

Reef effects of structures in the North Sea: Islands or connections? (RECON)

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About me

- Joop W.P. Coolen : Wageningen Marine Research
- Postdoctoral researcher
- Benthic ecologist hard substrates
- Commercial SSE diver
- Diving instructor
- Wreck diver

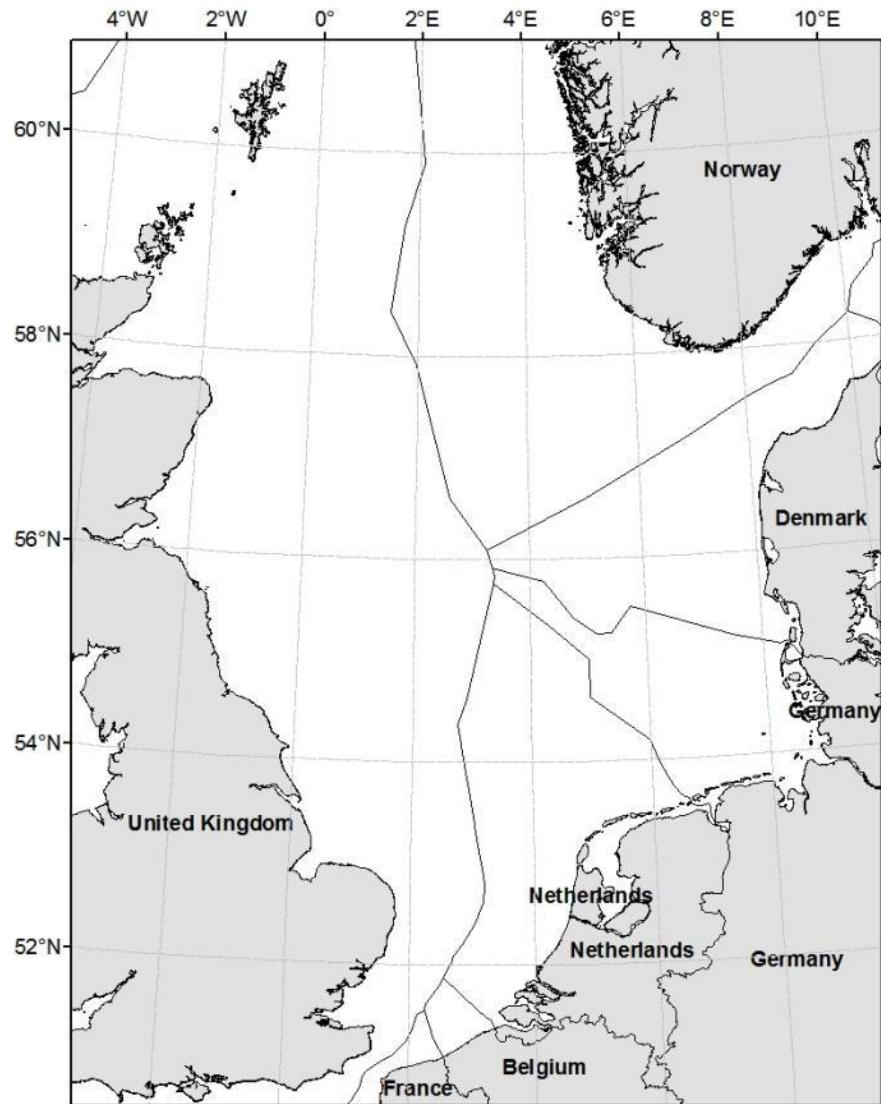


Contents

- Intro artificial objects North Sea
- RECON research questions
- Timeline
- Methods & Results
- Progress
- Related projects
- INSITE cooperation opportunities

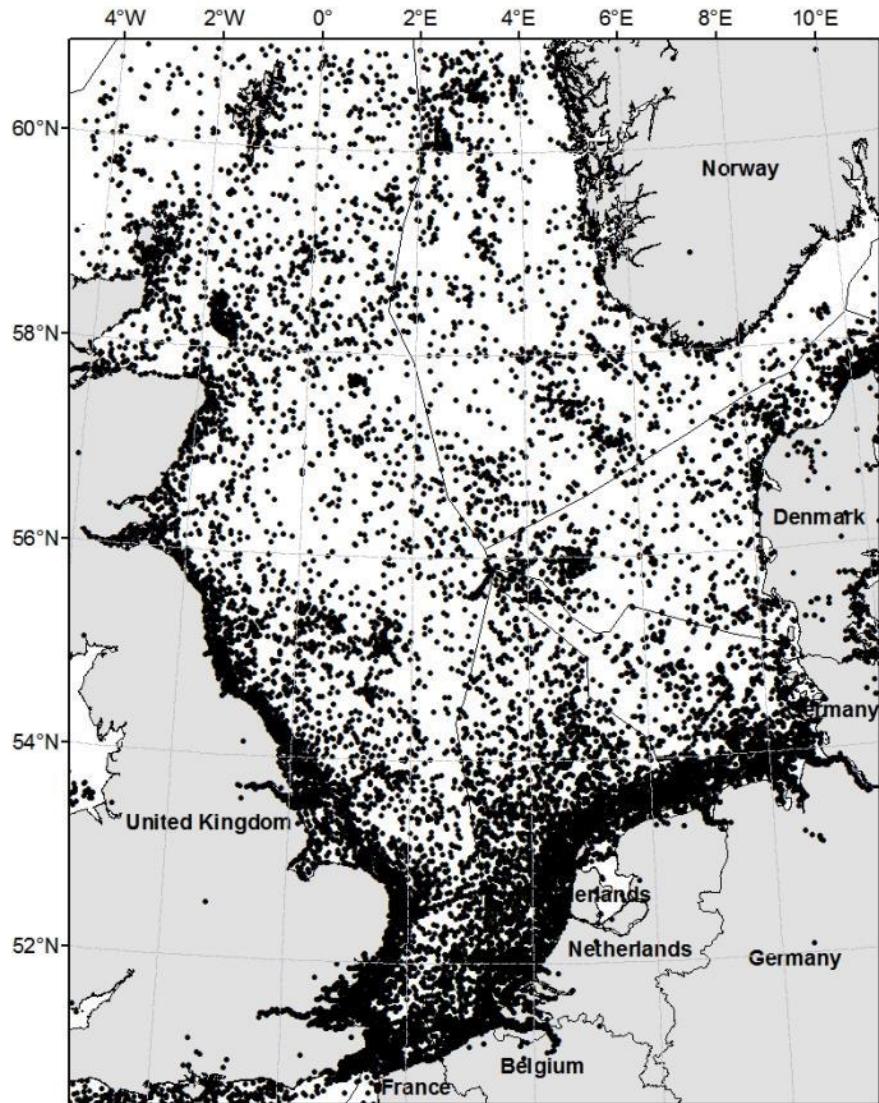
North Sea artificial objects

- Mainly sand bottom
- Add objects:



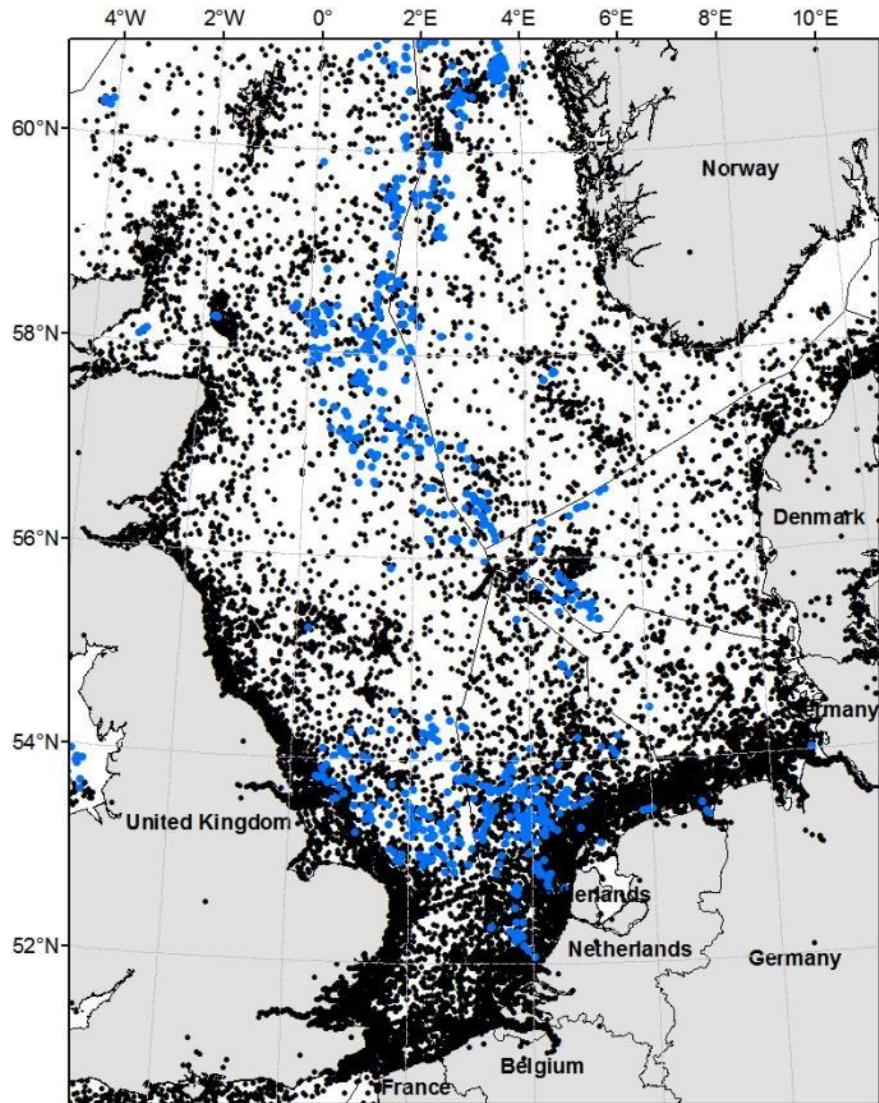
North Sea artificial objects

- Mainly sand bottom
- **Add objects:**
- Wrecks (~25.000)



