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SUSTAINABLE NORDIC SEAWEED

Lessons learnt and future approaches on measuring impact on the marine ecosystem related to marco algae cultivation

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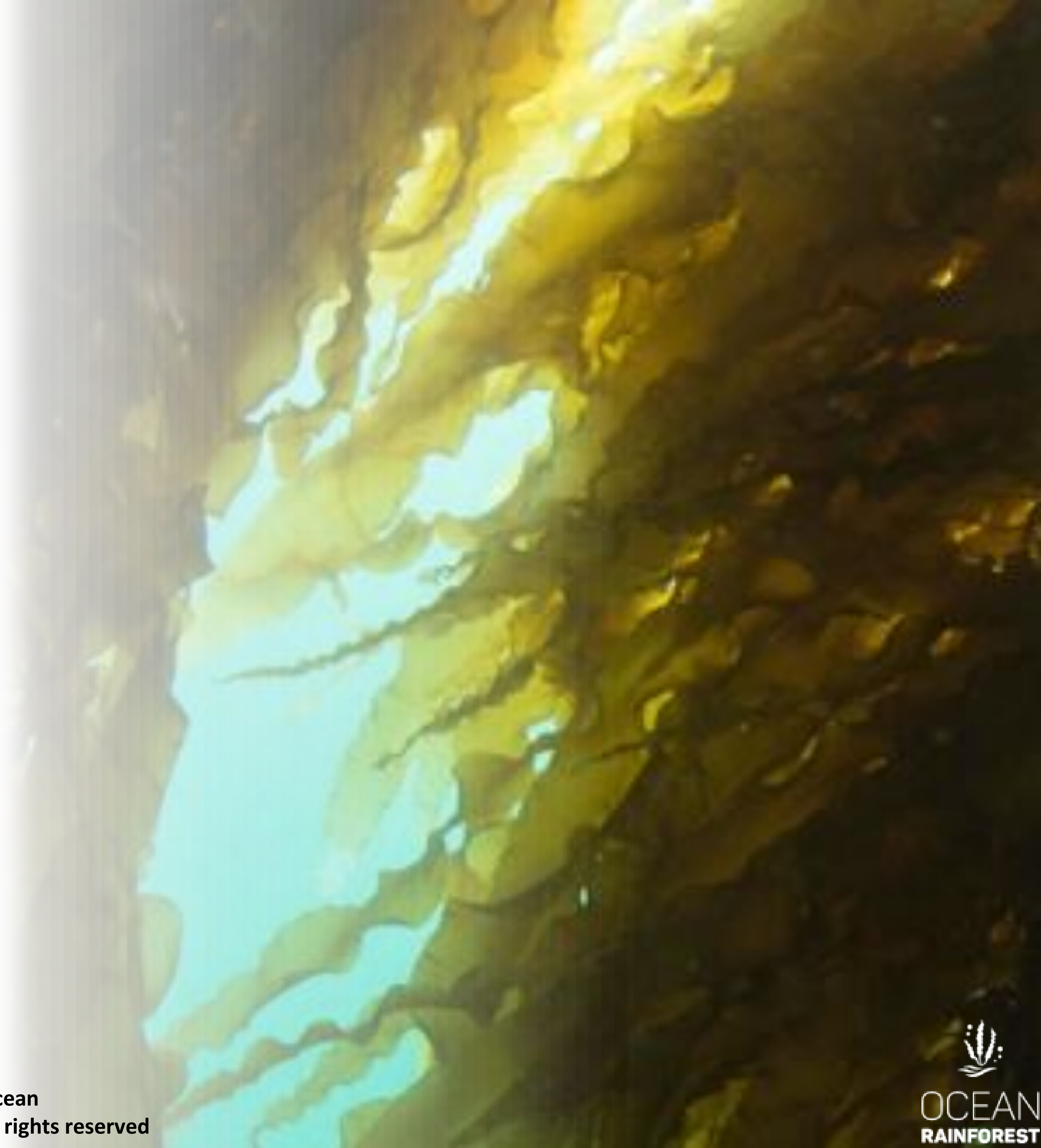
CEO, Ocean Rainforest

March 15, 2023



The pain – and the gain!

PROBLEMS TO SOLVE:

Global shortages of sustainable and healthy feed and food.

To mitigate climate change.

OUR SOLUTION:

Cultivate seaweed as they are among the fastest growing crops on the planet. To grow, they only need sunlight, CO_2 and natural nutrients.

THE MARKET

Increasing demand in Europe and North America to use seaweed in human food, animal feed, as bio stimulants for agriculture, and replacing fossil-based packaging material (bio-plastic).

Sustainably cultivated seaweed

“The potential for providing large quantities of food and biomass from seaweed mariculture is much larger than for any other group of marine organisms.”

Ref. SAPEA 2017 Evidence Review Report, more than 100 European scie nce academies.

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Win-win solutions proving environmental benefits

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13 CLIMATE ACTION

CO_2 uptake

Reduces global heating and acidification of the oceans

14 LIFE BELOW WATER

Creates ecosystems

Provides shelter, nursery habitat and feeding chamber for fish and other marine animals

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

Uptake of nutrients (bioremediation)

No use of land, fertilizer or freshwater

Establishment of a cultivation site

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Feasibility Study	Finite Element Analysis	Front End Engineering Design	Permit processing
Final Rig Configuration	Deployment	Operation (seeding and harvesting)	Monitoring & maintenance

Feasibility Study

Primary parameters

- Current (speed and direction)
- Wave (significant wave heights and length)
- Temperature (mean over year)
- Bathymetry (depth of seawater)
- Benthic environment (sand, mud, rocks, etc.)
- Wind rose and speed (average over year)
- Natural populations (macro algae species)
- Nutrient profiles

Secondary parameters

- Main sailing/shipping routes
- Sanctuary constraints due to habitat/environment
- Marine mammals' behavior in the area

Optimal cultivation conditions for *S. latissima* and *A. esculenta*

Based on the experience of Ocean Rainforest optimal seaweed cultivation requires:

