

SEALOOP

Scaling the seaweed cultivation cycle

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SWD Connectors



Content

- SWD Connectors: introduction and share our vision
- Site selection and seaweed crop development
- Seaweed farming offshore (offshore rigs, de-risking)
- Large scale seaweed farming (mechanization, automation)
- SEALOOP (Enterprise Resource Planning, ERP)





www.swdconnectors.com

- Seaweed Connectors provides seaweed consultancy services.
- Field of expertise ranging from seaweed propagation towards seaweed processing and extraction technologies

**We help you to develop your ideas or to materialize your projects,
products and/or seaweed business**



Job Schipper



Theo Verleun



Bert Groenendaal

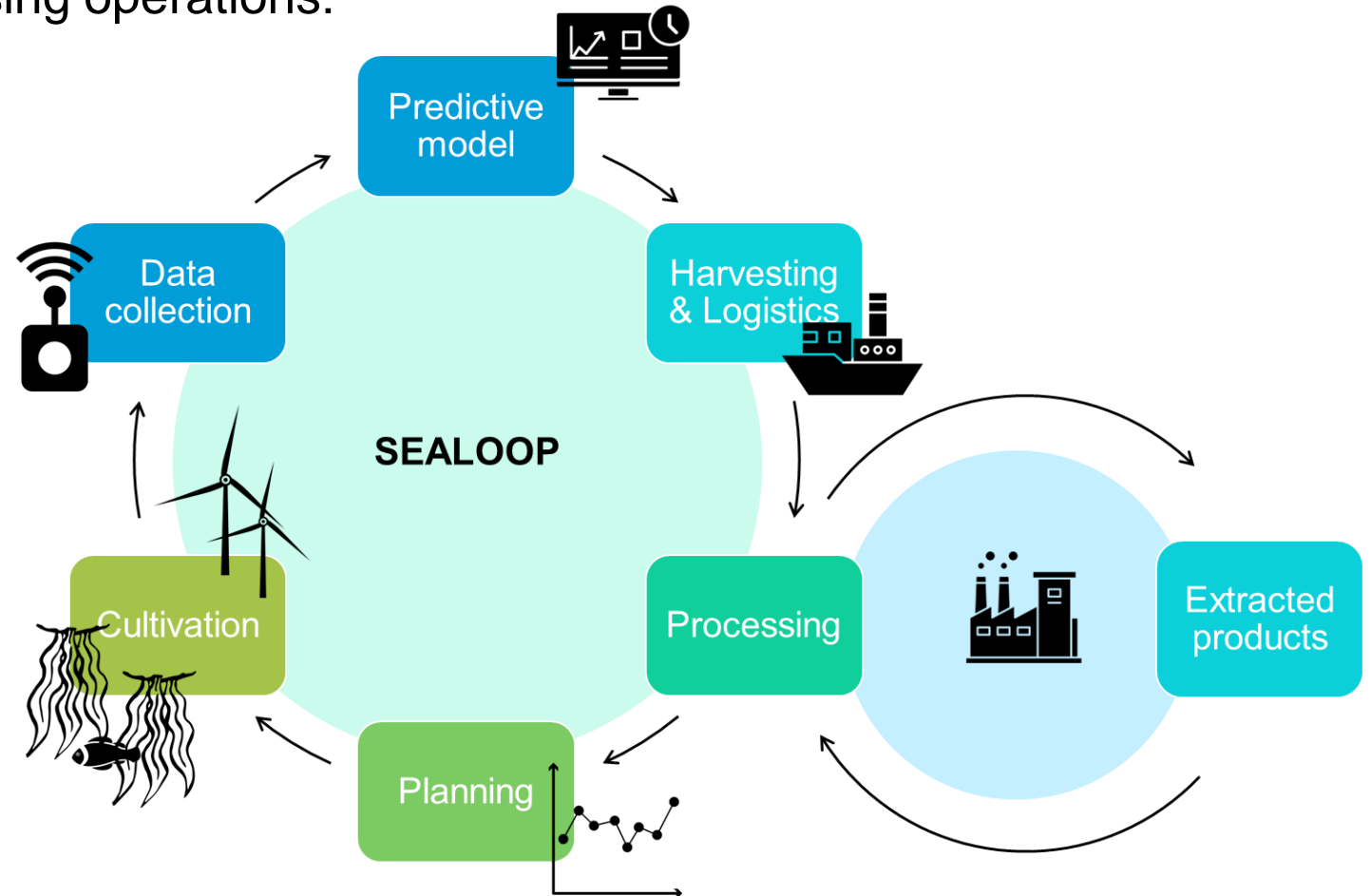


Javier Infante

Introducing the SEALOOP

Optimally connect farming and processing operations:

