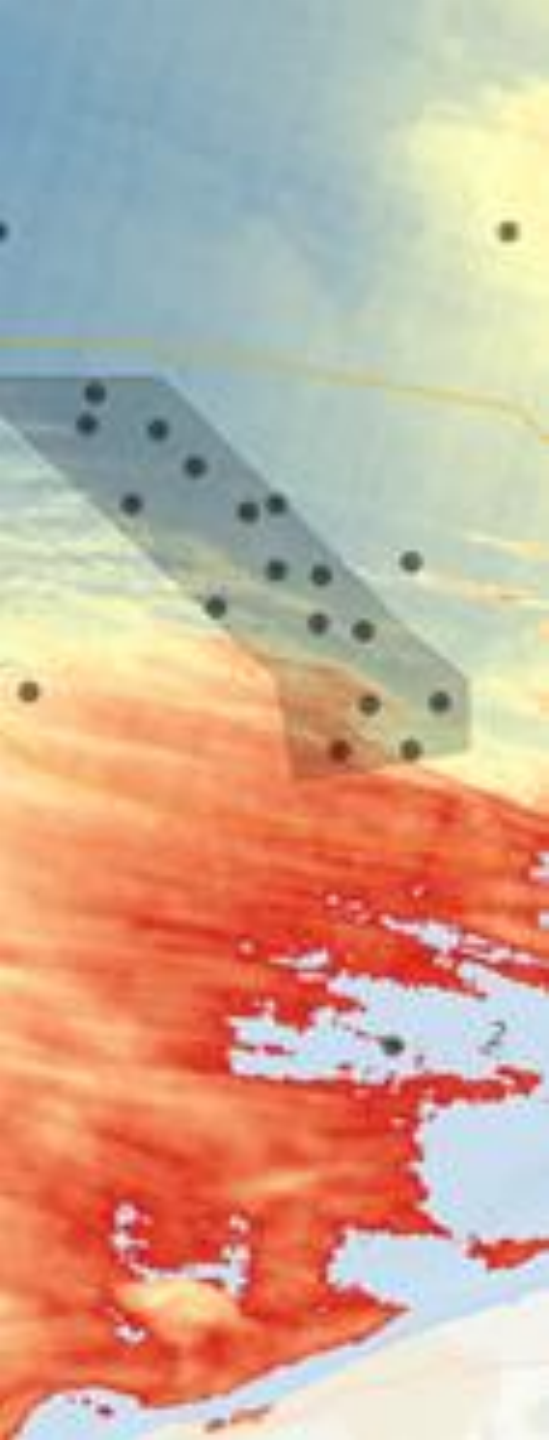


Monitoring sediment disturbance using Sentinel-2

Keith Cooper, Tiago Silva, Roi Martinez

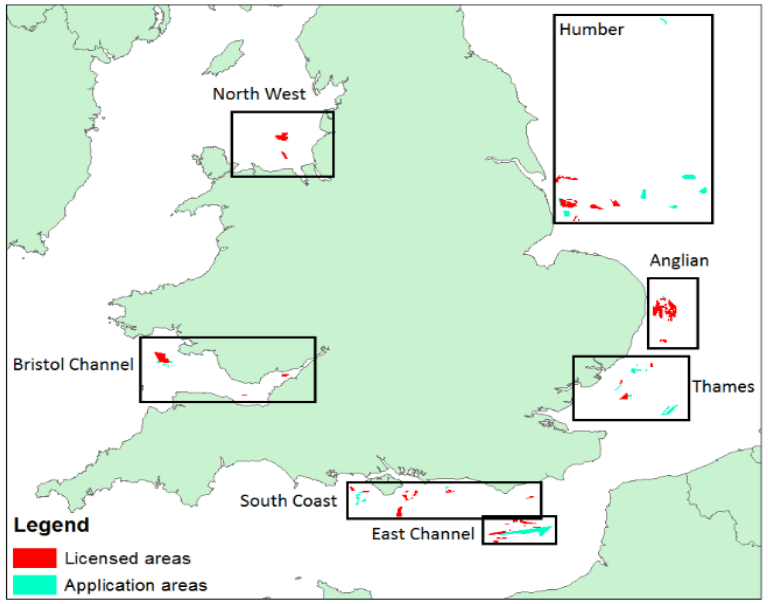
Cefas

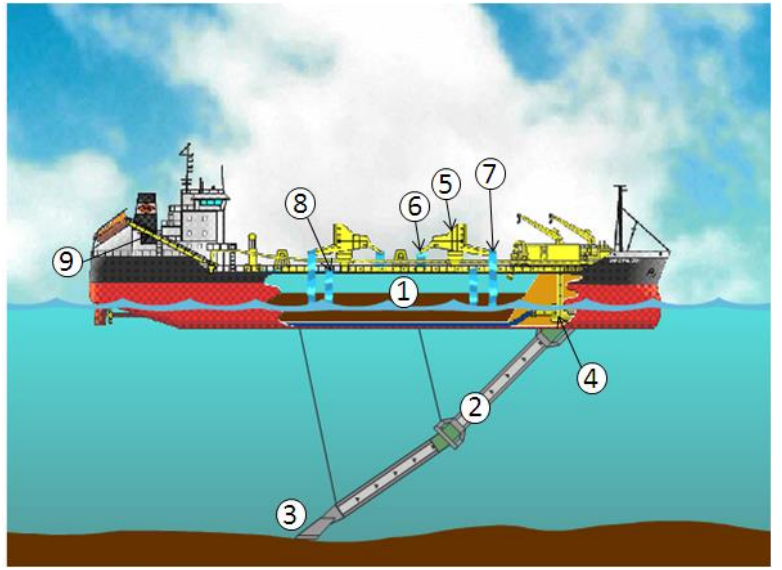
Presentation Structure

1. The Aggregates Industry
2. Impacts
3. Recovery/Restoration
4. Monitoring
5. Use of earth observation data
6. Next steps

1. The Industry

- Produces sand and gravel
- Licensed extraction areas
- Purpose built vessels
- Uses: construction, fill and coastal defense





(Source: www.bmapa.org)

