



**BLUE
MISSION
BANOS**

1st MISSION ARENA
14-16 November 2023 | Gothenburg, SE

MULTI-USE TECHNOLOGY ROADSHOW – Infrastructure

Annelies Declercq – Ghent University

Lab of Aquaculture and Artemia Reference Center – Faculty of Bioscience Engineering

THEME: UNITED FINAL EVENT



Funded by the European Union (H2020 Grant Agreement no 862915). Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union. Neither the European Union nor the granting authority can be held responsible for them



in  #MissionArenaBANOS1



Funded by
the European Union



Technical challenges and lessons learnt from multi-use in the Belgian part of the North Sea

Annelies M. Declercq, Jessica Knoop, Molly Hughes, *Koen Allewerelt, Stefanie Debels, Daan Delbare, Sander Devriese, Sam Desmet, Bert Groenendaal, Thomas R.H. Kerkhove, Frank Leroy, Simon Petit, Laura Pilgrim, Steven Degraer, Brecht Stechele, Nancy Nevejan, Elisabete Pinto da Silva, Ajie B.K. Pribadi, Jan Vanaverbeke, Dirk Vandercammen, Olivier De Clerck, Vicky Stratigaki, Evert Lataire*

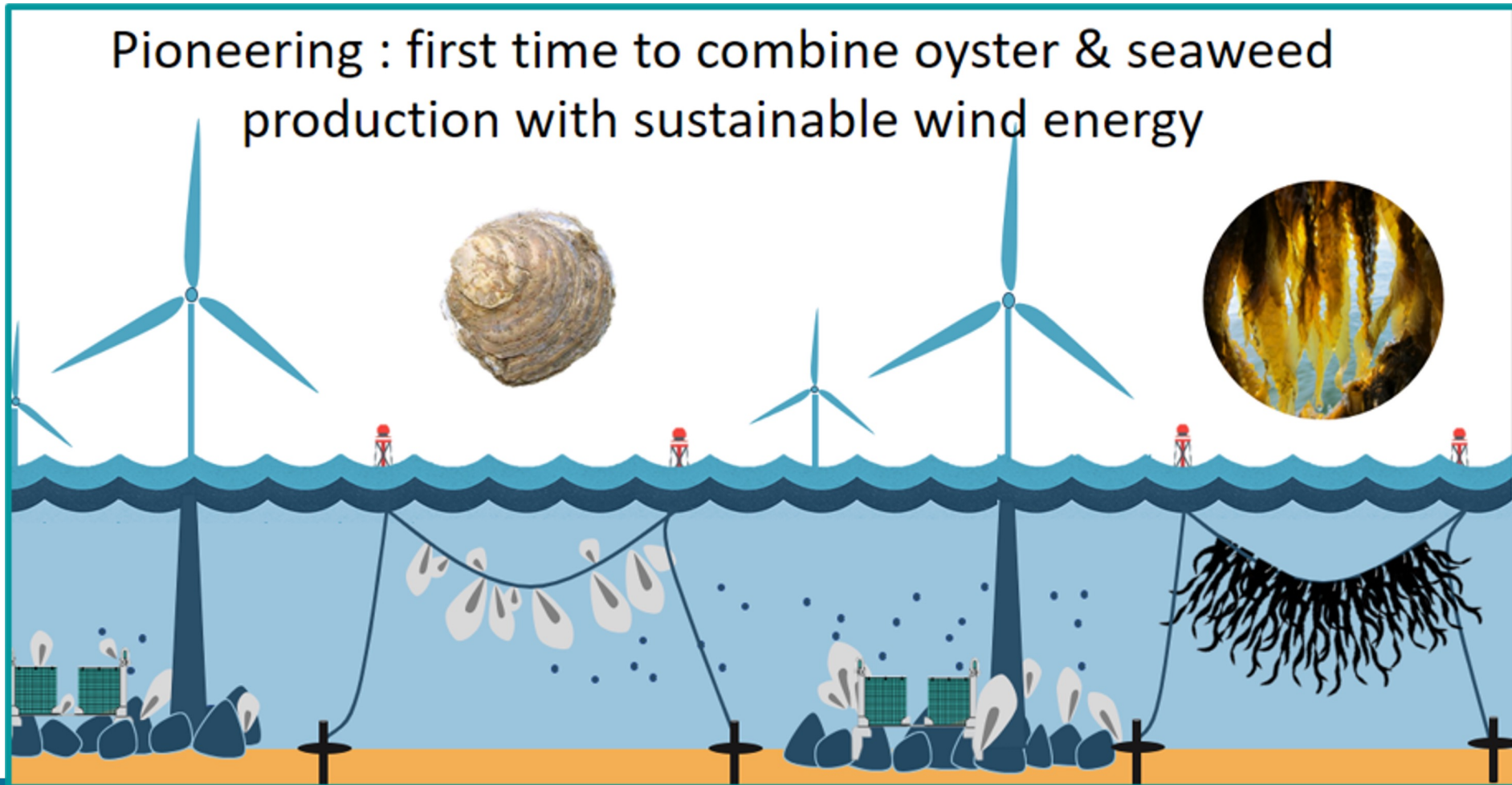


Funded by the European Union (H2020 Grant Agreement no 862915). Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union. Neither the European Union nor the granting authority can be held responsible for them

