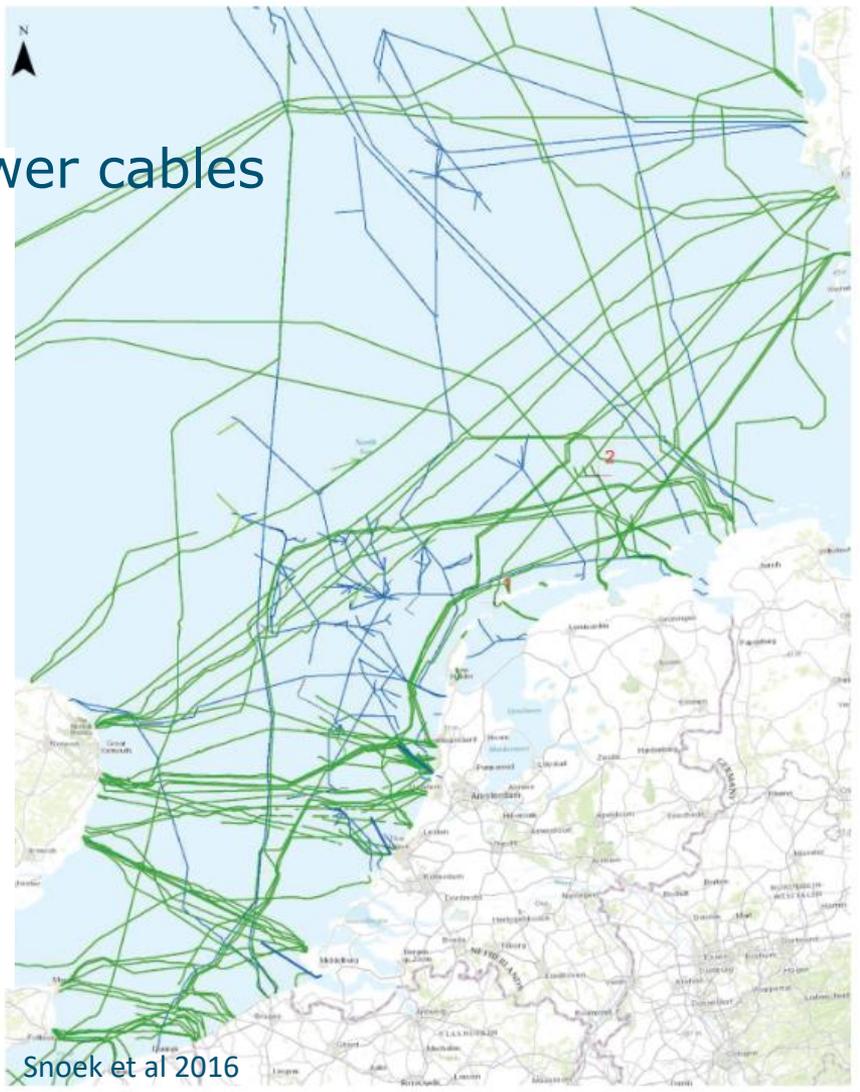
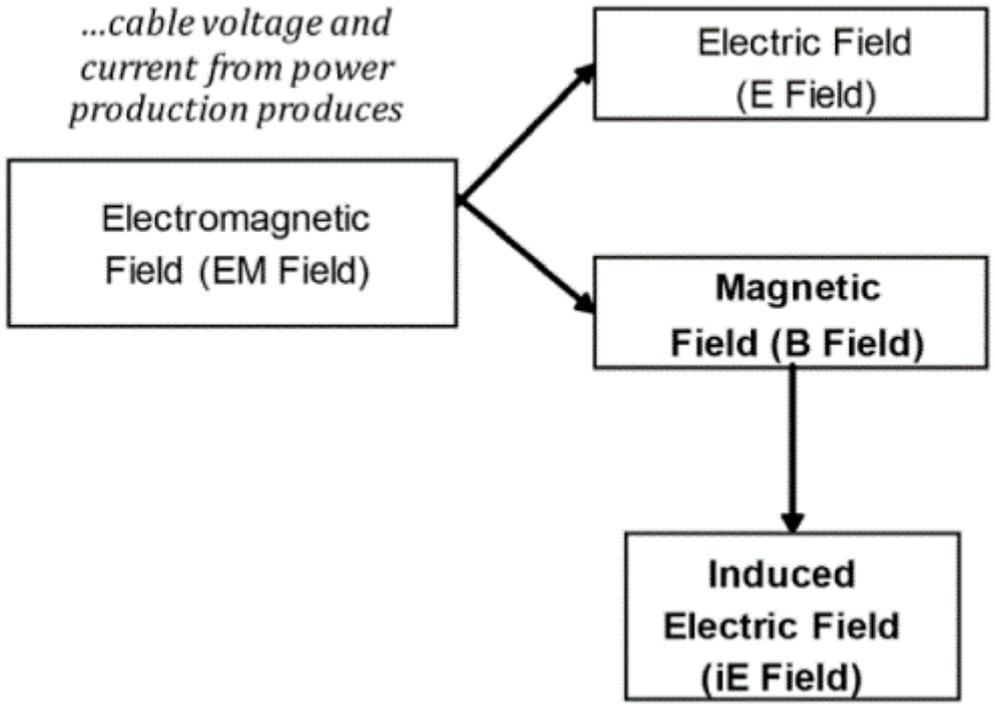