- Water depth between 30-150m (100-500ft)
- A maximum sea temperature of 15 C (59F)
- Exposed with respect to wave (Max 10m significant) and current (max 1.5m/sec)
- At minimum 3 μM for nutrient availability

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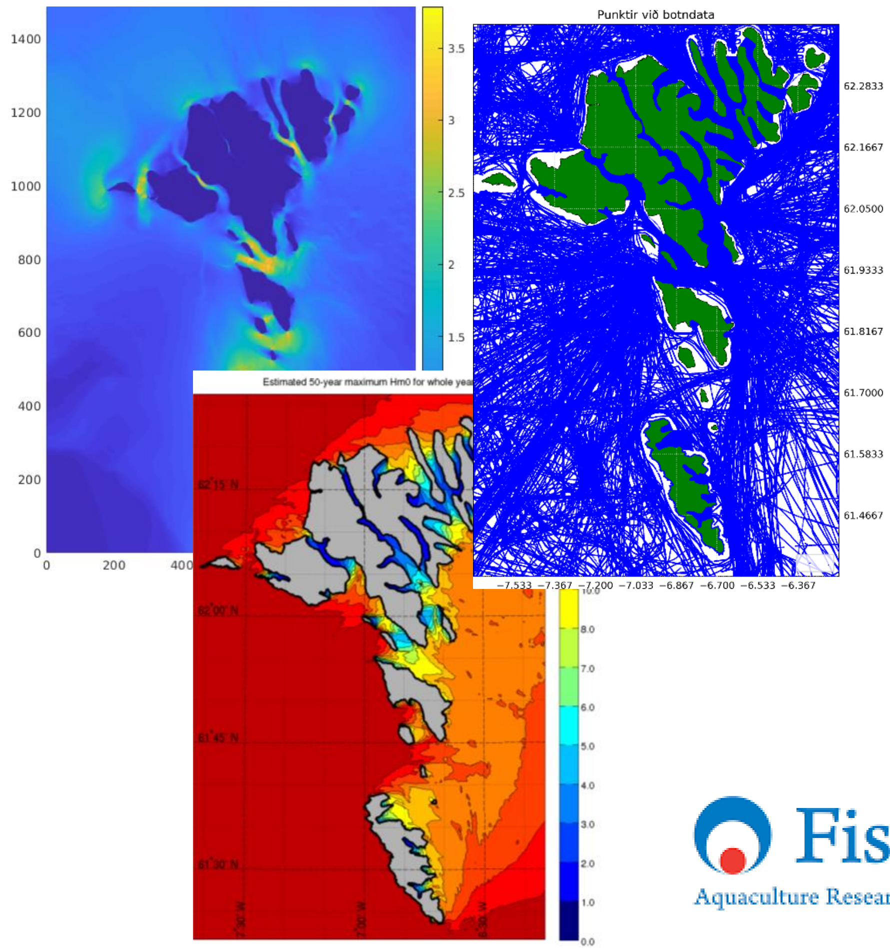
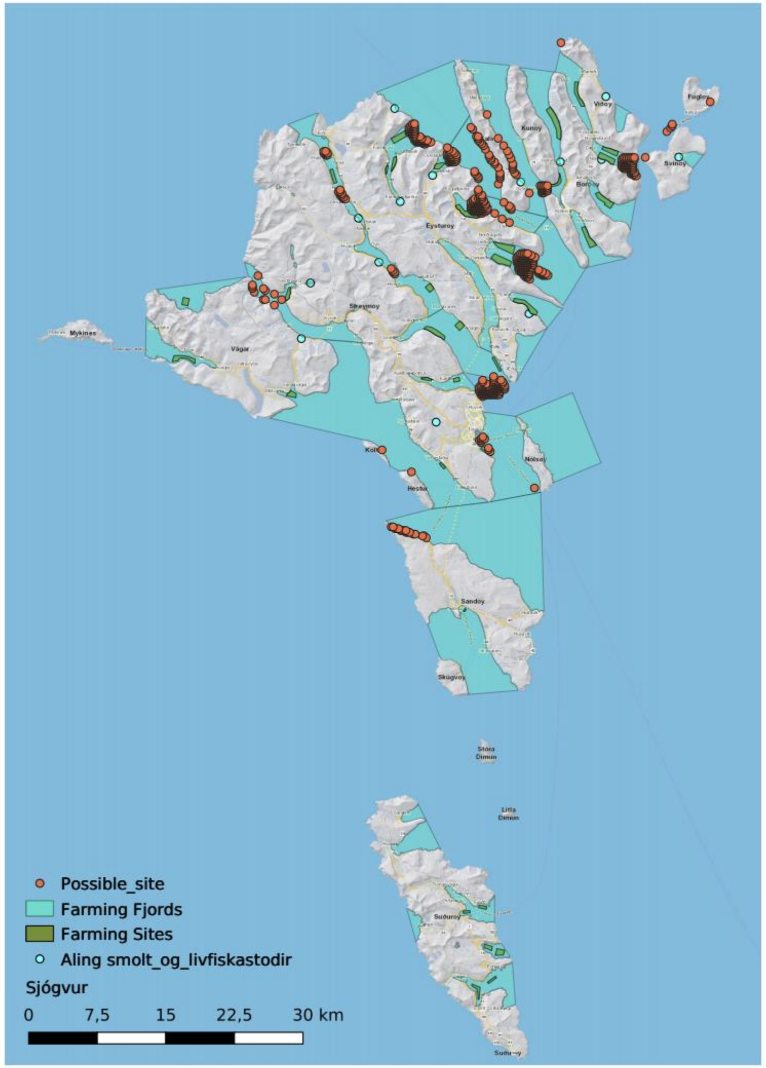
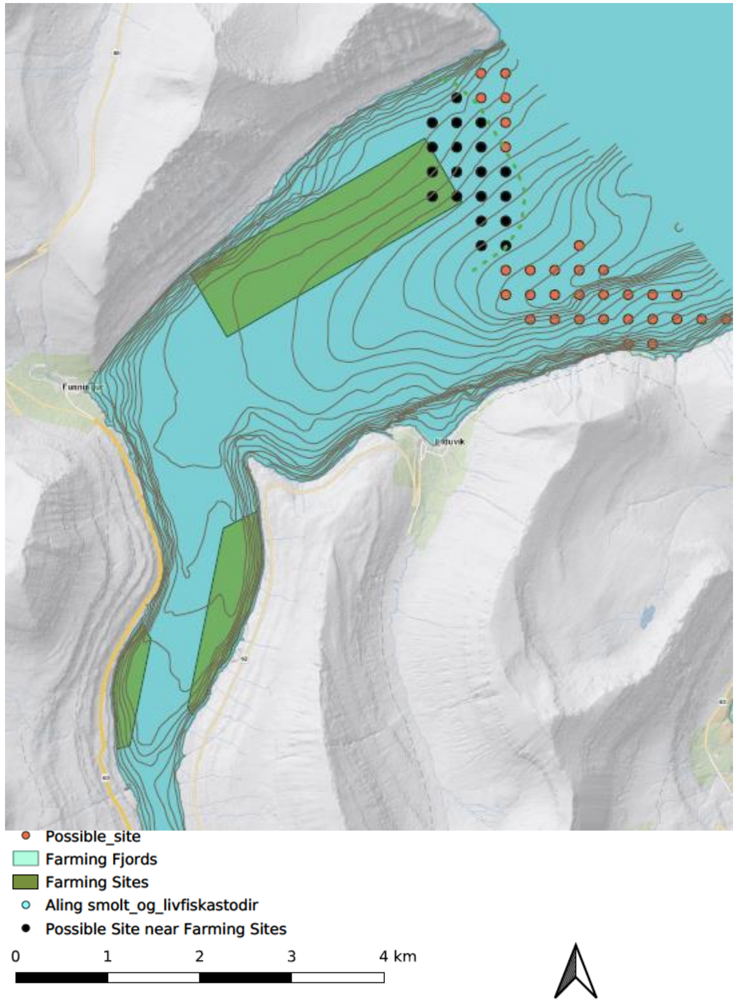
Site selection in the Faroe Islands