1. Planning of sites/plots/volumes
2. Cultivation (seeding/deployment)
3. Estimation of the crop and yield
4. Plan harvest and harvester
5. Processing and re-planning



Aspects of large scale farming

- Product: a biomass for industrial processing
- Site selection: offshore; many factors and hardly any experience!
- Biology: species and fouling organisms; potential pests and diseases
- Technology: rigs, machinery and biotechnology to be developed
- Operations: expensive, risky
- Management: need for tools like SEALOOP
- Economy: focus on cost reduction
- Risk mitigation: smart rig design and monitoring

Site selection biological criteria

- Possibility to farm year-round
 - Nutrients, light, temperature
 - Fouling pressure
 - Species selection: *Saccharina latissima* or *Laminaria digitata*?
- Nutrient flux versus concentration:
 - Micro algae drift in a volume water
 - Macro algae are fixed, water streams

high flux - low concentration



+ Add layer...



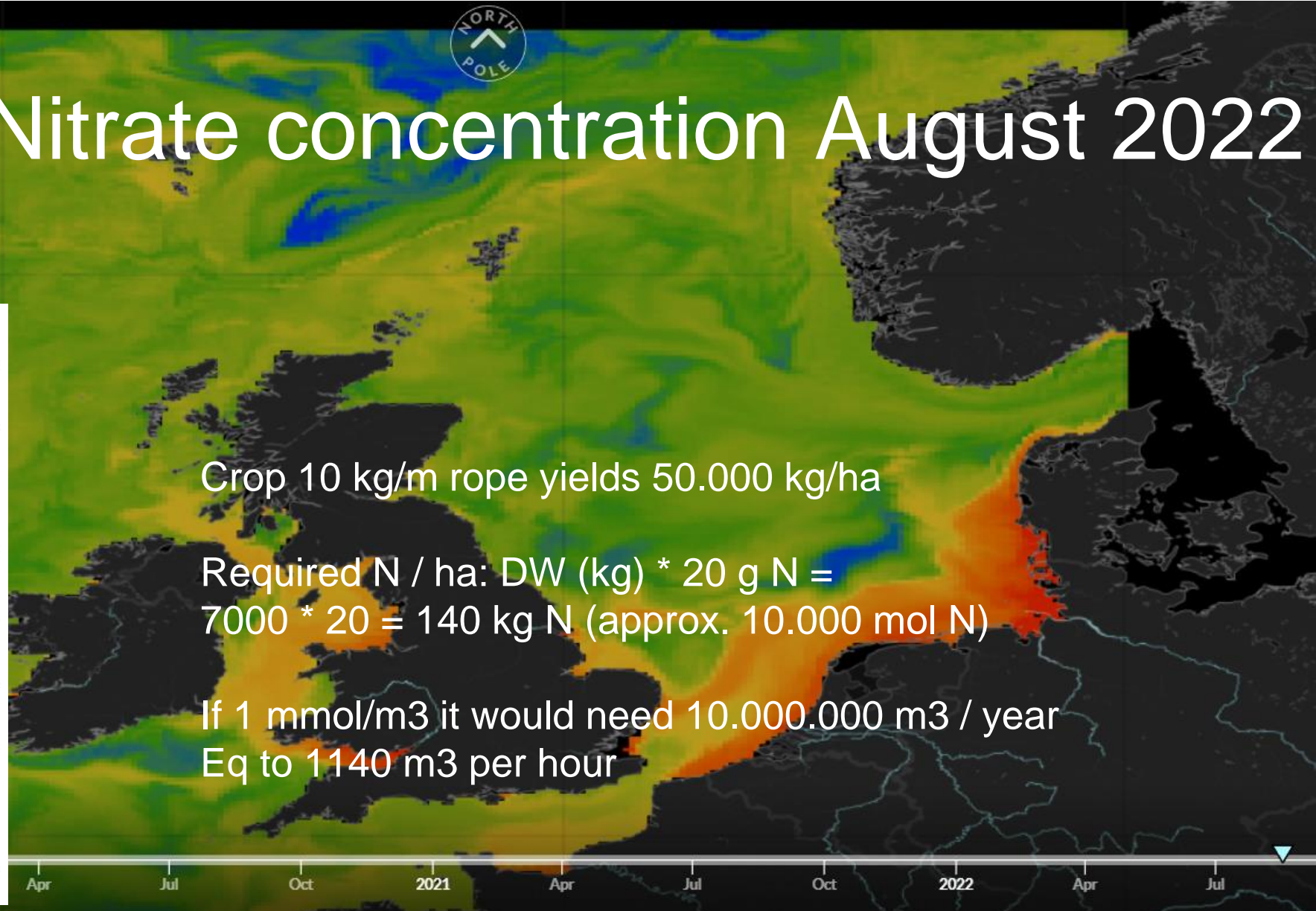
Mole concentration of nitrate in sea water no3