Risk assessment



Hazard identification

Expanding number of offshore power cables



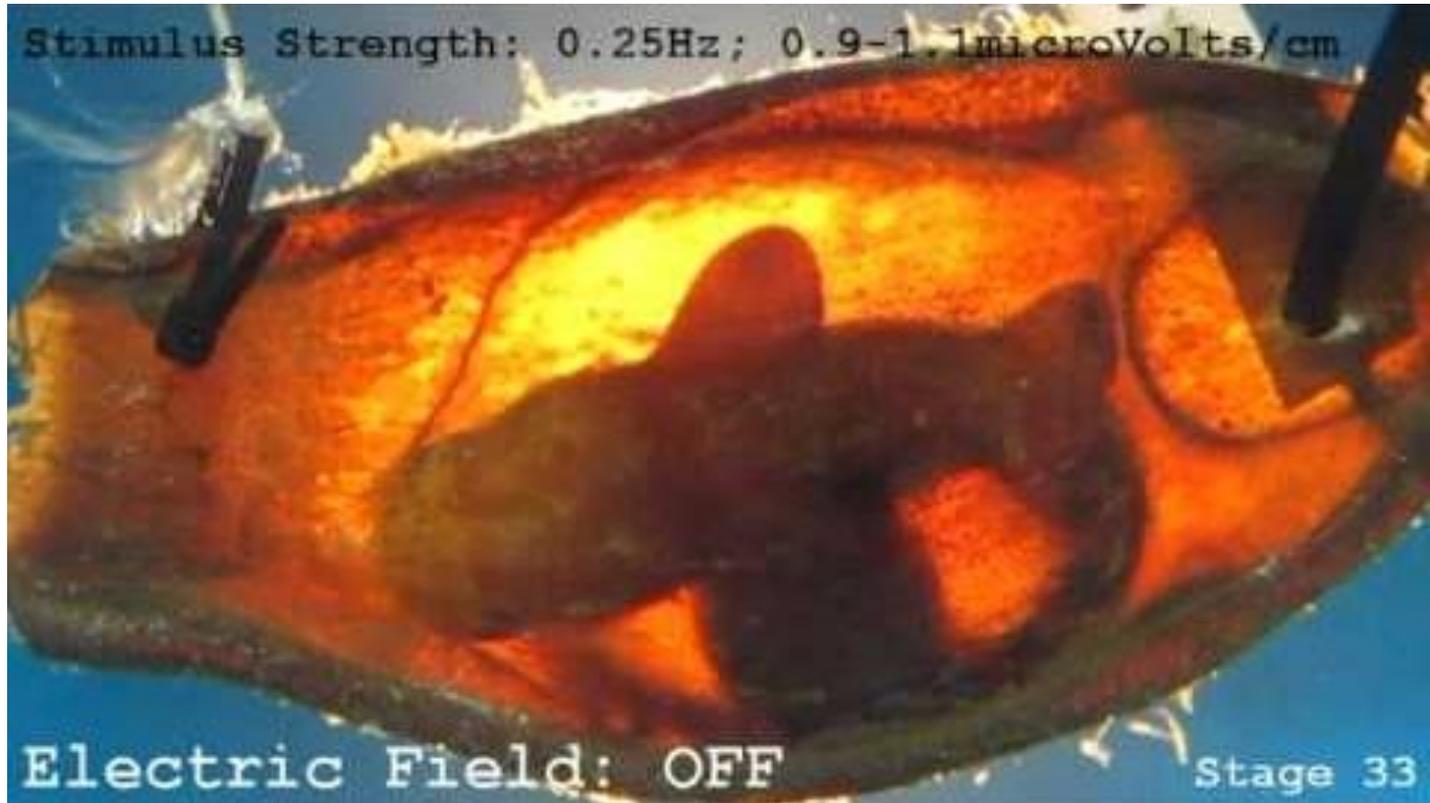
Snoek et al 2016

Gill et al 2009

Exposure assessment

Different responses – sensitivity to (i)E-fields

Kempster et al
2013 - Video clip
of a bamboo shark
embryo (stage 33)
responding to an
electrical stimulus
(stimulus
strength: 0.25 Hz;
0.9–1.1 mV/cm)
by ceasing gill
movements