2. Impacts

- **Direct:**

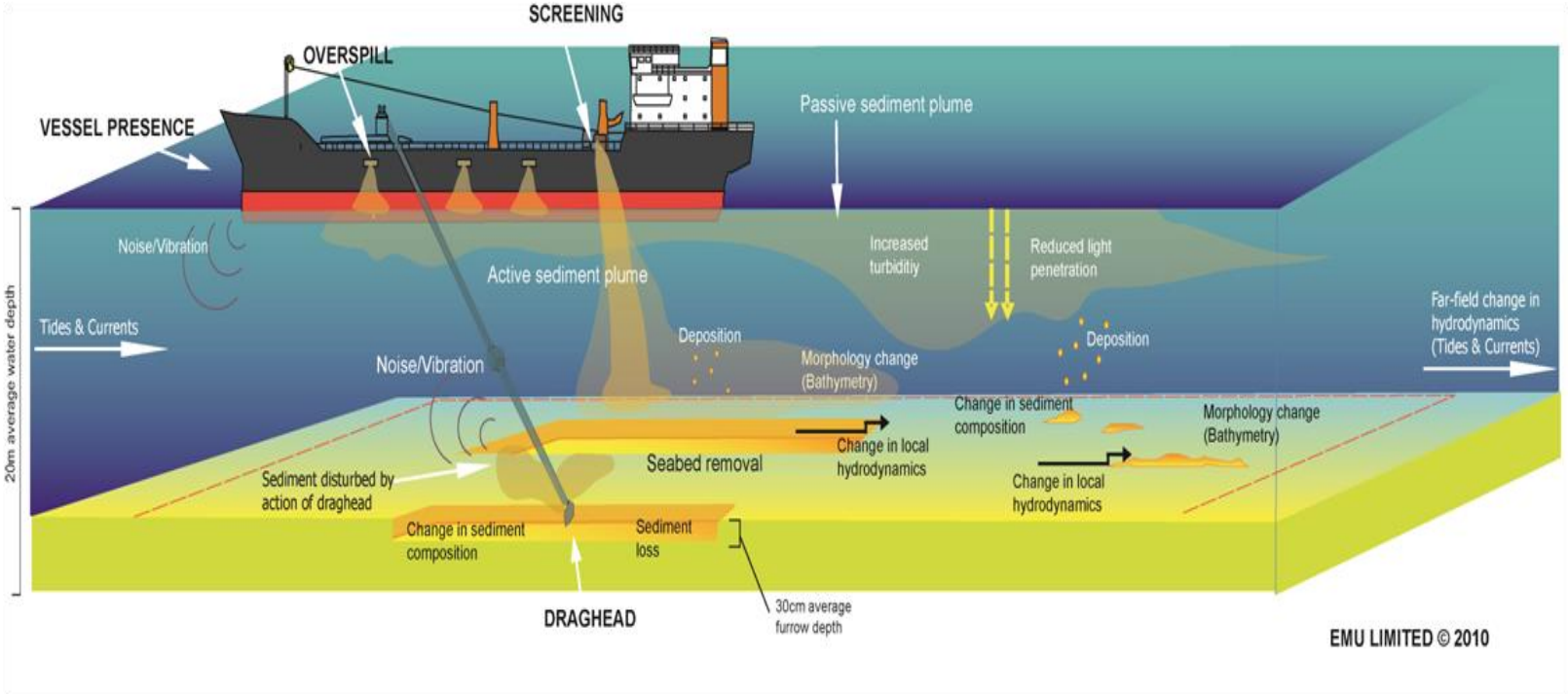
  - Seabed topography
  - Loss of fauna

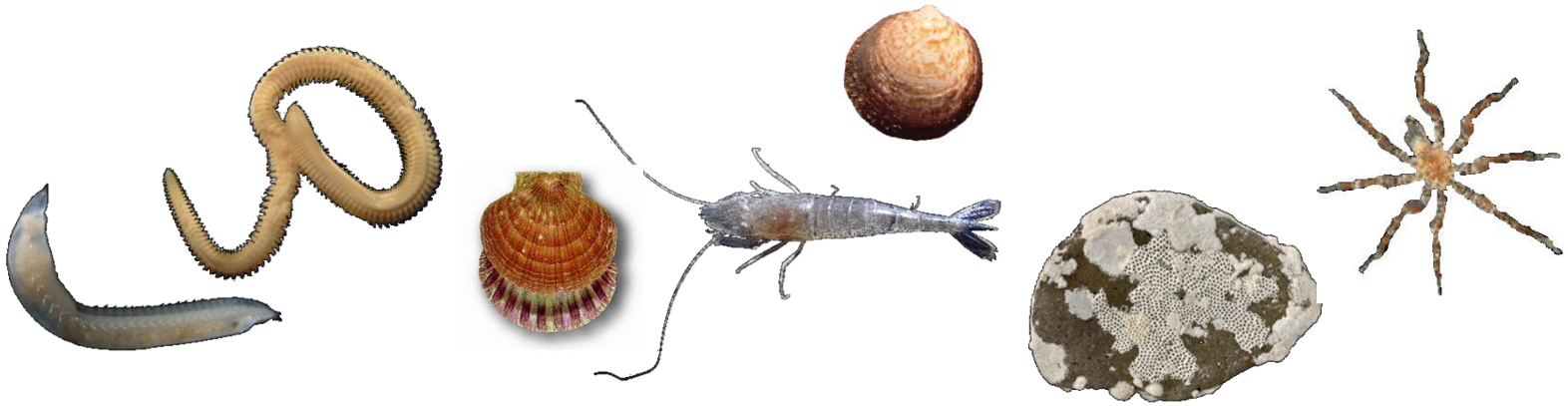
- **Indirect:**

  - sediment plumes
  - sediment composition
  - smothering of fauna

- **Impacts are variable**

- **Implications for recovery**





3. Recovery

- Changes in sediment composition can prolong faunal recovery period

Contents lists available at ScienceDirect

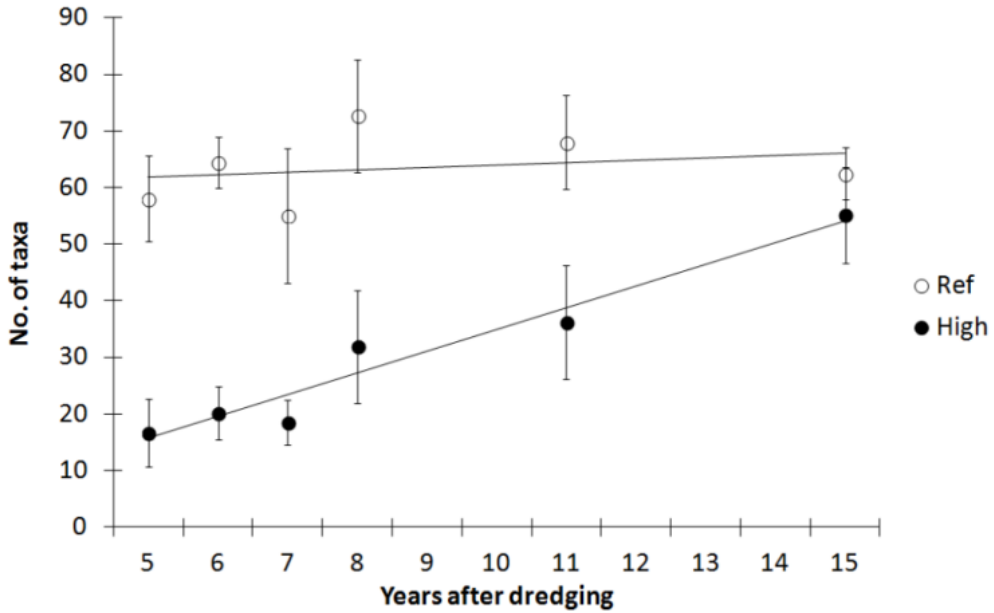
Marine Pollution Bulletin

journal homepage: www.elsevier.com/locate/marpolbul

The effects of marine sand and gravel extraction on the sediment composition and macrofaunal community of a commercial dredging site (15 years post-dredging)