- Model for suitable sites based on current, depth and waves.







Fiskaaling
Aquaculture Research Station of the Faroes

AquaVitae

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Front End Engineering Design and permit processing

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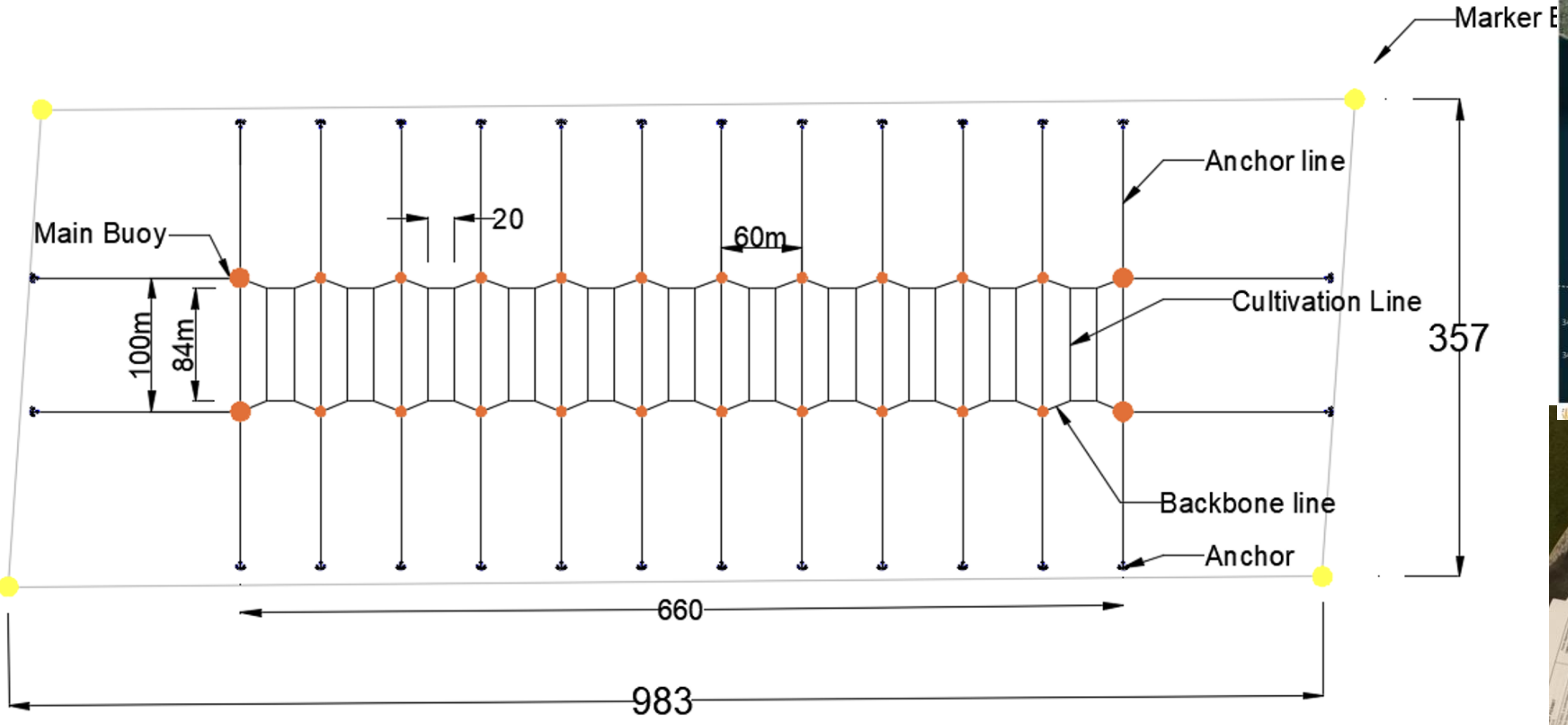