WWW.H2020UNITED.EU   

Belgian Pilot Infrastructure

Wind energy • Flat oyster cultivation & restoration • Seaweed cultivation



Preoperational phase – nearshore testing

Identification and development of suitable cultivation techniques for offshore conditions

Flat oyster cultivation



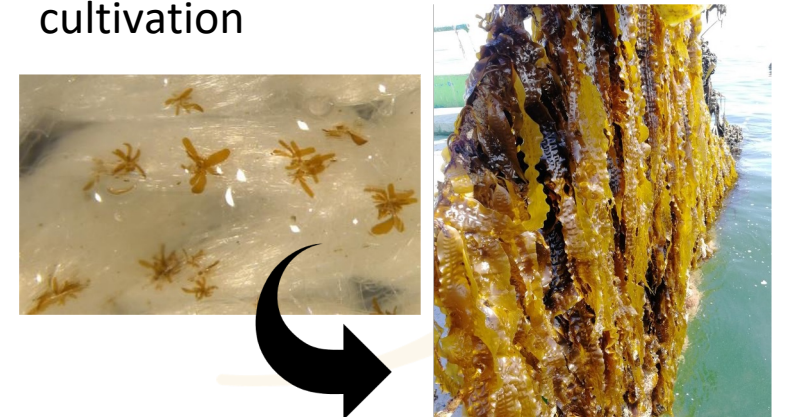
- Various cultivation structures tested for oyster grow out
- Two nearshore growth cycles (5 km off the coast)

Flat oyster restoration



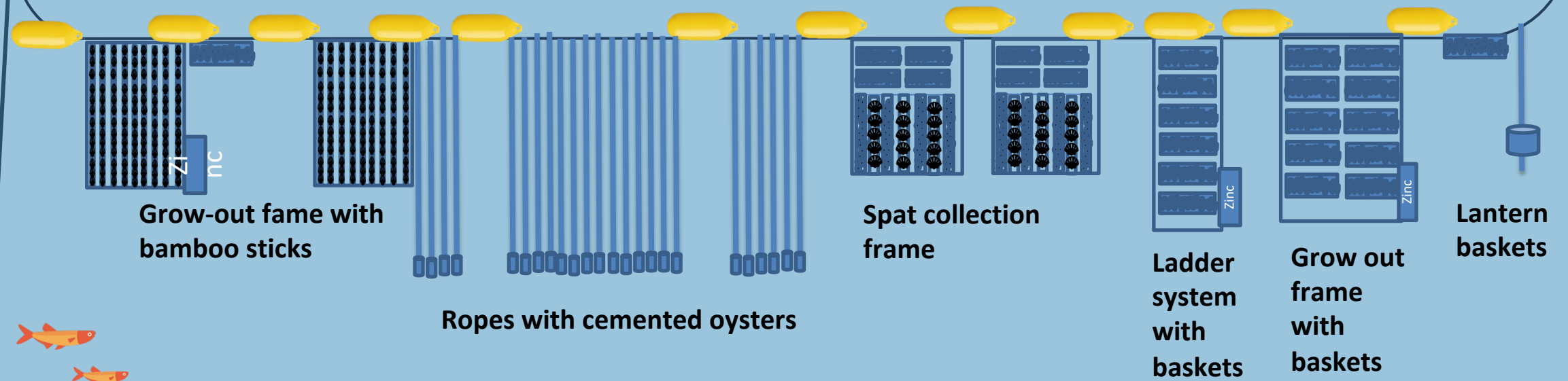
- Restoration tables with adult & spat oysters + substrate
- Two restoration tables placed at nearshore site