17/08/2022 · 0 m



Map interaction icons: download, info, layers, settings, and log.

Nitrate concentration August 2022

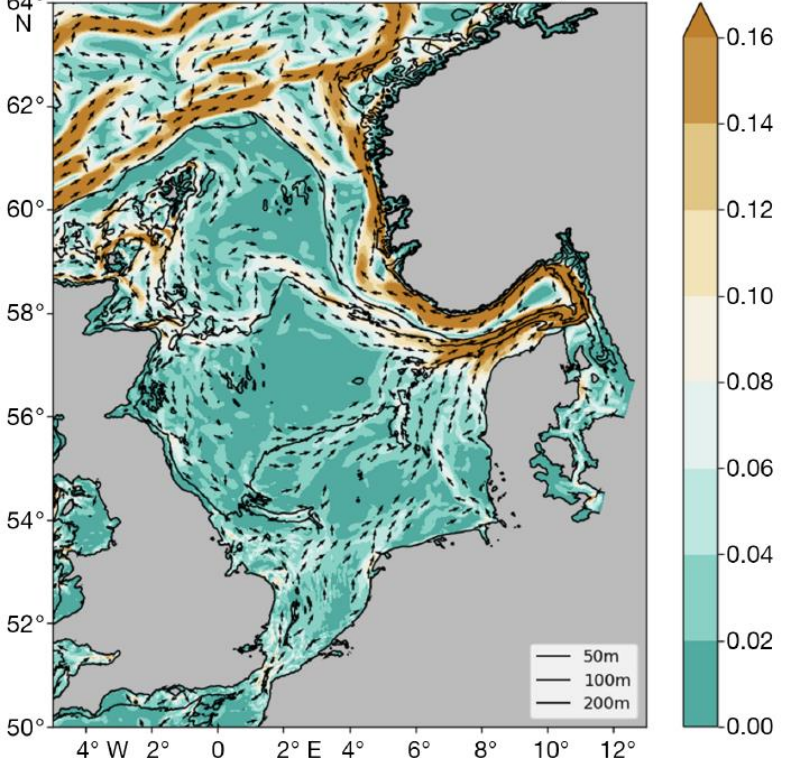


Crop 10 kg/m rope yields 50.000 kg/ha

Required N / ha: DW (kg) * 20 g N =
7000 * 20 = 140 kg N (approx. 10.000 mol N)

If 1 mmol/m³ it would need 10.000.000 m³ / year
Eq to 1140 m³ per hour

Jul10: Upper 50 m depth mean current (m s⁻¹)

