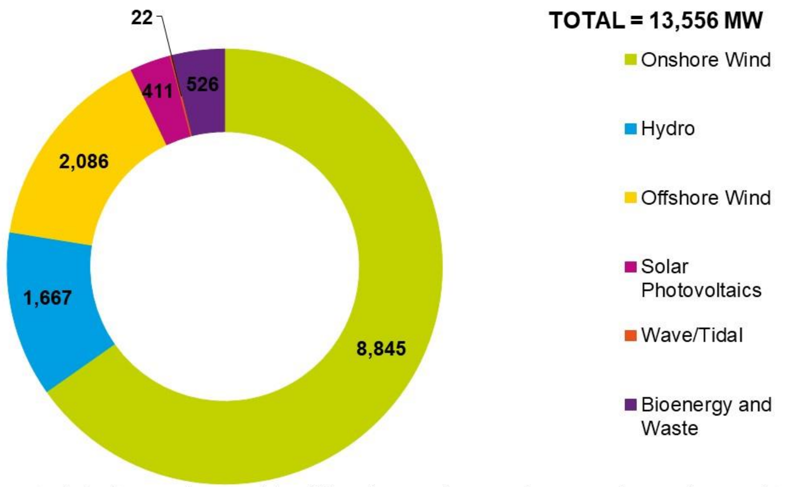
Potential Impacts of EMF on Brown Crab

St Abbs Marine Station

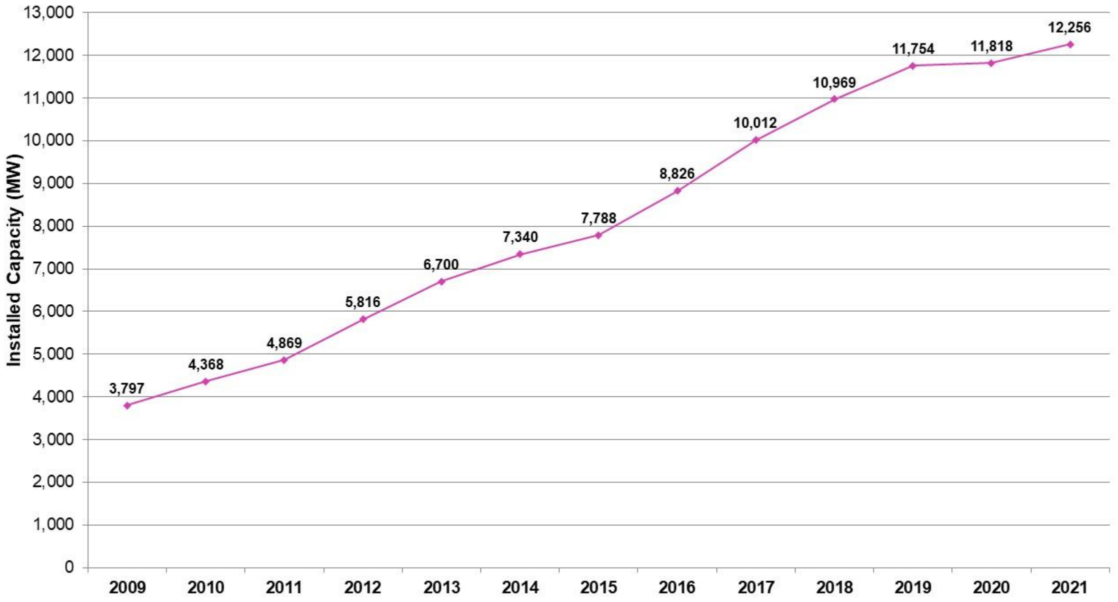
Dr Kevin Scott – kevin.scott@marinestation.co.uk

CURRENT INSTALLED CAPACITY BY TECHNOLOGY Q3 2022 (MW)

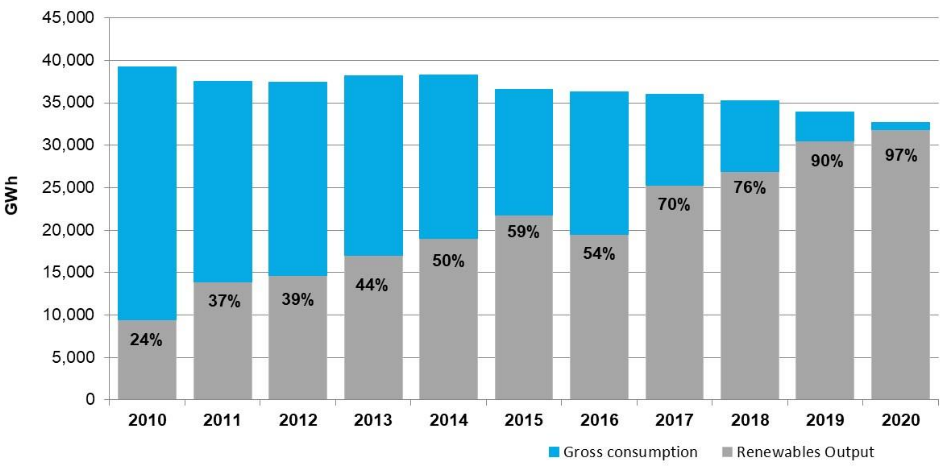


Note: Bioenergy and Waste includes biomass (272 MW), landfill gas (116 MW), energy from waste (70 MW), anaerobic digestion (60 MW) and sewage, sludge digestion (8 MW).