Saccharina latissima cultivation



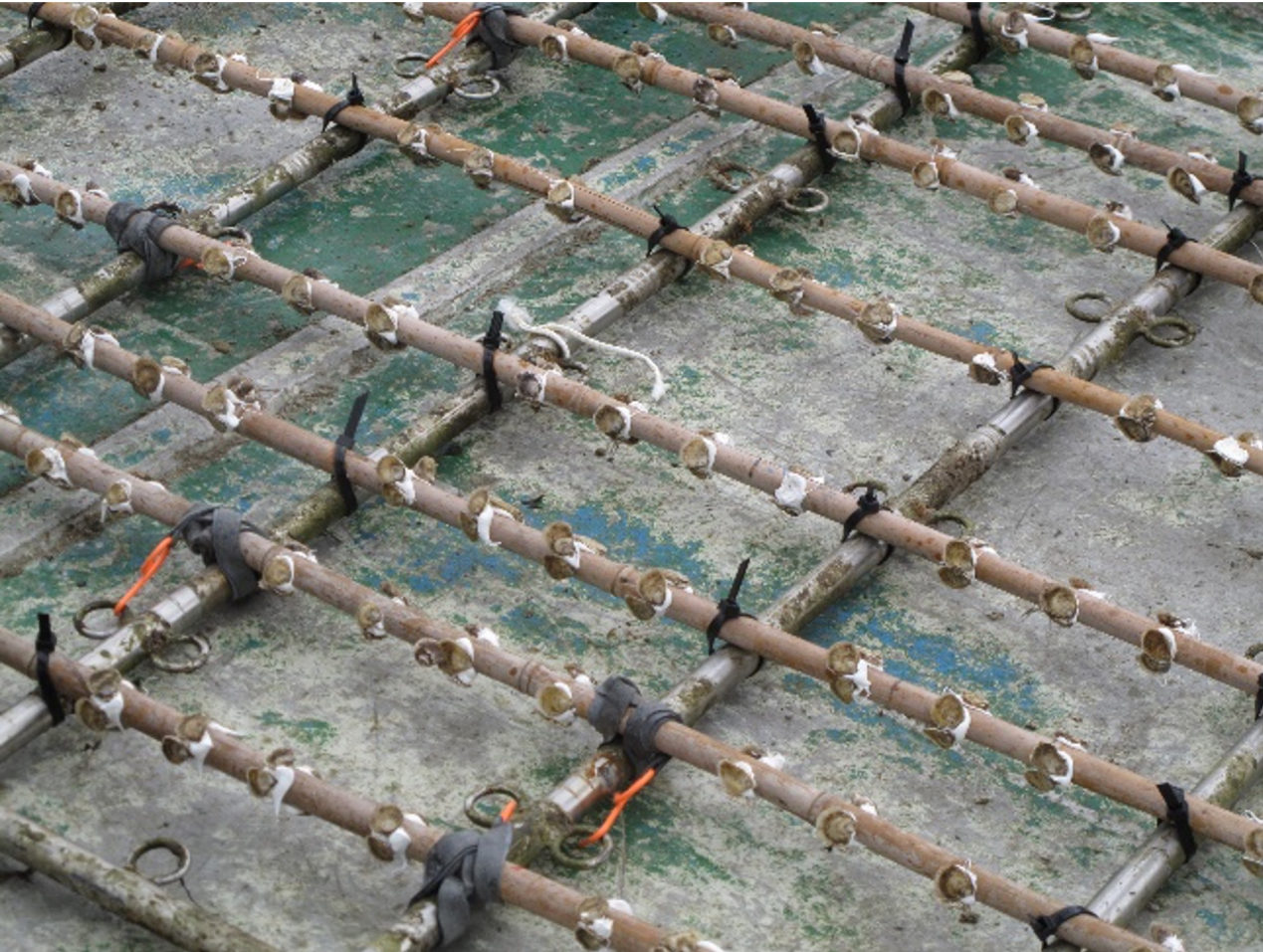
- Optimised seeding technique & cultivation substrate
- Two nearshore growth cycles (5 km off the coast)

Nearshore line after seamission 02 August 2021



Grow out 2021 : nearshore prep for offshore

Bamboo sticks with glued and cemented oysters : grow-out



Ropes with lantern baskets – grow out



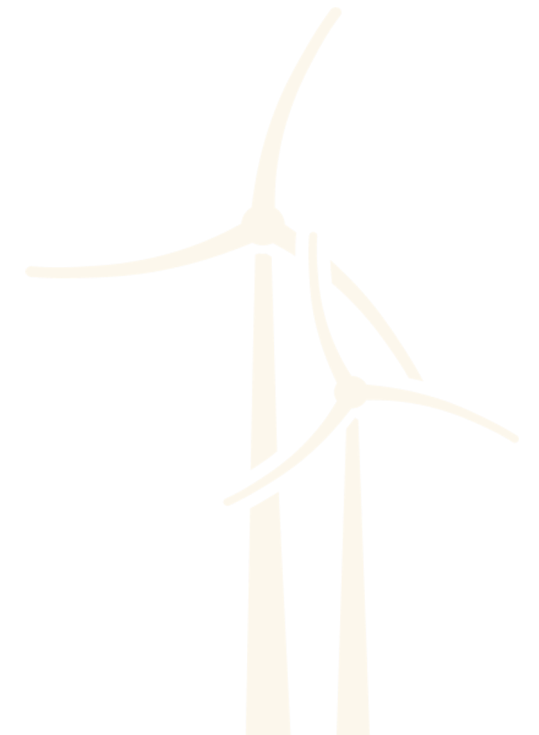
- Left: intermediate sampling August 2021
- Redesigned (right) for offshore : one depth



Baskets in ladder and frames – grow out before (left) and after (right) partly being cleaned



Oysters cemented on ropes at installation (June 2021) versus...