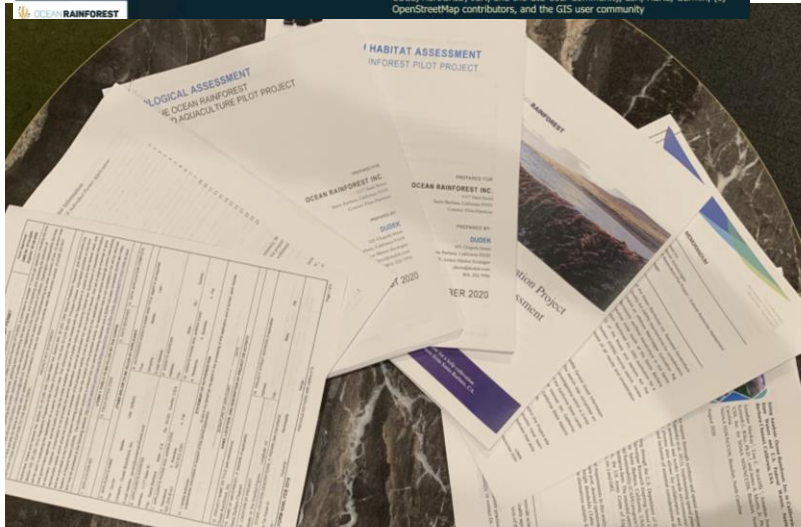

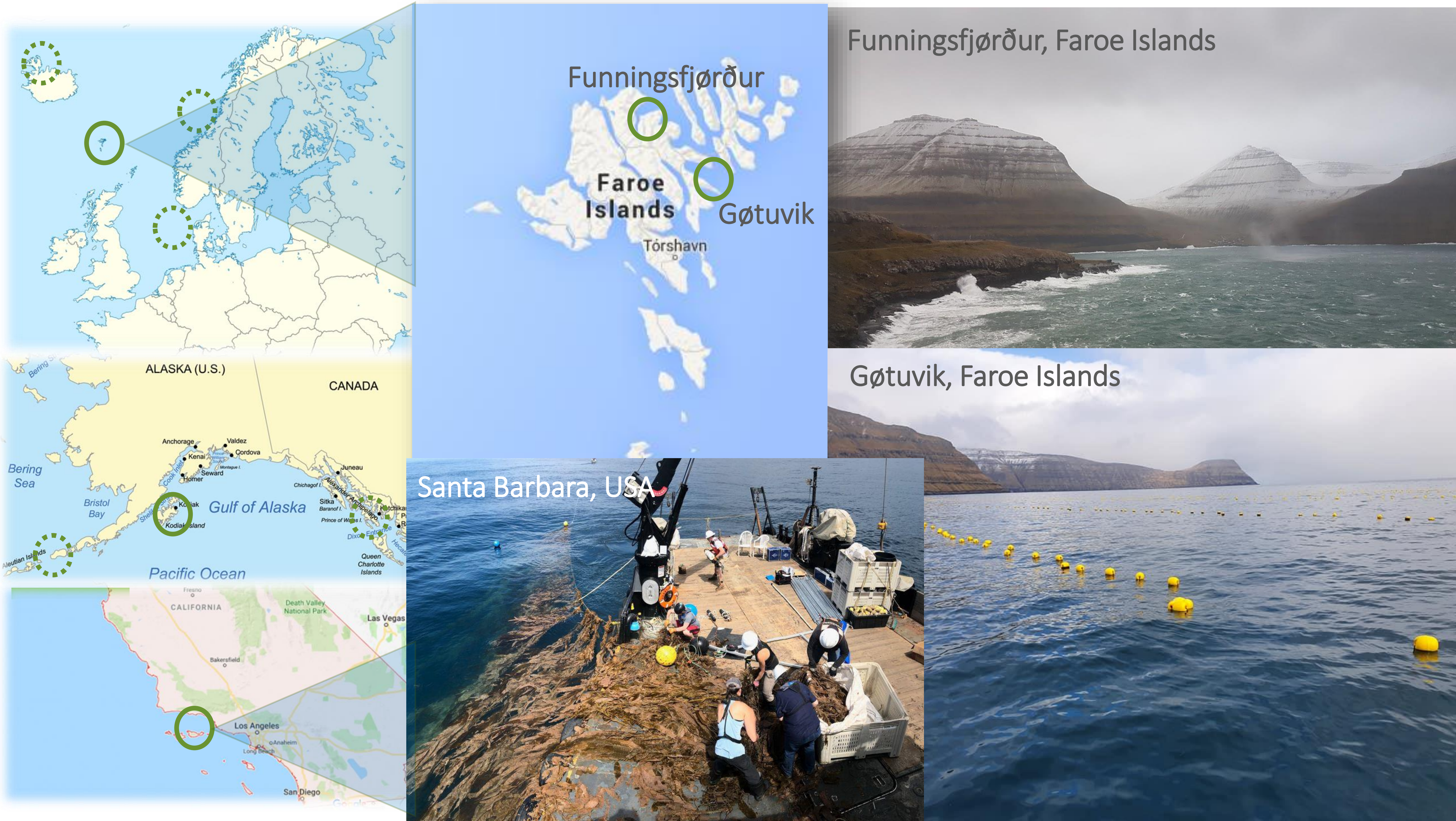

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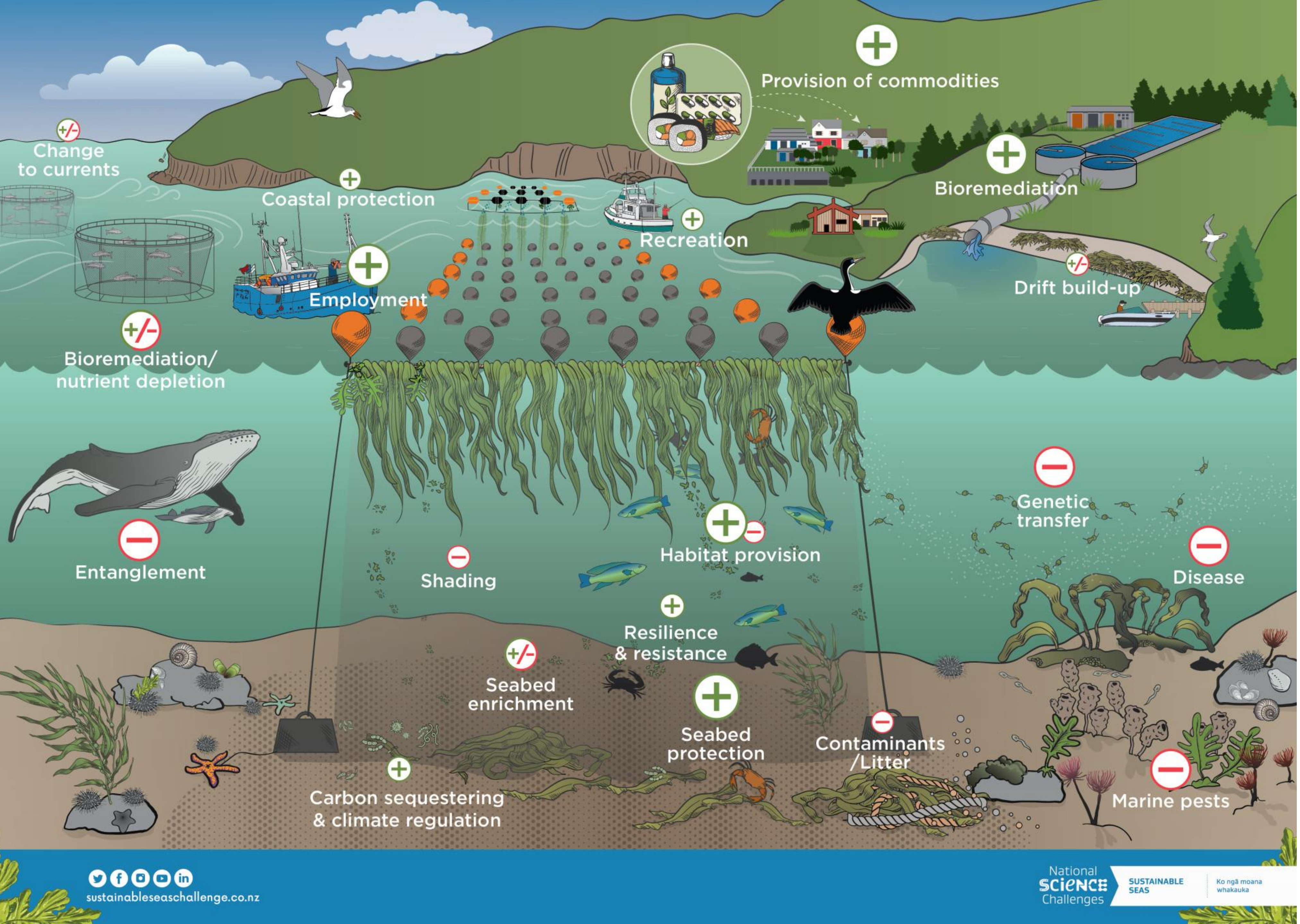
Faroe Islands
Gøtuvik
Tórshavn
Gøtuvik, Faroe Islands
Santa Barbara, USA
ALASKA (U.S.)
CANADA
Bering Sea
Bristol Bay
Anchorage
Valdez
Kenai
Cordova
Seward
Homer
Juneau
Sitka
Gulf of Alaska
Pacific Ocean
Queen Charlotte Islands
CALIFORNIA
Death Valley National Park
Las Vegas
Bakersfield
Los Angeles
Anaheim
Long Beach
San Diego



Possible ecosystem services and negative environmental effects associated with seaweed aquaculture in coastal environments

Source: Stocktake and characterisation of New Zealand's seaweed sector: Environmental effects of seaweed wild-harvest and aquaculture, Graphic by Revell Design

WP9:
Ecosystem services and LCA

WP LEADER: WUR
TASK LEADER: SJOKOVIN – BLUE RESOURCE, OCEAN RAINFOREST
OTHER CONTRIBUTORS: SUBMARINER, ALGOLESKO, ALGAIA, NOFIMA, ALGAPLUS, FERMENTATION EXPERTS,