Georgia A. Waye-Barker [a], Paul McIlwaine [b], Sophie Lozach [b], Keith M. Cooper [b,*]

[a] University of East Anglia, Norwich Research Park, Norwich NR4 7TJ, United Kingdom
[b] Centre for Environment, Fisheries and Aquaculture Science, Lowestoft NR33 0HT, United Kingdom



3. Restoration

- Actions to promote recovery
- Passive vs Active
- Trials:
  - *Shell cultch (Collins & Mallinson, 2007)*
  - *Gravel seeding*
- Can be done
- Better termed ‘enhancement’

Contents lists available at ScienceDirect

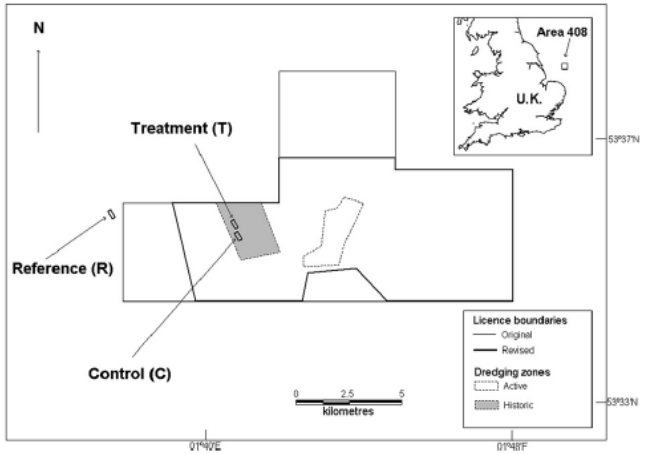
Estuarine, Coastal and Shelf Science

journal homepage: www.elsevier.com/locate/ecss

Gravel seeding – A suitable technique for restoring the seabed following marine aggregate dredging?

Keith Cooper*, Suzanne Ware, Koen Vanstaen, Jon Barry

The Centre for Environment, Fisheries and Aquaculture Science, Lowestoft Laboratory, Pakefield Road, Lowestoft, Suffolk NR33 0HT, UK



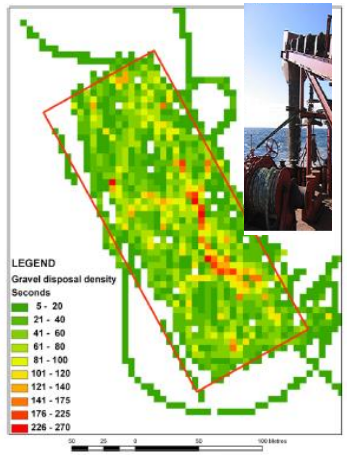
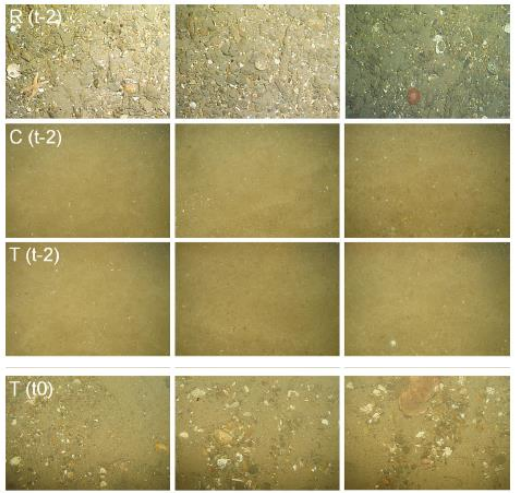
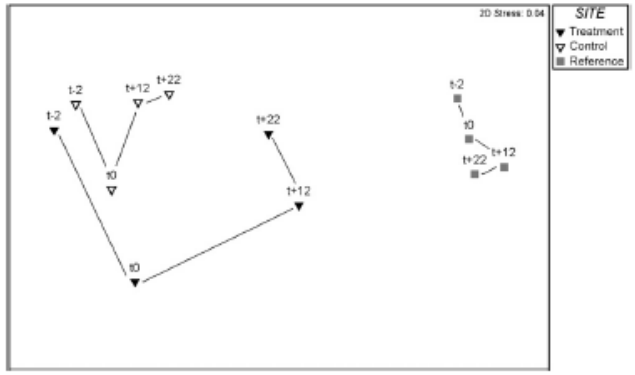


Fig. 3. Plot of vessel track (offset to discharge point) during discharge of material. Colour scale indicates density of coverage.