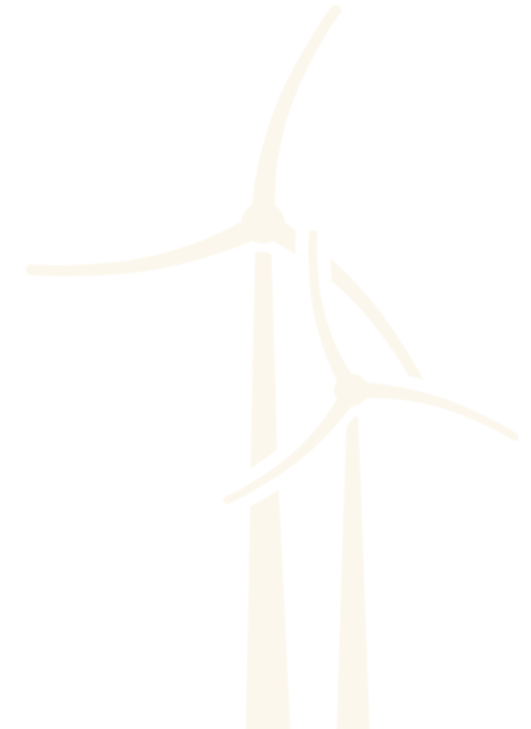


Oysters cemented on ropes after eight (left) & two (right) months at sea



Spat collection 2021: nearshore only

Cultch + adult oysters in frames while being cleaned



Seaweed nearshore testing results: Year

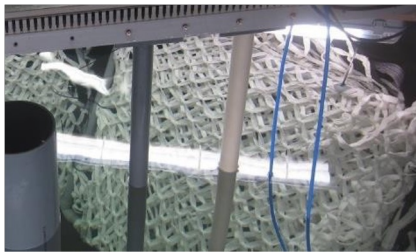
Identification and development of suitable cultivation techniques for offshore conditions