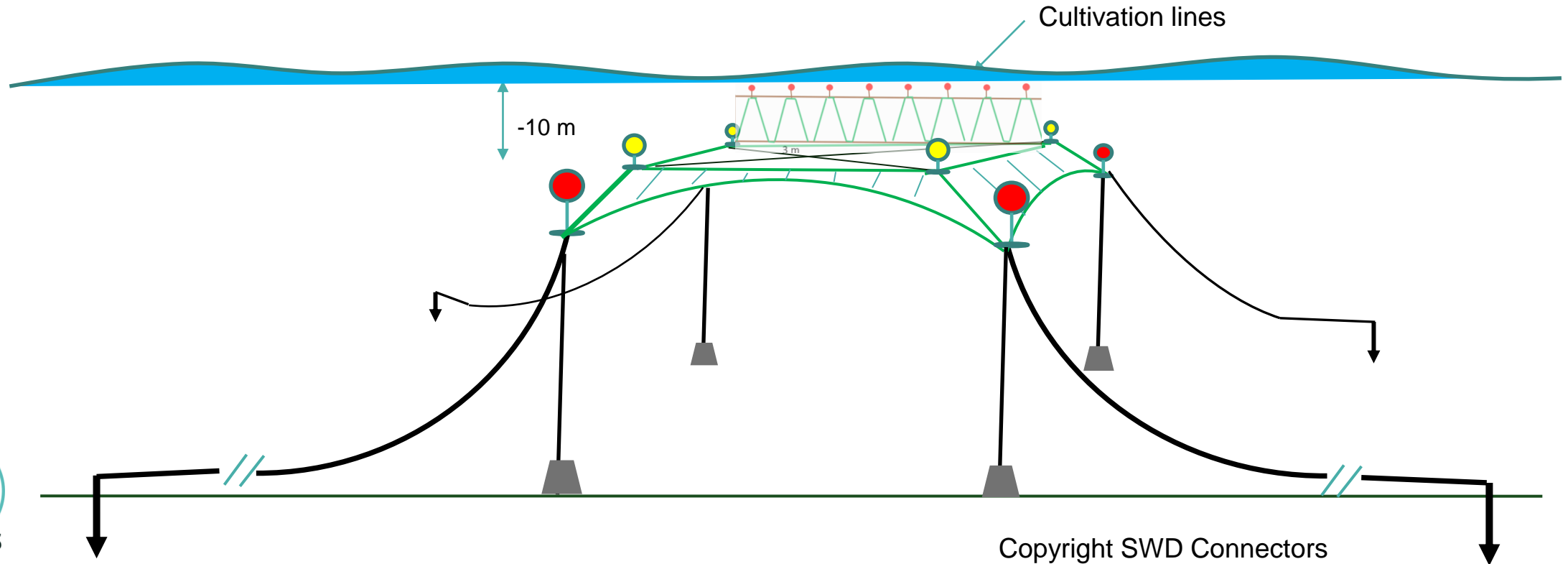


Figures: Marine Copernicus EU and <https://doi.org/10.3354/meps13970>

Offshore modular rig

Meeting marine conditions:

- No extreme safety factors but high redundancy by smart design
- Sensors for monitoring rig integrity and shape
- Mitigated risks: mooring rig at stable depth
- Bottom-up cultivation rig
- Lowest cost per meter deployed cultivation rope



Cultivation and harvesting technology



Seeding:

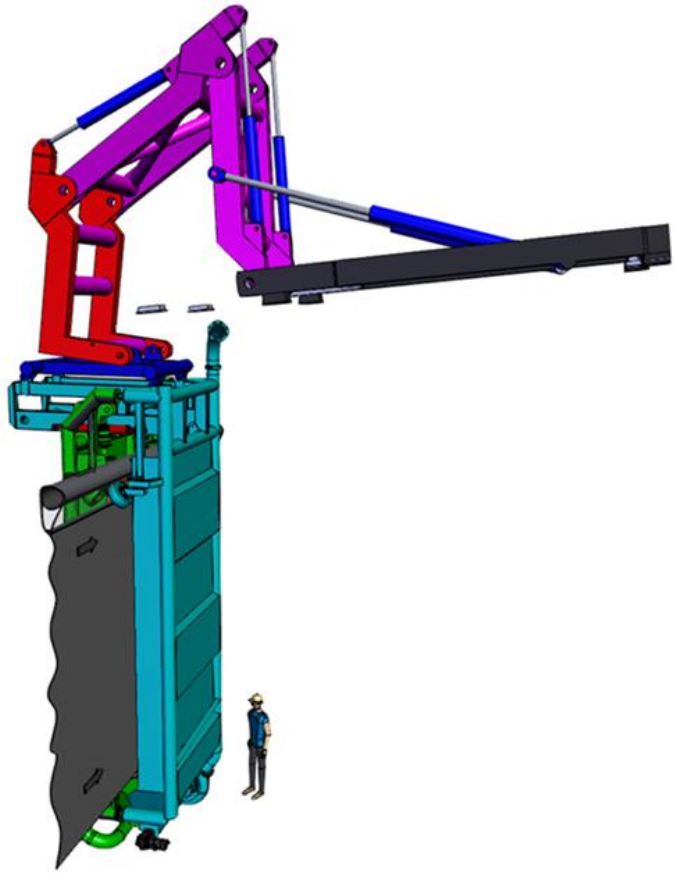
- Direct seeding using adhesive (improved)
- To be used on board, direct deployment
- 2-step direct seeding apparatus: SEASEEDER