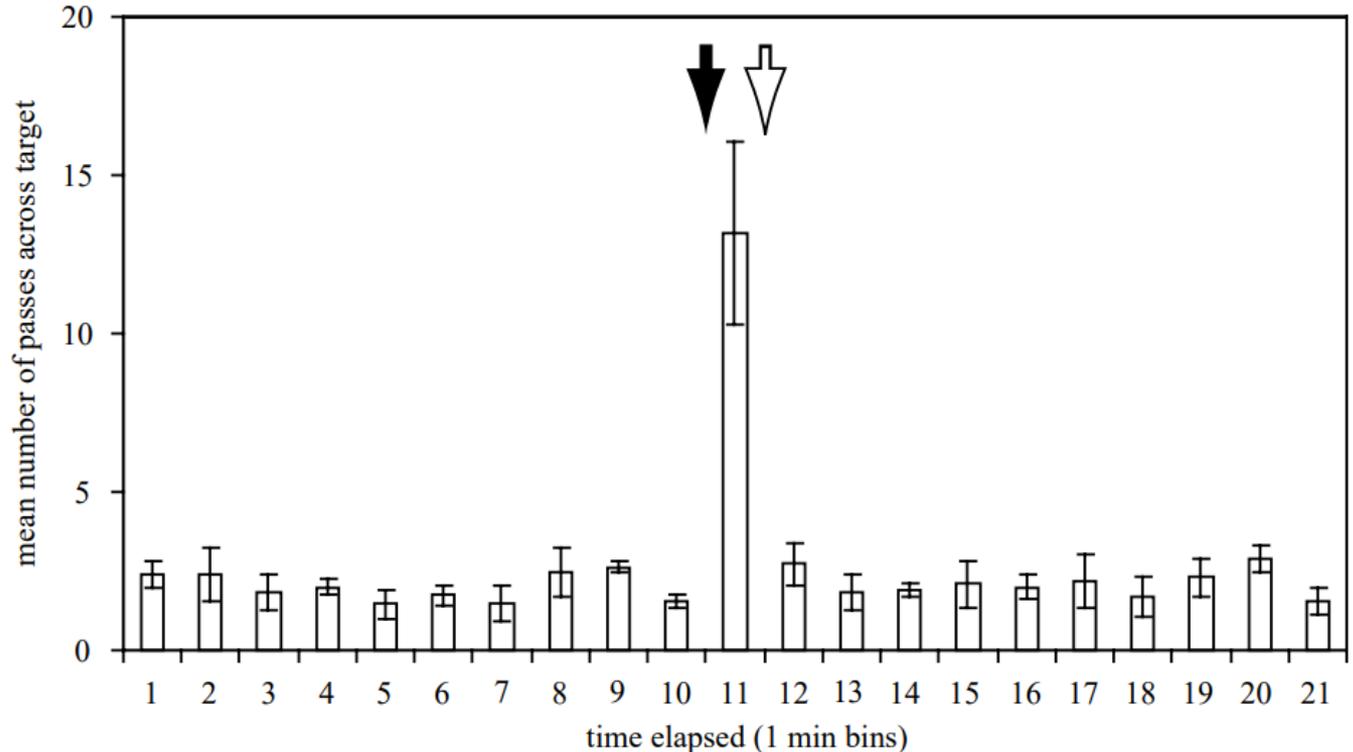


Exposure assessment

Different responses – sensitivity to magnetic fields

Meyer et al 2015 -
Sharks detect
changes in the
geomagnetic field

Shaded arrow, artificial
magnetic field
activated; unshaded
arrow, artificial field