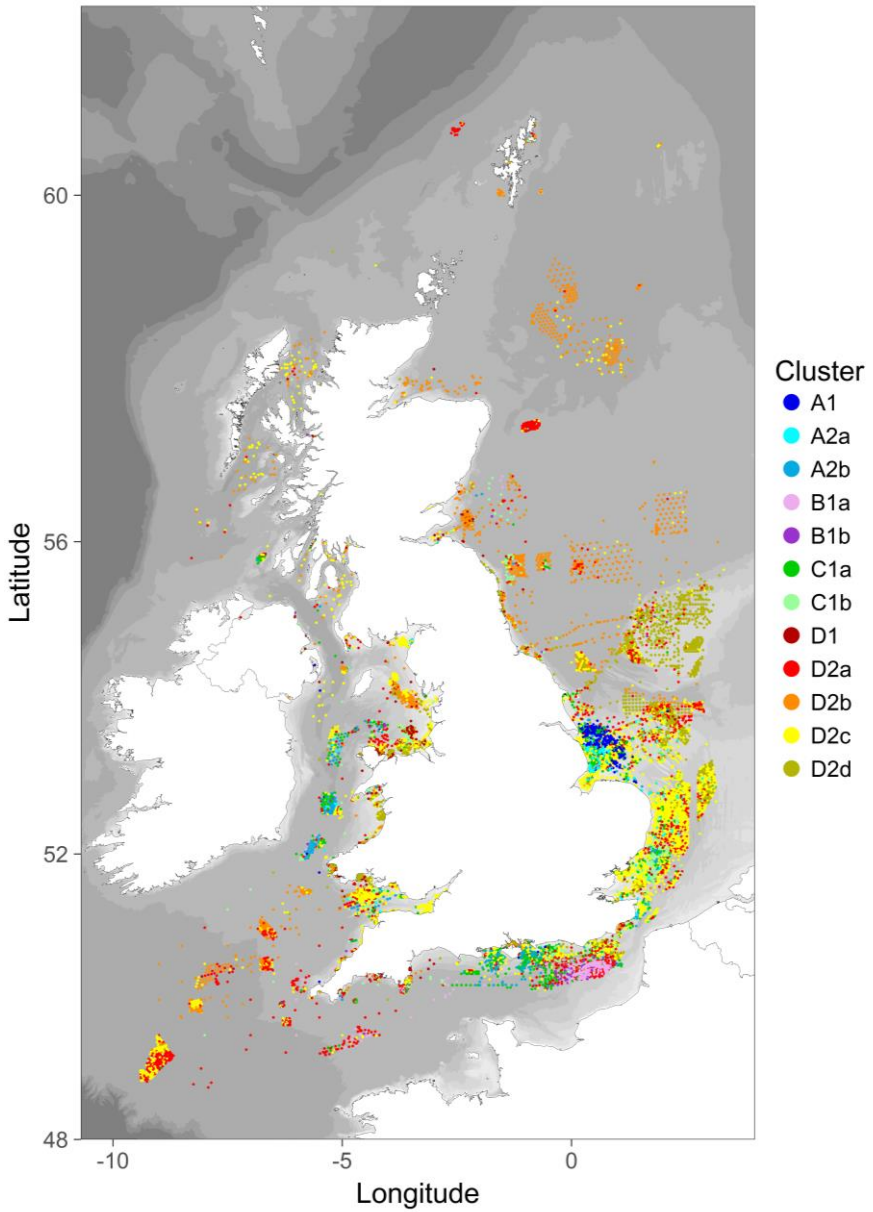


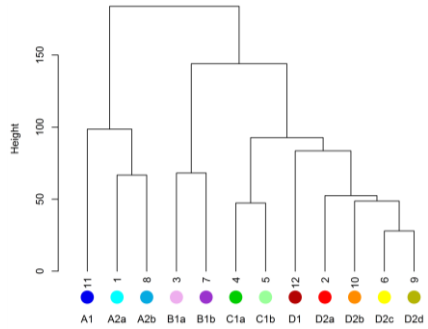
4. Monitoring

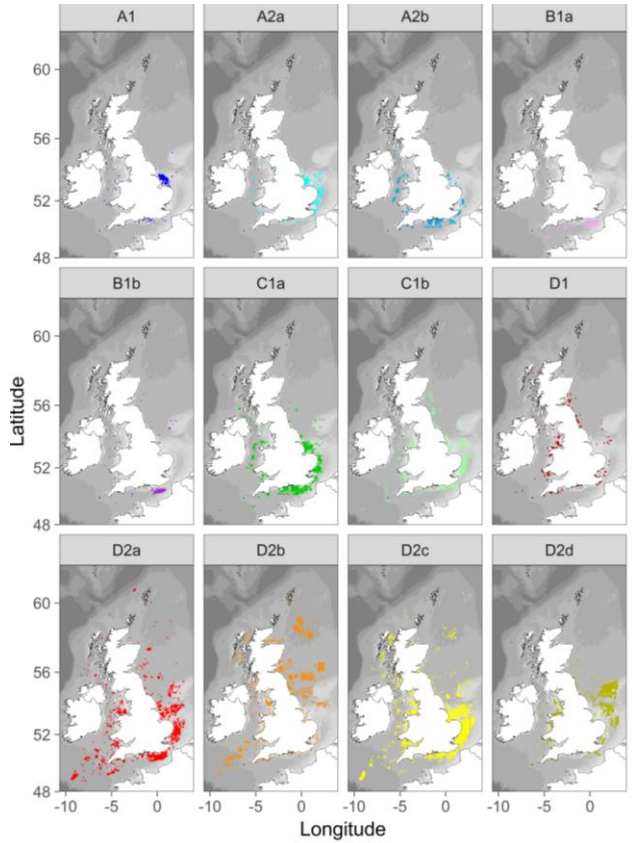
- Regional Seabed Monitoring Programme (RSMP)
- Big data used to determine acceptability of habitat change

[redacted]