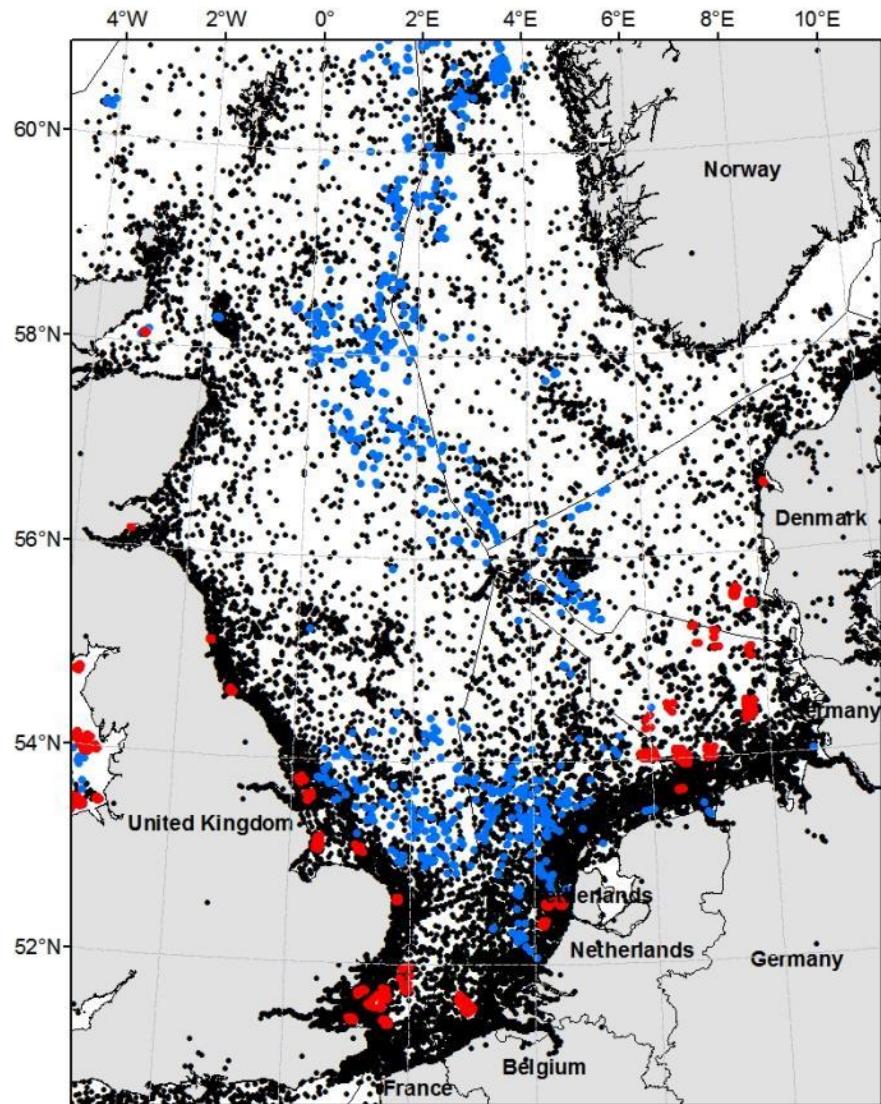
North Sea artificial objects

- Mainly sand bottom
- **Add objects:**
- Wrecks (~25.000)
- O&G installations (~ 1,300)



North Sea artificial objects

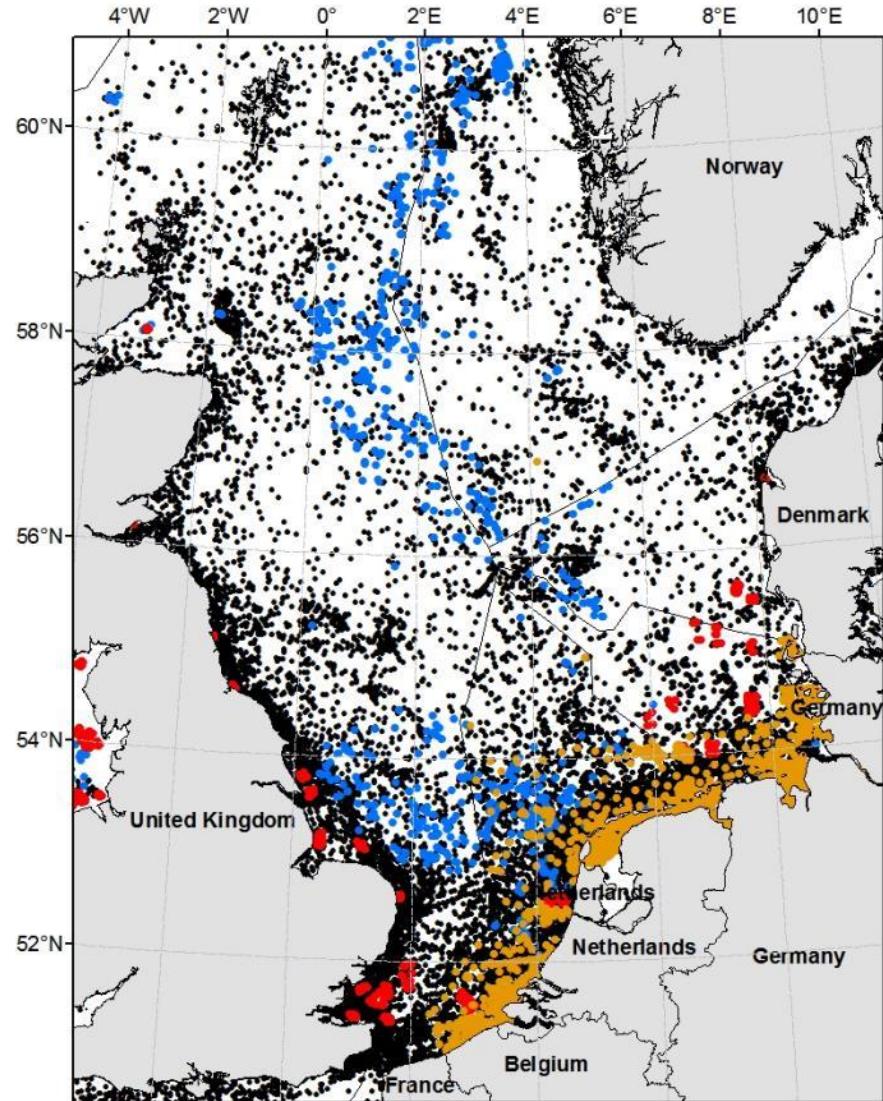
- Mainly sand bottom
- **Add objects:**
- Wrecks (~25.000)
- O&G installations (~ 1,300)
- Wind turbines (> 1,800)



North Sea artificial objects

- Mainly sand bottom
- **Add objects:**
- Wrecks (~25.000)
- O&G installations (~ 1,300)
- Wind turbines (> 1,800)
- Buoys (many thousands)
- Et cetera

→ New habitat for species



RECON Research questions

- What is the effect of artificial objects on the distribution of reef species in the North Sea?
 1. Which benthic species live on offshore structures?
 2. Can we identify the drivers for their presence?
 3. Can we predict which species grow at locations?
 4. Are these locations interconnected or isolated?

RECON team

WMR
Joop Coolen
Han Lindeboom

Bureau Waardenburg

Wouter Lengkeek
Martijn Dorenbosch
Floor Driessen



WUR ABGC

Richard Crooijmans



WUR MAE

Lisa Becking



Krone Projekte

Roland Krone



NIOZ

Piternella Iuttikhuizen



Wageningen Marine Research

Sander Glorius
Babeth vd Weide
Babette Bontes
Oscar Bos



Current projects related to RECON

RECON is part of a combination of projects



Biodiv offshore:	Biodiversity of old production platforms and new offshore wind farms	FINISHED November 2016
RECON:	Reef effects of structures in the North Sea: Islands or connections?	
UNDINE:	UNDERstanding the INfluence of man-made structures on the Ecosystem functions of the North Sea	
EDSPOD:	Ecology-driven support system for planning future offshore developments	

Partners & sponsors platform projects



Royal Netherlands Institute for Sea Research



Ministerie van Economische Zaken

+ UNDINE consortium

Which species live on offshore structures?

Analyse ROV inspection video's

- Pilot 2014-2015 on 5 NL installations (published)
- RECON: expand with NL, DK, NO locations
- Output: Paper biodiversity of offshore platforms using ROV video analyses



Publication: van der Stap T, Coolen JWP, Lindeboom HJ. Marine fouling assemblages on offshore gas platforms in the southern North Sea: Effects of depth and distance from shore on biodiversity. PLoS One. 2016;11(1):e0146324

Which species live on offshore structures?