1st year (Nov 20 – May 21)
Nearshore net Offshore net

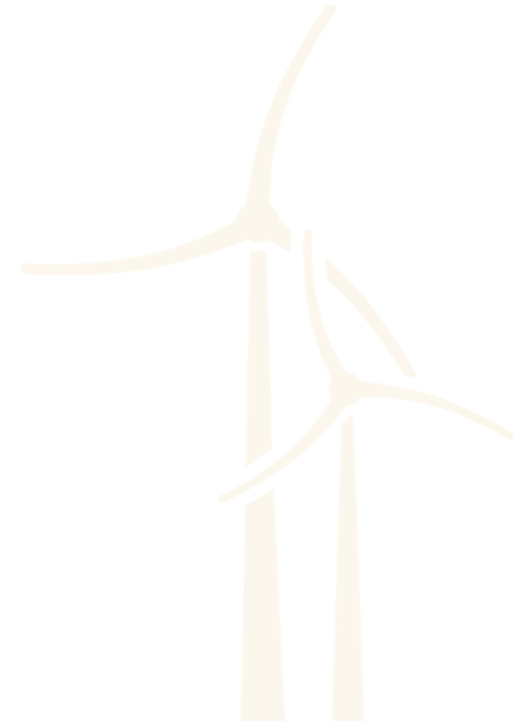
Substrates



Nursery period



Direct seeding

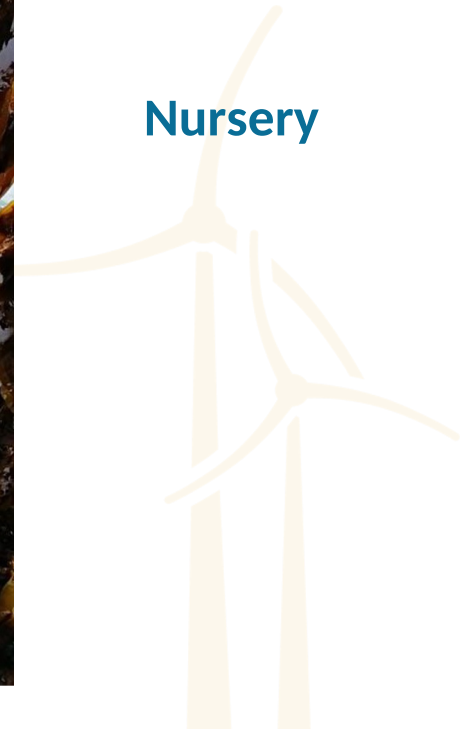


Year 1 - February: Importance of seeding technique

Direct seeding

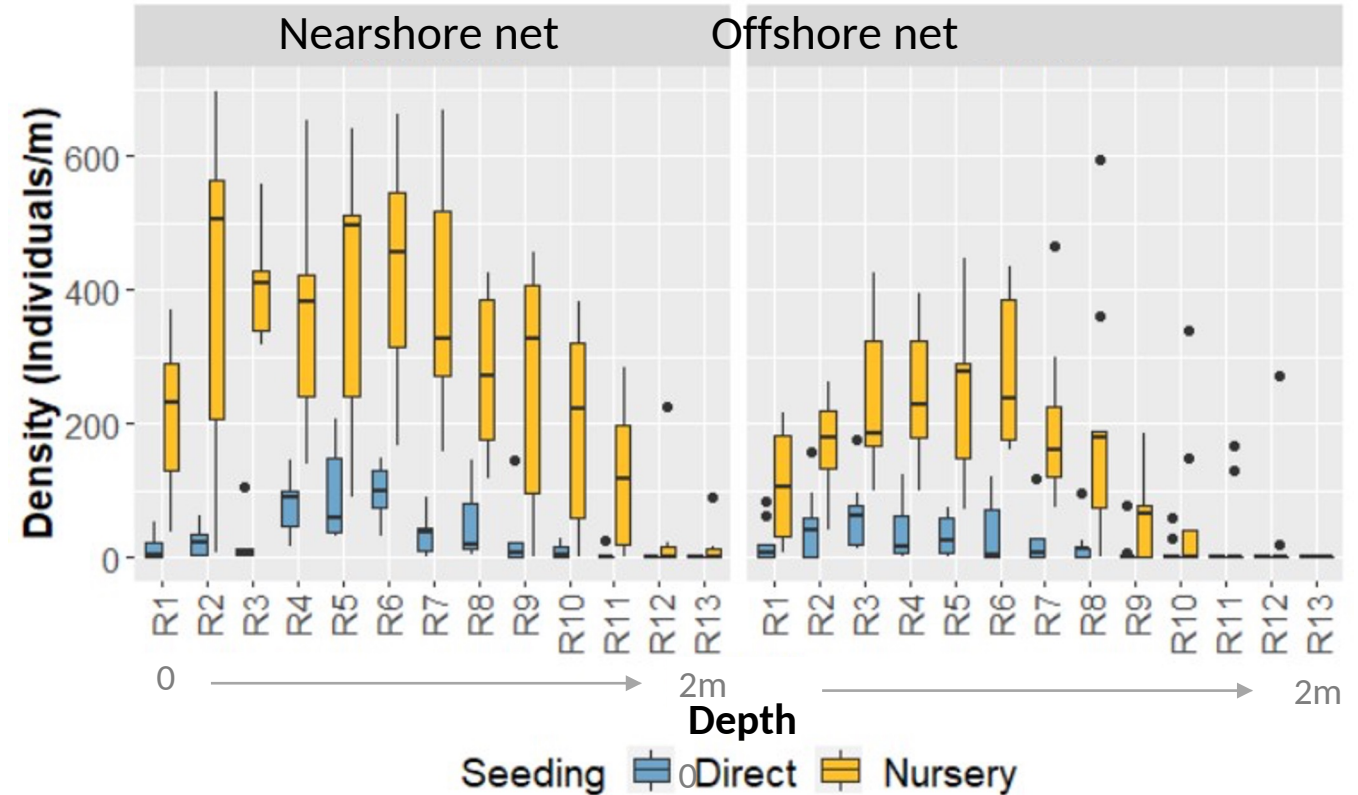


Nursery



Year 1 – First successful harvest May 2021

Yield and density



- Maximum yield:
 - Nursery period: 1.1 kg m⁻¹ substrate
 - Direct seeding: 0.5 kg m⁻¹ substrate

Seaweed nearshore testing results: Year 2

Identification and development of suitable cultivation techniques for offshore conditions

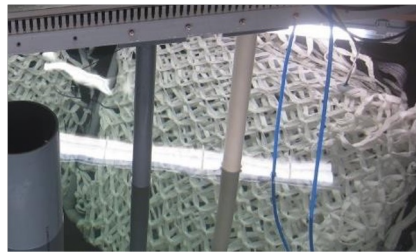
1st year (Nov 20 – May 21)
Nearshore net Offshore net

2nd year (Nov 21 – May 22)

