Scottish Innovations in Seaweed Aquaculture

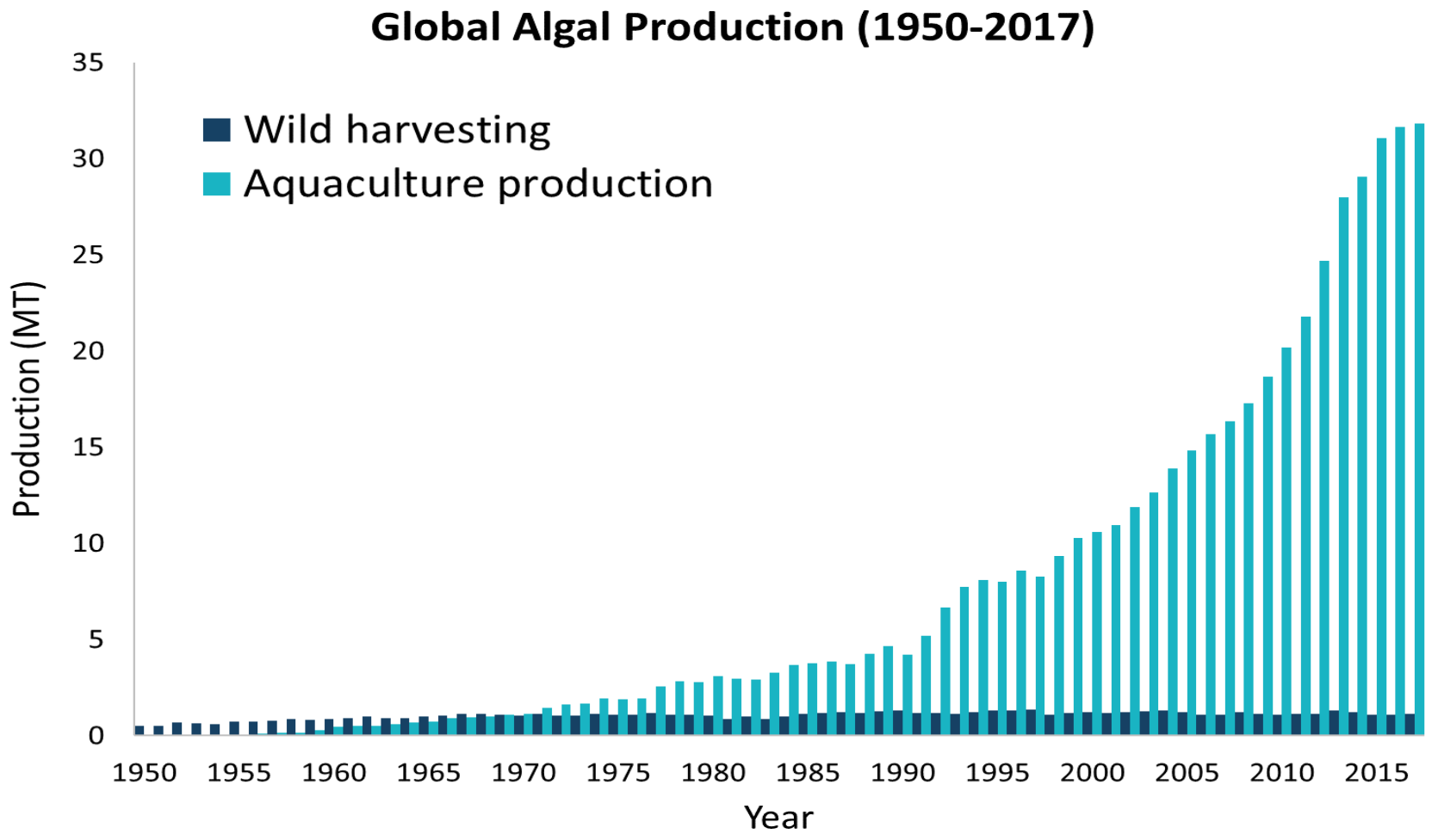
Michele Stanley, Kati Michalek and Adrian MacLeod