turned off.



Deterrence, or change in migratory behavior

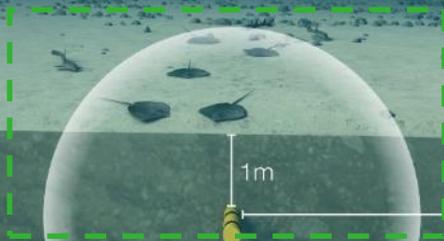
Barry et al 2008



Change in orientation, foraging behavior, finding a mate



Attraction



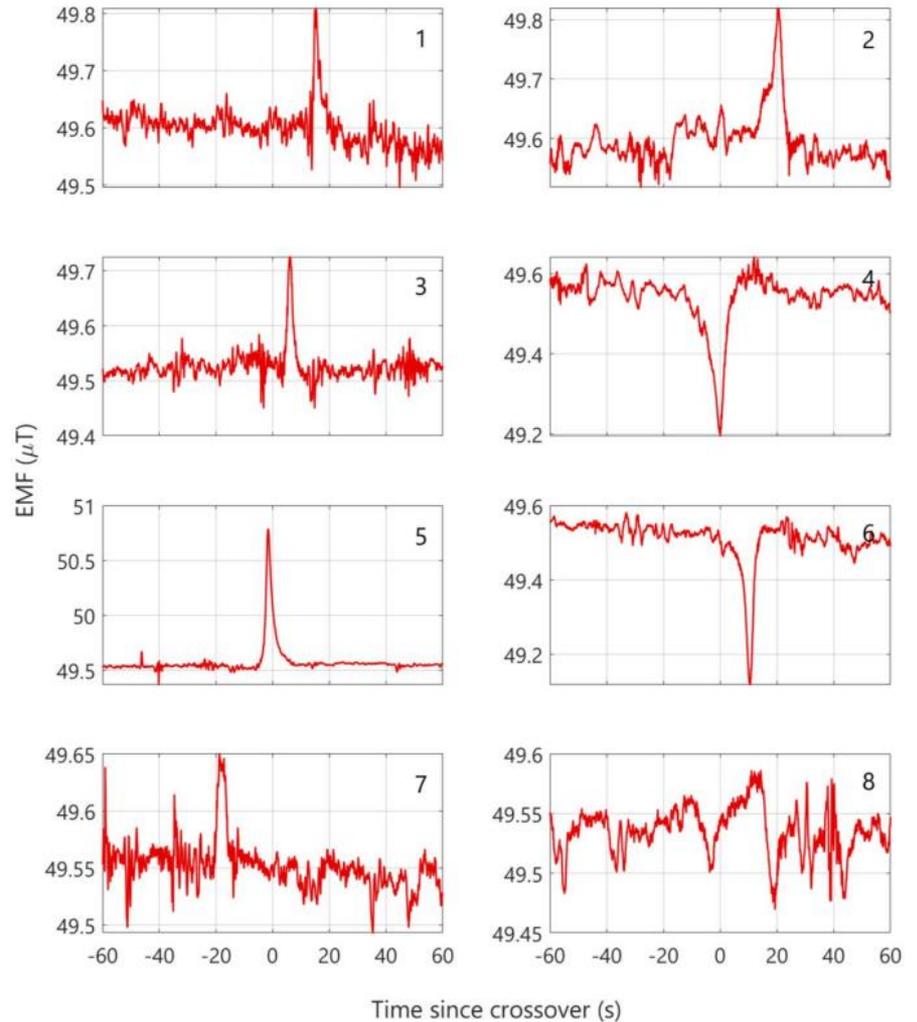
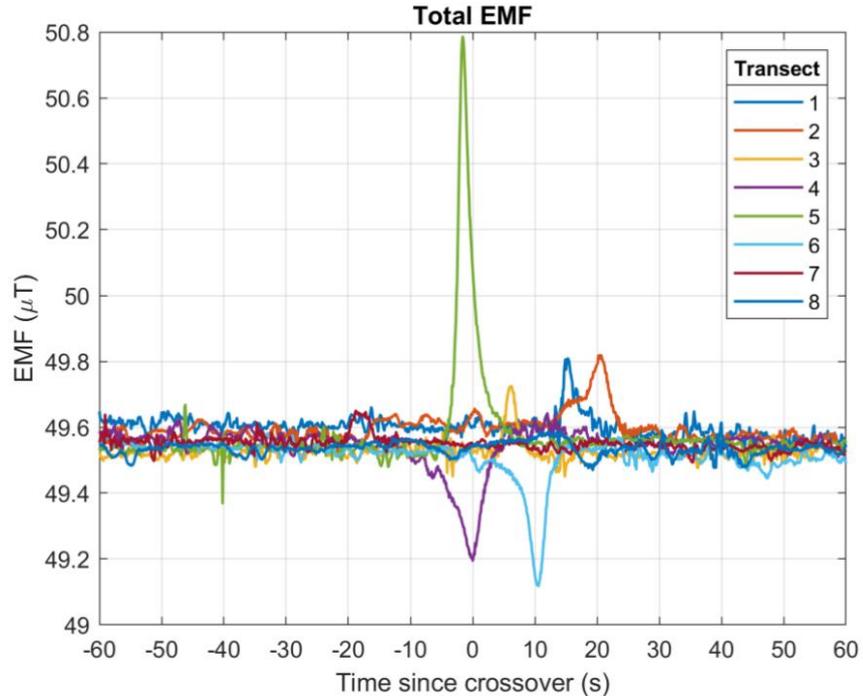
1m