Take samples at O&G platforms

- Using diver airlift sampler

■ Outputs

1. paper species distribution Caprellids
2. paper biodiversity 5 platforms



Processing of samples

1. Sort all specimens
2. Identify species
3. Store information in database
4. Data analysis



G24	A	B	C	REBV [µ]
1	Monterecode	Diporeta	Soort	
2	1-010-N-2013	10	<i>Ectoplectura larynx</i>	
3	1-010-N-2013	10	<i>Electra pilosa</i>	
4	1-010-N-2013	10	<i>Tubularia indivisa</i>	
5	1-010-N-2013	10	<i>Ulva intestinalis</i>	
6	1-010-N-2013	10	<i>Gittina sarsi</i>	0.000
7	1-010-N-2013	10	<i>Stenothoe validus</i>	0.0002
8	1-010-N-2013	10	<i>Clionoflus serratus</i>	0.0003
9	1-010-N-2013	10	<i>Stenocioncoelium moniliferoides</i>	0.0007
10	1-010-N-2013	10	<i>Sycozoa amphibia</i>	0.0010
11	1-010-N-2013	10	<i>Dissidiumene cincta</i>	0.0135
12	1-010-N-2013	10	<i>Balanus crenatus</i>	0.0153
13	1-010-A-2013	10	<i>Heteronomia squamula</i>	0.0167
14	1-010-N-2013	10	<i>Caprella linearis</i>	0.0357
15	1-010-N-2013	10	<i>Encrella longissima</i>	0.0643
16	1-010-N-2013	10	<i>Leucosolenium variabilis</i>	0.0768
17	1-010-N-2013	10	<i>Plumaria hirtellus</i>	0.2413
18	1-010-N-2013	10	<i>Harmothoe impar</i>	0.2789
19	1-010-N-2013	10	<i>Lanice conchilega</i>	0.2903
20	1-010-N-2013	10	<i>Phidilia longicornis</i>	0.3500
21	1-010-N-2013	10	<i>Monocerophium sexzonae</i>	0.4007
22	1-010-N-2013	10	<i>Diplosoma lichenoides</i>	0.7550
23	1-010-N-2013	10	<i>Leptodora histrio</i>	1.0031
24	1-010-N-2013	10	<i>Phrixo marina</i>	1.1786
25	1-010-A-2013	10	<i>Harmothoe extenuata</i>	2.8086
26	1-010-N-2013	10	<i>Sagartia tropholytes</i>	8.2807
27	1-010-N-2013	10	<i>Metridium senile</i>	9.5036
28	1-010-N-2013	10	<i>Jassa北海</i>	98.0569
29	1-010-N-2013	10	<i>Mytilus edulis</i>	289.9636
30	1-010-Z-2013	10	<i>Celleporella hyalina</i>	
31	1-010-Z-2013	10	<i>Ectoplectura larynx</i>	
32	1-010-Z-2013	10	<i>Electra pilosa</i>	
33	1-010-Z-2013	10	<i>Tubularia indivisa</i>	
34	1-010-Z-2013	10	<i>Stenothoe validus</i>	0.0000
35	1-010-Z-2013	10	<i>Stenothoe monoculoides</i>	

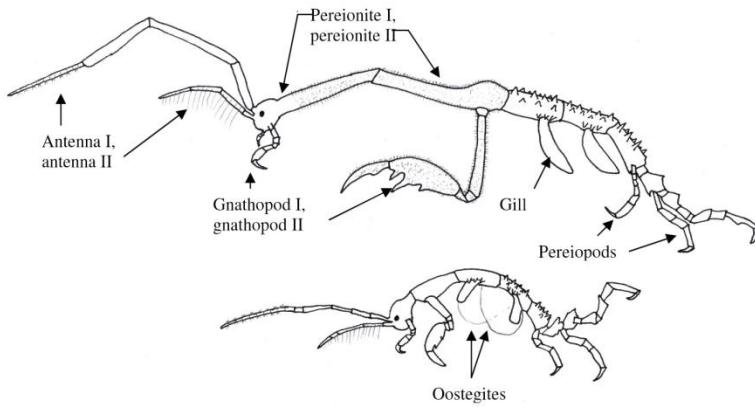


Can we identify the drivers?

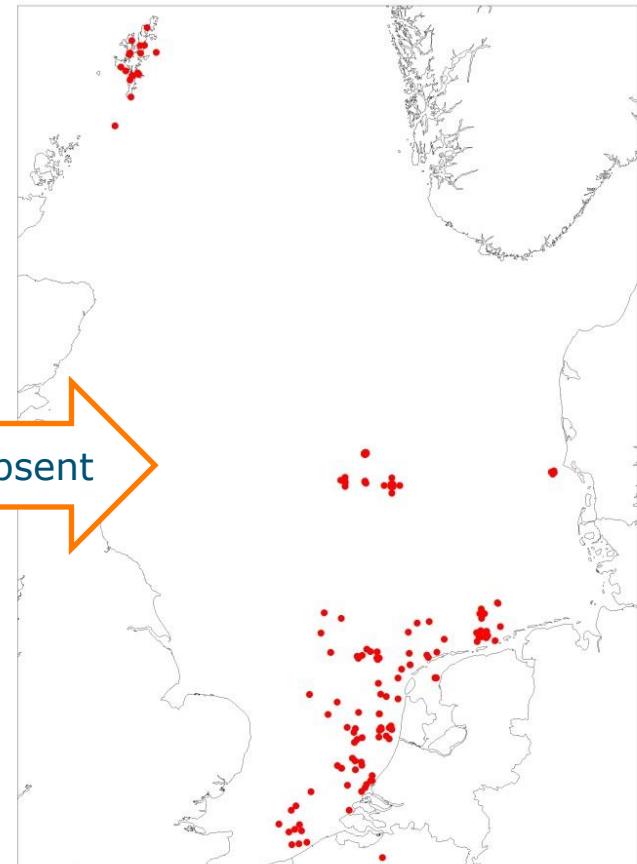
Example: *Caprella spp.* pilot study

Species distribution modelling with use of:

1. Species observation data



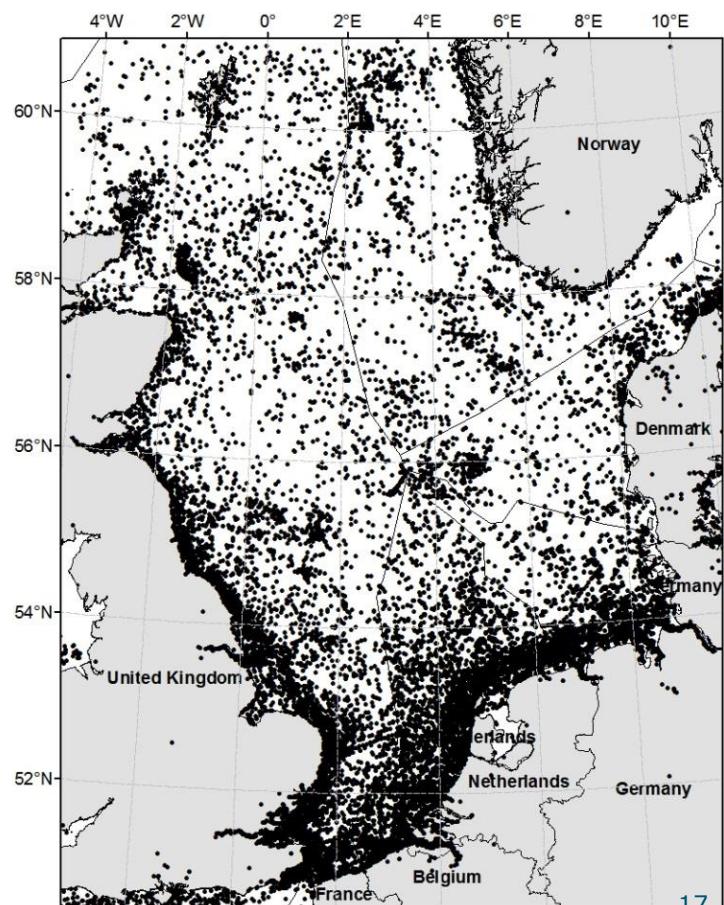
Present / absent



Can we identify the drivers?

Species distribution modelling with use of:

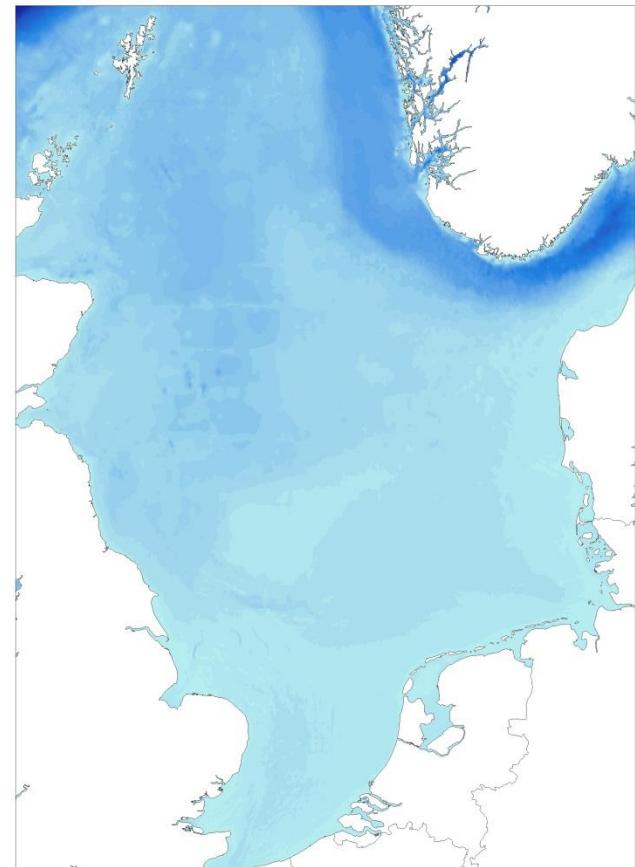
1. Species observation data
2. Presence of objects



Can we identify the drivers?

Species distribution modelling with use of:

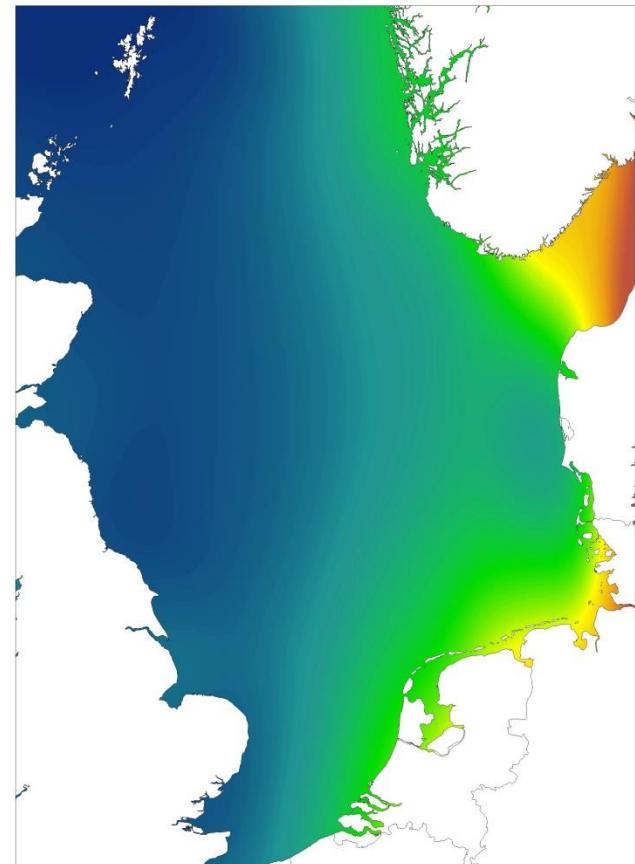
1. Species observation data
2. Presence of objects
3. Sea bottom depth



Can we identify the drivers?