Harvesting:

- Rope harvesting equipment for near shore
- Urgent need for an offshore harvester which can handle 2,5 m significant wave height



Harvesting machine



Murre System



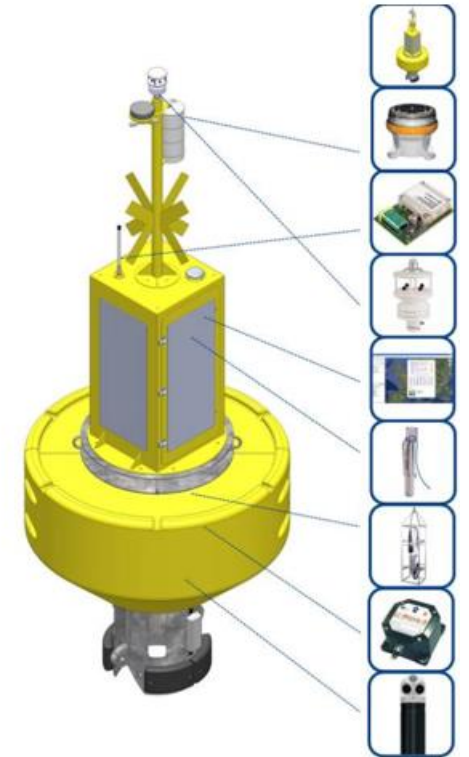
Sensing (+data collection) and AI

Why?

- *De-risking* the installations and operations
- *Prediction* of the growth and harvest
- *Optimisation* of the use of the company's assets
- Optimal *planning* and timing

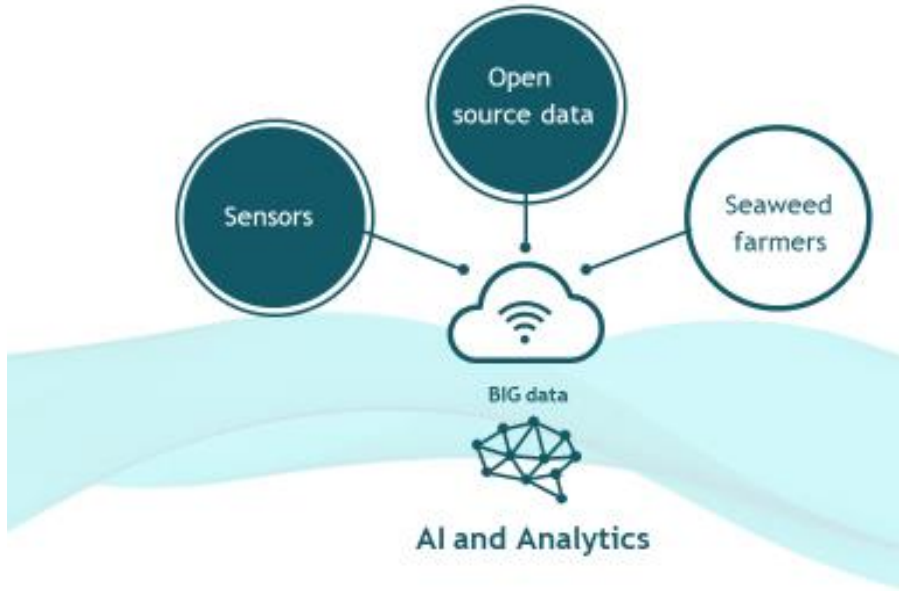
How:

- Central sensor buoy for general farm data (marine; light etc)
- Rig integrity and location sensors
- Remote sensing by satellites
- Collecting multi-annual data for AI software
- AI supported growth models for yield prediction