Scottish Association for Marine Science

Michele.Stanley@sams.ac.uk

Photo credit Alasdair O'Dell

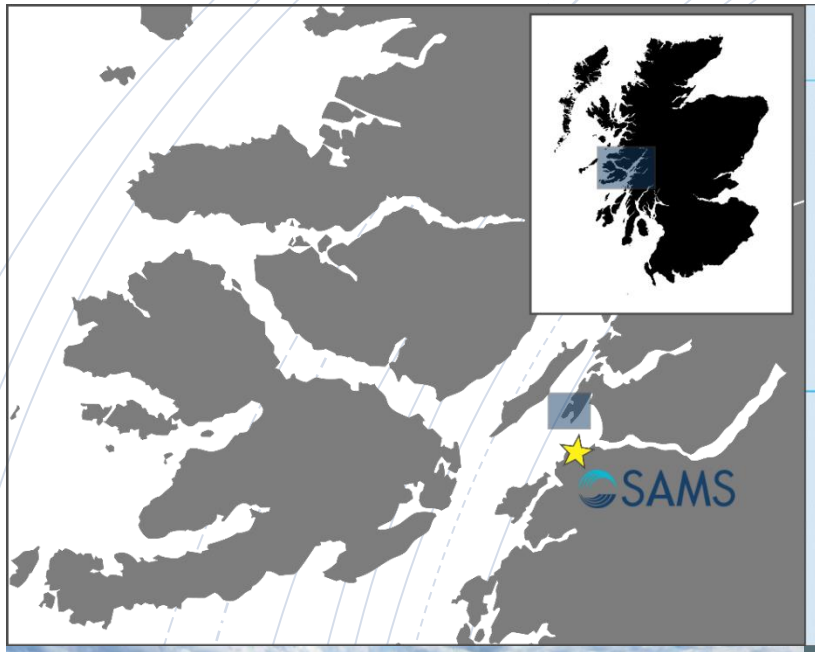
Global Seaweed Production

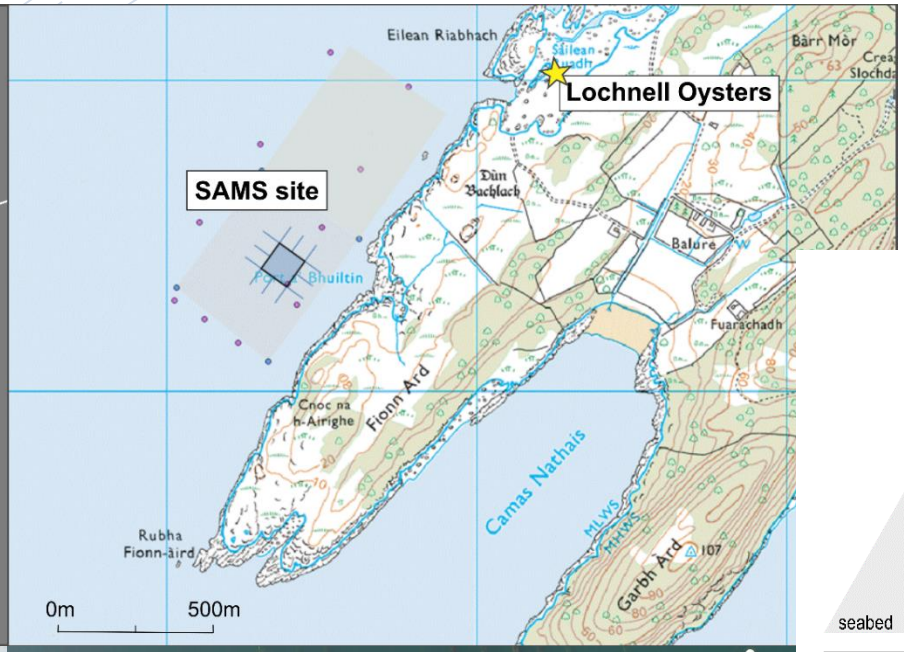


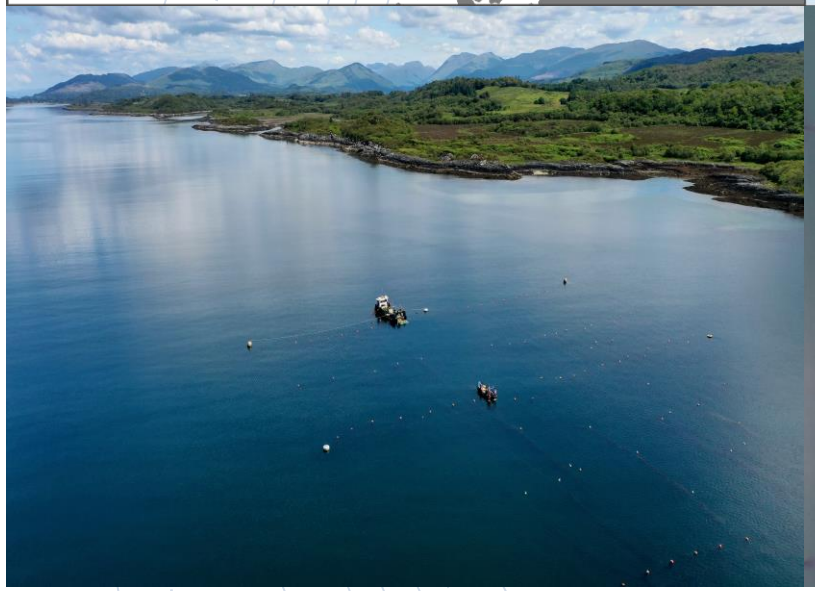
Global production of cultivated and wild harvested algae between 1950 and 2017 (from FAO 2018)

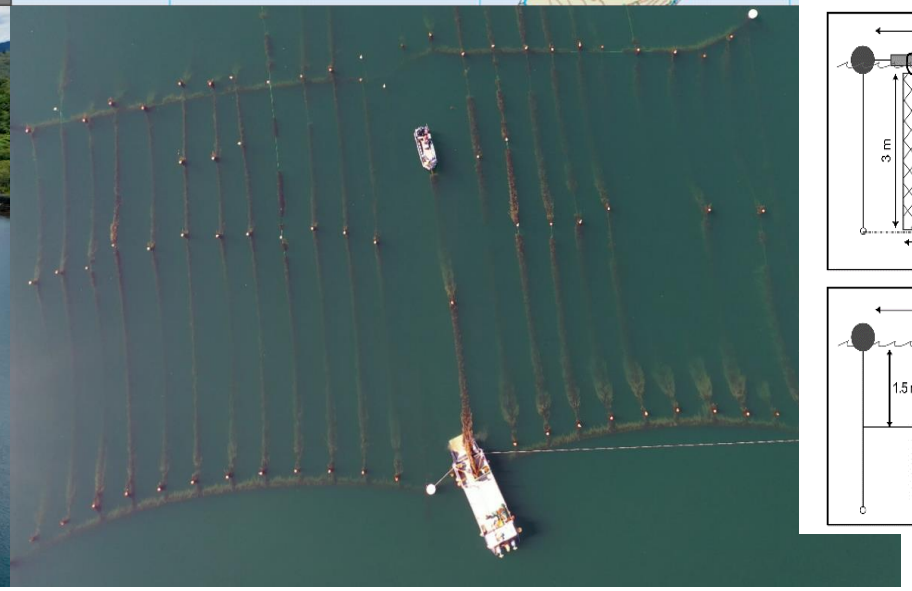
IMPAQT
Intelligent Management System for Integrated Multi-trophic Aquaculture

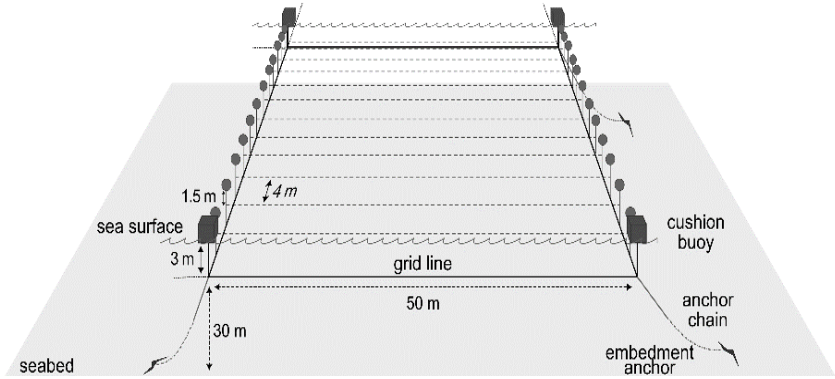
This project has received funding from the EU H2020 research and innovation programme under Grant Agreement No 774109