35m



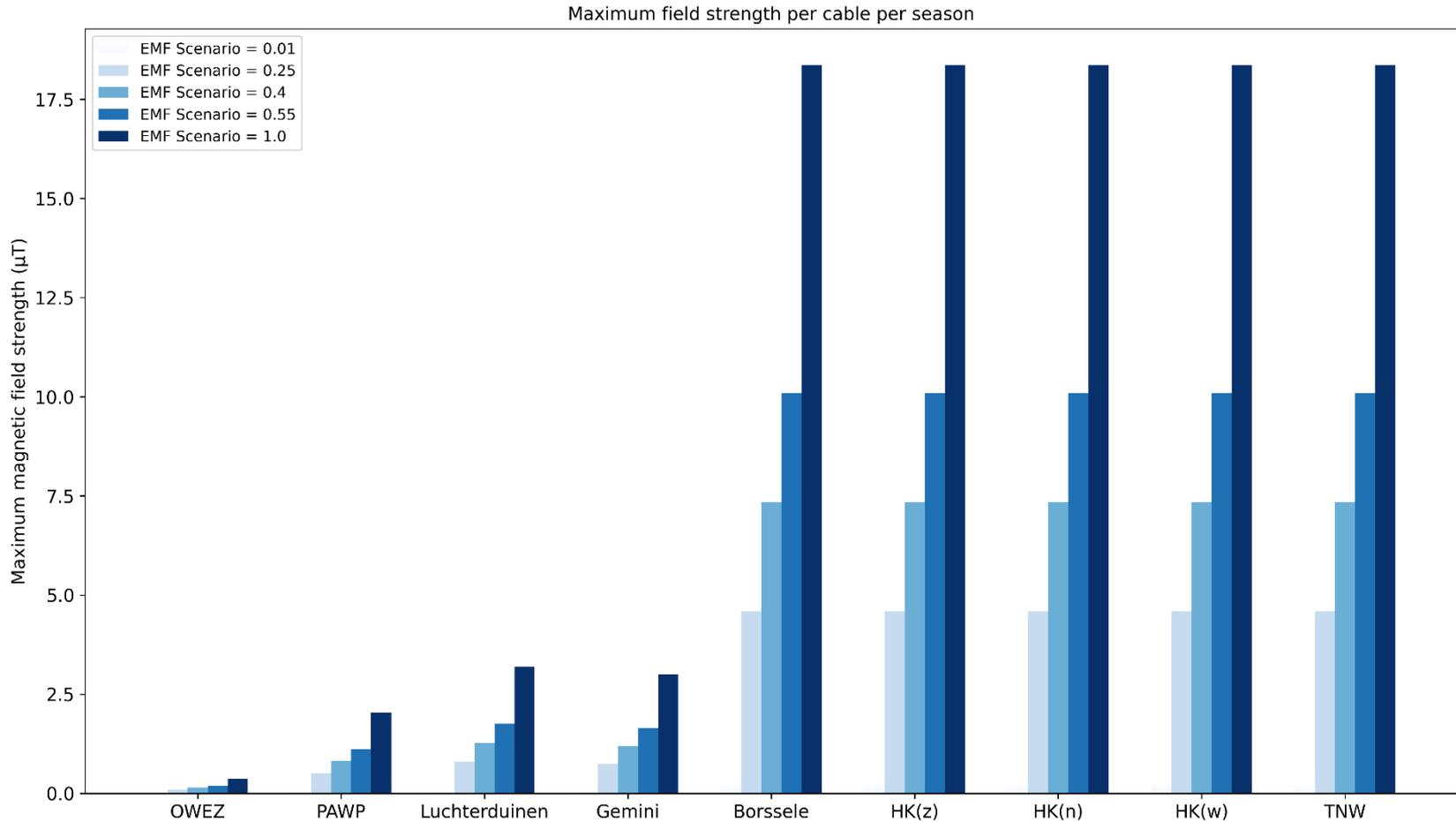
Hazard characterization HVDC cable field measurements