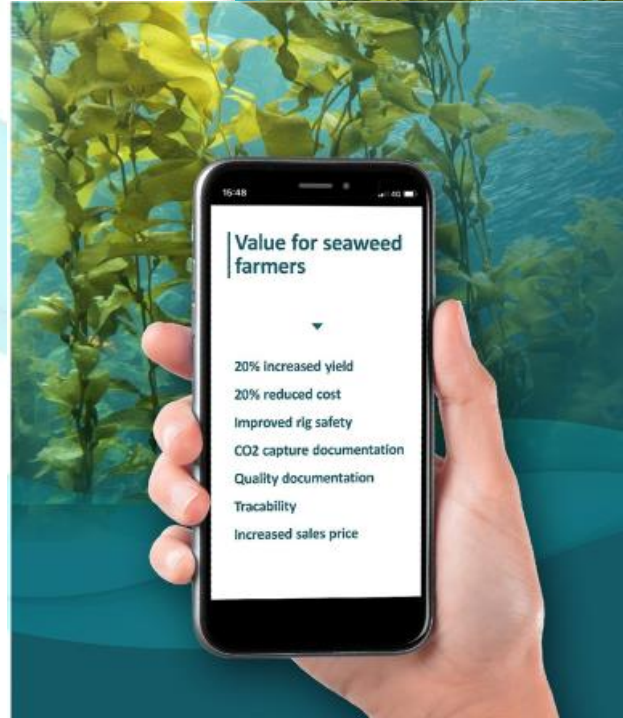


Information sources for Seaweed farm data analysis

Big Data, AI, Sensor packages



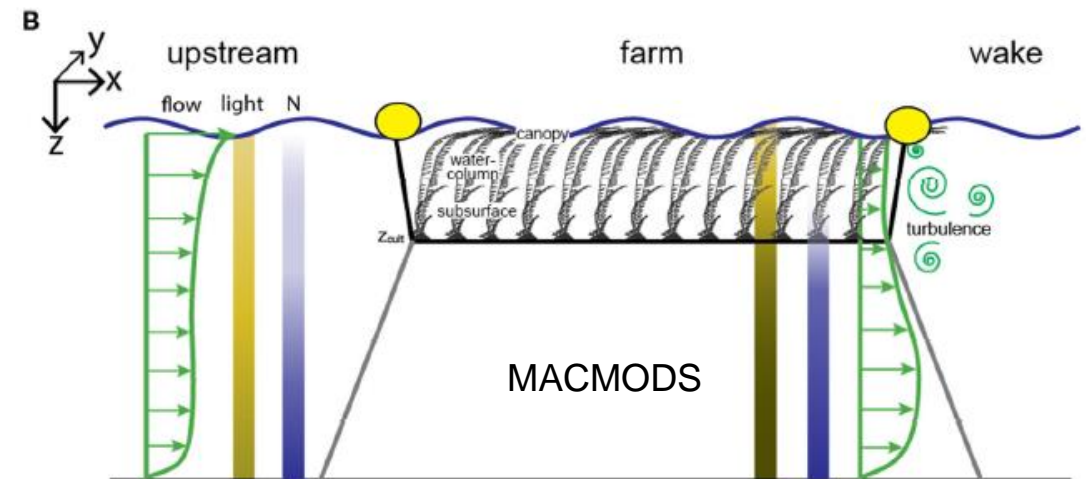
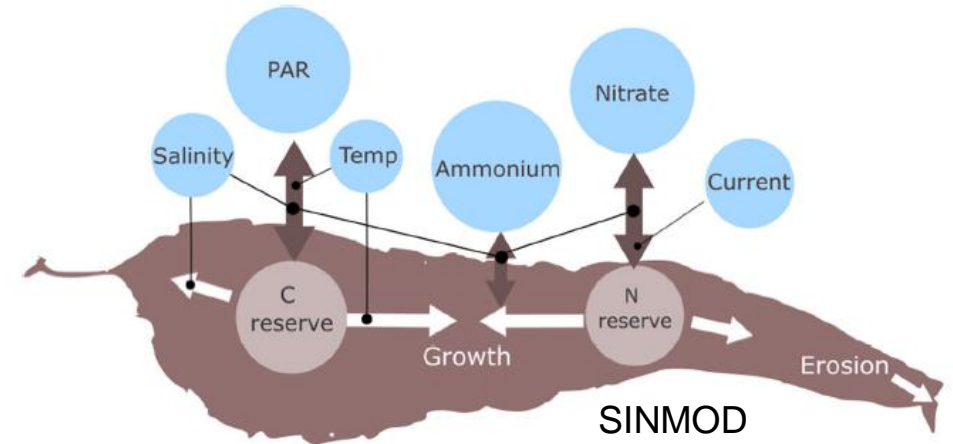
Hardware and SaaS



Models which can be used in ERP

Now need for practical tools which companies can use:

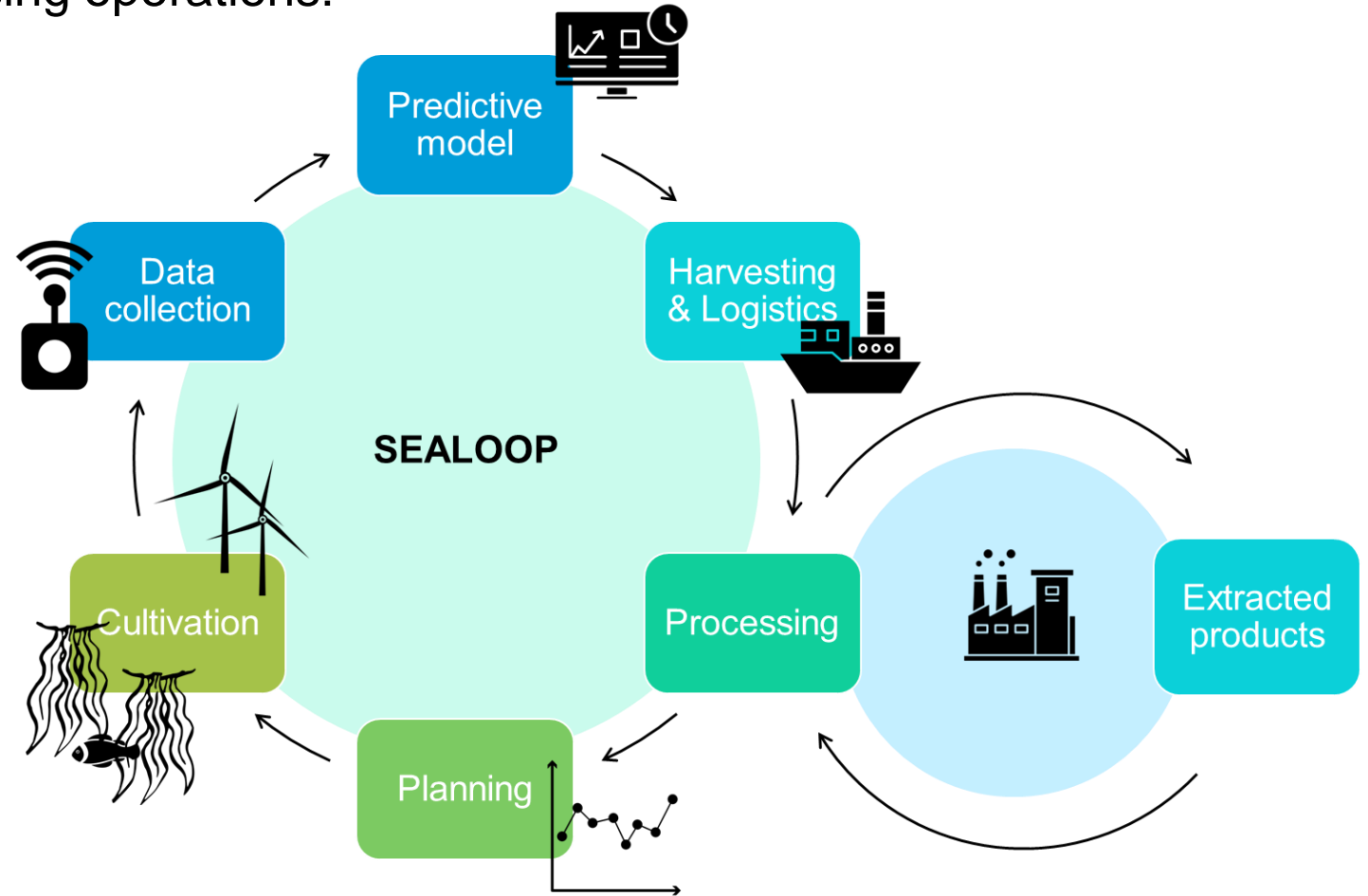
- site selection based on nutrient flux + light
- farm design parameters (density, spacing)
- support permit application (ecosystem impacts)
- operational planning
- predictive tools for yield



SEALOOP: Enterprise Resource Planning

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Summary

- SEALOOP aims to provide an offshore farm management approach
- Key success factor is site selection for year-round production
- Reducing the fouling pressure is mainly controlled by selecting a nutrient high flux – low concentration site
- Challenges we face are building smart mooring/cultivation rigs at a reasonable cost
- De-risking of the cultivation rigs not by increasing security factors but by rig integrity sensing
- Need for predictive tools for crop development and yield

Discussion

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