9TH OF JANUARY 2023, WP LEADER MEETING, ROSCOFF

Co-funded by the European Union

Methodology for data collection for Ecosystem Services (framework)

For ecosystem services (ES):

- An overview of categorized ecosystem services, comparing various categorisations
- An overview of methodologies used to quantify and valuate ES in literature
- Decision process for specific partners to decide and plan the final data collection

This project has received funding from the European Union's Horizon Europe research and innovation programme under Grant Agreement No 101060379

Specific protocol 2: ROV monitoring

Related hazards:

- Inorganic waste as result of seaweed farming practices
- Accumulated algae on the seafloor after harvest

Method

- BACI experiment
- ROV survey before installation and 2 weeks after harvest

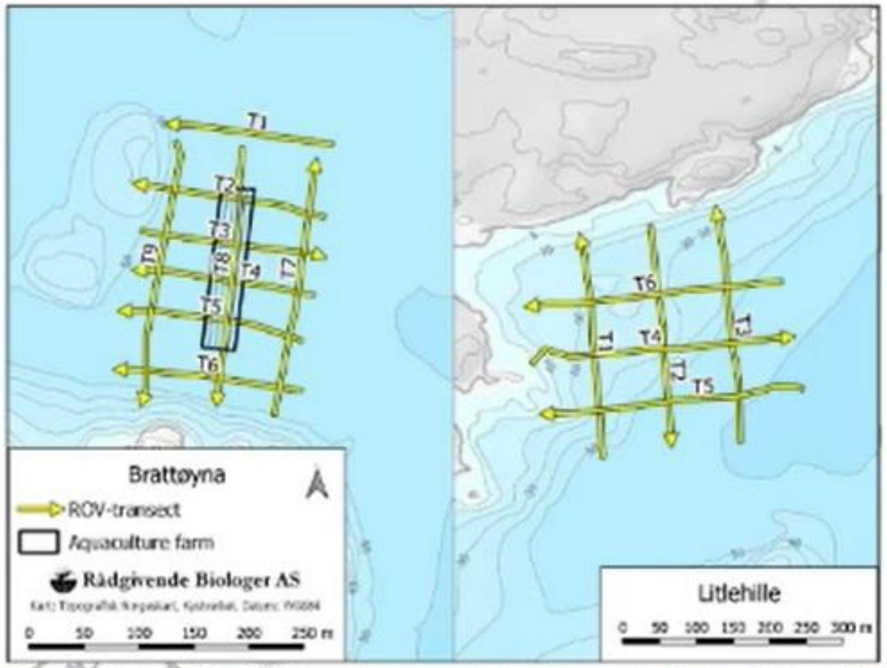


Figure 2. Overview of the ROV-transects carried out at the harvest site, Brattøyna (left), and the reference site, Litlehille (right).

