



4th International
Marine Protected Areas Congress
IMPAC4 Chile 2017



Co-location of renewable energy installations with MPAs.

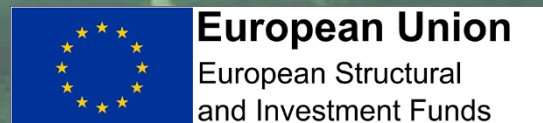
Dr Emma Sheehan, Dr Matthew Witt, Amy Cartwright, Dr Luke Holmes, Dr Tony Bicknell, Prof Martin Attrill, et al.



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Introduction

- MPAs – Marine Renewables –
- Alternative to fossil fuels
- Reduce emissions/Climate change



- Wave Energy Convertors
 - Tidal stream
 - Offshore Wind
- (not including tidal barrages or lagoons)



Introduction

● Marine renewable energy - Defacto MPAs? Gill et al 2005; Inger 2009; Witt et al 2011

Journal of Applied Ecology



Journal of Applied Ecology 2009, **46**, 1145–1153

doi: 10.1111/j.1365-2664.2009.01697.x

Marine renewable energy: potential benefits to biodiversity? An urgent call for research

Richard Inger¹, Martin J. Attrill², Stuart Bearhop¹, Annette C. Broderick¹, W. James Grecian², David J. Hodgson¹, Cheryl Mills¹, Emma Sheehan², Stephen C. Votier², Matthew J. Witt¹ and Brendan J. Godley^{*,1}

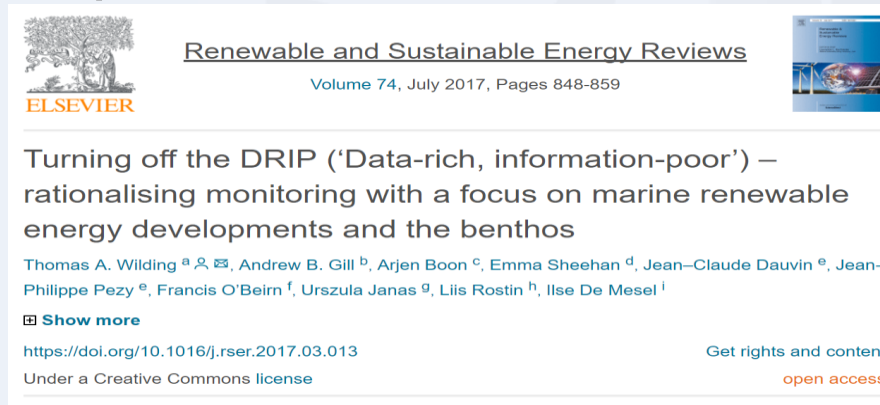
¹Centre for Ecology and Conservation and Peninsula Research Institute for Marine Renewable Energy (PRIMaRE), School of Biosciences, University of Exeter, Cornwall Campus, Penryn, Cornwall TR10 9EZ, UK; and ²Marine Biology & Ecology Research Centre, PRIMaRE and Marine Institute, University of Plymouth, Drake Circus, Plymouth, Devon PL4 8AA, UK

● Positive: FAD/Artificial reef/Fisheries exclusion

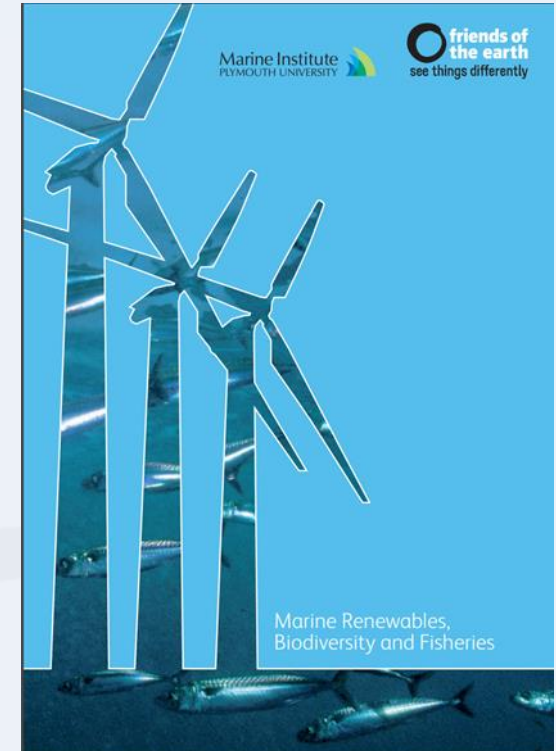
● Negative: Noise/EMF/Habitat loss

Introduction

● Lack of good data: ICES Working Group on Marine Benthos and Renewable Energy Developments