Faunal Assemblages



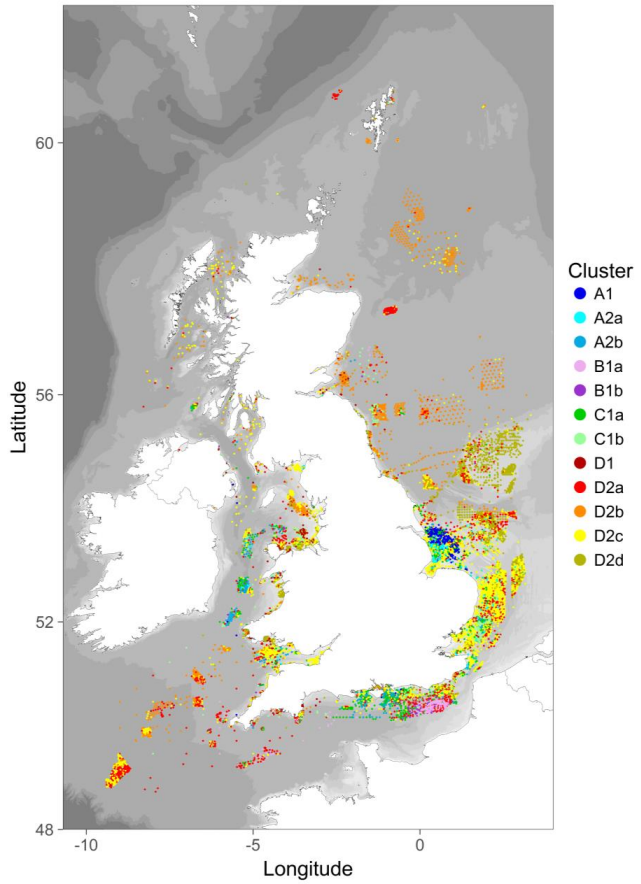




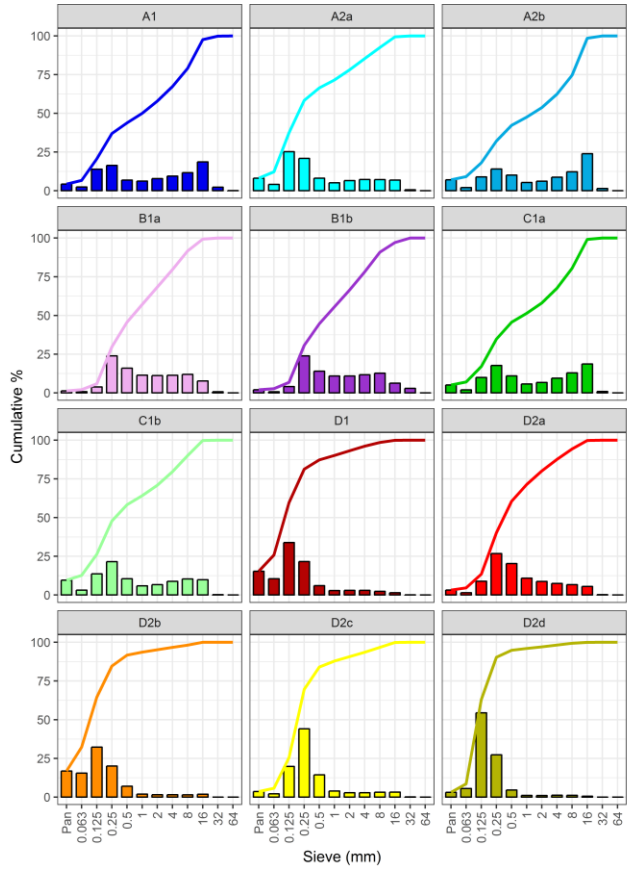
4. Monitoring

- Faunal-Sediment relationships

Faunal Assemblages



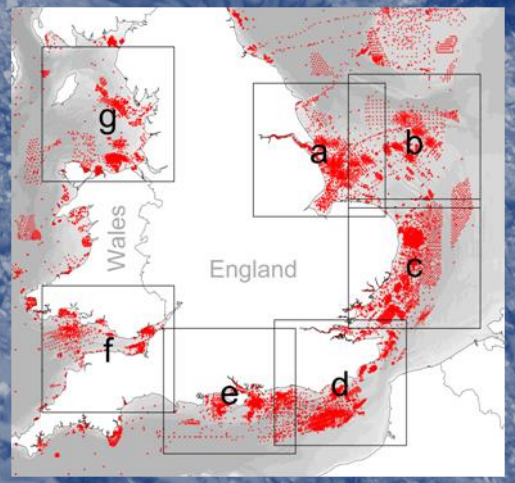
Sediment composition



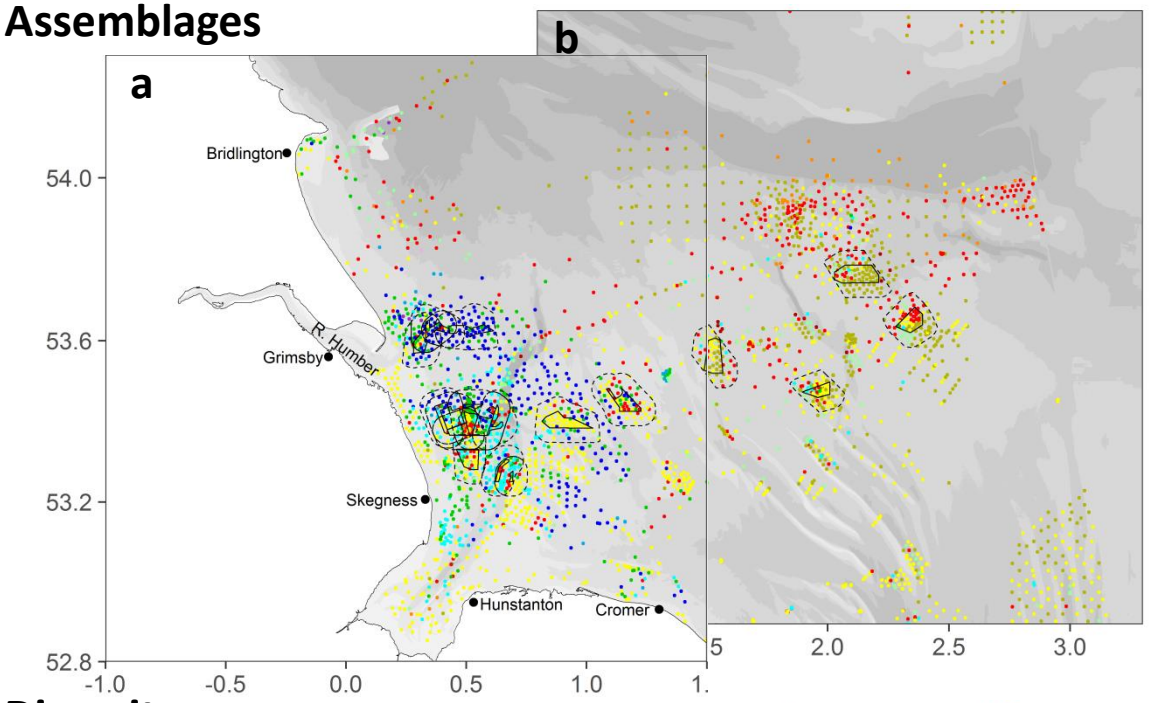
Bio Cluster	*n*	% Mud	% Sand			% Gravel					Description	MVDISP
		Sum	fS	mS	cS	Sum	fG	mG	cG	Sum		
A1	290	4	16	16	13	46	17	12	21	50	v slightly muddy sandy gravel	0.74
A2a	458	8	29	21	13	63	14	7	7	28	slightly muddy gravelly sand	0.73
A2b	731	7	11	14	15	40	15	12	25	52	slightly muddy sandy gravel	0.81
B1a	1010	1	5	24	27	56	23	12	8	43	v slightly muddy gravelly sand	0.44
B1b	774	2	5	24	25	54	23	13	9	44	v slightly muddy gravelly sand	0.44
C1a	1327	5	12	18	17	46	16	13	20	49	slightly muddy sandy gravel	0.90
C1b	1018	10	17	22	16	55	16	10	10	36	slightly muddy gravelly sand	0.80
D1	145	15	44	22	9	75	6	2	2	10	slightly gravelly slightly muddy sand	0.99
D2a	1522	3	10	27	31	68	16	7	6	29	v slightly muddy gravelly sand	0.94
D2b	652	17	48	20	9	77	3	1	2	6	slightly gravelly slightly muddy sand	1.05
D2c	3485	4	22	44	18	84	6	3	3	12	v slightly muddy slightly gravelly sand	1.15
D2d	1014	3	60	27	6	93	2	1	1	4	v slightly gravelly v slightly muddy sand	0.82