Note the small scale on the x-axis



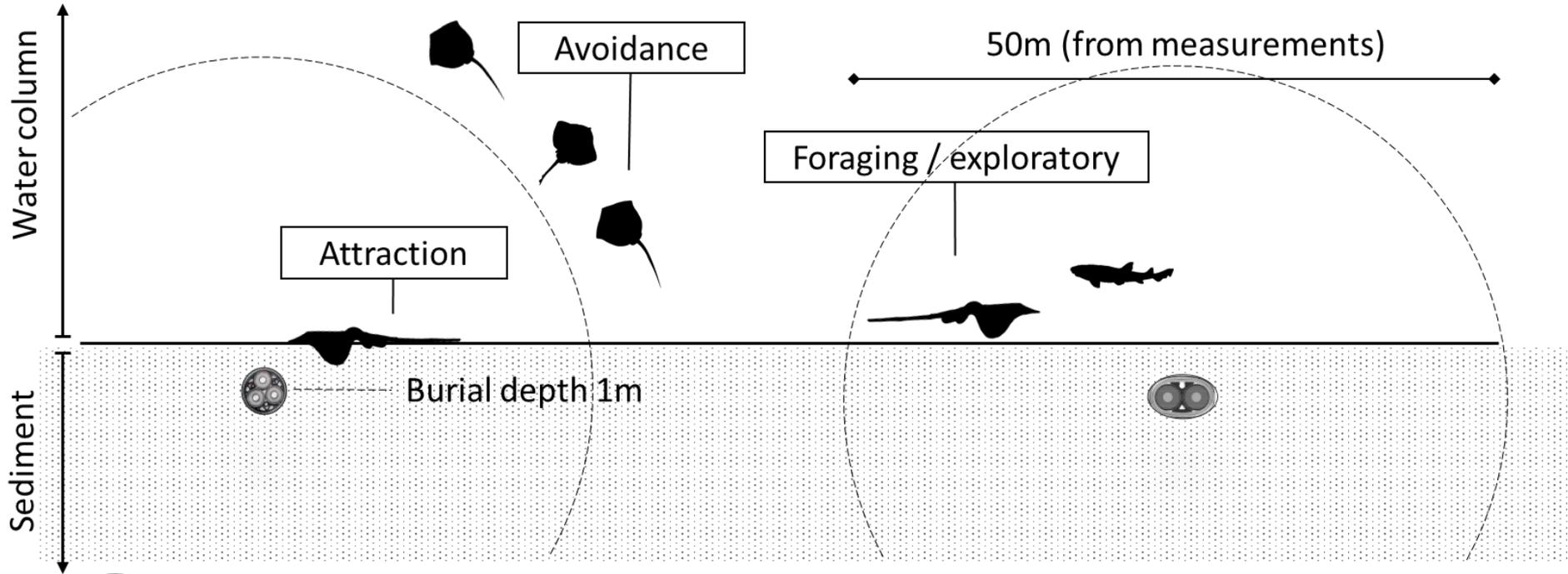
Snoek et al 2021 – with thanks to TenneT