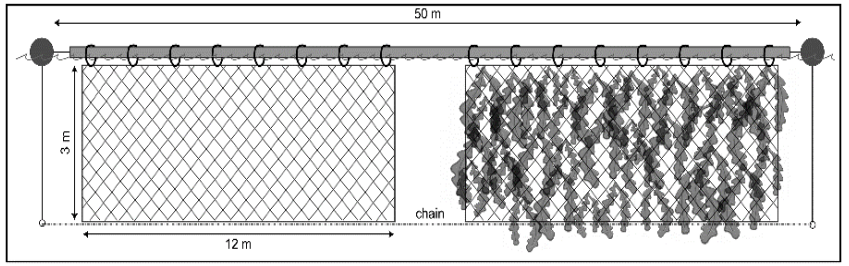

SAMS

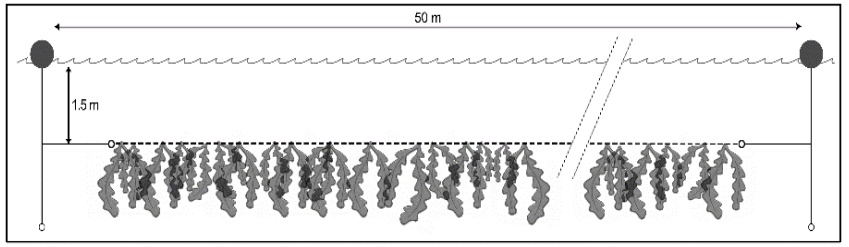

Eilean Riabhach
Lochnell Oysters
SAMS site
Dùn Bachlach
Balure
Fuarachadh
Fionn Ard
Camas Nathais
Rubha Fionn-àird
Garbh Ard
0m
500m






1.5 m
4 m
sea surface
cushion buoy
3 m
grid line
50 m
anchor chain
30 m
seabed
embedment anchor


50 m
3 m
chain
12 m


50 m
1.5 m

IMAQT (Intelligent Management System for IMTA) and ASTRAL

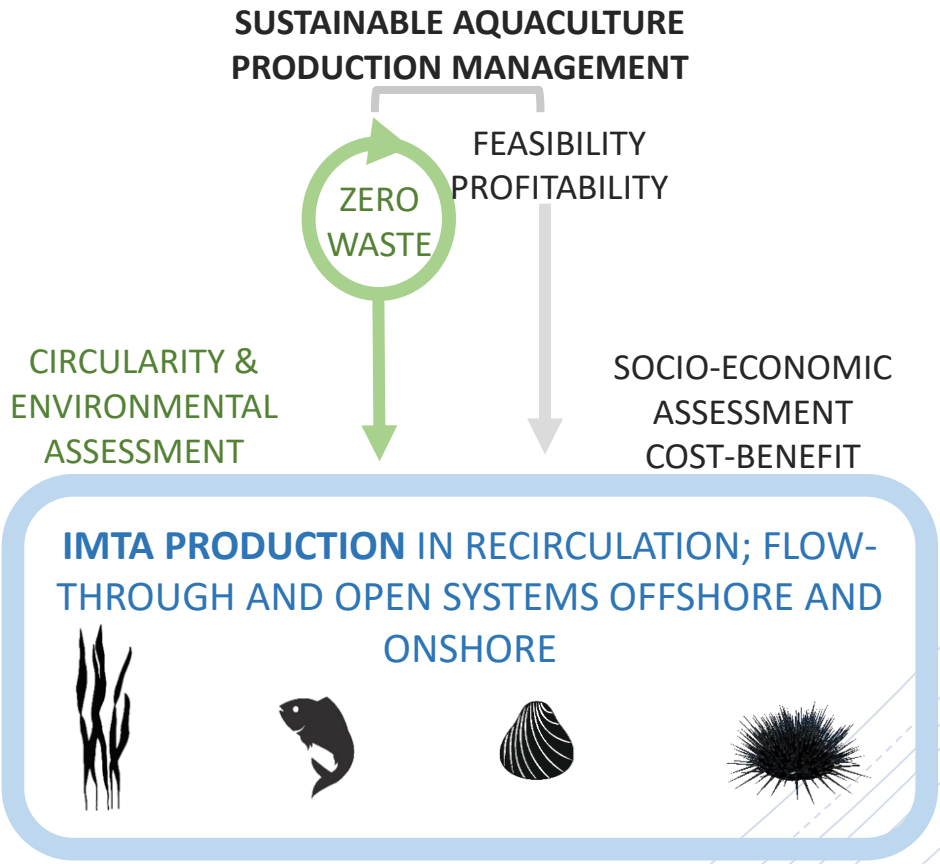
- **Sensors to improve management of IMTA sites- ASTRAL builds on this from IMPAQT**
- **Zero Waste in Aquaculture-**