4. Monitoring

- Humber RSMP



Assemblages



Diversity

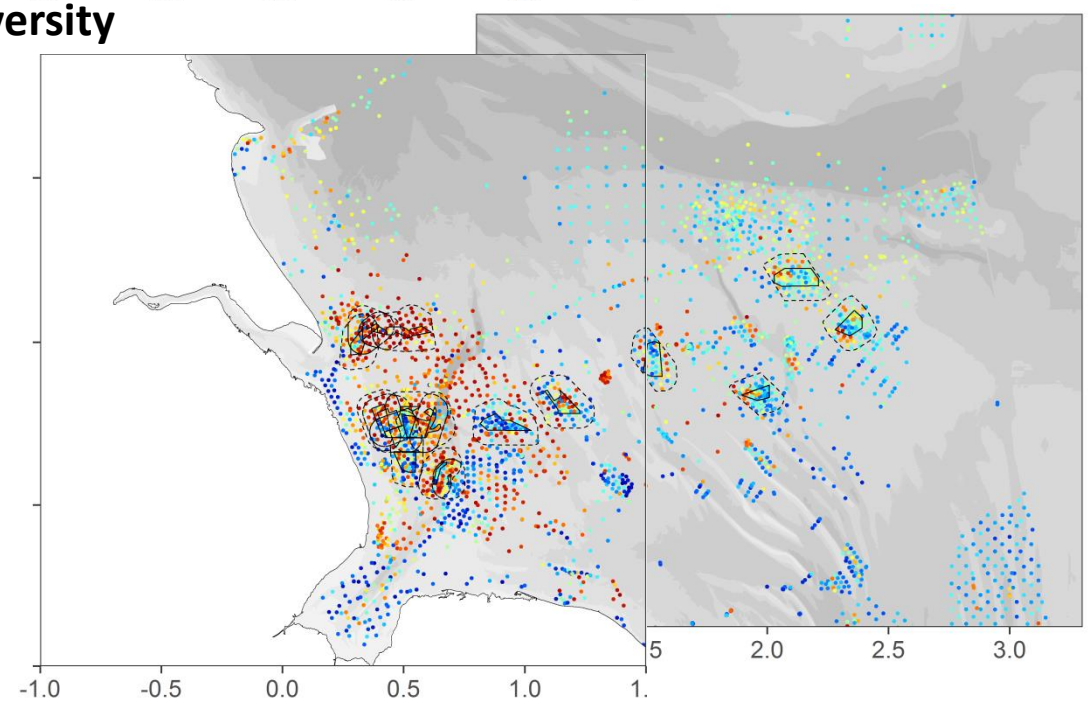


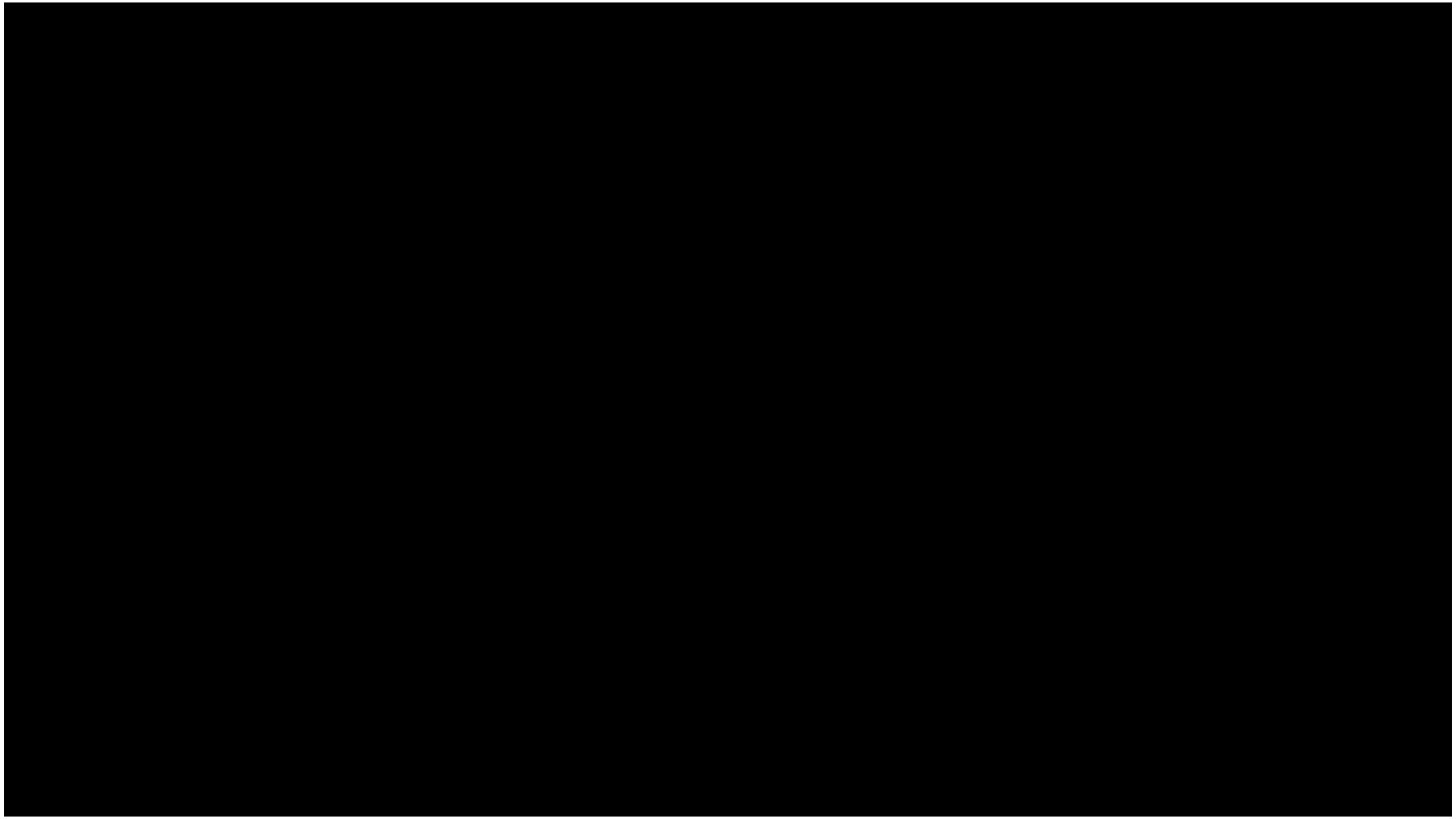
Fig. 7. Faunal cluster group and diversity (taxon Richness) for samples by sub region (see Figure 1b for submap extents). Areas of aggregate dredging interest (licensed and application areas) shown as solid black lines, whilst areas of potential secondary effect are shown as dashed black lines.