Modelling results Example for HVAC cables



Risk characterization – effect range

Animals not to scale!



DC joined core ($\pm 35 \mu\text{T}$)



AC triple phase ($\pm 12 \mu\text{T}$)



Thornback ray $\pm 85 \text{ cm}$



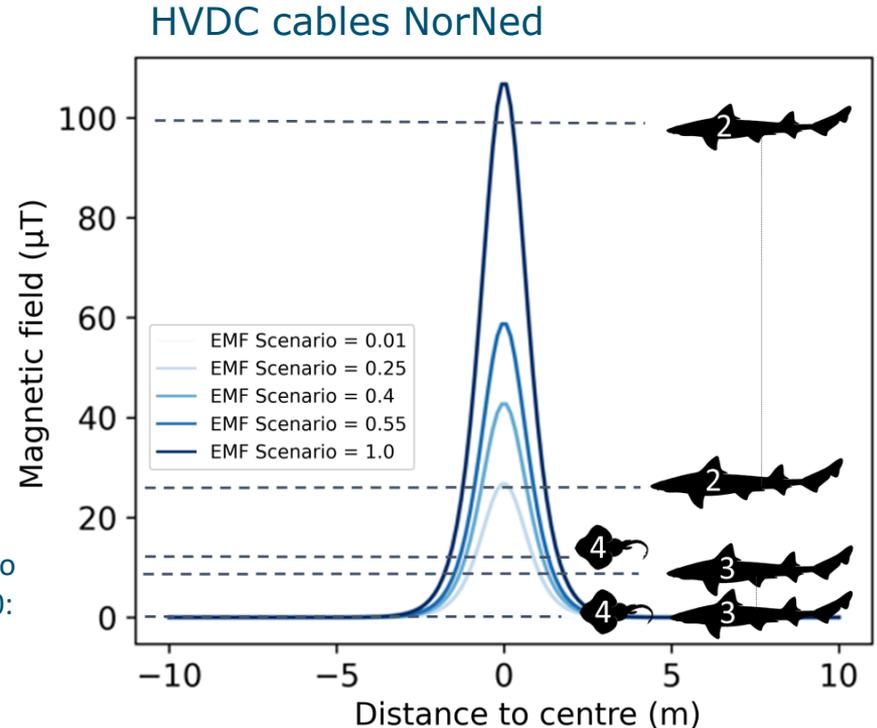
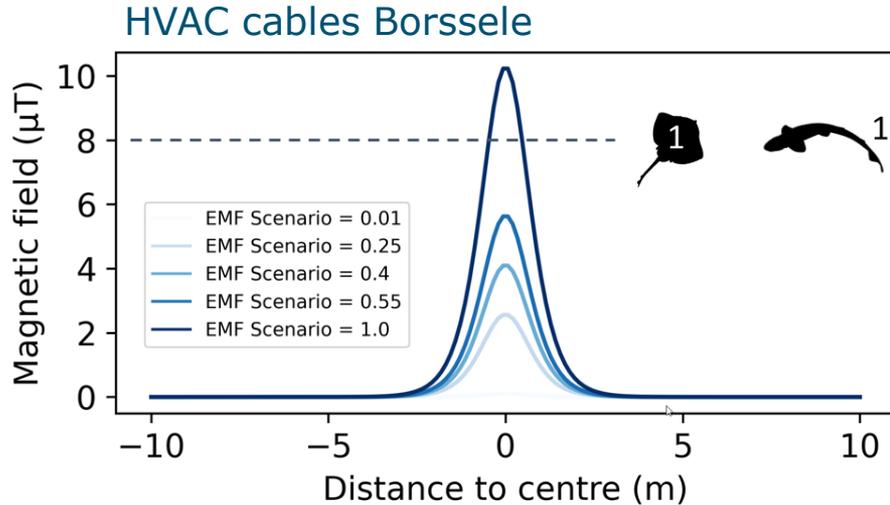
Small-spotted catshark $\pm 80 \text{ cm}$