Presented by **Sander Van Den Burg**
Senior Researcher
Wageningen Economic Research, at the International Seaweed Symposium, 2023

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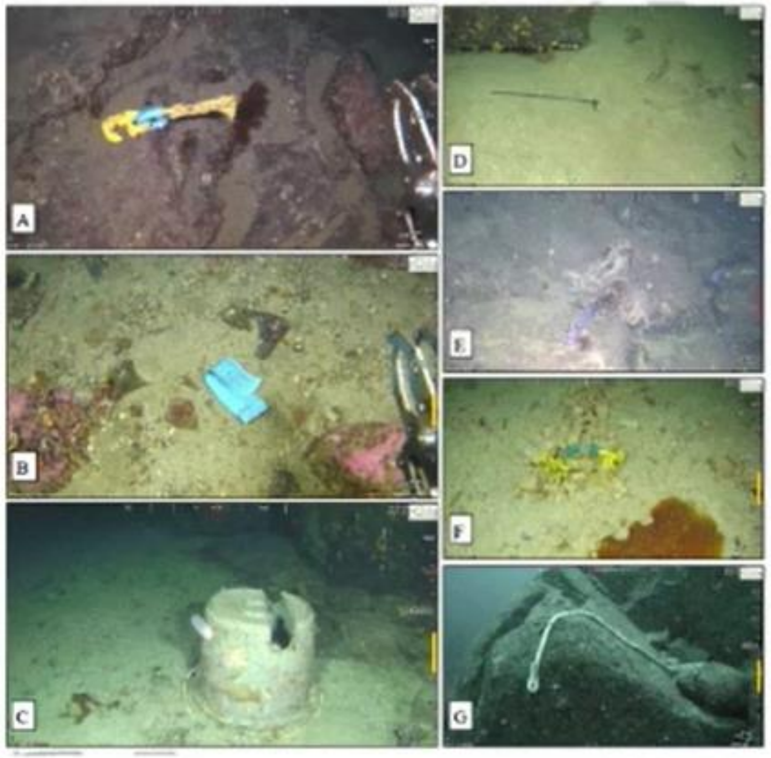
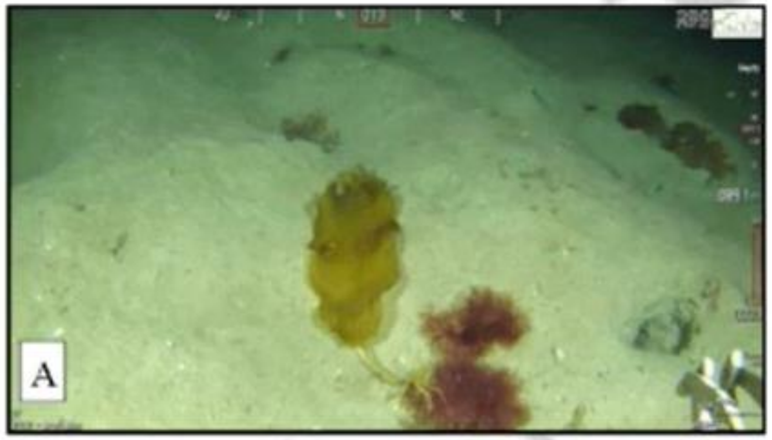
Results

- Debris is present, some can be related to seaweed farming but not all
- Post-harvest winged kelp made up roughly 1/3 of all macroalgae debris on the sea floor,
- Debris registered in the pre-harvest survey were mainly other species of macroalgae.
- Sea bottom underneath the farm did not appear impacted in a negative manner by macroalgae debris.





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Recommendations for this method

Value of the method:

- Established methodology for salmon farming
- Direct insight into inorganic waste

But also:

- Expensive method
- Difficult to find good reference site

Suggested when installing a seaweed farm or adapting design, not regularly

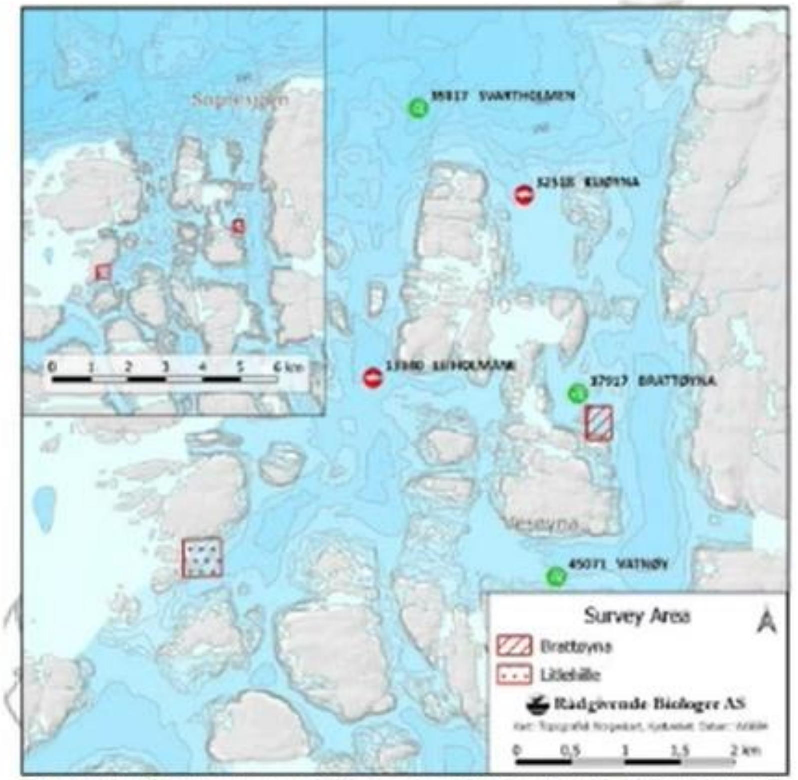

Figure 1. Map of the survey area, with Brattøyna located in the east and Litlehille in the west. The map also shows other aquaculture locations near to the survey site.