  valorisation routes; best practice
- **Circularity Assessment**

  feed waste, species by-product use, recirculation
- **Environmental Assessment**

  life cycle perspective
- **Eco-Value Chain Standards**

  regulatory framework, requirements for compliance



SAMS IMTA Lab

IMPAQT
Intelligent Management System for Integrated Multi-trophic Aquaculture

ASTRAL

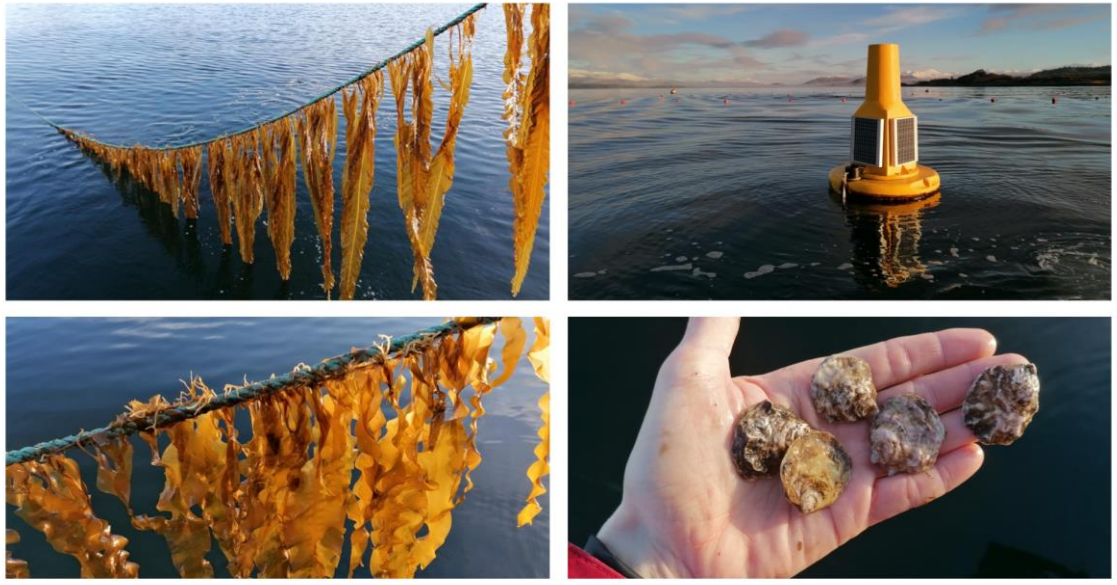
- **Develop new IMTA value chains**
- **"Reduce – Reuse – Recycle"**