Substrates



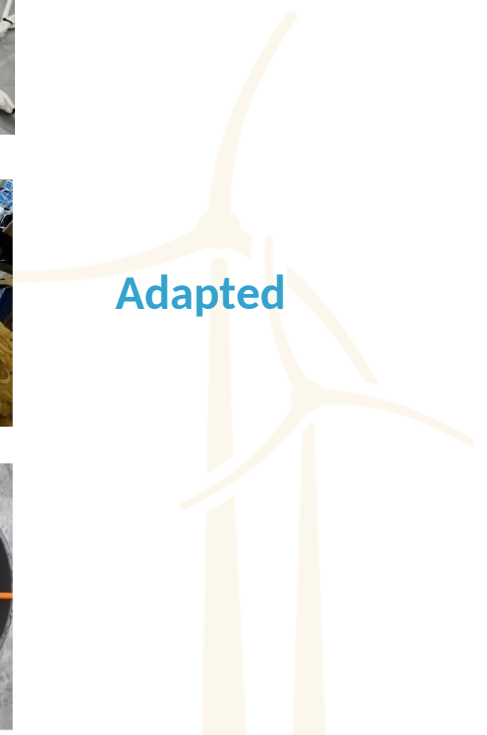
Nursery period



Direct seeding



Adapted



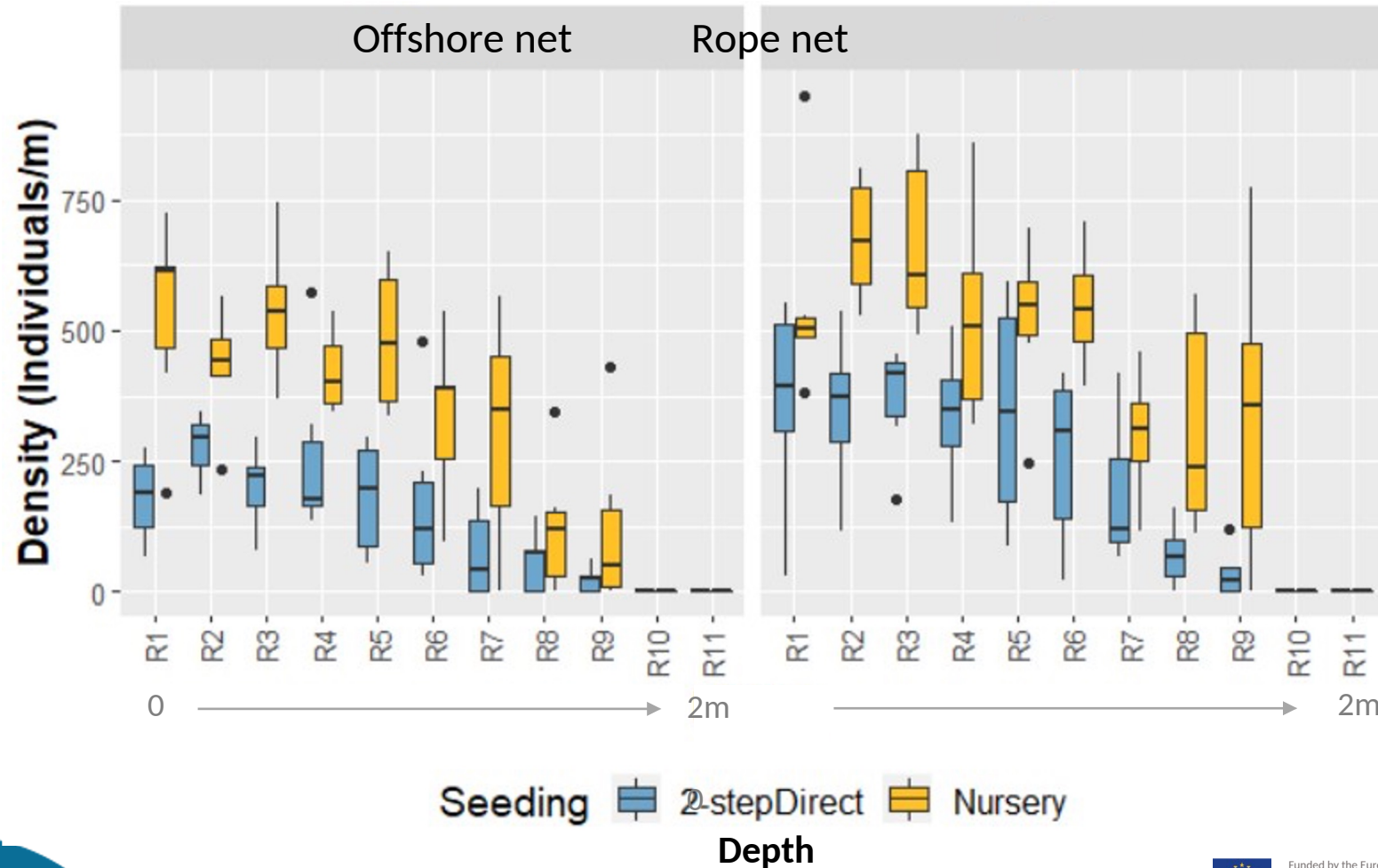
Year 2 – Improved harvest May 2022



□ Best performing rope net (nursery seeding): maximum of 2.8 kg m⁻¹, on average 10.6 kg m⁻² in the upper first meter of cultivation

Year 2 – Improved harvest May 2022

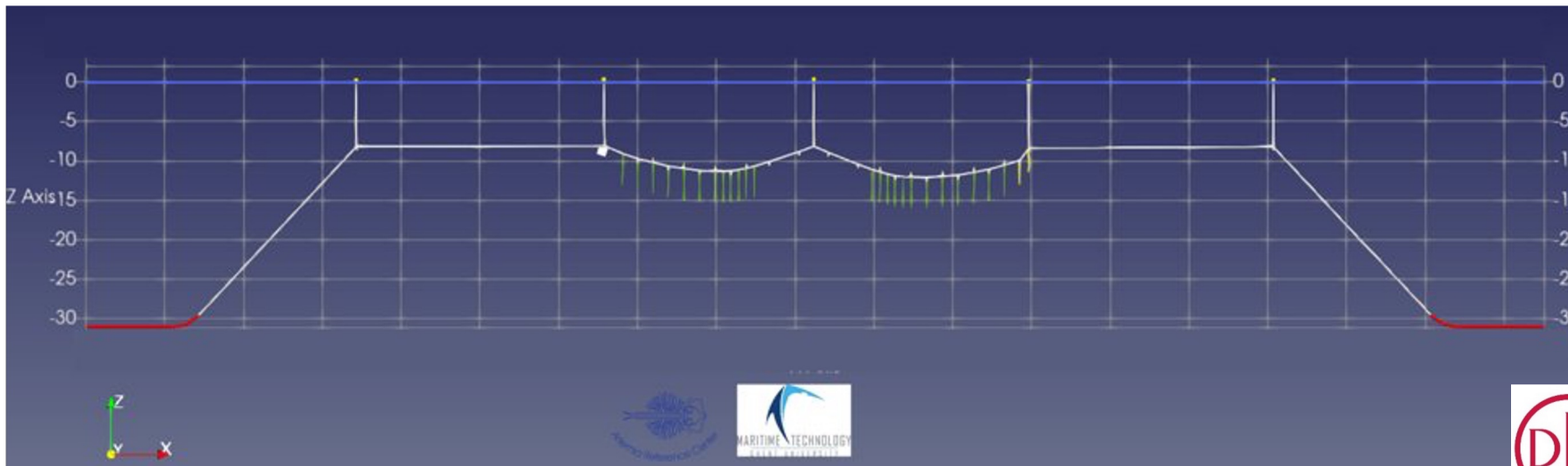
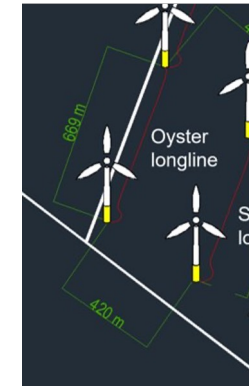
Density