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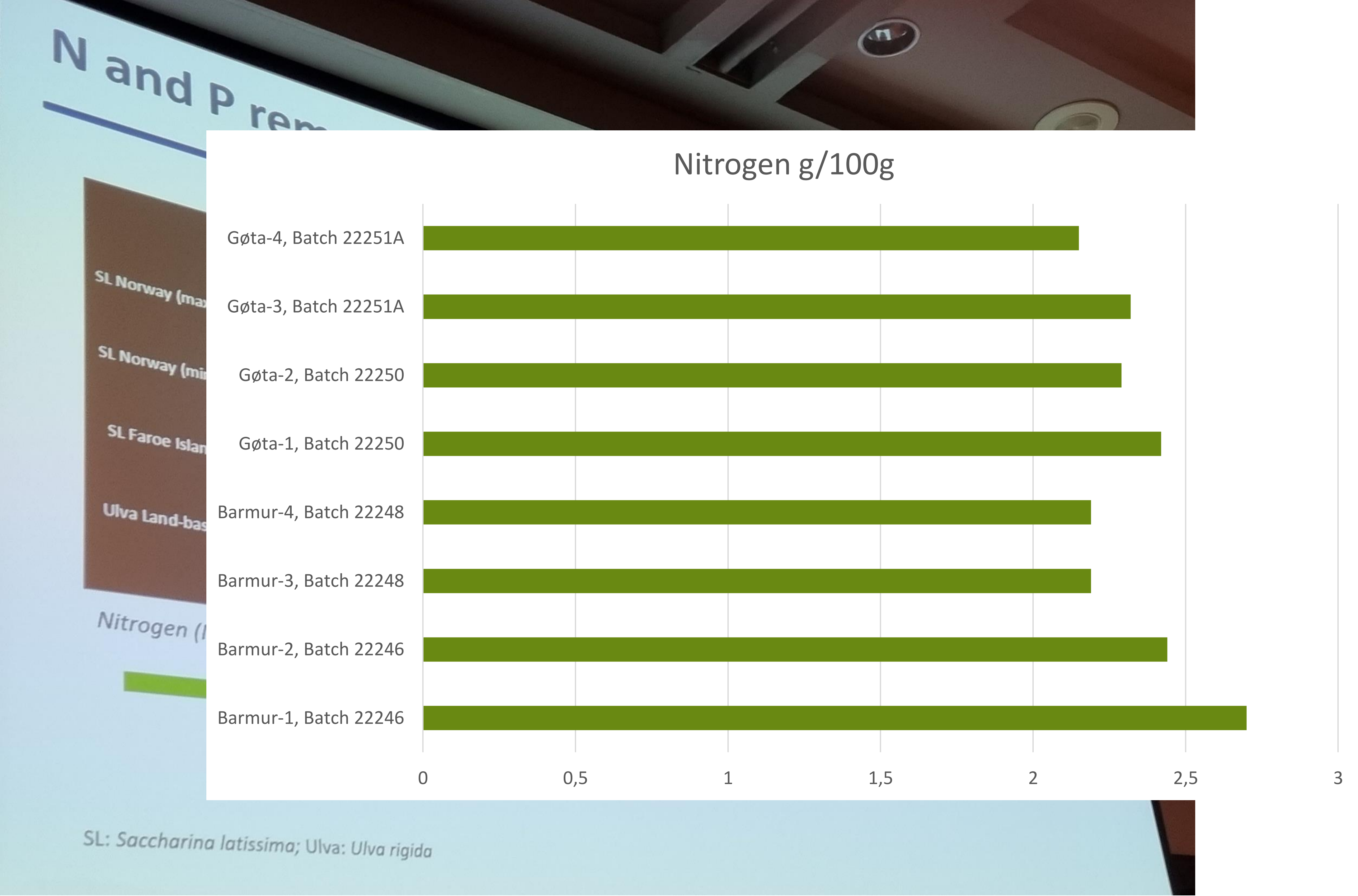