reduce plastics, polypropylene rope, steel

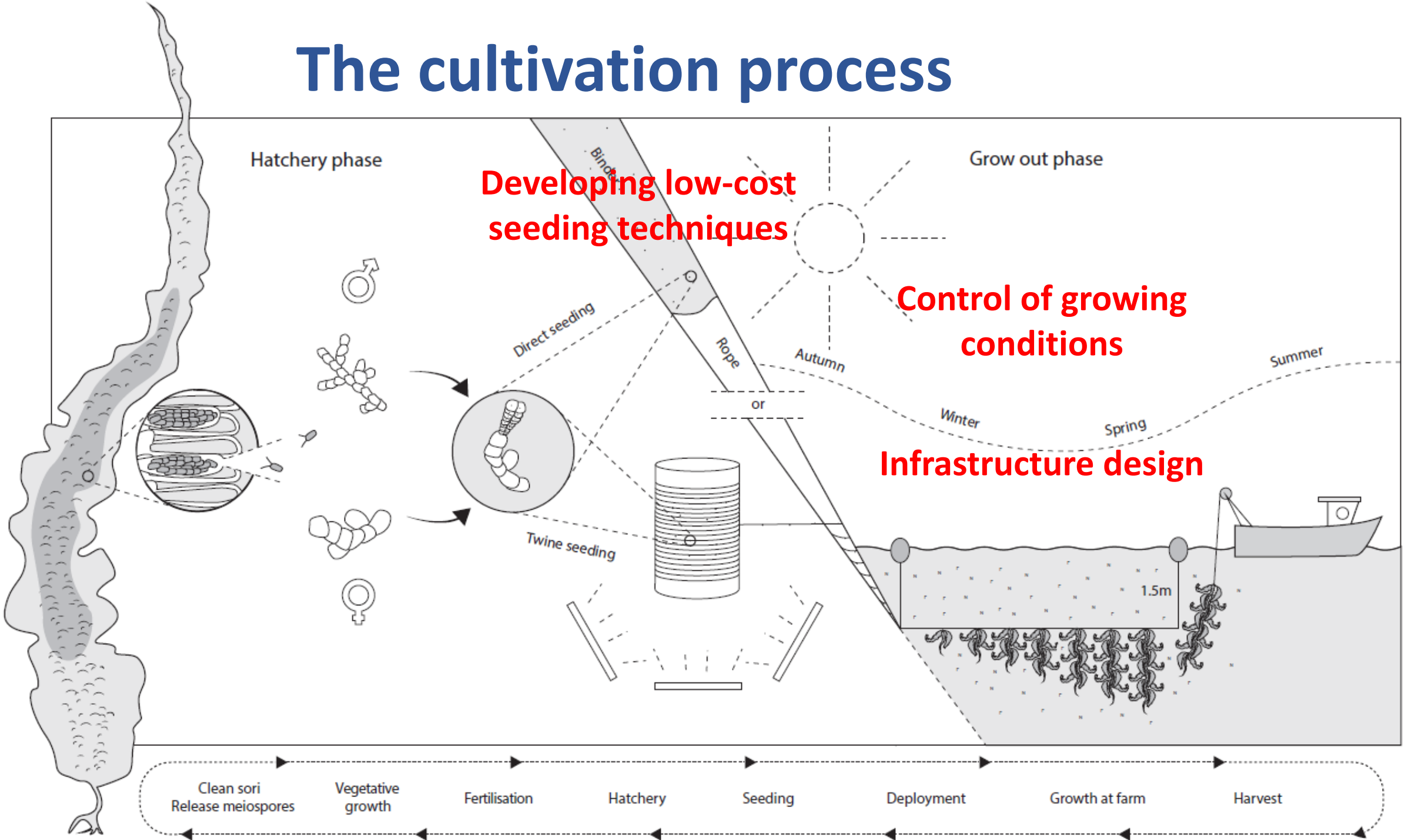
- **Adjust cultivation practices**

rope diameter vs biomass yield, seeding- & stocking density,

sustainable polymers: biodegradable (e.g. hemp rope) or recyclable



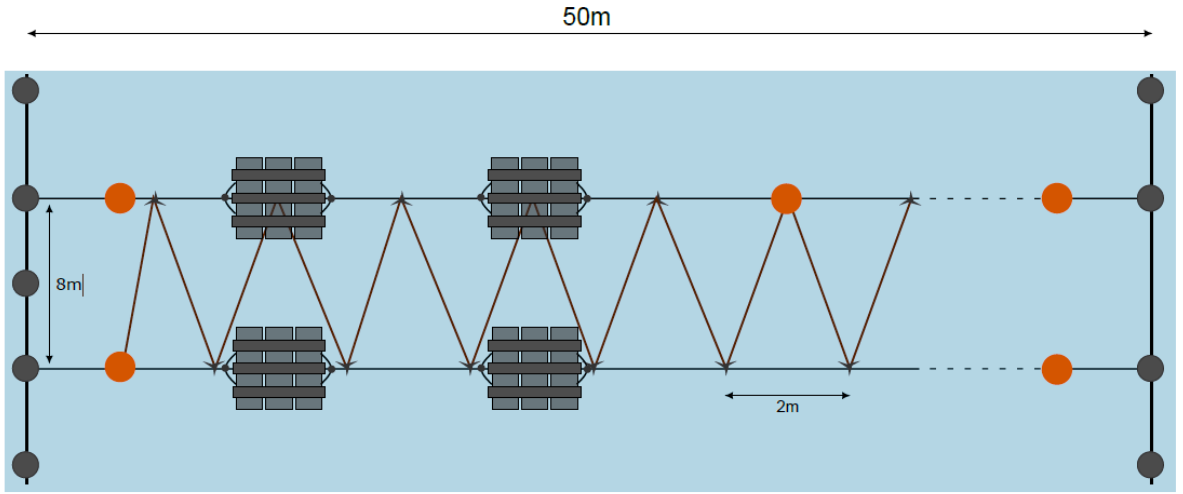
The cultivation process



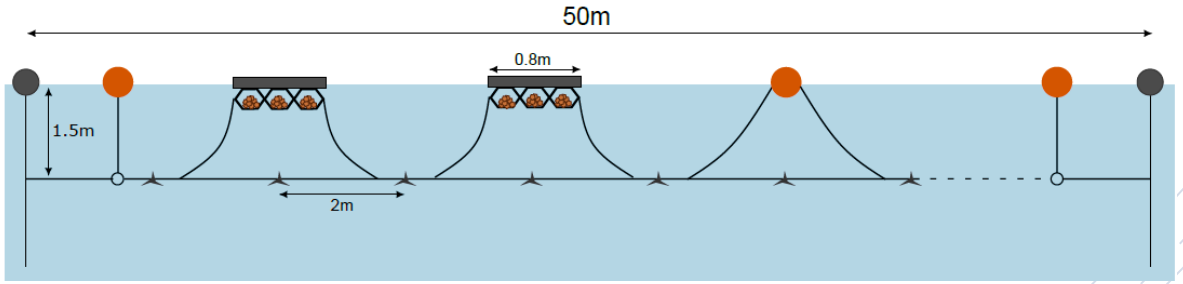
Key Activities:

- Develop and validate on integrated oyster/seaweed cultivation system with improved stocking density. Comparing oyster growth rate, composition and mortality to an intertidal site.

A. Top View



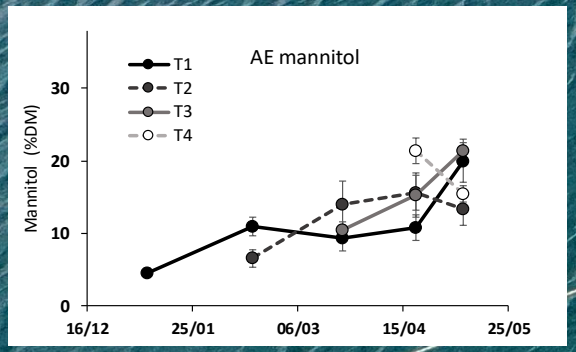
B. Side View

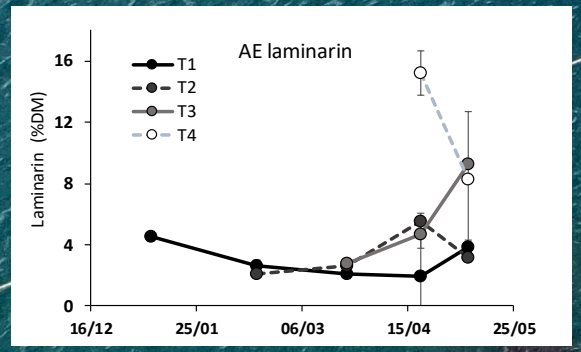


oyster-seaweed cultivation system aims to test a combined native oyster and seaweed cultivation system by exploiting the buoyancy built into the oyster baskets creating two permanent catenary lines held at 1.5m water depth and 8m apart.

Key Activities:

- Monitoring growth rate, yield, mortality (oysters) and composition throughout the year and relating this to environmental monitoring to inform best practice