Species distribution modelling with use of:

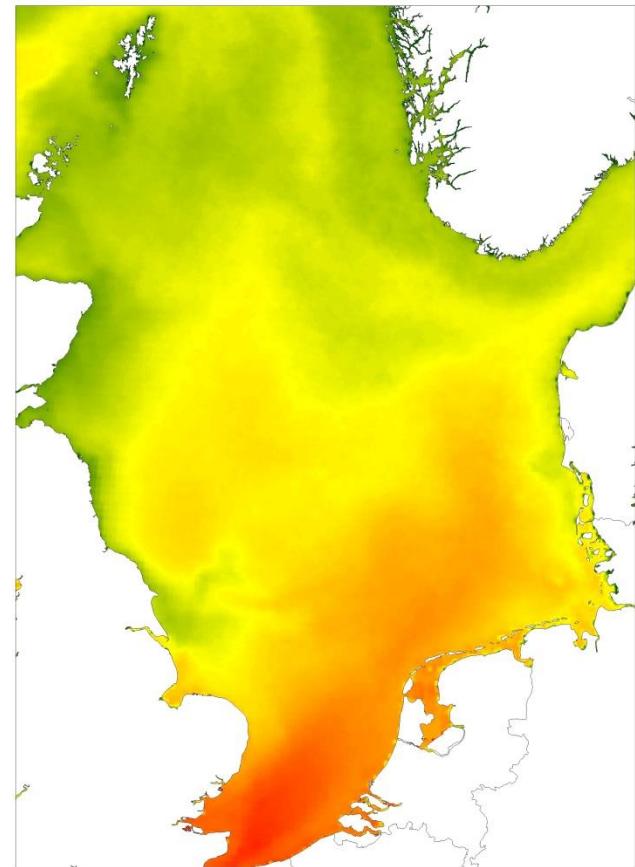
1. Species observation data
2. Presence of objects
3. Sea bottom depth
4. Salinity



Can we identify the drivers?

Species distribution modelling with use of:

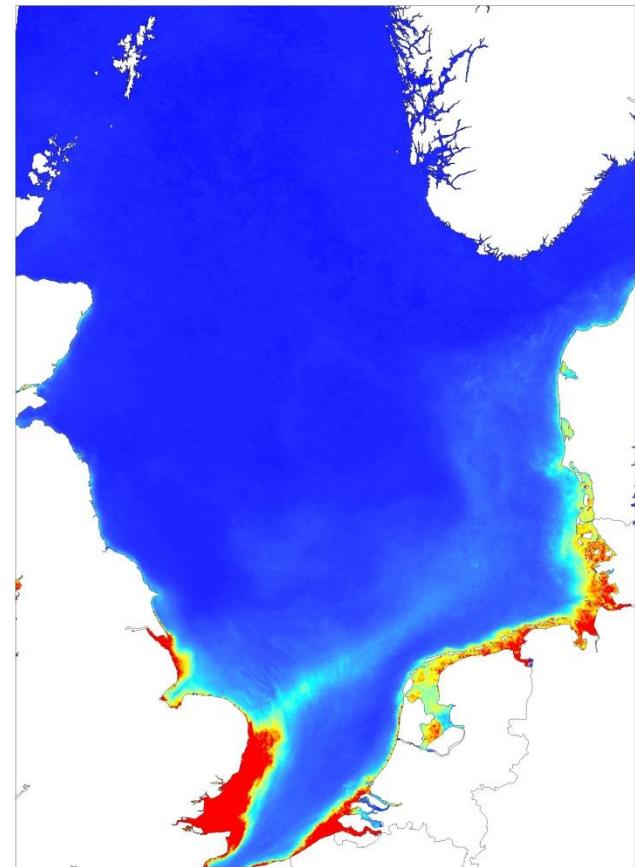
1. Species observation data
2. Presence of objects
3. Sea bottom depth
4. Salinity
5. Temperature



Can we identify the drivers?

Species distribution modelling with use of:

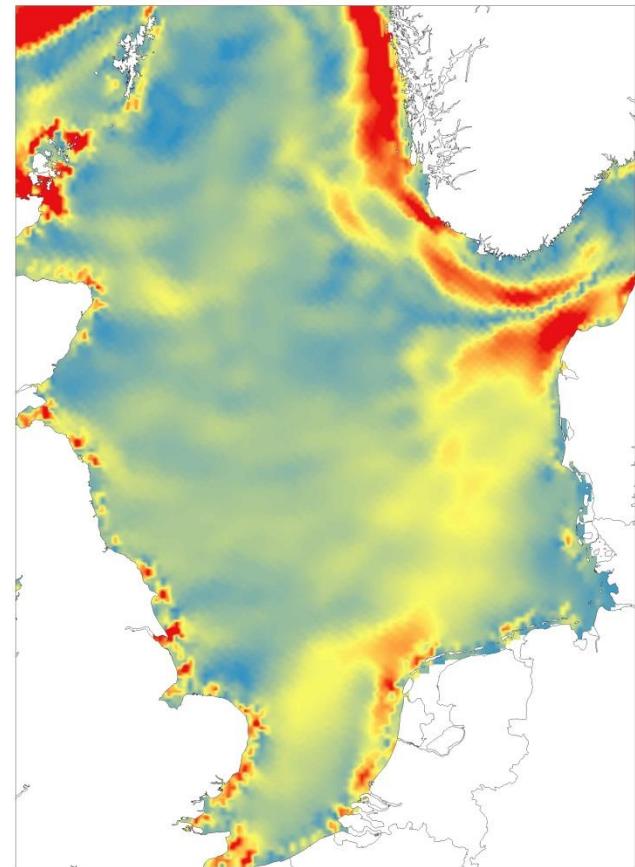
1. Species observation data
2. Presence of objects
3. Sea bottom depth
4. Salinity
5. Temperature
6. Density of particles (= food)



Can we identify the drivers?