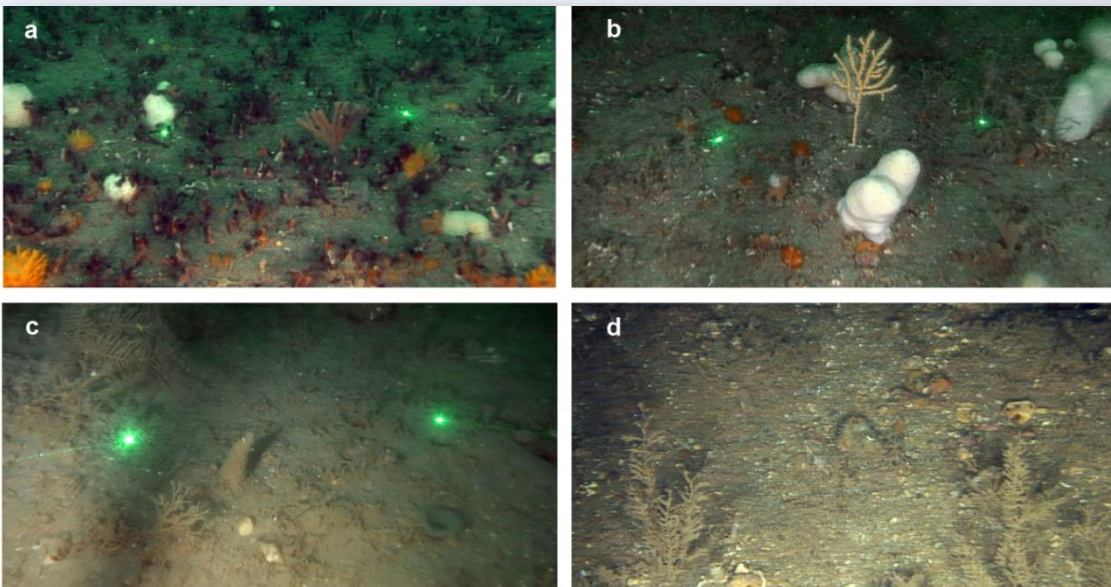
● Lack of data holding up progress of renewables – Friends of the earth report



Sites

- MPA designation are evidence and feature based which as a result of shifting baselines may miss important sites
- Renewable sites may be approved due to the lack of conservation features at the time.
- Over time however, as a result of habitat provision and exclusion of most destructive activities, desired features may establish and flourish.

Sand scour? Pebbly sand reef!



- Sheehan *et al* 2013 Mar. Poll. Bull.



Marine Pollution Bulletin

Volume 76, Issues 1–2, 15 November 2013, Pages 194–202



Drawing lines at the sand: Evidence for functional vs. visual reef boundaries in temperate Marine Protected Areas

E.V. Sheehan^a, S.L. Cousens^a, S.J. Nancollas^a, C. Stauss^b, J. Royle^b, M.J. Attrill^a

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<http://dx.doi.org/10.1016/j.marpolbul.2013.09.004>

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Highlights

- MPAs can either protect all seabed habitats within them or discreet features.
- If discreet features are protected humans have to know where the boundaries are.
- Following 3 years protection, reef fauna indicated expansion of the reef feature.
- MPA management should therefore be site based to allow for shifting baselines.
- Site based MPAs will be more effective at delivering ecosystem goods and services.

Thanet

- Recovery of biogenic habitat between monopiles where bottom towed fishing was excluded.



Continental Shelf Research

Volume 83, 15 July 2014, Pages 3-13

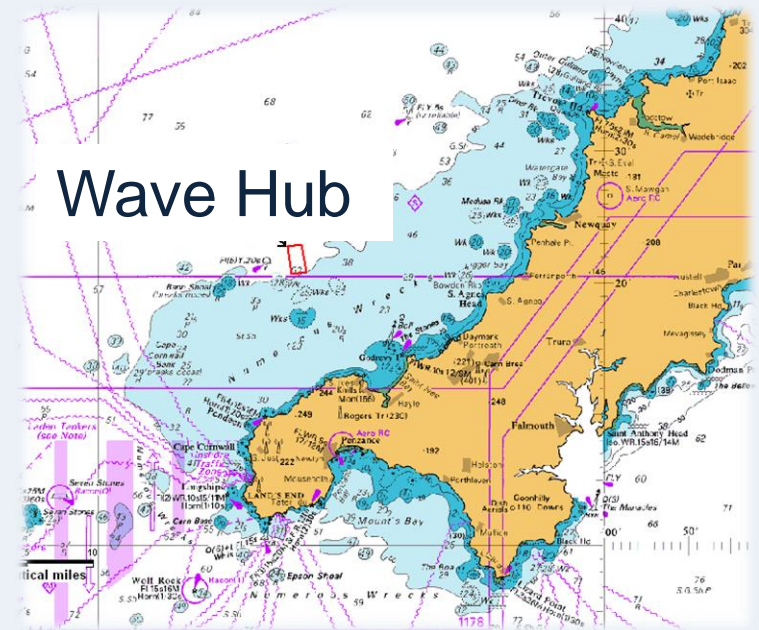


Repeated mapping of reefs constructed by *Sabellaria spinulosa* Leuckart 1849 at an offshore wind farm site

Bryony Pearce ^{a, b} ✉, Jose M. Fariñas-Franco ^c ✉, Christian Wilson ^d ✉, Jack Pitts ^a ✉, Angela deBurgh ^a ✉, Paul J. Somerfield ^e ✉