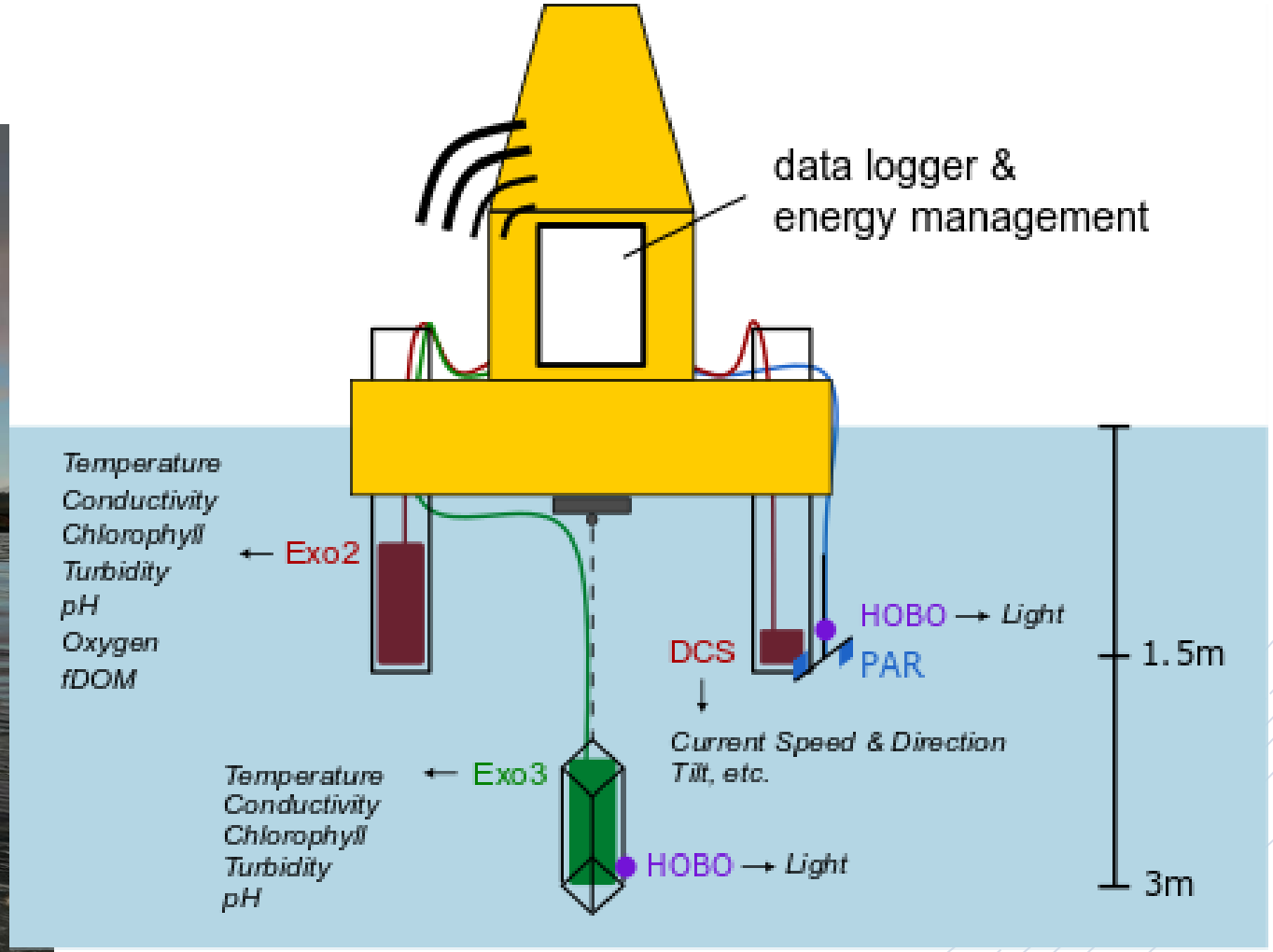


Mannitol and Laminarin as percentage dry weight of samples of *Alaria esculenta* (AE) sampled from 08/01 until harvest. Seaweed deployments dates are T1 - 06/10/16; T2 – 24/11/16, T3 – 08/01/17, T4 - 17/02/17, T5 - 23/03/17. Unpublished data.

Aquaculture Monitoring

- Transition to AUTONOMOUS REAL-TIME data collection

Data buoy at SAMS IMTA Lab



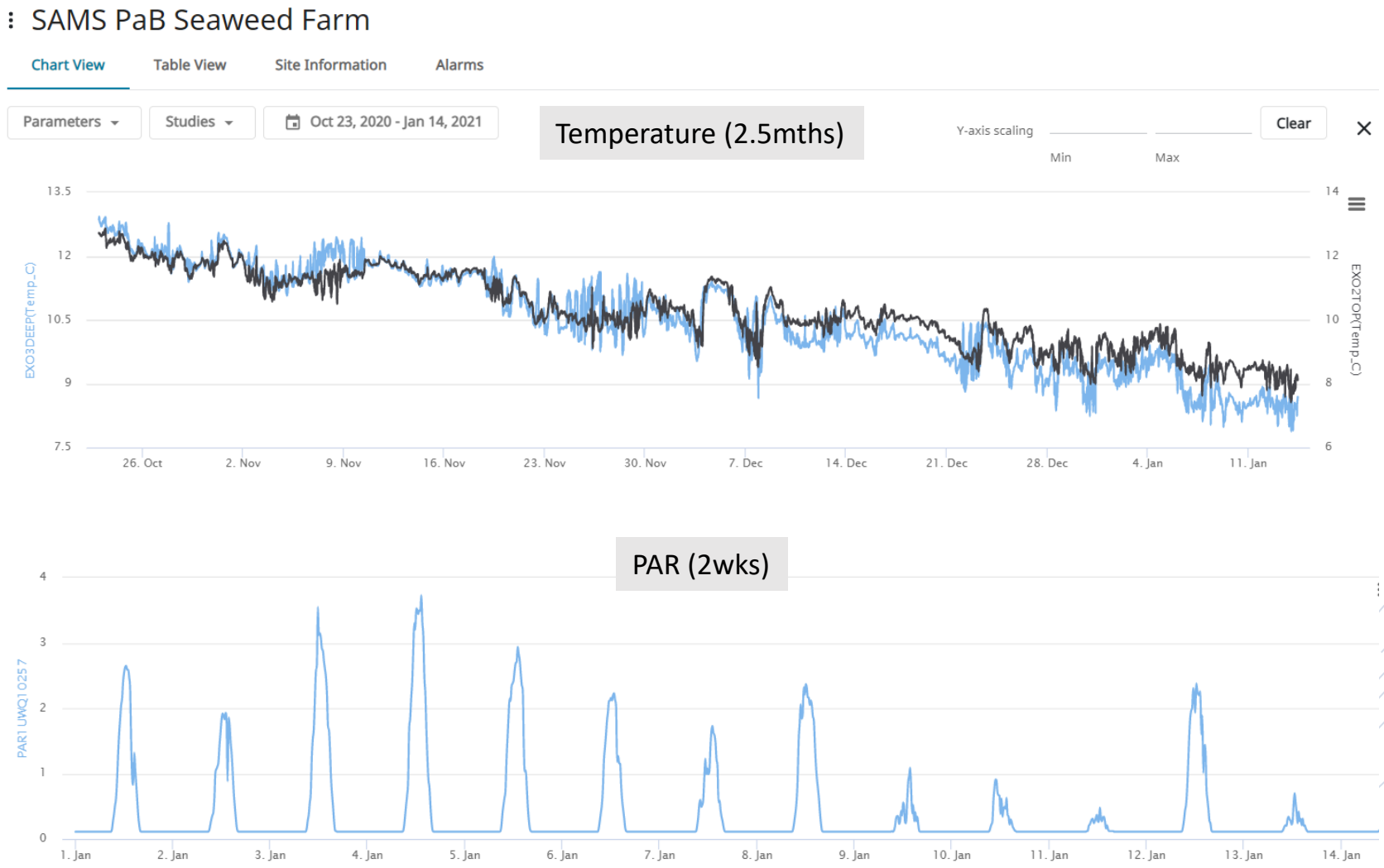
Monitoring for Management

- suite of parameters
- data every 15min

Seaweed Performance

- ✓ Biomass yield
- ✓ Morphology & Biofouling
- ✓ Composition
- ✓ Carbohydrates
- ✓ Heavy Metals

Etc.