4. Monitoring

- Check sediments remain suitable for recolonisation

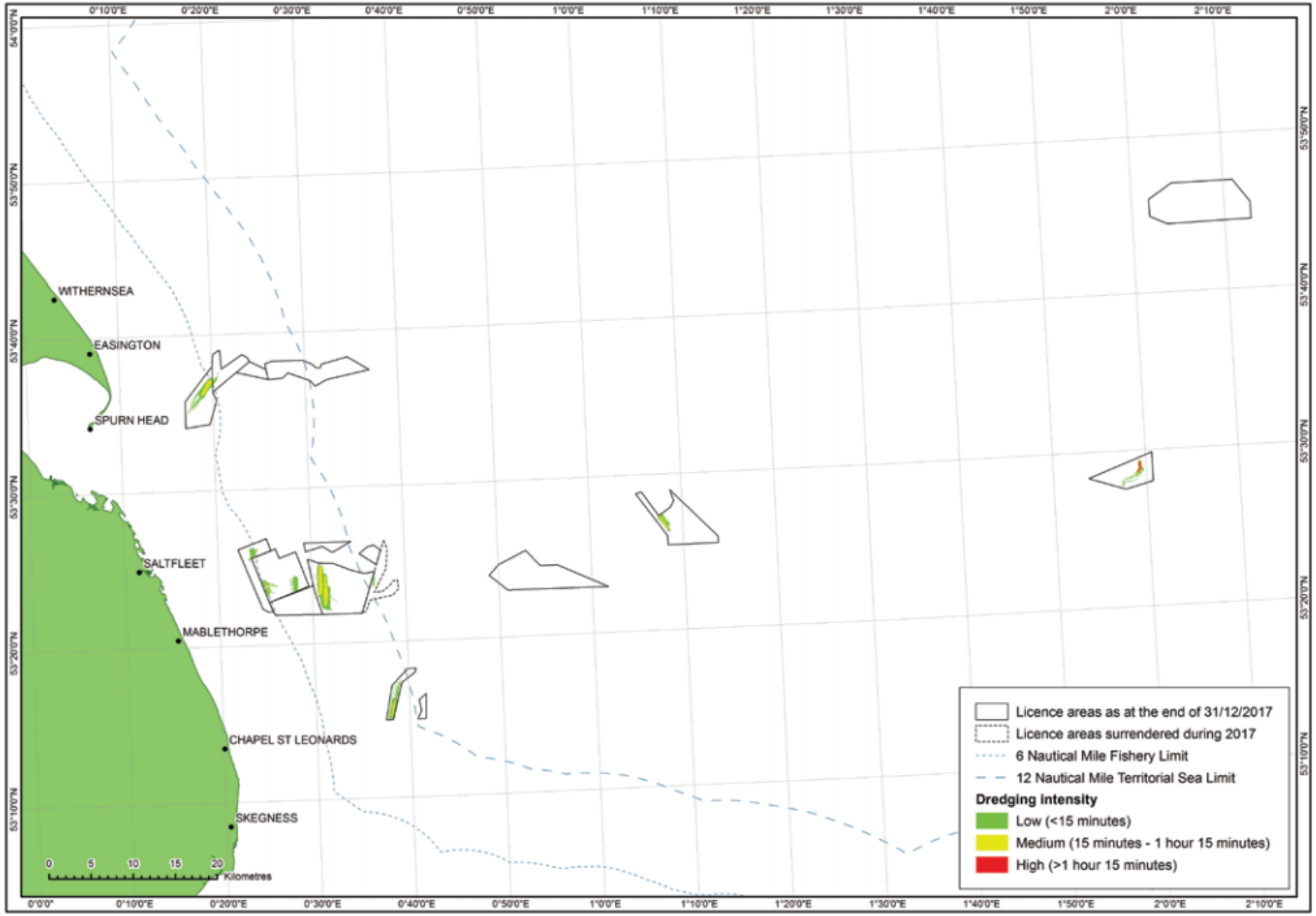
- M-Test tool

https://openscience.cefas.co.uk/matool_mhtest/



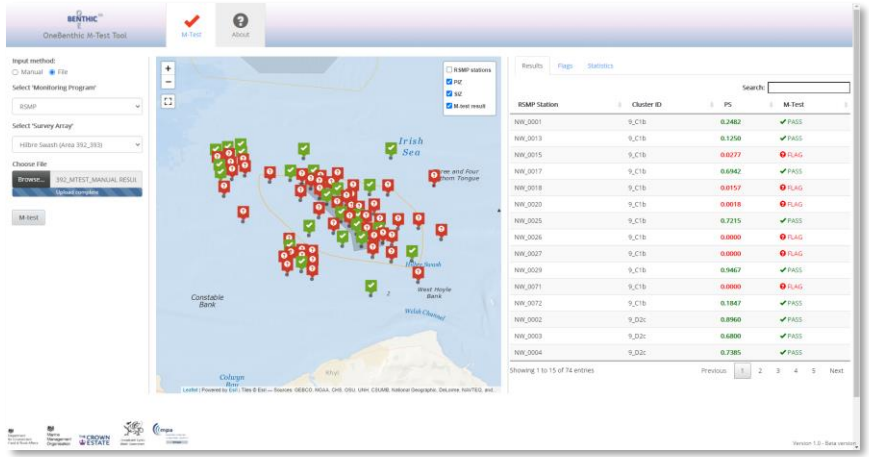
4. Monitoring

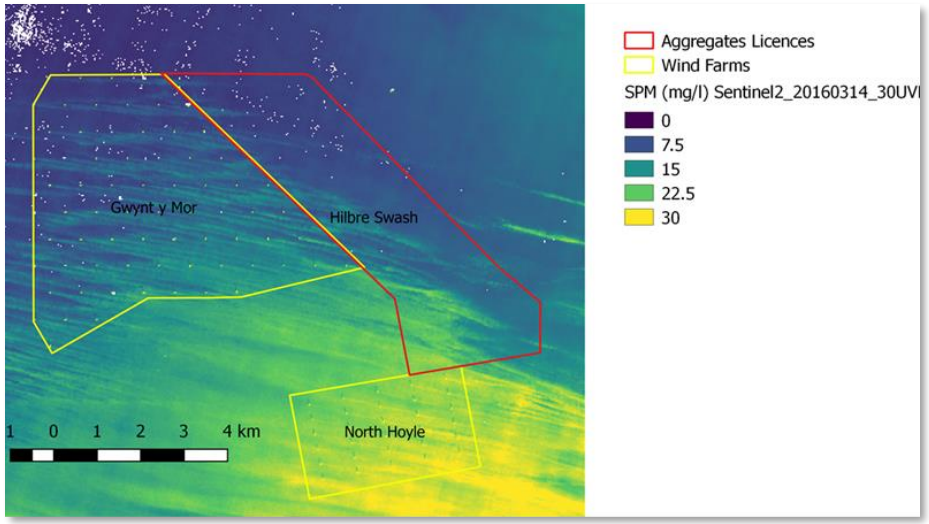
- Interpretation of M-test results
- Electronic Monitoring System (EMS) data
- VMS?
-