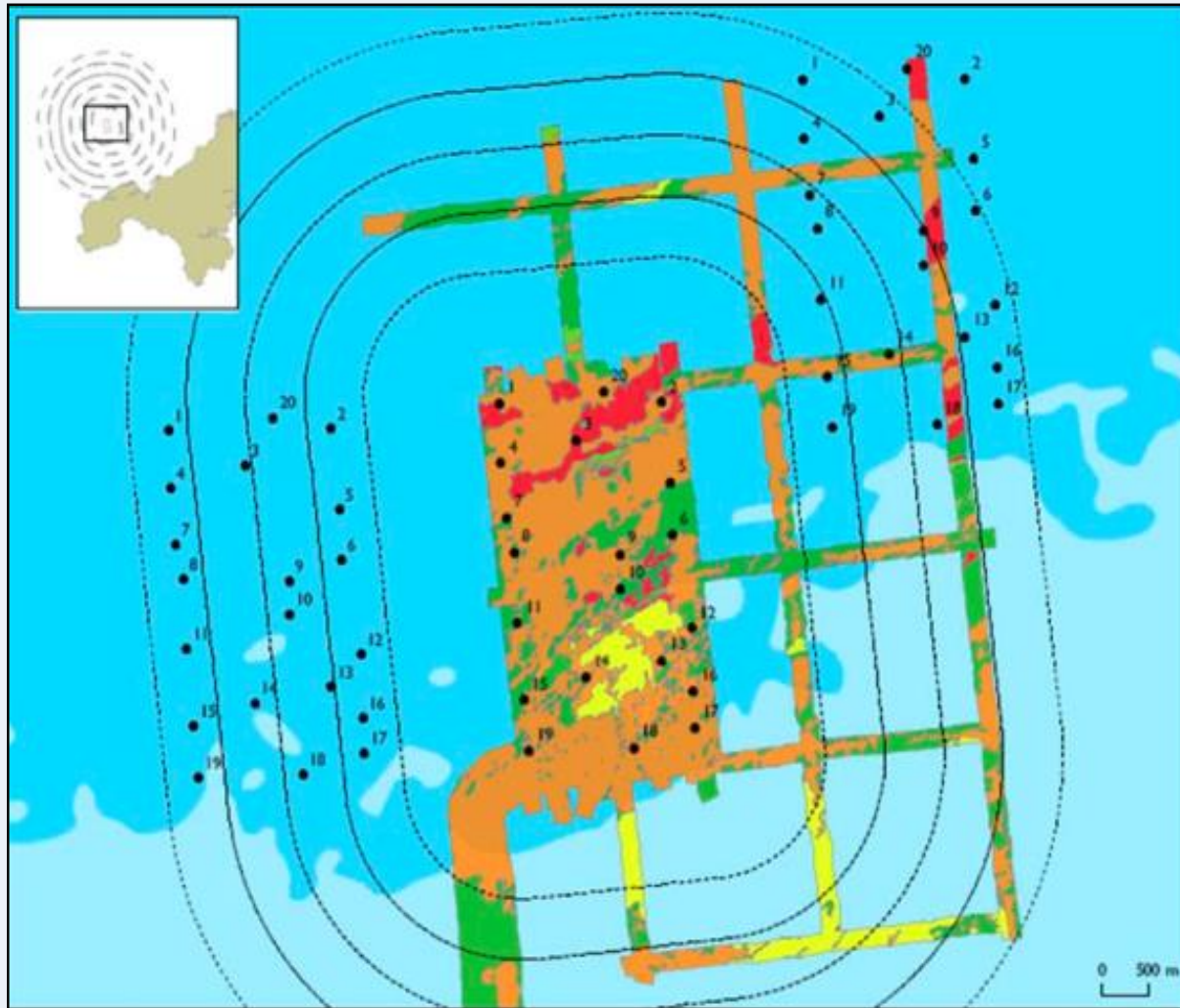
Wave Hub

- Wave Hub is a site for testing devices and monitoring ecological impacts
- 18 km of seabed cable, and 80,000 tonnes of rock armouring (deployed in 2010)
- Baseline data has been gathered since 2009 for impact assessment across the WH site and the cable route