TOTAL INSTALLED CAPACITY OF RENEWABLE ELECTRICITY IN SCOTLAND 2009-2021

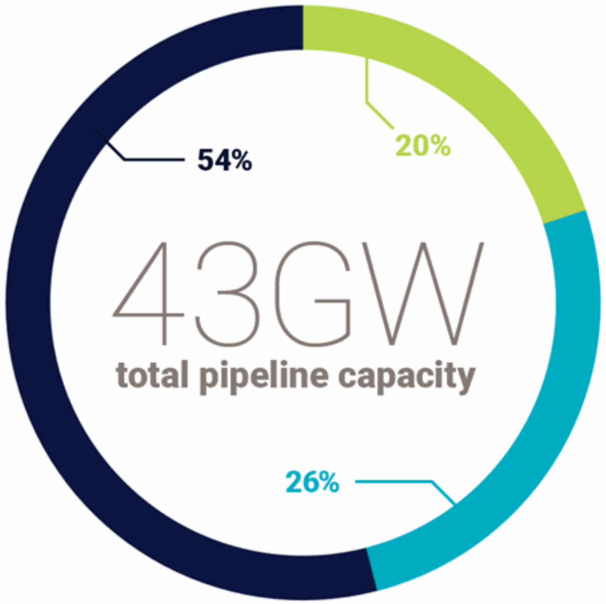


GROSS ELECTRICITY CONSUMPTION AND % RENEWABLES OUTPUT



Source: Scottishrenewables.com

Offshore wind capacity by location

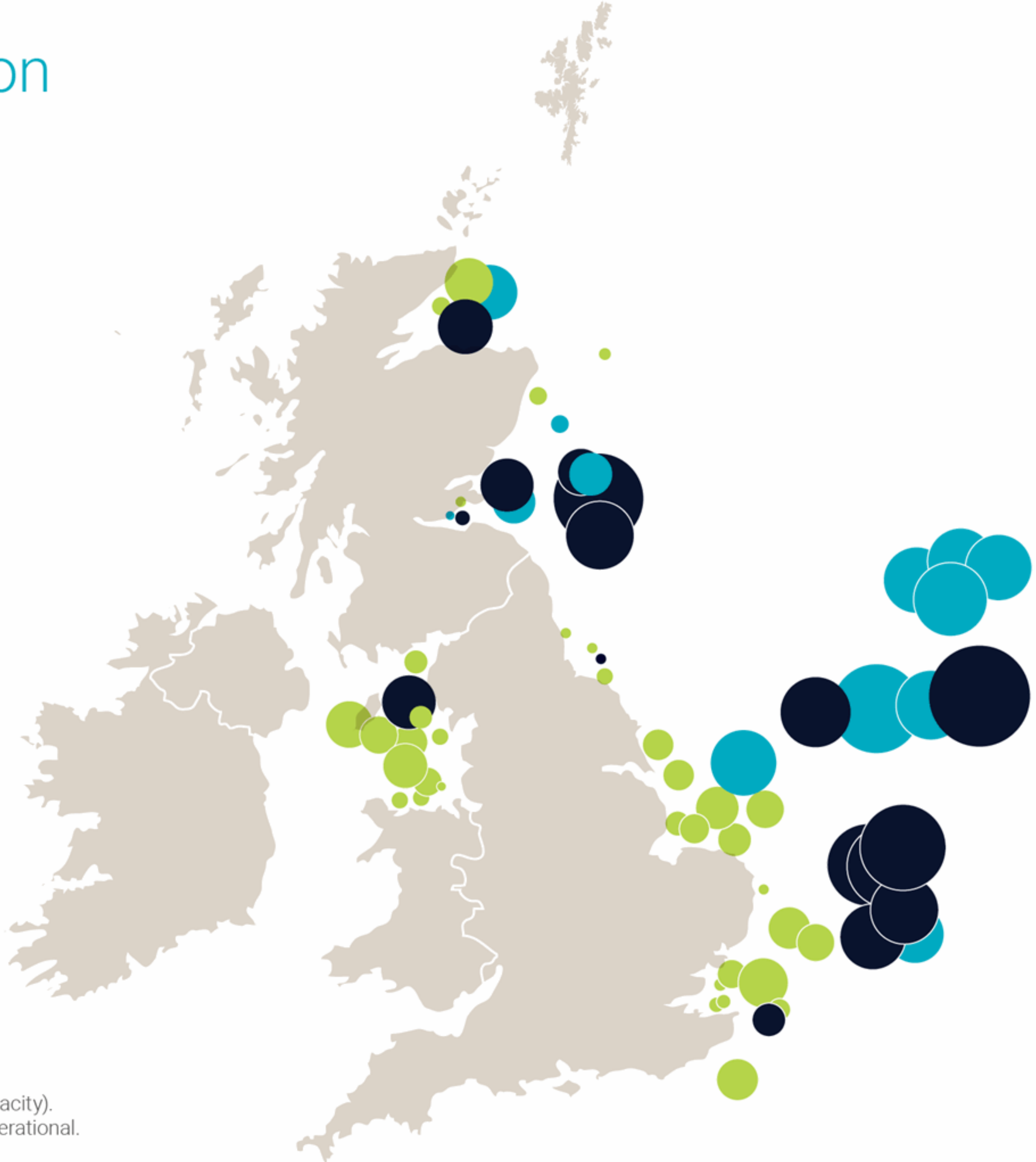


1GW Project Size

Operational*

Secured pipeline**

Early stage pipeline***



Source: Wood Mackenzie

Note: *'Operational' refers to capacity which is fully grid-connected (including decommissioned capacity).

**'Secured pipeline' refers to capacity which has been awarded a support scheme but is still not operational.

***'Early stage' refers to capacity which has not secured a support scheme.

What are Marine Renewable Energy Devices (MREDs)?

3 main types:

1. Wind

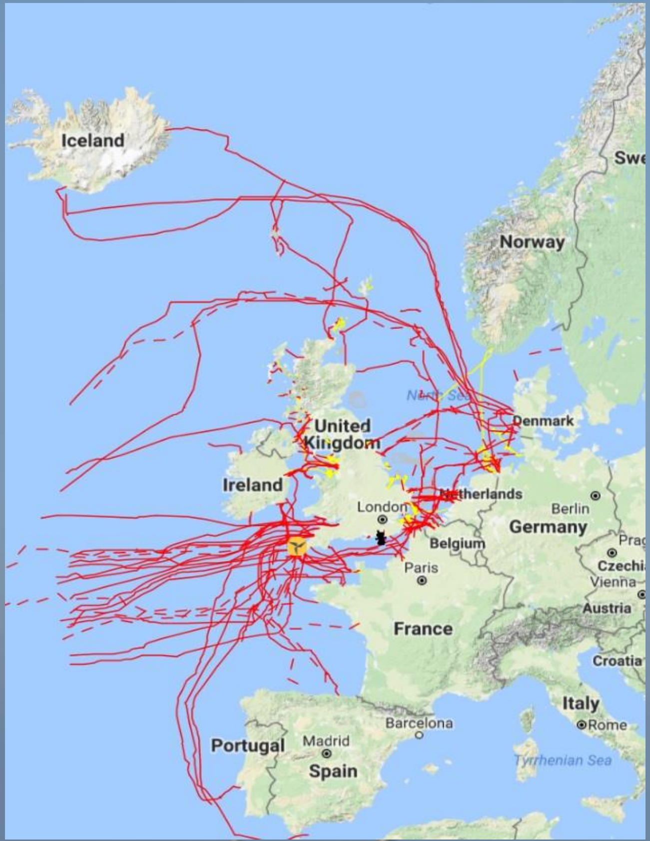
2. Tidal

3. Wave

Sources:
1. Subsea World News
2. Siemens plc
3. European Marine Energy Centre

ST ABBS MARINE STATION

Subsea cables and the resulting electromagnetic fields (EMFs)



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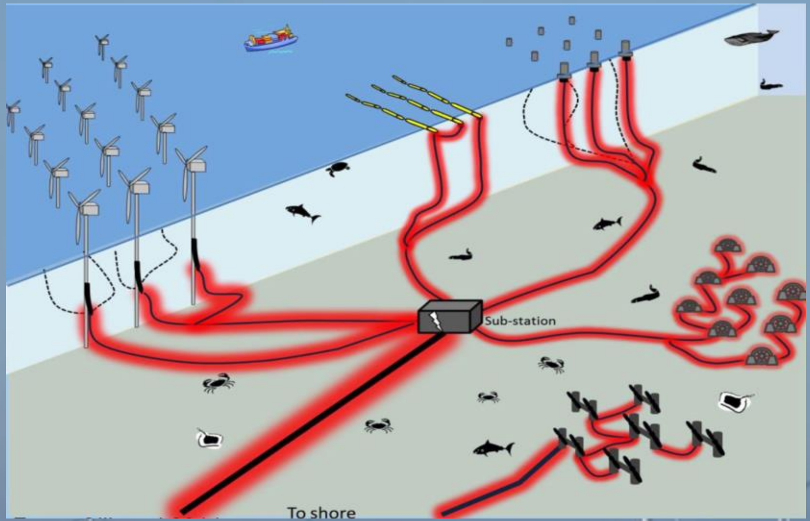

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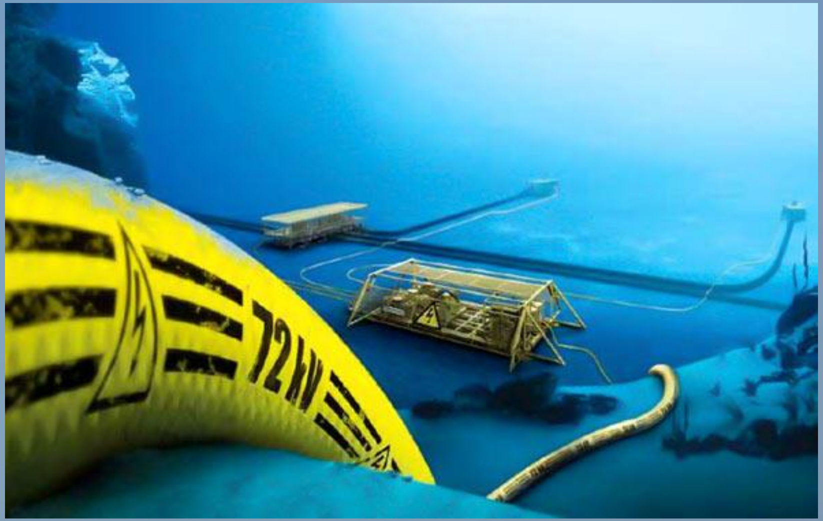

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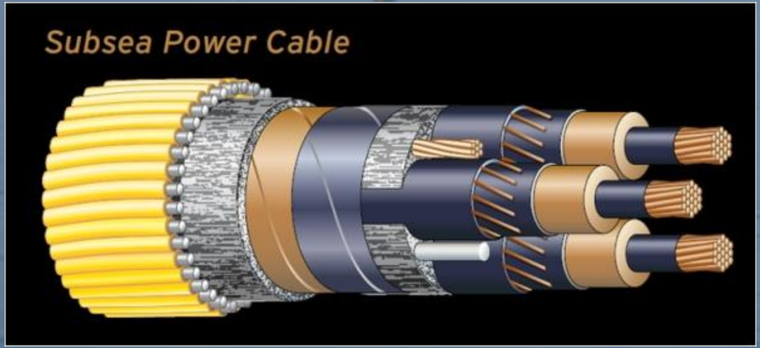


4.