----- Detection range

Risk characterization

Overlap magnetic field & elasmobranch sensory range

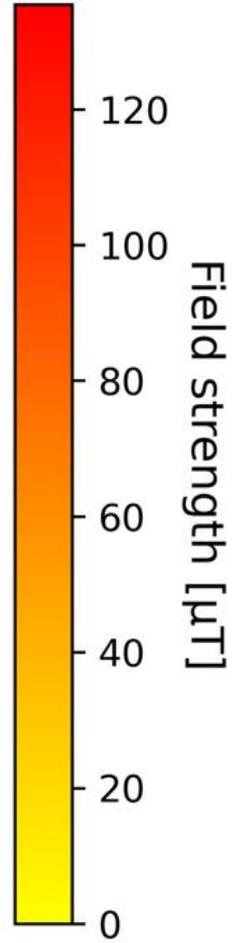
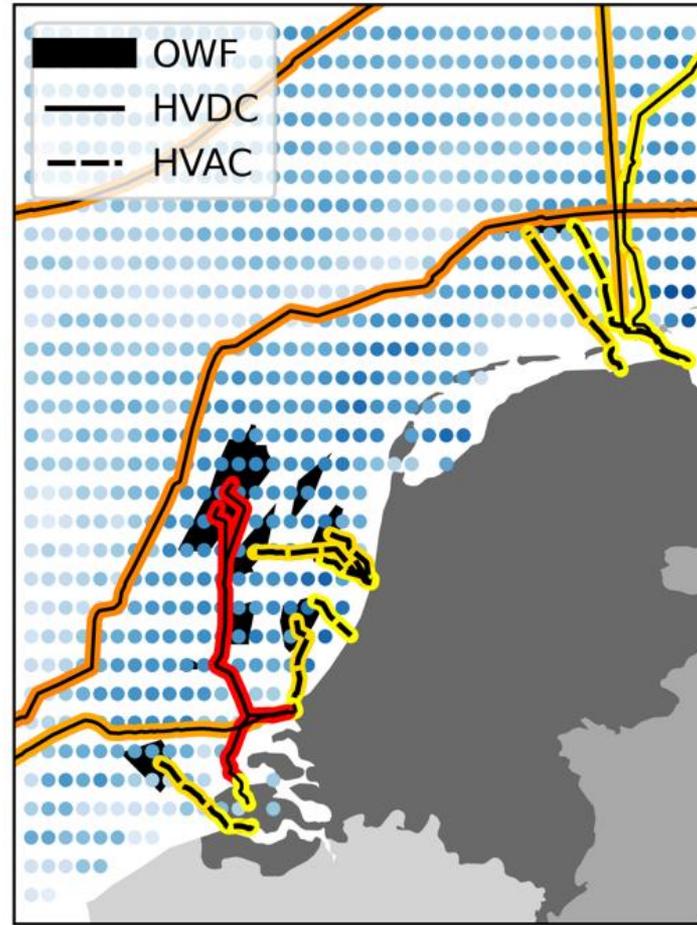
Note difference in power systems and axis!



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

Magnetoscape

Elasmobranch species presence



Concluding



Yes – there is overlap in habitat and cable routes



Yes – there seems to be overlap in magnetic field levels and sensory range



Yes – there could be a risk and we need to investigate this further



ElasmoPower project

More information?

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Also see our poster on non-invasive magnetometer sensor attachment on benthic elasmobranchs

With thanks to:

- Co-authors (Tinka Murk, Erwin Winter & Andrew Gill)
- Project partners
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- Elasmobranch data: Marieke Desender - Cefas
- Field work: Roelant Snoek & team