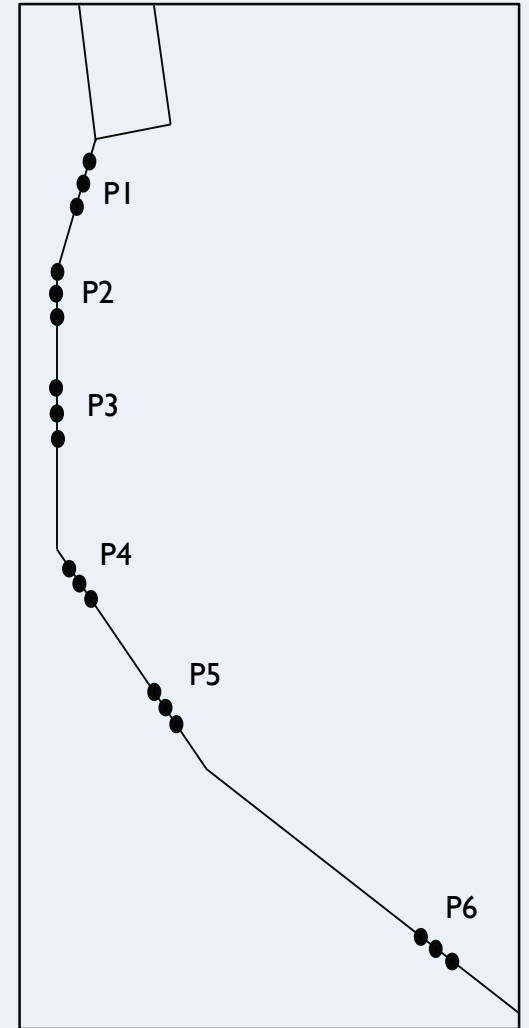


Design

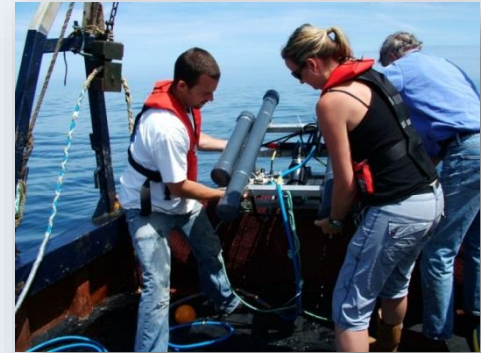
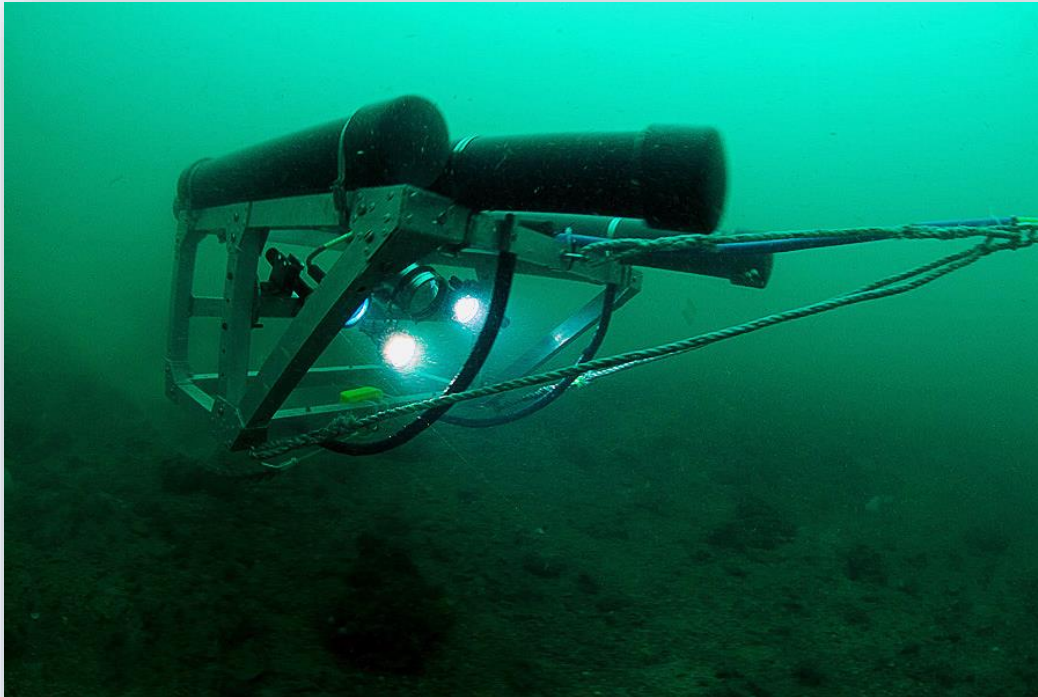
1. H1 Defacto Marine Protected Area effect



2. H2 Artificial Reef effect



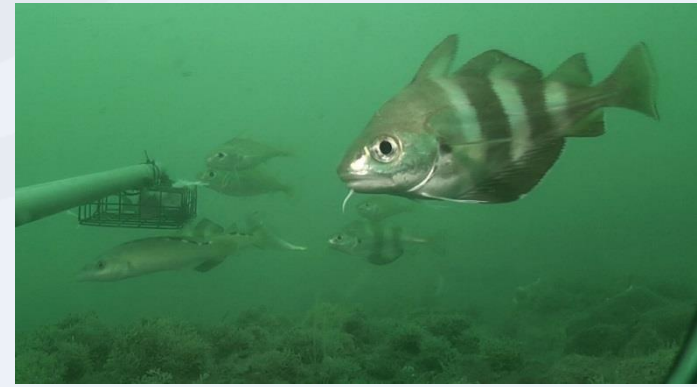
Flying array



- Sheehan et al 2010 PLOS ONE;
- Sheehan et al 2016 Methods in Ecology and Evolution