Species distribution modelling with use of:

1. Species observation data
2. Presence of objects
3. Sea bottom depth
4. Salinity
5. Temperature
6. Density of particles (= food)
7. Current velocity
8. + others in future models



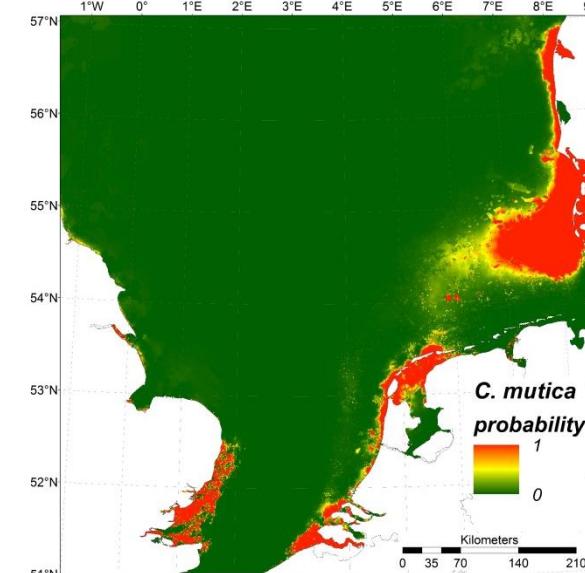
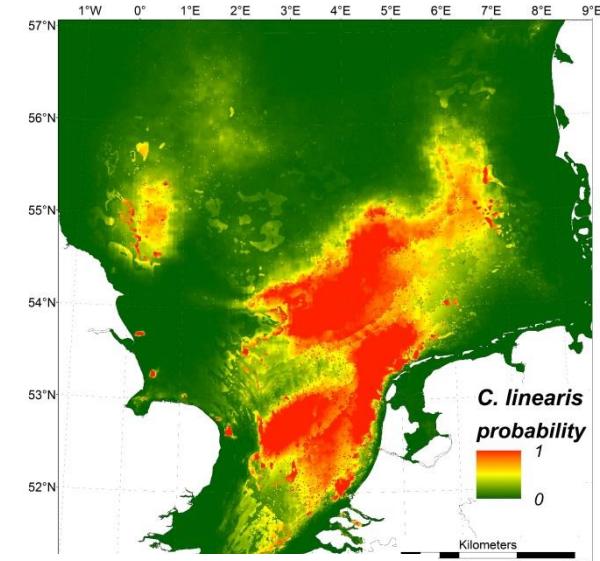
Predict which species grow at locations

Caprella mutica & C. linearis pilot distribution modelling results:

Publication: Coolen JWP, Lengkeek W, Degraer S, Kerckhof F, Kirkwood RJ, Lindeboom HJ (2016)

Distribution of the invasive *Caprella mutica* Schurin, 1935 and native *Caprella linearis* (Linnaeus, 1767) on artificial hard substrates in the North Sea: separation by habitat. Aquatic Invasions 11:437–449.

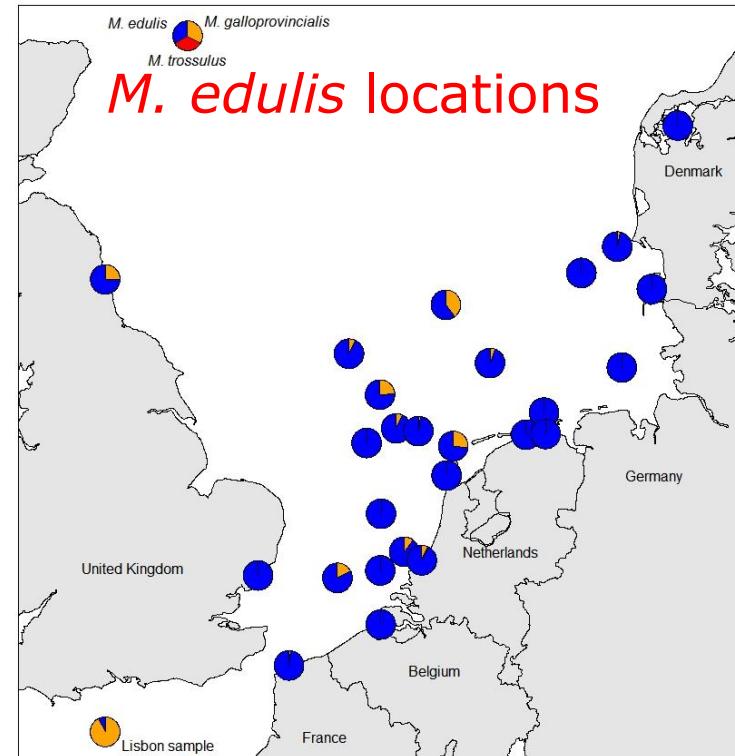
Next: model more species in future projects (EDSPOD)



Connectivity analysis

Investigate connections between hard substrate locations

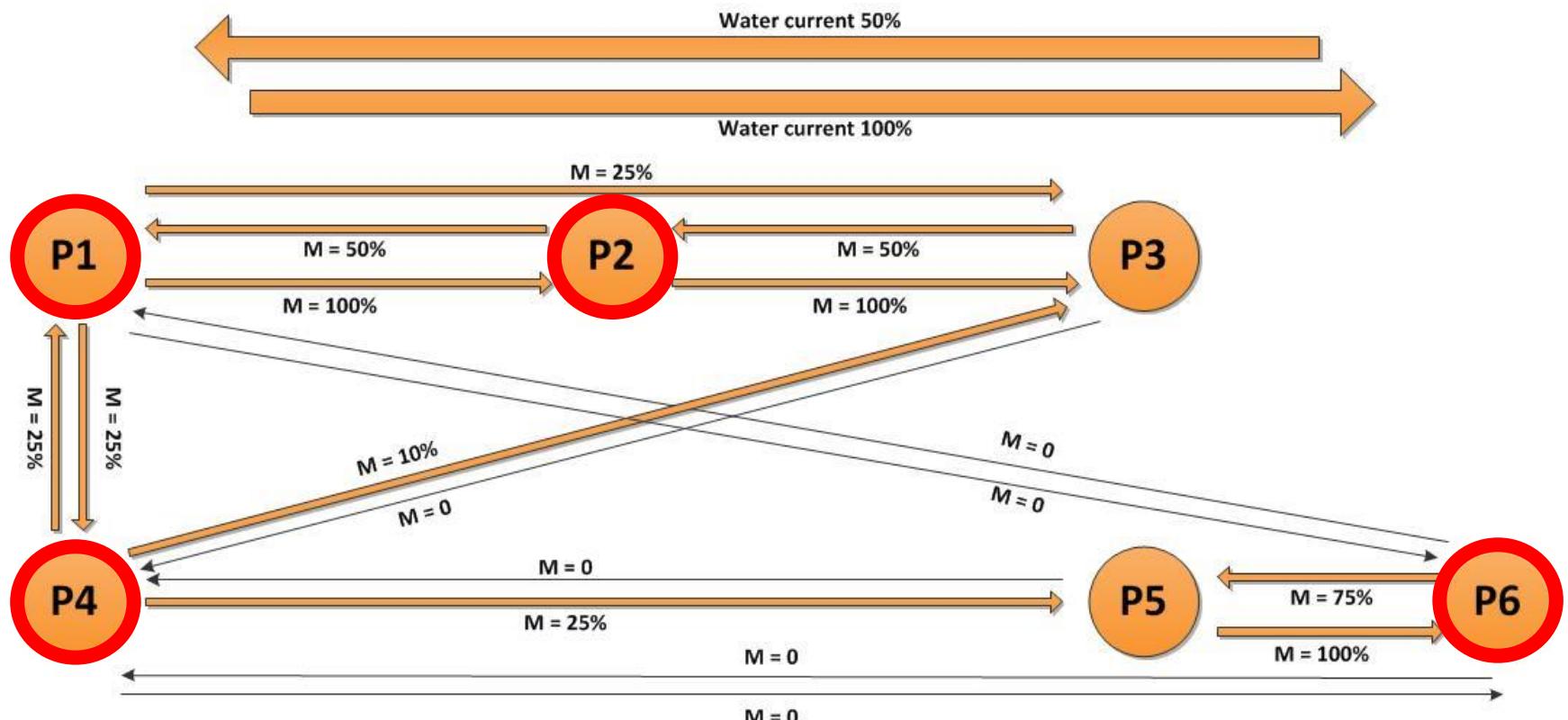
- Molecular (DNA) techniques
- Do structures offer step stones between generations?
- Output 1: *M. edulis* stepping stones in the North Sea
- Output 2: *Jassa spp.* & *M. edulis* & connectivity models