Offshore oyster cultivation

Longline system

- Screw anchor □ mooring chain □ mooring rope
- Cultivation line submerged 10m
- Slack lines to accommodate lifting



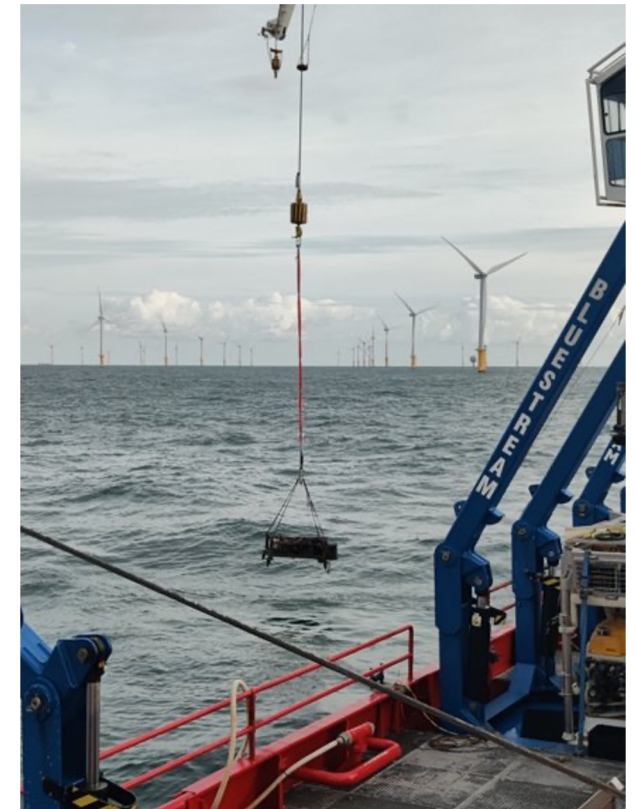
Oyster restoration offshore 2021

Installation of restoration tables June 2021

Proof of concept



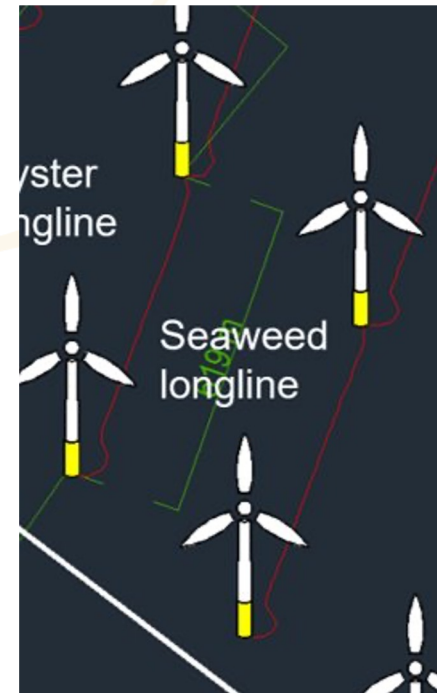
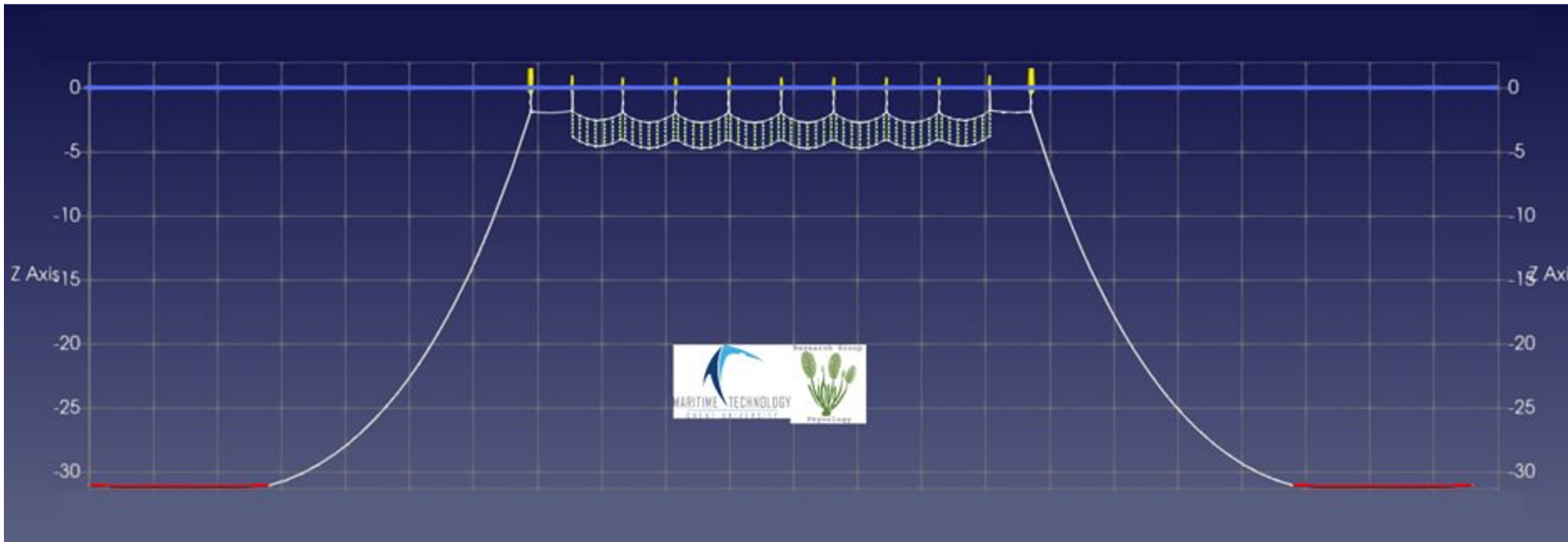
- *Bonamia*-free adult oysters placed in gabion baskets with substrate
- 6 gabions per restoration table
- Tables placed on the scour protection
- One gabion sampled
- **60% survival adult oysters**
- **Spat settlement observed**