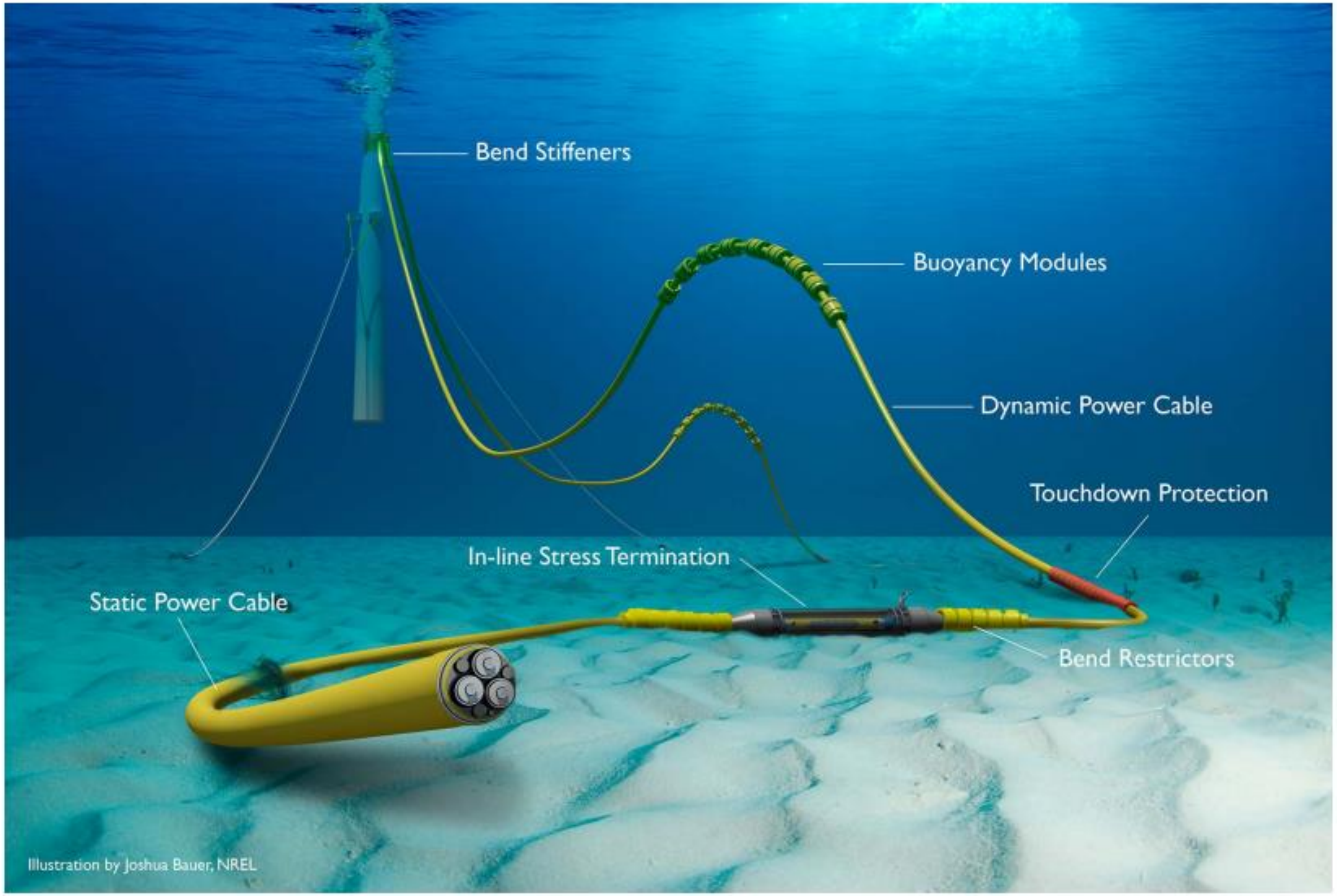
Sources:

1. KIS-ORCA.EU
2. Gill *et al.* 2014
3. OnLanka
4. Offshore-Technology.com
5. Funcage.com

5.

Source: Siemens https://www.youtube.com/watch?v=zUQifpcGTrg

Floating Electrical Connections



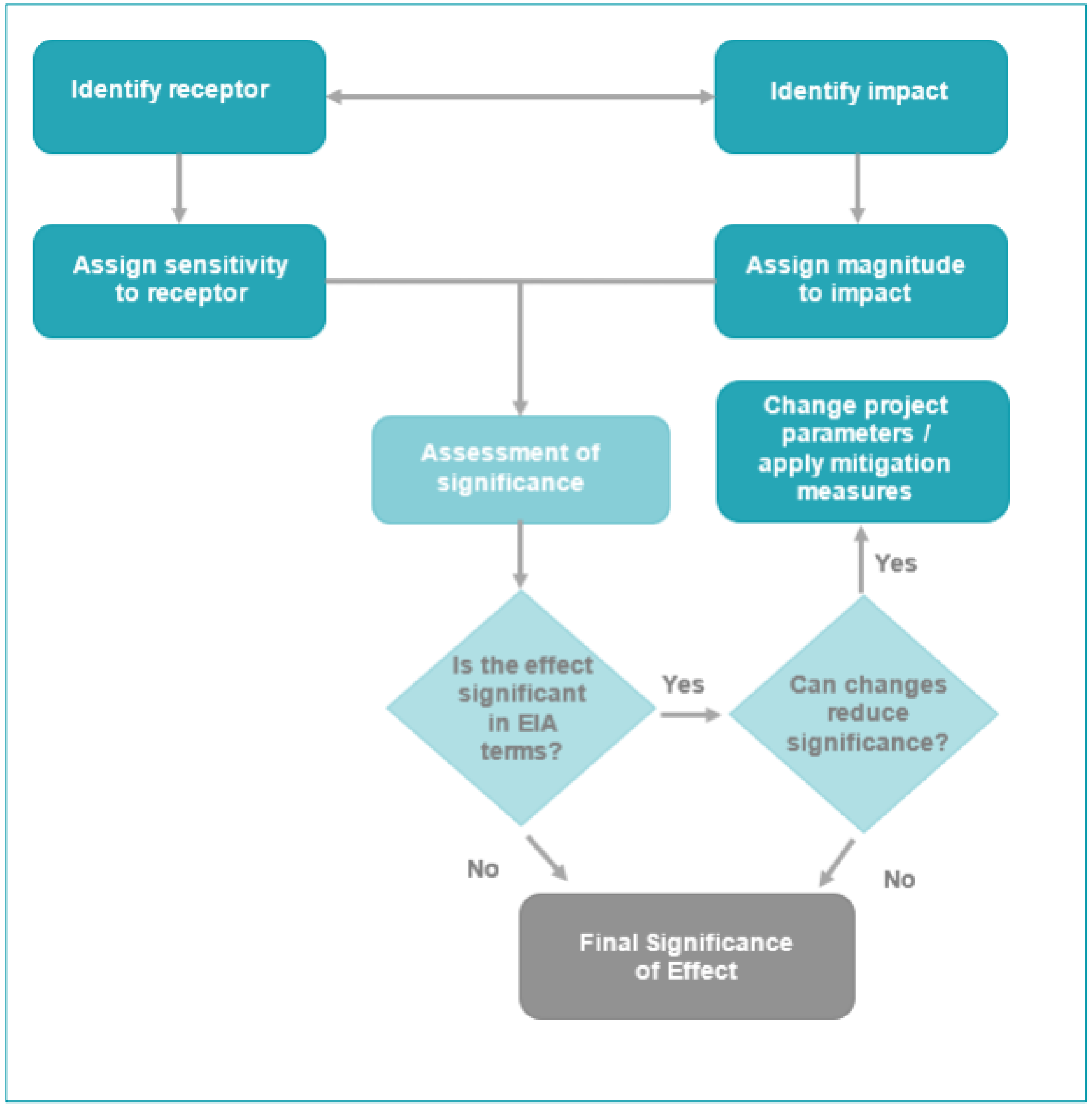


Figure 6.1: Proposed Iterative Approach to Mitigation Within the Proposed Development EIA

Table 8.24: Typical EMF Levels over AC Undersea Power Cables from Offshore Wind Energy Projects (CSA, 2019)

Power Cable Type	Directly Above Cable		3 to 7.5 m Laterally Away from Cable	
	1 m above Seafloor	At Seafloor	1 m above Seafloor	At Seafloor
Magnetic Field Levels (mG)				
Inter-Array	5 to 15	20 to 65	<0.1 to 7	<0.1 to 10
Offshore export cables	10 to 40	20 to 165	<0.1 to 12	1 to 15
Induced Electric Field Levels (mV/m)				
Inter-Array	0.1 to 1.2	1.0 to 1.7	0.01 to 0.9	0.01 to 1.1
Offshore export cables	0.2 to 2.0	1.9 to 3.7	0.02 to 1.1	0.04 to 1.3

255. During the operation phase of the project there will be up to 1,225 km of 66 kV inter-array cables and up to 872 km of 275 kV offshore export cables (Table 8.10). The minimum burial depth for cables will be 0.5 m.