Baited video/ Exeter University

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Results I. Defacto MPA

- Diverse assemblages and habitats
- North south divide

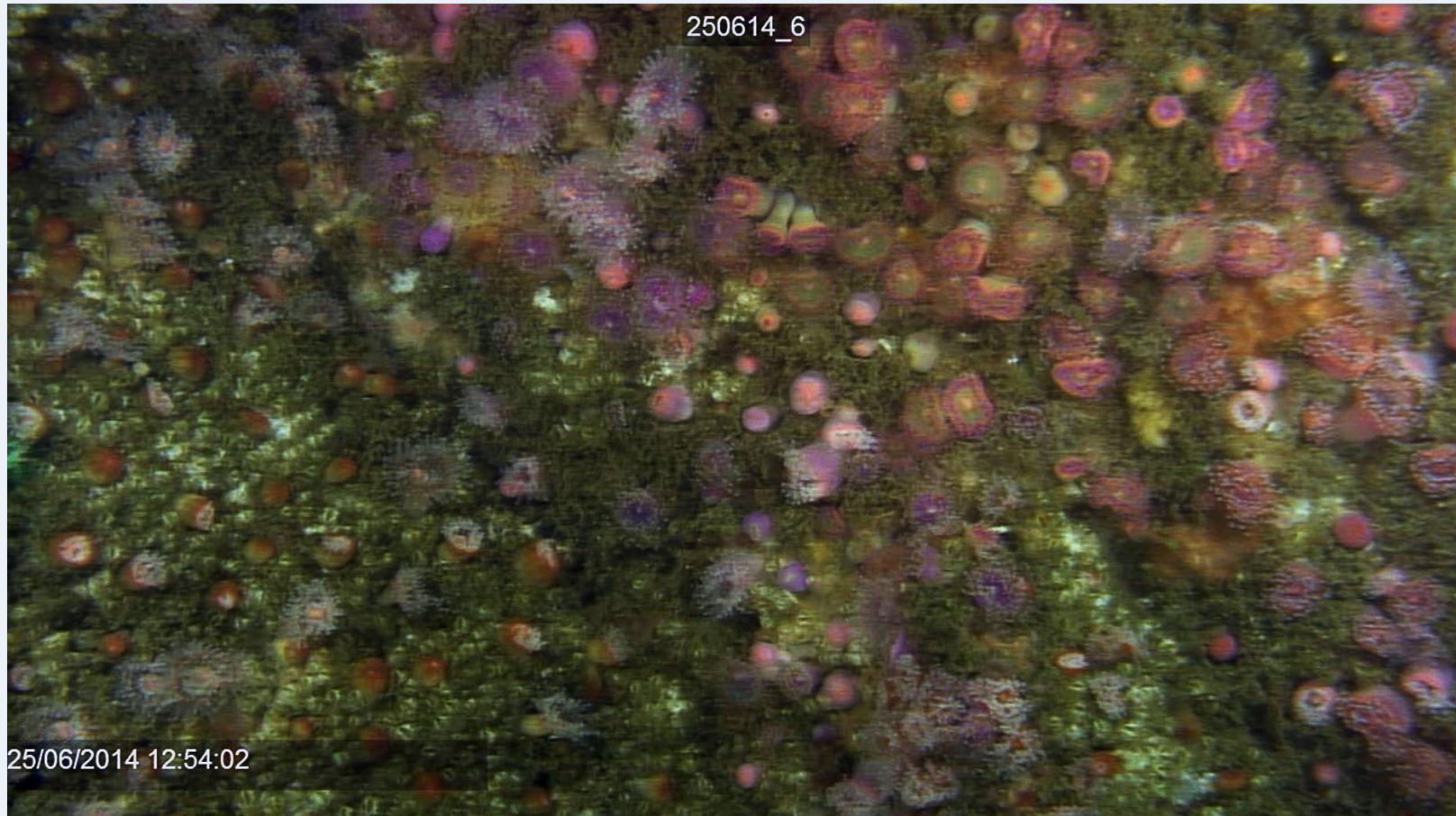


Results I.WH site North

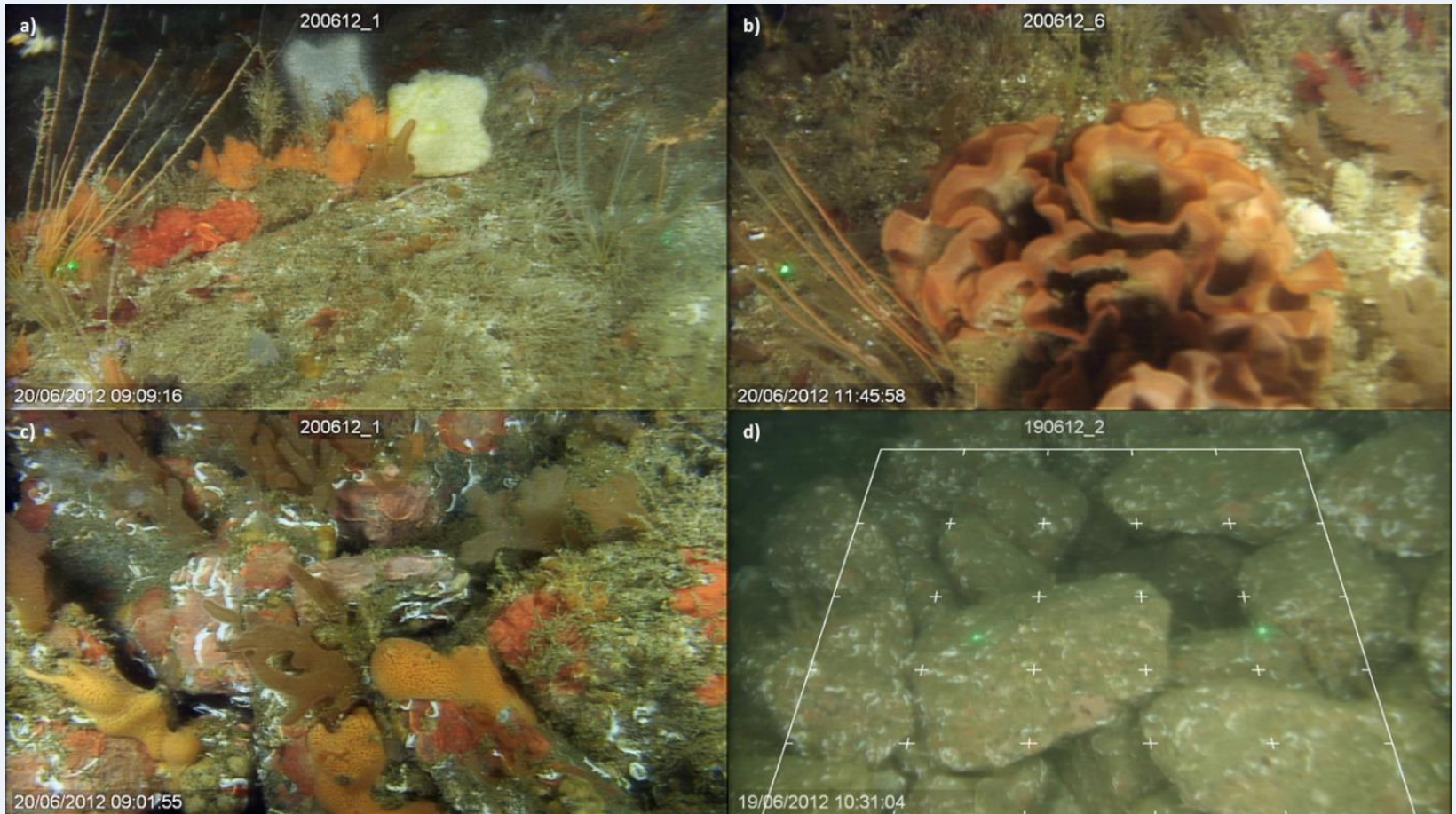


Results I.WH site South