Linked to **UNDINE**

Current step: migration analysis

Account for bi-directional genetic patterns and indirect connections

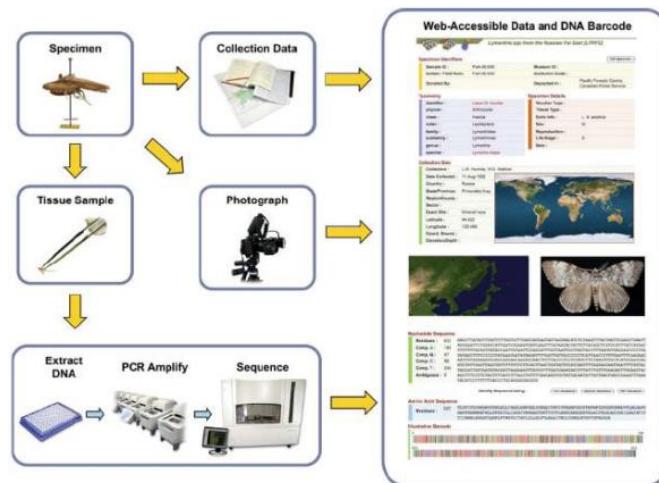


M = migration potential (0 to 100%)²⁵

Meta-barcoding for species identification

Using samples from offshore installations

- Add species to barcode databases
- Develop metabarcoding protocols
- Output: ~800 new barcodes for genbank database
Paper metabarcoding on North Sea artificial reefs



Status output so far

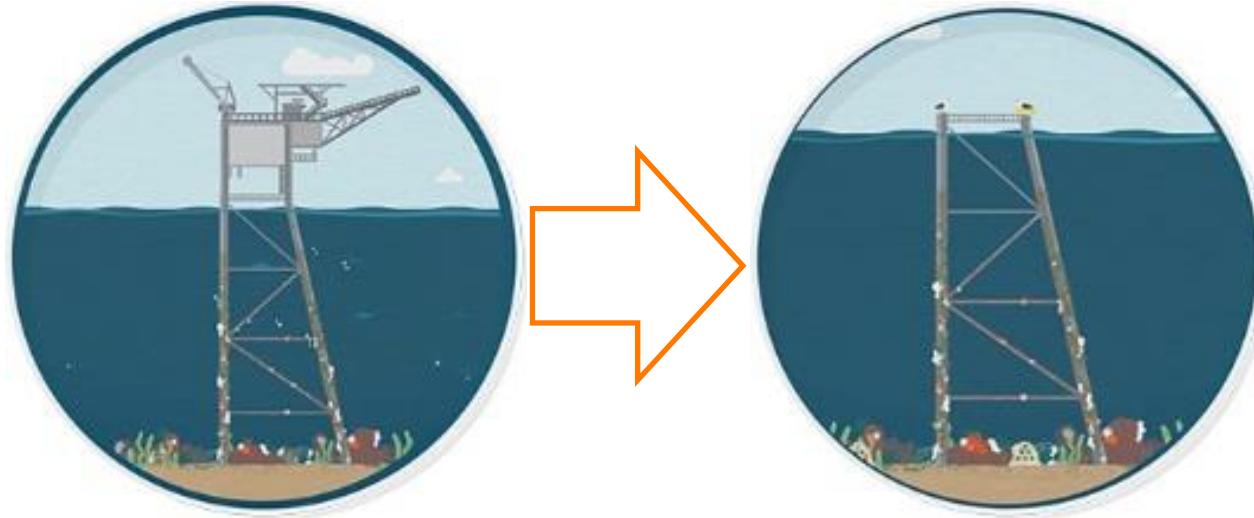
	PUBLISHED?
■ ROV data analysis in progress	Q1 2017
■ Species distribution paper	Published
■ Biodiversity overview 5 platforms	Q2 2017
■ Connectivity <i>Mytilus edulis</i>	Q1 2017
■ Connectivity <i>Jassa spp</i>	Q3 2017
■ Metabarcoding labwork in progress	Q3 2017

INSITE cooperation potential

- Links with other INSITE programmes
 - UNDINE: species data, molecular work
 - COSM: species data, GIS data layers
 - EcoConnect: validate connectivity modelling
 - ANCHOR: validate connectivity modelling
 - Shadow: share barcodes
 - Data: provide data

Potential future research scope

- NL: Alternative uses of decommissioned platforms proposed
→ENGIE pilot → Leave platforms in place & monitor



- Re-introduction Oyster *Ostrea edulis* around installations
- Connectivity populations invasive species on installations

Thanks to our sponsors



INSITE



Ministerie van Economische Zaken

End

Thank you for your
attention



More info:

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