256. The impact is predicted to be of local spatial extent, long term duration, continuous and high reversibility (when the cables are decommissioned). It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be negligible.

Firth of Forth Banks Complex MPA

257. The magnitude of the impact on benthic invertebrates due to EMF is consistent across the Proposed Development including in the sections which overlap with the FFBC MPA, therefore for detail on the magnitude refer to paragraphs 251 to 255.

258. Furthermore, based on the proportion of the FFBC MPA which overlaps with the Proposed Development, for the purposes of this assessment it is assumed that there may be up to 527 km of cables installed within the FFBC MPA. Of which 413 km will be associated with inter-array and interconnector cables, and 114 km will be associated with offshore export cables. For the purposes of this assessment it is assumed that up to 400 km of the cables would be within Berwick Bank and up to 127 km within Scalp and Wee Bankie.

259. The impact is predicted to be of local spatial extent, long term duration, continuous and high reversibility (when the cables are decommissioned). It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be negligible.

Berwickshire and North Northumberland Coast SAC

260. The Berwickshire and North Northumberland Coast SAC is located 4.12 km from the Proposed Development export cable corridor. On the basis that there is no spatial overlap there is no pathway for impact from EMF effects and therefore no further assessment is required for this impact.

Sensitivity of the Receptor

Subtidal Habitat IEFs

261. Gill and Desender (2020) summarised current research on the impact of EMF emissions on organisms and also acknowledged that relatively little is known about the effects of EMF on invertebrates such as those common in benthic communities. This is supported by a recent evaluation of knowledge of the impacts of EMF on invertebrates which concluded, globally, no direct impact on survival has been identified in the literature (Hervé, 2021). Furthermore, the methods to assess benthic invertebrates are variable therefore creating the same variability in results, as well as, in some cases, contradiction (Hutchinson *et al.*, 2020). Some studies found that benthic communities which grow along cable routes were generally similar to those in the nearby area (Gill and Desender, 2020). These communities however are not exposed to the maximum EMF emissions due to cable burial creating a physical distance between the cable and the seabed surface, although the EMF which reaches the surface is measurable at biologically relevant scales at the seabed and in the water column (Hutchinson *et al.*, 2020).

262. Experimental evidence has demonstrated that exposure to EMF did not change the distribution of the ragworm *Hediste diversicolor*, the same result was also found by Jakubowska *et al.* (2019). Experimental evidence has however demonstrated magnetoreception in marine molluscs and arthropods and biogenic magnetite has been known to occur in marine molluscs for over five decades (Normandeau, 2011). Magneto-receptive and electro-receptive species have evolved to respond to small changes in the Earth's geomagnetic fields and bioelectric fields making the presence of an EMF more perceivable to receptive species (Hutchinson *et al.*, 2020). Reported sensitivities to electric fields for invertebrates range from around 3 mV/cm to 20 mV/cm (Steullet *et al.*, 2007).

263. Normandeau (2011) summarises that despite these sensitivities no direct evidence of impacts to invertebrates from undersea cable EMFs exists. What is known about invertebrate sensitivities to EMF does provides some guidance for considering likely significant effects. Likely significant effects would depend on the sensory capabilities of a species, the life functions that its magnetic or electric sensory systems support, and the natural history characteristics of the species. Life functions supported by the electric and magnetic sense indicate that species capable of detecting magnetic fields face likely significant effects different from those that detect electric fields.

264. Shellfish which also occupy the sea floor, are anticipated to be more sensitive to EMF. Scott *et al.* (2021), investigated the effects of different strength EMF exposure on the commercially important decapod *Cancer pagurus* edible crab. This investigation measured stress related parameters as well as behavioural and response parameters over a 24-hour period. The results of this investigation indicated that exposure to 500 μT and 1,000 μT were found to attract crabs, limiting their time spent roaming as well as disrupting the production of chemicals associated with circadian rhythms leading to increased physiological stress when exposed to EMF of 500 μT or above. These results however are not directly applicable to the cables used in the Proposed Development as the magnetic field levels tested by Scott *et al.* (2021) are an order of magnitude higher than those associated with a buried cable such as those at the Proposed Development. These effects on shellfish receptors are fully considered in volume 2, chapter 9.

265. Research regarding the impact of EMF on invertebrates still has a number of knowledge gaps which hinder our ability to fully understand the effects. Hervé (2021) identifies that establishing the impact on groups such as Molluscs is highly underdeveloped, the impact on species relative to the strength of the EMF, as well as the impact of different types of cable, are key knowledge gaps.

266. The subtidal sand and muddy sand sediments IEF, the subtidal coarse and mixed sediments IEF and the moderate energy subtidal rock IEF are deemed to be not sensitive and of regional value. The sensitivity of the IEFs is therefore, considered to be negligible.

267. The seapens and burrowing megafauna IEF, the cobble/stony reef outside of an SAC IEF, the rocky reef outside an SAC IEF and the *Sabellaria* reef outside of an SAC IEF are deemed to be not sensitive and of national value. The sensitivity of the IEFs is therefore, considered to be negligible.

268. As the PMFs are not sensitive to this feature there will be negligible impact on their national status.

Firth of Forth Banks Complex MPA

269. The IEFs within the FFBC MPA are deemed to be not sensitive and of national value. The sensitivity of the IEFs is therefore, considered to be negligible.

Significance of the Effect

Subtidal Habitat IEFs

270. For the subtidal sand and muddy sand sediments IEF, the subtidal coarse and mixed sediments IEF and the moderate energy subtidal rock IEF, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptors is considered to be negligible. The effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms.

271. For the seapens and burrowing megafauna IEF, the cobble/stony reef outside of an SAC IEF, the rocky reef outside an SAC IEF and the *Sabellaria* reef outside of an SAC IEF, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptors is considered to be negligible. The effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms.

Firth of Forth Banks Complex MPA

272. Overall, the magnitude of the impact is deemed to be negligible, and the sensitivity of the receptors (subtidal sands and gravels, shelf banks and mounds, and ocean quahog) is considered to be negligible. The effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms.

Secondary Mitigation and Residual Effect

273. No benthic subtidal and intertidal ecology mitigation is considered necessary for the impact of EMF because the likely effects in the absence of further mitigation (beyond the designed in measures outlined in section 8.10), are not significant in EIA terms.

LONG TERM SUBTIDAL HABITAT LOSS

274. Long term subtidal habitat loss within the Proposed Development array area and Proposed Development export cable corridor will occur during the construction phase as infrastructure is gradually installed as well as during the operation and maintenance phase (Table 8.10). Long term habitat loss will occur directly under all wind turbine and OSP/Offshore convertor station platform foundation structures (suction caisson and jacket foundations respectively). The installation of scour protection and cable protection (including at cable crossings), where this is required, will also lead to habitat alteration and a physical change to another seabed type under the scour/cable protection material. Magnitude has been considered for both phases combined as the structures will be placed during construction and will be in place during the operation and maintenance phase. The impact of habitat loss occurring during the decommissioning phase has also been considered as the maximum design scenario assumes that scour and cable protection will be left *in situ* following decommissioning. Although cables and cable protection may be removed where reasonably practicable and appropriate to do so.