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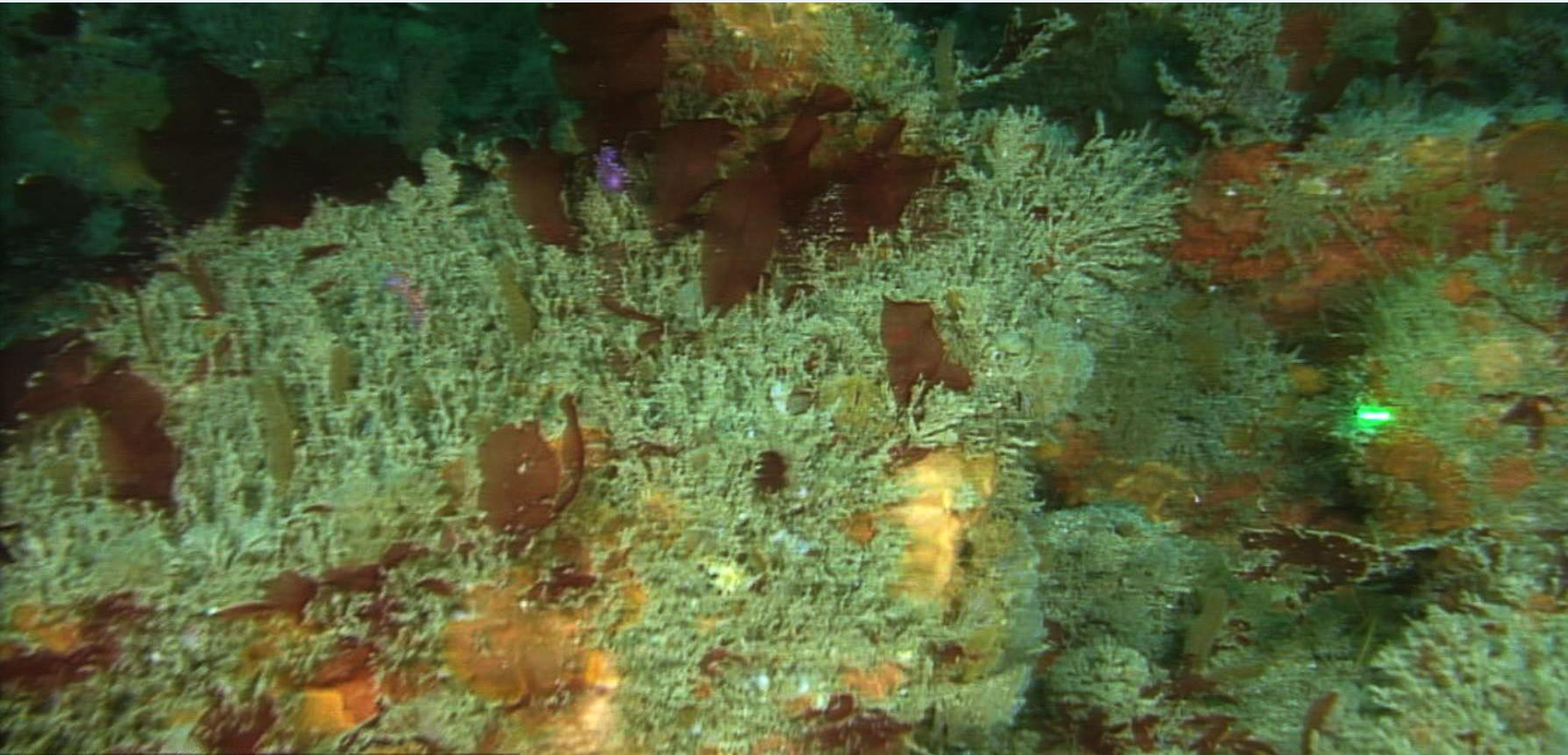


Results 2. Cable Impact (+2 years)



Results 2. Cable Impact 2014 (+4 yrs)

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Results 2. Cable Impact 2014 (+4 yrs)

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Clean Energy From Ocean Waves