Informed Decision Making

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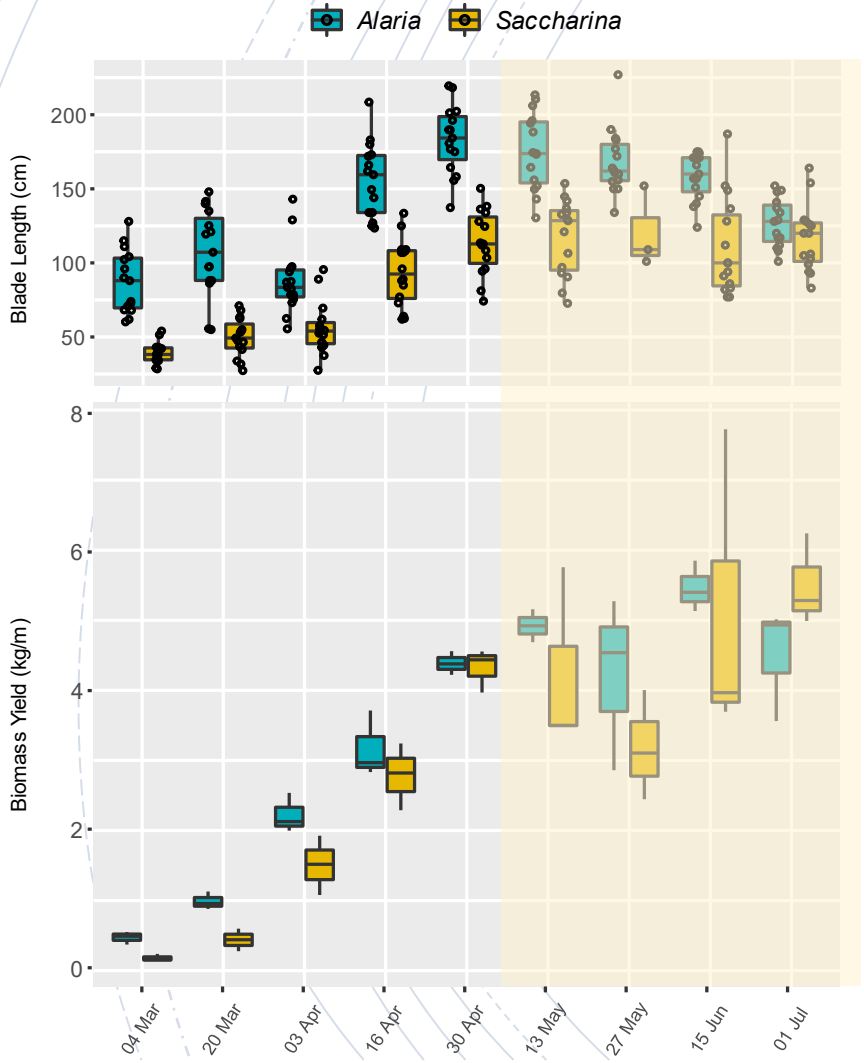
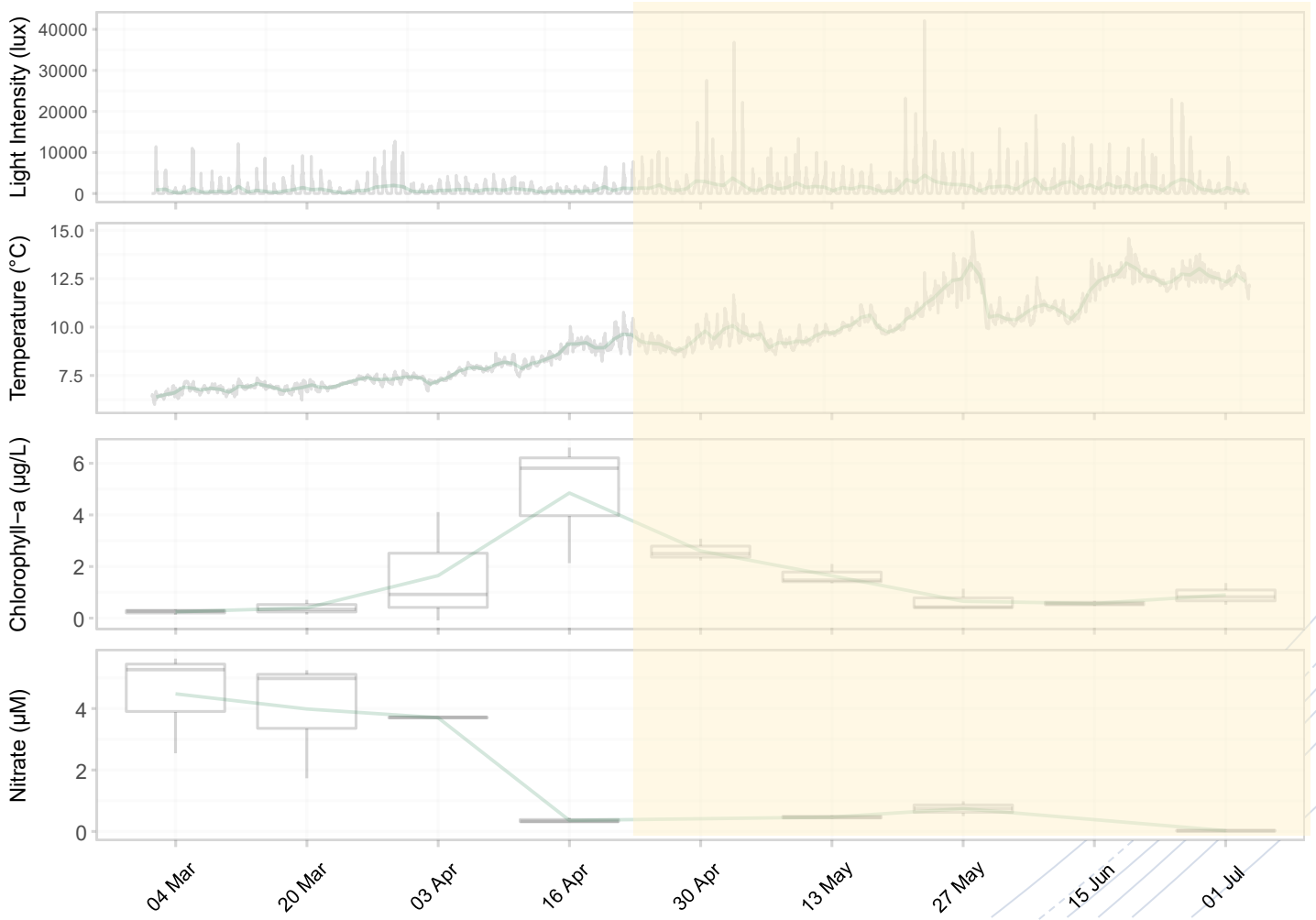
ASTRAL