275. The relevant MarESA pressures and their benchmarks which have used to inform this assessment of effect are described here.

- Physical change (to another seabed type): the benchmark for which is change in sediment type by one Folk class (based on UK SeaMap simplified classification (Long, 2006)) and change from sedimentary or soft rock substrata to hard rock or artificial substrata or vice-versa.

276. The relevant FeAST pressures and their benchmarks which have used to inform this assessment of effect are described here.

- Physical change (to another seabed type): the benchmark for which is the permanent change of one marine habitat type to another marine habitat type, through the change in substratum. For instance, a change from sediment to solid substrate including artificial (e.g. concrete mattresses, rock deposition, and moorings), or from one type of sediment to another. This pressure concerns disposal or the deposit of material, whilst the removal of material is covered under abrasion pressures.

277. These pressures are relevant to the installation of wind turbine and OSP/Offshore convertor station platform foundations, the associated scour protection and the cable protection which will replace the sedimentary seabed with hard structures for the duration of the construction and operation and maintenance phase (35 years). In the decommissioning phase only cable protection and scour protection may remain *in situ* contributing towards long term habitat loss, whereas wind turbine and OSP/Offshore convertor station platform foundations will be removed.

Construction and Operation and Maintenance Phase

Magnitude of Impact

Subtidal Habitat IEFs

278. The presence of the Proposed Development infrastructure within the Proposed Development array area and offshore Proposed Development export cable corridor will result in long term habitat loss/alteration. The maximum design scenario is for up to 7,798,856 m^2 of long term habitat loss due to the installation of suction caisson jacket foundations and associated scour protection and cable protection associated with wind turbines, OSP/Offshore convertor station platform interconnectors, offshore export cables, inter-array cables, interconnector cables and cable crossings (Table 8.10). Cable protection will also be required for 78 cable crossings for the array cables and 16 crossings for the offshore export cables (Table 8.10). The total long term habitat loss equates to a small proportion (0.54%) of the benthic subtidal and intertidal ecology study area.

279. Long term subtidal habitat loss impacts will occur during the construction phase and will be continuous throughout the 35 year operation and maintenance phase.

280. As outlined in Table 8.10 and as discussed previously in paragraph 81, cables will be installed at the landfall via trenchless techniques which means there will be no impact to, or long term loss of, any intertidal IEFs and they have not been considered further in this assessment.

281. The exit punches out for the selected trenchless technique (e.g. HDD) will be located between 488 m and 1,500 m from MHWS. The seaward installation of the offshore export cables in the nearshore area will therefore be through the nearshore subtidal rock habitat resulting in potential for long term habitat loss. It should however be noted that the cable, if surface laid, would be protected by cable protection and where the cable is installed in a trench, this would be back-filled or protected with cable protection. This would therefore provide substrate for colonisation by benthic organisms after the cessation of construction activities, potentially resulting in habitat alteration rather than total habitat loss. The seaward installation of offshore export cables through the nearshore subtidal rock may cross up to 1,416 m of this habitat per cable with rock protection at a width of 20 m. Of the 7,798,856 m^2 of total long term habitat loss discussed in paragraph 278, up to 226,560 m^2 may occur within nearshore rock. This equates to approximately 2.8% of this nearshore rock habitat which lies within the Proposed Development export cable corridor (this extent was calculated based on JNCC Annex I reef data for the UK|) and an even smaller proportion of the distribution of this habitat within the regional benthic subtidal and intertidal ecology study area. As outlined in Table 8.16, pre-construction Annex I reef surveys will be undertaken to determine the location, extent and composition of any geogenic reefs within the Proposed Development. Should reef features be identified appropriate measures will be discussed with the statutory consultees to avoid direct impacts to

Description of Impact	Phase C	Phase O	Phase D	Magnitude of Impact	Sensitivity of Receptor	Significance of Effect	Additional Measures	Residual Effect	Proposed Monitoring
		✓			Negligible (seapens and burrowing megafauna IEF, cobble/stony reef outside of an SAC IEF, rocky reef outside an SAC IEF, intertidal sands IEF, *Sabellaria* reef outside of an SAC IEF and ocean quahog IEF)	**Negligible**	None	N/A	None
		✓			Negligible (intertidal sands IEF)	**Negligible**	None	N/A	None
		✓			Medium (Intertidal rock IEF and fucus dominated intertidal rock IEF)	**Negligible**	None	N/A	None
		✓			Low (large shallow inlets and bays IEF, and mudflats and sandflats not covered by seawater at low tide SAC IEF)	**Negligible**	None	N/A	None
		✓			Medium (Reefs (subtidal and intertidal rocky reef) IEF and submerged or partially submerged sea caves IEF)	**Negligible**	None	N/A	None
			✓	Low	Medium (cobble/stony reef outside of an SAC IEF, rocky reef outside an SAC IEF and moderate energy subtidal rock IEF)	**Minor**	None	N/A	None
			✓		Low (subtidal sand and muddy sand sediments IEF, subtidal coarse and mixed sediments IEF, moderate energy subtidal rock IEF, subtidal sands and gravel IEF, and shelf bank and mound IEF)	**Minor**	None	N/A	None
			✓		Negligible (seapens and burrowing megafauna IEF, intertidal sands IEF, *Sabellaria* reef outside of an SAC IEF and ocean quahog IEF)	**Minor**	None	N/A	None
			✓	Negligible	Low (large shallow inlets and bays IEF, and mudflats and sandflats not covered by seawater at low tide SAC IEF)	**Negligible**	None	N/A	None
			✓		Medium (Reefs (subtidal and intertidal rocky reef) IEF and submerged or partially submerged sea caves IEF)	**Negligible**	None	N/A	None
			✓		Negligible (intertidal sands IEF)	**Negligible**	None	N/A	None
			✓		Medium (Intertidal rock IEF and fucus dominated intertidal rock IEF)	**Minor**	None	N/A	None
Impacts to benthic invertebrates due to EMF	×								
		✓		Negligible	Negligible (all IEFs)	**Negligible**	None	N/A	None
			×						
Long term subtidal habitat loss	✓			Low	High (subtidal sand and muddy sand sediments IEF, subtidal coarse and mixed sediments IEF, moderate energy subtidal rock IEF, cobble/stony reef outside of an SAC IEF, rocky reef outside an SAC IEF, *Sabellaria* reef outside of an SAC IEF, subtidal sands and gravels IEF, and shelf banks and mounds IEF)	**Minor**	None	N/A	None
		✓		Low	High (subtidal sand and muddy sand sediments IEF, subtidal coarse and mixed sediments IEF, moderate energy subtidal rock IEF, cobble/stony reef outside of an SAC IEF, rocky reef outside an SAC IEF, *Sabellaria* reef outside of an SAC IEF, subtidal sands and gravels IEF, and shelf banks and mounds IEF)	**Minor**	None	N/A	None
			✓	Low	High (subtidal sand and muddy sand sediments IEF, subtidal coarse and mixed sediments IEF, moderate energy subtidal rock IEF, cobble/stony reef outside of an SAC IEF, rocky reef outside an SAC IEF, *Sabellaria* reef outside of an SAC IEF, subtidal sands and gravels IEF, and shelf banks and mounds IEF)	**Minor**	None	N/A	None
Colonisation of hard structures	×								
		✓		Low	High (subtidal sand and muddy sand sediments IEF, subtidal coarse and mixed sediments IEF, moderate energy subtidal rock IEF, cobble/stony reef outside of an SAC IEF, rocky reef outside an SAC IEF, *Sabellaria* reef outside of an SAC	**Minor**	None	N/A	Commitment to engaging with MSS, NatureScot and other relevant key stakeholders to identify