CEFOW – Penguin device



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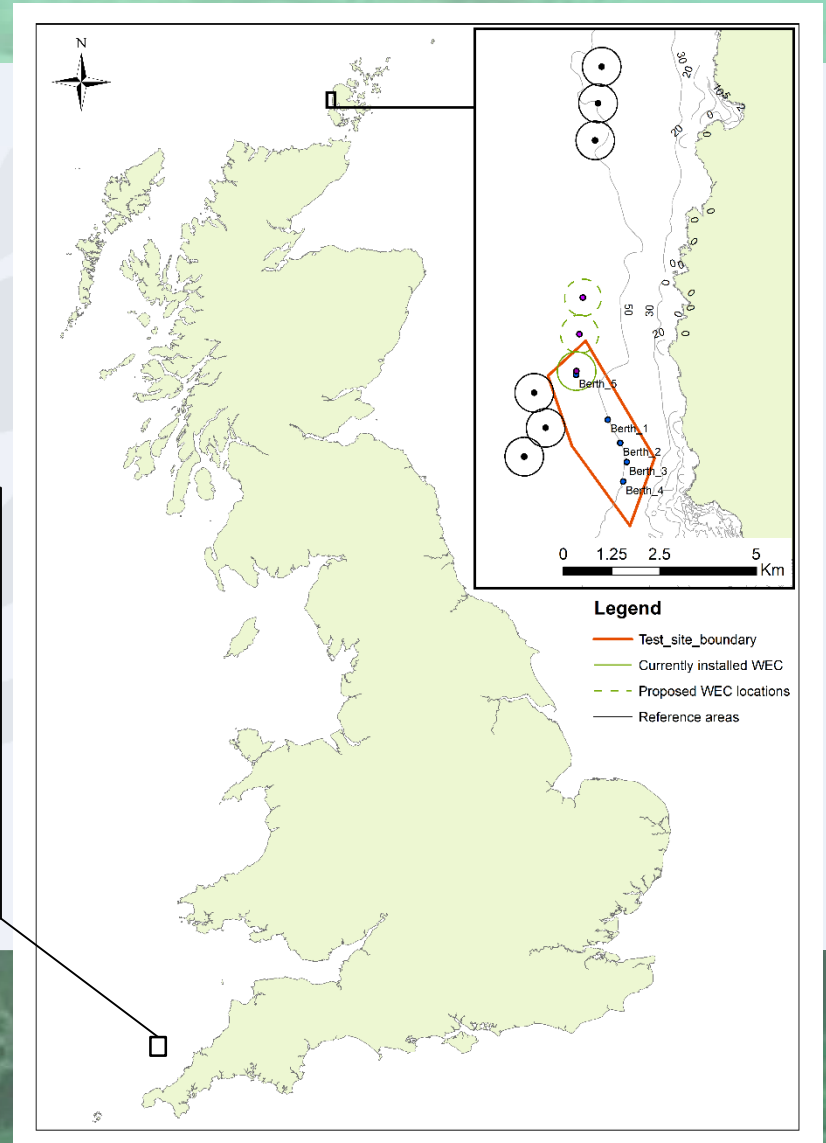
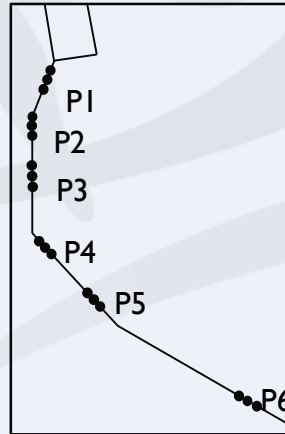
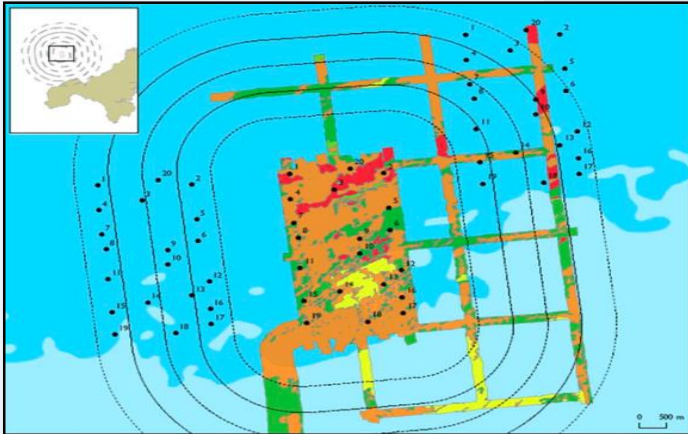
- Brand new 5 year project
- **Fortum, Wello, GreenMarine, (Mojo Maritime, Wave Hub)**
 - Universities: Exeter, Plymouth and Uppsala

CEFOW

● Clean Energy From Ocean Waves















● Wave Hub Cornwall (2009 – 2015)

● EMEC Orkney (2017-2019)