Offshore seaweed cultivation

Longline system with seaweed nets: ppt Ajie Pribadi

- Screw anchor → mooring chain → mooring rope
- 8 nets of 4 m x 2 m

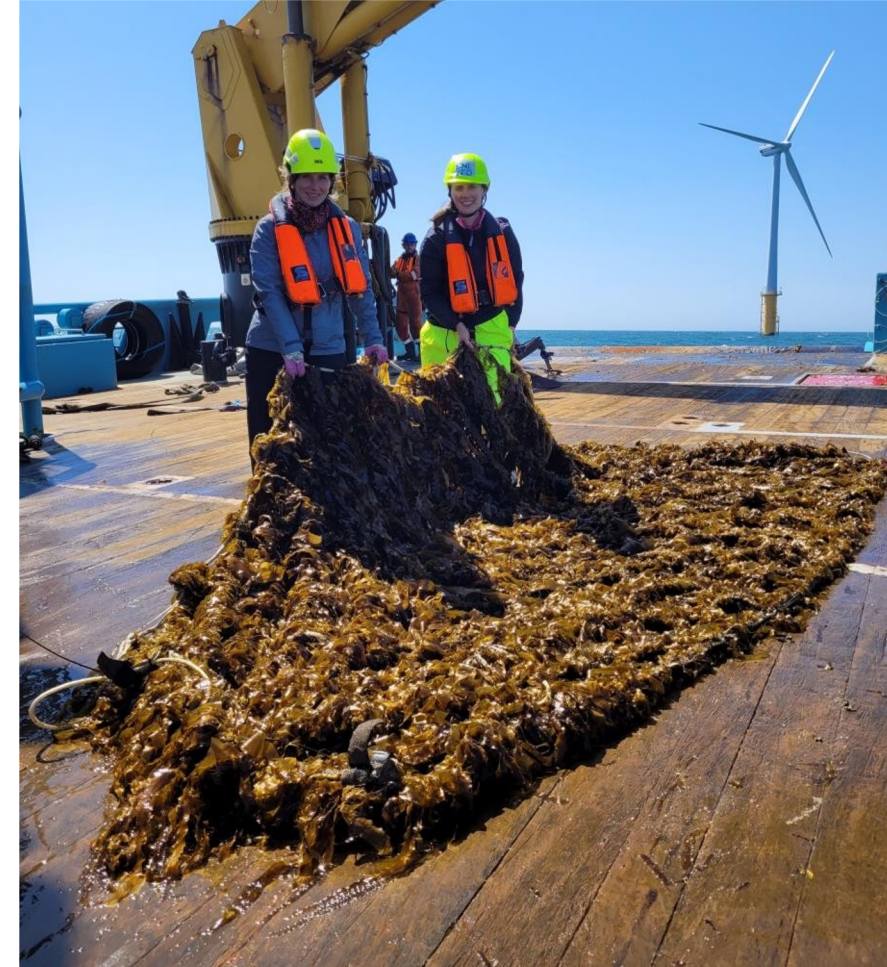


Belgian Pilot: *Saccharina latissima* cultivation

Identification and development of suitable cultivation techniques for offshore conditions

- One offshore growth cycle (46 km offshore)

World's first cultivation within an offshore wind farm



Lessons learned

1. Seeding technique crucial for successful cultivation for highly exposed environment
 - Poor results with direct seeding
 - Improvement with 2-step direct seeding
 - Nursery period important

2. Oyster structures success dependent on:
 - Fouling – less offshore
 - Structure design and weight

3. Installation and harvest highly weather dependent ☹️ possible delays

4. Offshore installation needs specialized companies and extra safety measures

5. For oyster restoration, large scale approach will likely require a different design and co-design with the OWF is recommended





The Team

Dat betekent dat die oesters wel goed gegroeid zijn de voorbije maanden.



WWW.H2020UNITED.EU   



Prof. Annelies Declercq

Andclerc.Declercq@UGent.be

Dr. Jessica Knoop

Jessica.Knoop@ugent.be