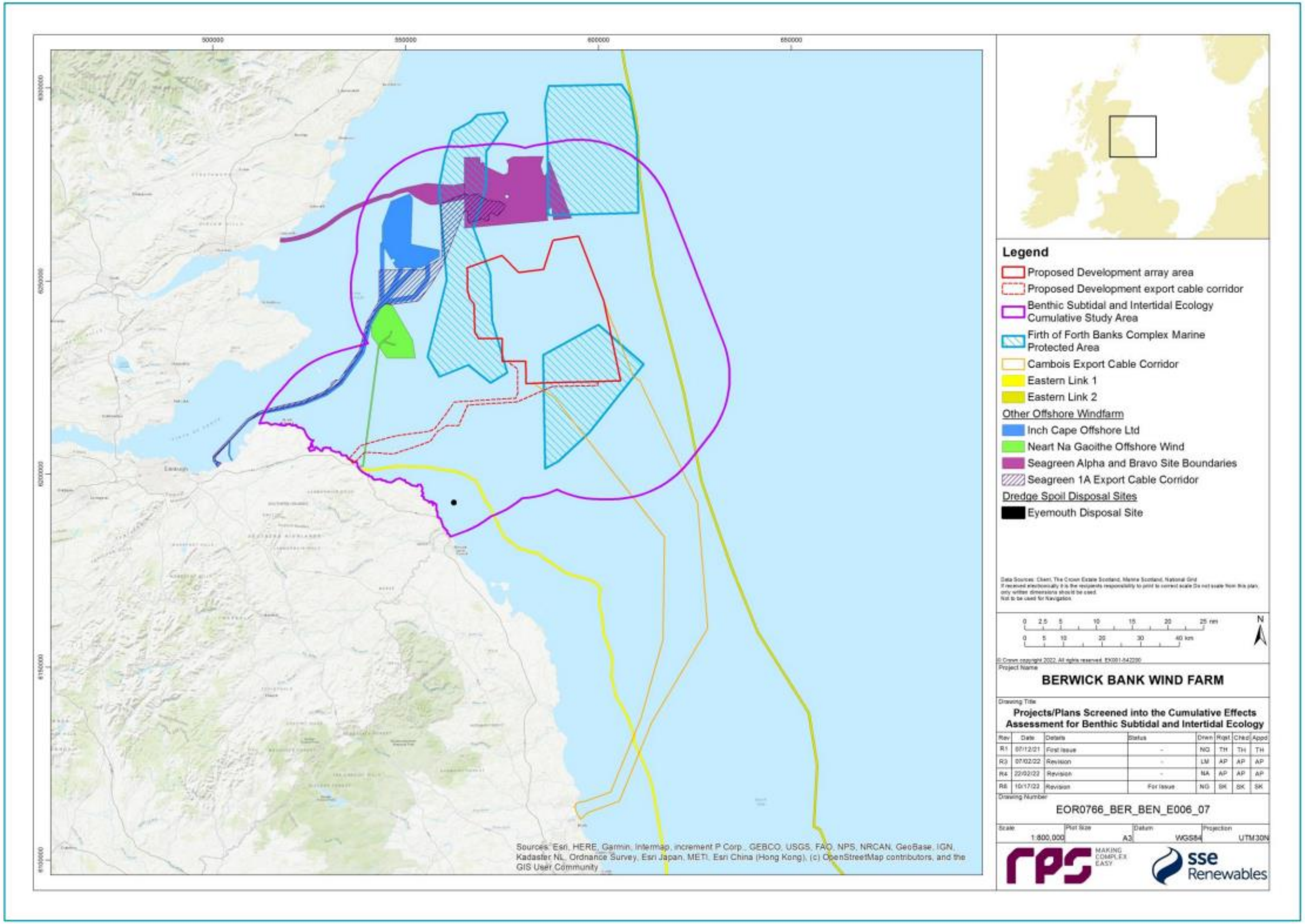


Figure 8.7: **Other Projects/Plans Screened into the Cumulative Effects Assessment for Benthic Subtidal and Intertidal Ecology**

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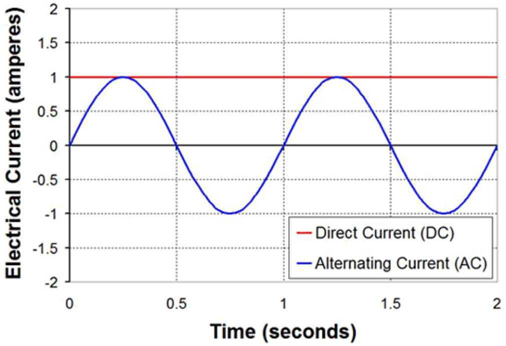
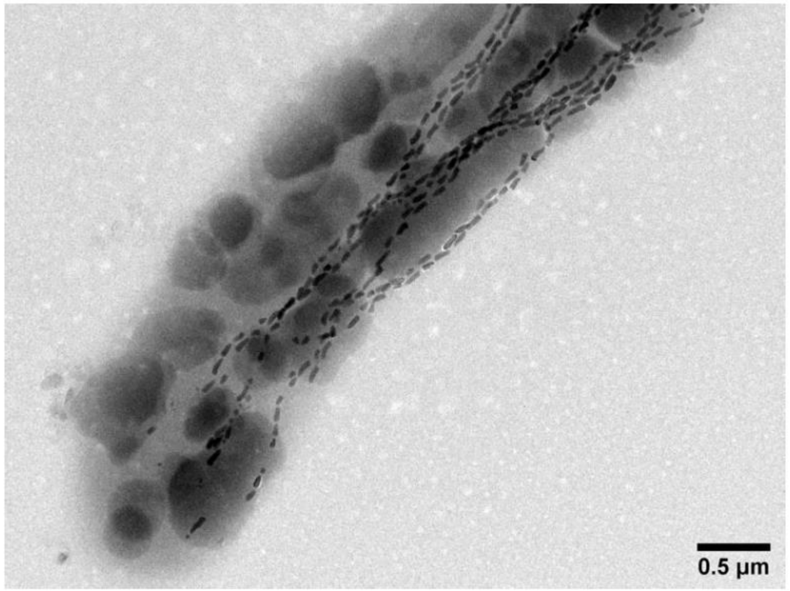
Problems with EMF research



Source: Veichi Electric

- Lack of understanding surrounding if/how organisms detect EMF
- Dynamic conditions – AC/DC, cable size + length, number of devices, weather conditions, cable configurations
- Lack of productive collaborations between researchers and energy companies
- Difficult to recreate EMF of same shape, size and strength as predicted in the field
- No ACOP
- Funding – invisible stressor
- Cost

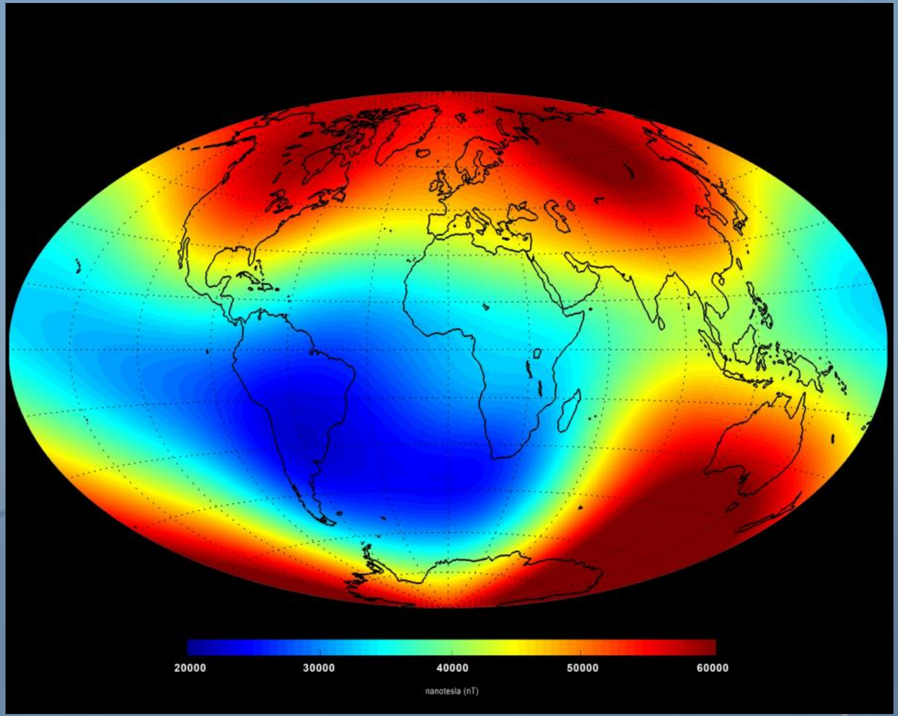
CHRISTOPHER FURLONG/GETTY IMAGES



A *Candidatus* Magnetobacterium casensis cell containing magnetite crystals (small, dark, elongated shapes) is seen here under a transmission electron microscope. Credit: Jinhua Li

Are reported EMF strengths reliable?