Introduction

Tue 29 Aug BST

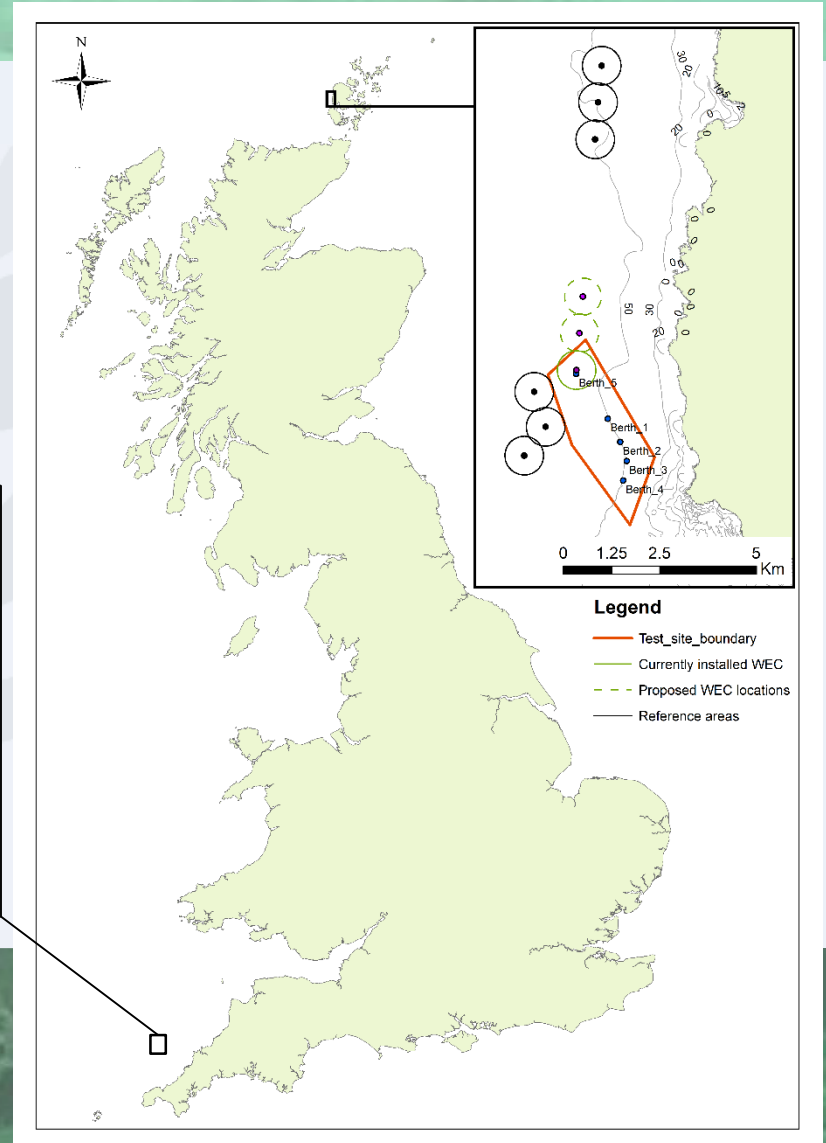
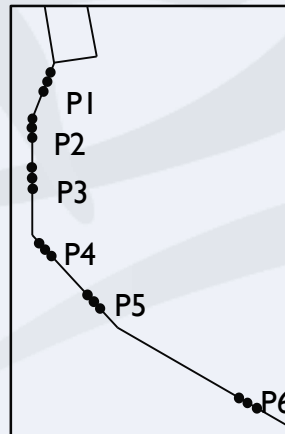
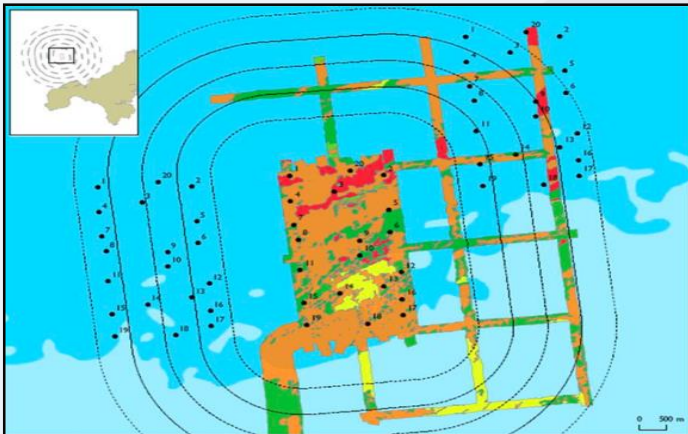
Hour	Wind		Avg.		Gust	Temp.	Rain		Cloud	Press.
01:00		SW	30 mph	to	38 mph	14 °C	0.2 mm		49 %	987 mb
04:00		SSW	36 mph	to	47 mph	13 °C	1.3 mm		100 %	985 mb
07:00		SW	38 mph	to	52 mph	13 °C	3.7 mm		100 %	984 mb
10:00		WSW	41 mph	to	53 mph	13 °C	4.8 mm		100 %	984 mb
13:00		WSW	43 mph	to	54 mph	14 °C	1.4 mm		100 %	985 mb
16:00		WSW	38 mph	to	49 mph	14 °C	1.8 mm		100 %	987 mb
19:00		WSW	37 mph	to	48 mph	14 °C	0.3 mm		100 %	988 mb

CEFOW

● Clean Energy From Ocean Wave

● Wave Hub Cornwall (2009 – 2015)

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Orkney

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Conclusion

● Issues related to marine renewables after 8 years of trying test defacto MPA hypothesis, I still don't have the data...

Conclusion

- Cable route: Artificial reef effect
- Following initial deployment impact....after 2 years Cable bouldering was colonised by fast growing opportunistic fauna.
- While assemblages were still different. 2014 survey showed increasing evidence of the artificial reef effect.

Conclusion

● Important to support this industry and appropriately monitor developments so that both the positive and negative impacts can be quantified as future developments could make significant contributions to our ecosystem processes and services and the MPA network.



Acknowledgments

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- Funders: EC Horizon 2020 (The EU Framework Programme for Research and Innovation)
- Local fishers and operators
- For more information:

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