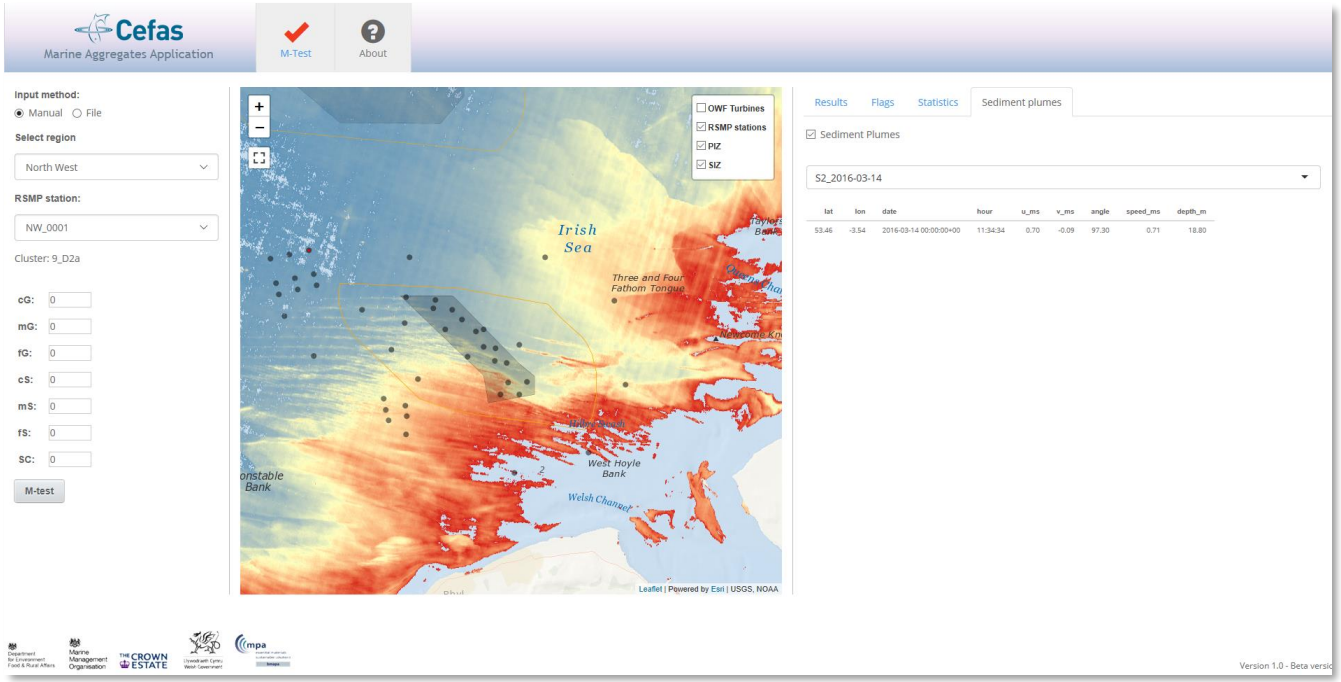


5. Earth Observation Data

- Sentinal-2
- Integration of Suspended Particulate Matter in M-test (
- Demo funded by DEFRA Centre of Excellence for Earth Observation)







6. Next Steps

- Further funding required to develop the tool

- Need to better understand nature of plumes arising from aggregate dredging

THANKS FOR LISTENING

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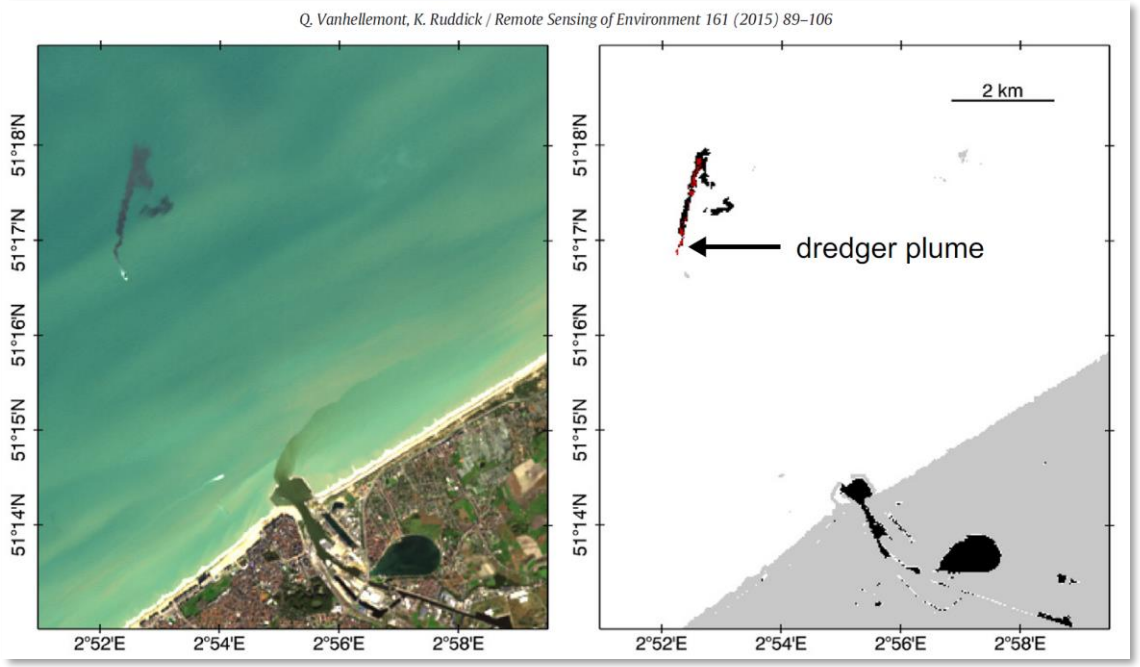
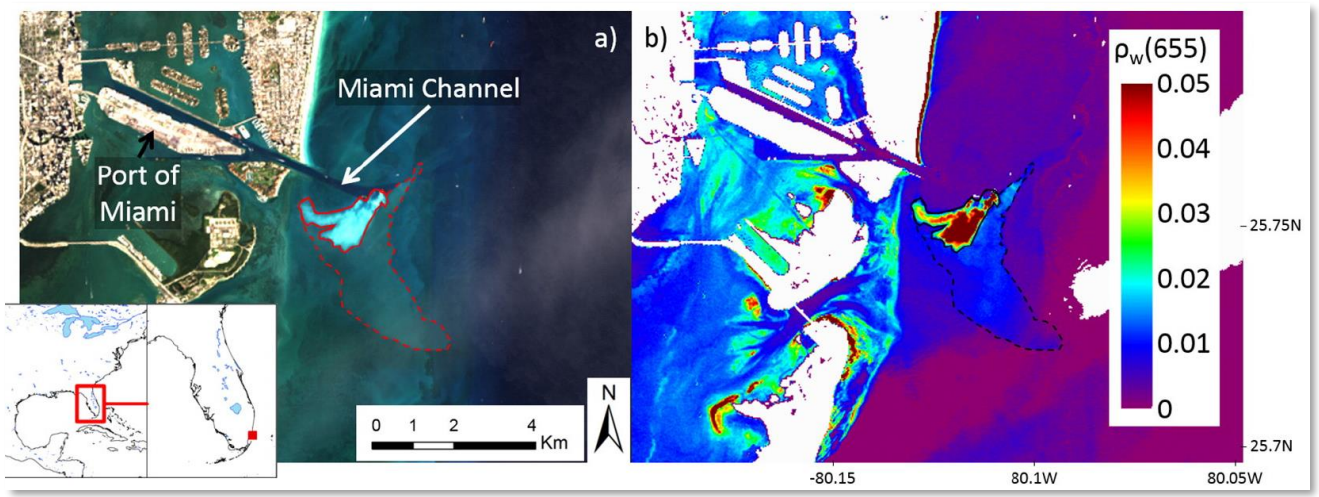
@OneBenthic



Vanhellemont and Ruddick (2015)



Barnes et al. (2015)