- Normandeau *et al.* 2011 – **0.18mT** (DC) and **0.26mT** (AC)
- Bochert and Zettler 2006 – **3.2mT** (DC)
- Moray Offshore Renewables Limited – **0.14mT** (DC)
- Britned HVDC Interconnector – **0.49mT** (DC)
- Cada *et al.* 2011 – **1.60mT** (AC), **6.66mT** (DC), **8.02mT** (AC)



Source: NASA Earth Observatory

Values used in research:

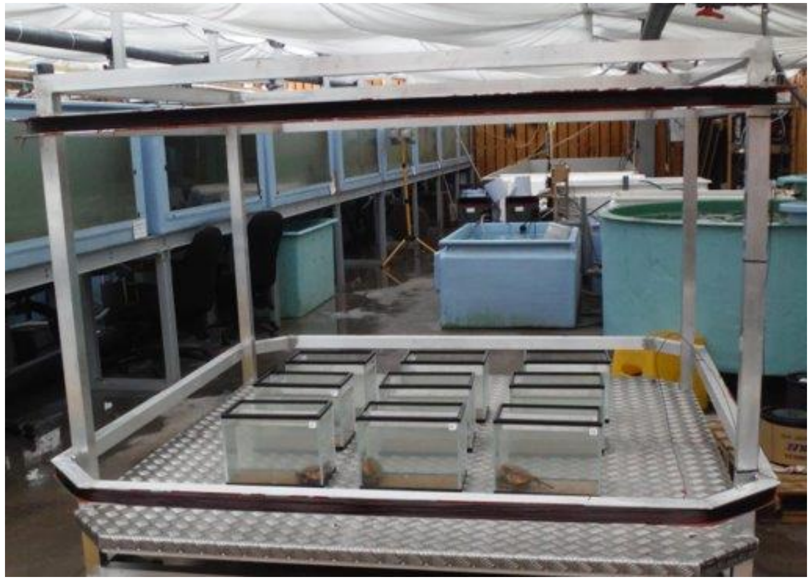
- Cada *et al.* 2012 - **36mT** (DC) and **165mT** (AC)
- Woodruff *et al.* 2012 – **3mT**
- Formicki *et al.* 2004 – **4.2mT**
- Bochert and Zettler 2004 – **3.7mT**

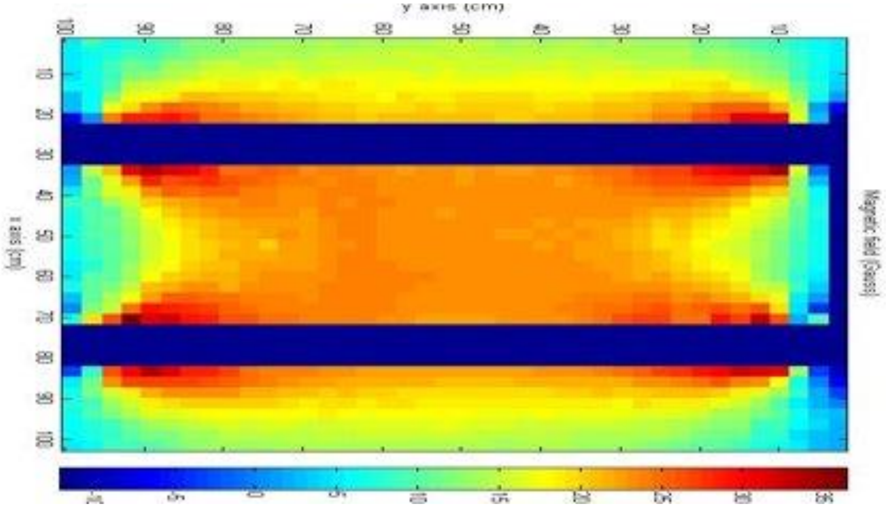
The Earth's magnetic field is ~0.03 mT

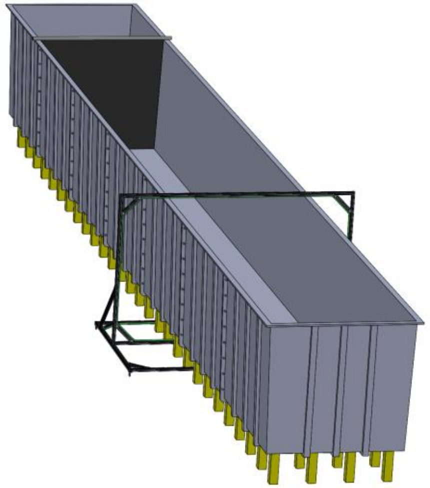
MRI – 1.5 – 7 Tesla

Generation of EMF

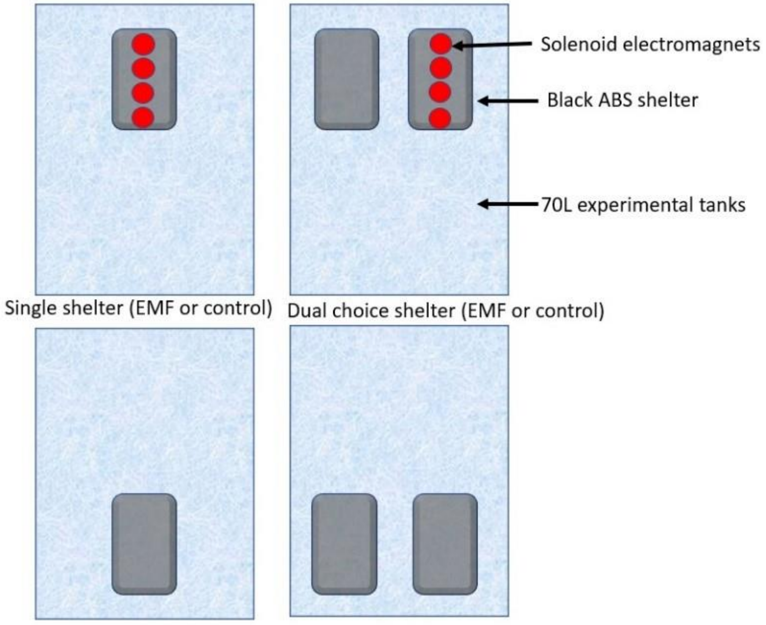
Helmholtz coil
Uniform field







Solenoid magnets
Non-uniform field



EMF: ecological importance and assessment parameters

- Use of Earth's geomagnetic field is widespread amongst marine fauna
- Artificial EMF (e.g. MRED cables) may interfere with organism's ability to detect and use geomagnetic field
- Assessment parameters for effects of EMF vary across taxa, but largely split into 3x areas:

Sensory

Orientation/navigation
Hormone/pheromone detection
Antennular flicking

Behavioural

Shelter preference
Swimming/locomotor activity
Feeding/foraging
Larval fitness
Burrowing
Attraction/avoidance
Anti-predation

Physiological

Blood/haemolymph parameters
DNA damage/expression
Embryological/ developmental parameters
Growth rate

Effects of EMF on adult edible crab (*Cancer pagurus*) and European lobster (*Homarus gammarus*)

	Cancer pagurus	*Homarus gammarus*
PHYSIOLOGY		
- **D-Glucose***	✓	✓
- **L-Lactate***	✓	✓
- **Haemocyanin**	✗	?
- **Total Haemocyte Count**	?	✓
BEHAVIOUR		
- **Activity level**	✗	✗
- **Attraction/Avoidance**	✓	✗
- **Shelter preference**	✓	✓

Attraction to EMF sources **coupled with associated behavioural and physiological changes** may have longer-term **ramifications** for populations health

Effects of multiple EMF strengths on adult edible crabs (*C. pagurus*)

	250 µT	500 µT	1000 µT
PHYSIOLOGY			
- **D-Glucose**	✗	✓	✓
- **L-Lactate**	✓	✓	✓
- **Total Haemocyte Count**	✗	✓	✗
BEHAVIOUR			
- **Activity level**	✗	✗	✓
- **Attraction/Avoidance**	✗	✓	✓
- **Shelter preference**	✗	✓	✓

Species-level influences may be EMF field **strength-dependent**

Effects of EMF on egg development and larval locomotory ability of the edible crab (*Cancer pagurus*) and the European lobster (*Homarus gammarus*)

- Early stage = potential population bottleneck

- 2x methods: berried hens in EMF and control; egg batches separated from mother and split across both treatments. Strength = 2.8 mT

PARAMETER	*C. pagurus*	*H. gammarus*
- **Development time**	✓	✓
- **Carapace length**	✓	✓
- **Survival rate**	✓	✓
- **Deformities**	✗	✓
- **Swimming fitness**	✗	✓

EMF sensitivity may **vary at a species and life-stage level** – knowledge is needed to underpin cable placement (geographic locations – permanent, temporal)

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2021/10/16, internationality

Study: Submarine cable magnetic fields "charm" crabs, offshore wind farms could harm marine life?