Crop Performance ~ Cultivation Environment

Q: Optimum Harvest Time for Seaweed?





‘Low-Cost’ Kits for Aquaculture

- **new sensors and improve existing ones**

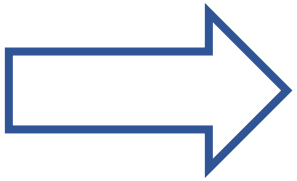
  identify relevant parameters & technology

  prototyped for e.g. biosensors, microplastics
- **Technology integration in IoT kits**

  cloud-based data management
- **low-cost A.I. vision sensor & algorithm**

  biomass estimation, phytoplankton
- **A.I. data science platform**

  predictive modelling



Integration & Validation in IMTA Labs and pilots

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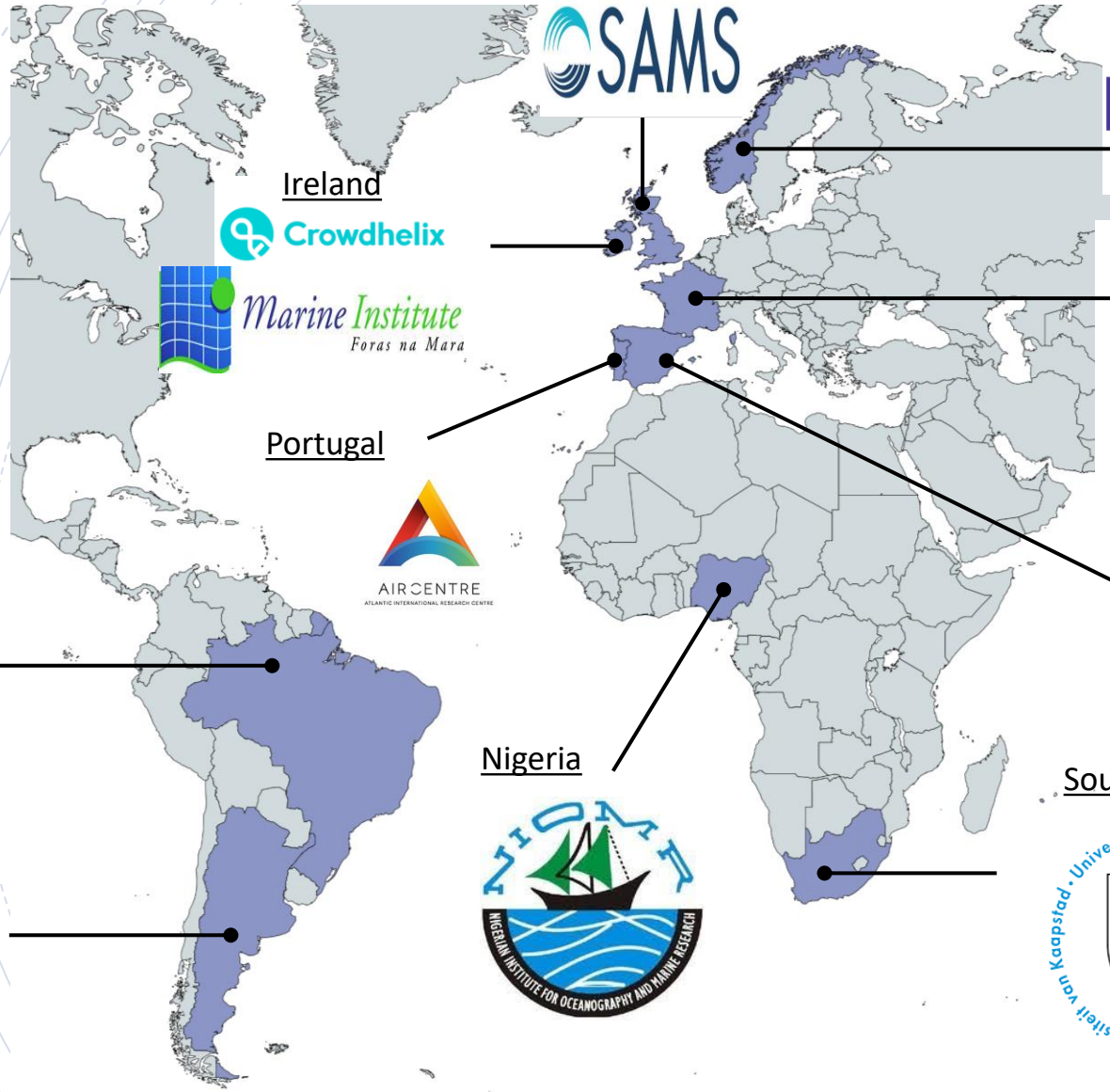
IMPAQT

Intelligent Management System for
Integrated Multi-trophic Aquaculture

The ASTRAL Consortium



UK

Ireland

Portugal

Brazil

Argentina

Nigeria

Norway

France

Spain

South Africa

Thank you!

Professor Michele Stanley

Michele.Stanley@sams.ac.uk

astral@norceresearch.no

astral-project.eu

@ASTRAL_H2020

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Project 863034
H2020-BG08-2019: All Atlantic Ocean Research Alliance Flagship
New value chains for aquaculture production