Attraction to power puts crabs in wind farm peril

Tests in an aquarium lab showed that brown crabs sat still when close to power cables

ALAMY

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DAILY NEWS 4 Dec 2021

Stunned Still: Offshore Wind Farm Power Cables Leave Crabs Mesmerised & Motionless

Gálvölgyi Jánosért

önállóságát is

2021. október. 11. 16:03 · TECH

Megmerevednek a tarisznyarákok a víz alatti kábelektől

TUDOMÁNY +

A megújuló energiaforrások víz alatti kábelei magukhoz vonzzák a nagy tarisznyarákokat, és veszélyes biológiai változásokat idéznek elő a szervezetükben – állapította meg egy skóciai kutatás.

LEGNÉPSZERŰBB

2023. május. 11. 08:03 · hvg.hu

Darabonként 71 ezer tonna acél spórolható meg a szélerőművekhez kitalált úszó talapzattal, amely már készen is áll a sorozatgyártásra

Úszó szélerőmű-platformot fejleszt egy cég, hogy így tegye modulárisabbá és még környezetbarátabbá a tengeri szélerőműparkokat – ehhez...

2023. május. 12. 17:03 · hvg.hu

Elég begépelni néhány sort, pár mp alatt élethű 3D-s modellt csinál belőle a mesterséges intelligencia

Az OpenAI, a mesterségesintelligencia-hullám beindítója egy izgalmas fejlesztést mutatott be, amelyik összekapcsolja a mesterséges...

Kopalnia Wiedzy.pl

wpisz szukaną frazę

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Strona główna > Wiadomości > Nauki przyrodnicze

Farmy produkujące energię odnawialną mogą zaszkodzić krabom i ważnej gałęzi gospodarki

A A A

18 października 2021, 14:42 | Nauki przyrodnicze

Podwodne linie energetyczne **zmieniają zachowanie krabów kieszeńców** (*Cancer pagurus*), donoszą naukowcy z brytyjskiego Heriot Watt University i węgierskiego Uniwersytetu Loránda Eötvösa. Uczeni stwierdzili, że kable łączące morskie elektrownie wytwarzające energię odnawialną **negatywnie wpływają na sposób, w jaki kraby wchodzą w interakcje ze środowiskiem.** Dochodzi do zmian biologii tych zwierząt na poziomie komórkowym. Problem nie ogranicza się tylko do kwestii środowiskowych, ale również ekonomicznych, gdyż kieszeńce są drugim najbardziej cennym brytyjskim skorupiakiem. Zmiana ich zachowania może więc wpływać również na firmy zajmujące się ich połowami.

Doktor Alastair Lyndon wyjaśnia: *Podwodne przewody elektryczne generują pole elektromagnetyczne. Gdy jego indukcja wynosi 500 mikrotesli lub więcej, czyli około 5% pola generowanego przez magnes przyczepiany do drzwi lodówki, kraby są przez to pole przyciągane. Gromadzą się przy kablu i siedzą nieruchomo. To nie jest problemem samo w sobie. Jednak gdy się nie ruszają, to się nie odżywiają i nie szukają partnerów. Ponadto zmiany w poziomie aktywności fizycznej prowadzą do zmian w metabolizmie cukrów. Podobnie jak u ludzi, w ich organizmach gromadzi się więcej cukru i mniej mleczanów.*

ZAP.aeiou

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Início › Notícias › Ciência & Saúde › Os caranguejos são "hipnotizados" pelos campos eletromagnéticos dos cabos submarinos

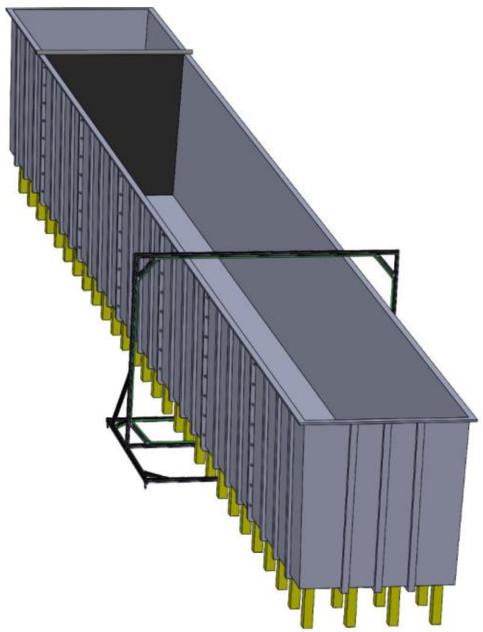
CIÊNCIA & SAÚDE / DESTAQUE

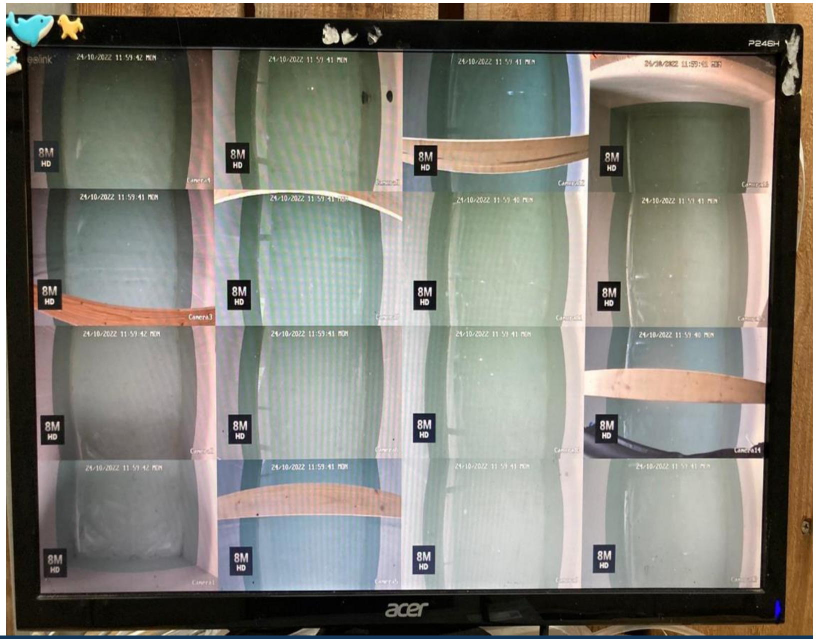
Os caranguejos são "hipnotizados" pelos campos eletromagnéticos dos cabos submarinos

ZAP 16 OUTUBRO, 2021

ElasmoPower: Investigating the effects of Electromagnetic Fields on elasmobranchs

Annemiek Hermans[1], Kevin Scott[2], Corentine Rochas[2], Petra Harsanyi[2], Erwin Winter[1], Tinka Murk[1]
[1]Wageningen University, NL [2]St Abbs Marine Station, UK





Model of the experimental tank (Peet Hovenkamp) and display of the 16 cameras

| Experimental set-up

- **15m experimental tank**, allowing animals to display natural behaviour
- Custom built generator to create artificial **alternating or direct current (AC or DC)** electromagnetic field in a designated area of the tank, allowing the development of an EMF gradient
- Replication of **measured EMF values** around live cables from offshore windfarms in the Netherlands
- Array of **cameras** fixed over the tank, recording behaviour for the duration of the experimental trials

Example of a stitched video of the full tank

Outlook

- Clear need for more research on the impacts of EMF on marine species
- More data on accurate in-situ EMF levels – easily accessible
- Collaborative or ‘standard’ approach to future EMF research
- Easier access to deployments sites for research, sensors, etc.
- More importance to the potential impacts of EMF comes with more robust research
- More focused approach on key species