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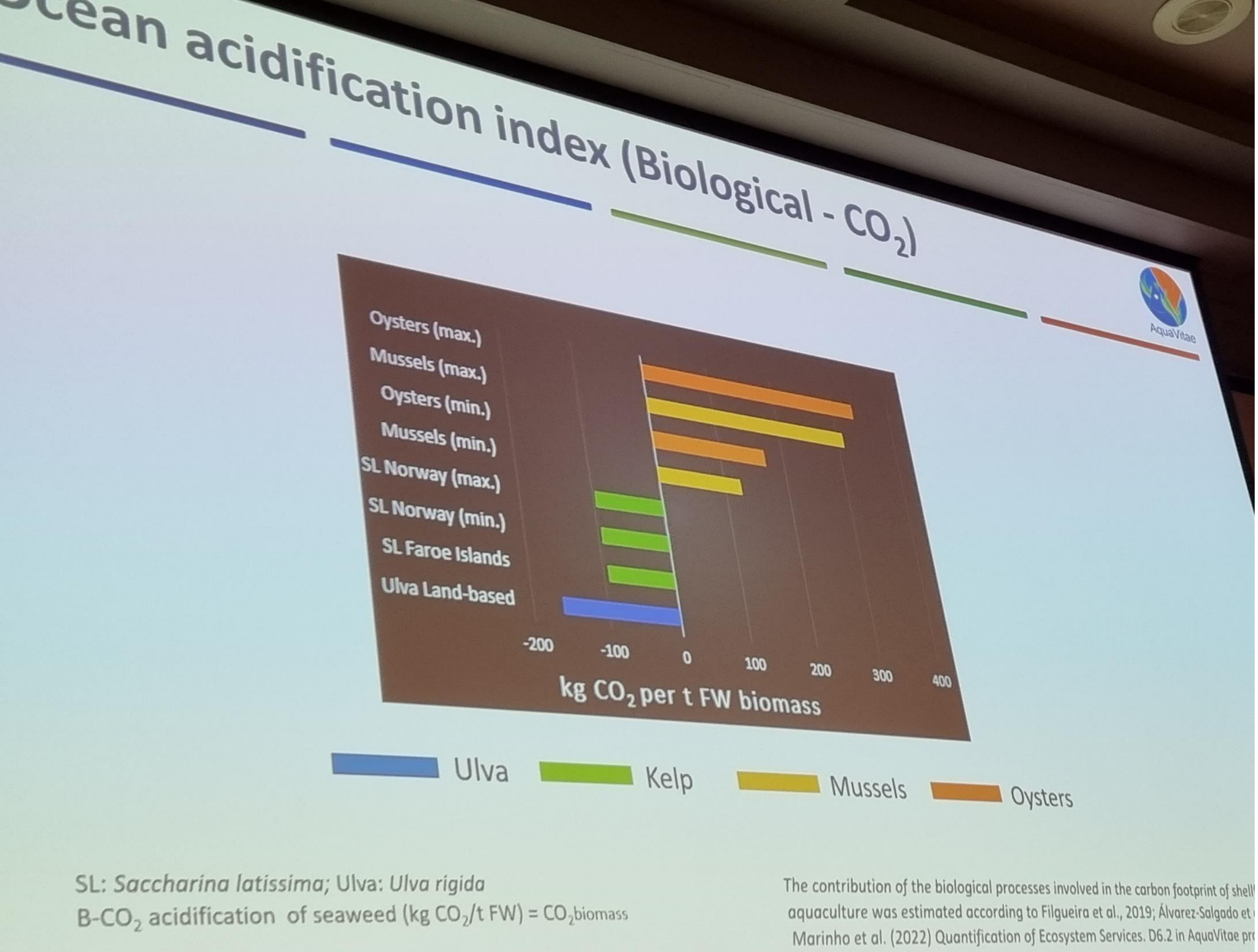

Presentation made at the International Seaweed Symposium, 2023
by Prof. **Isabel Sousa Pinto**
Professor & Group Leader
Ciimar and University of Porto.
Based on the abstract: "**Nature´s Contributions to People derived from seaweed aquaculture**"
Marinho et al.

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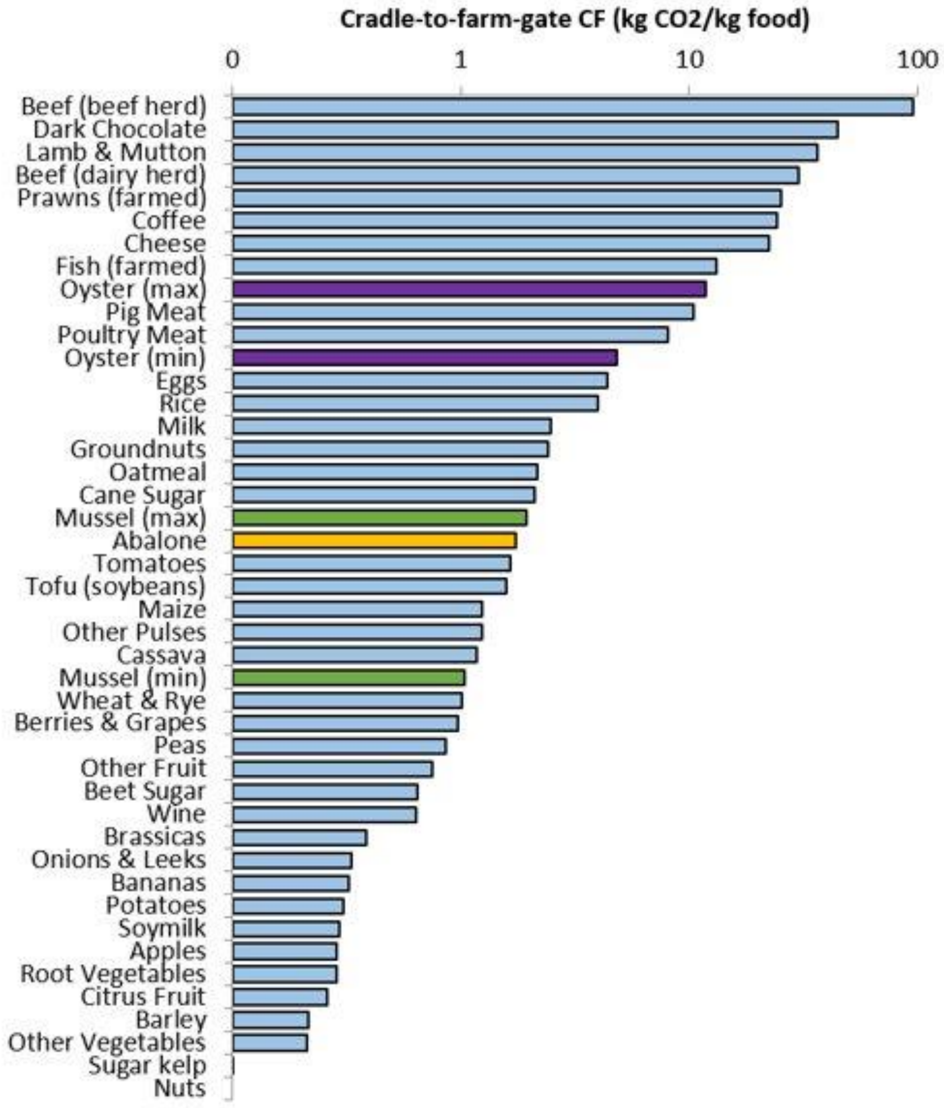
Carbon dioxide footprint of seaweed

Compared to other food production systems, sugar kelp/seaweed (16 gCO_2 per kg of food) reported the lowest carbon footprint, just higher than the CF of nuts and smaller than any other primary production system.



Source: Deliverable 6.2: New species, processes and products contributing to increased production and improved sustainability in emerging low trophic, and existing low and high trophic aquaculture value chains; The Horizon 2020 project Aavitae, 2022.

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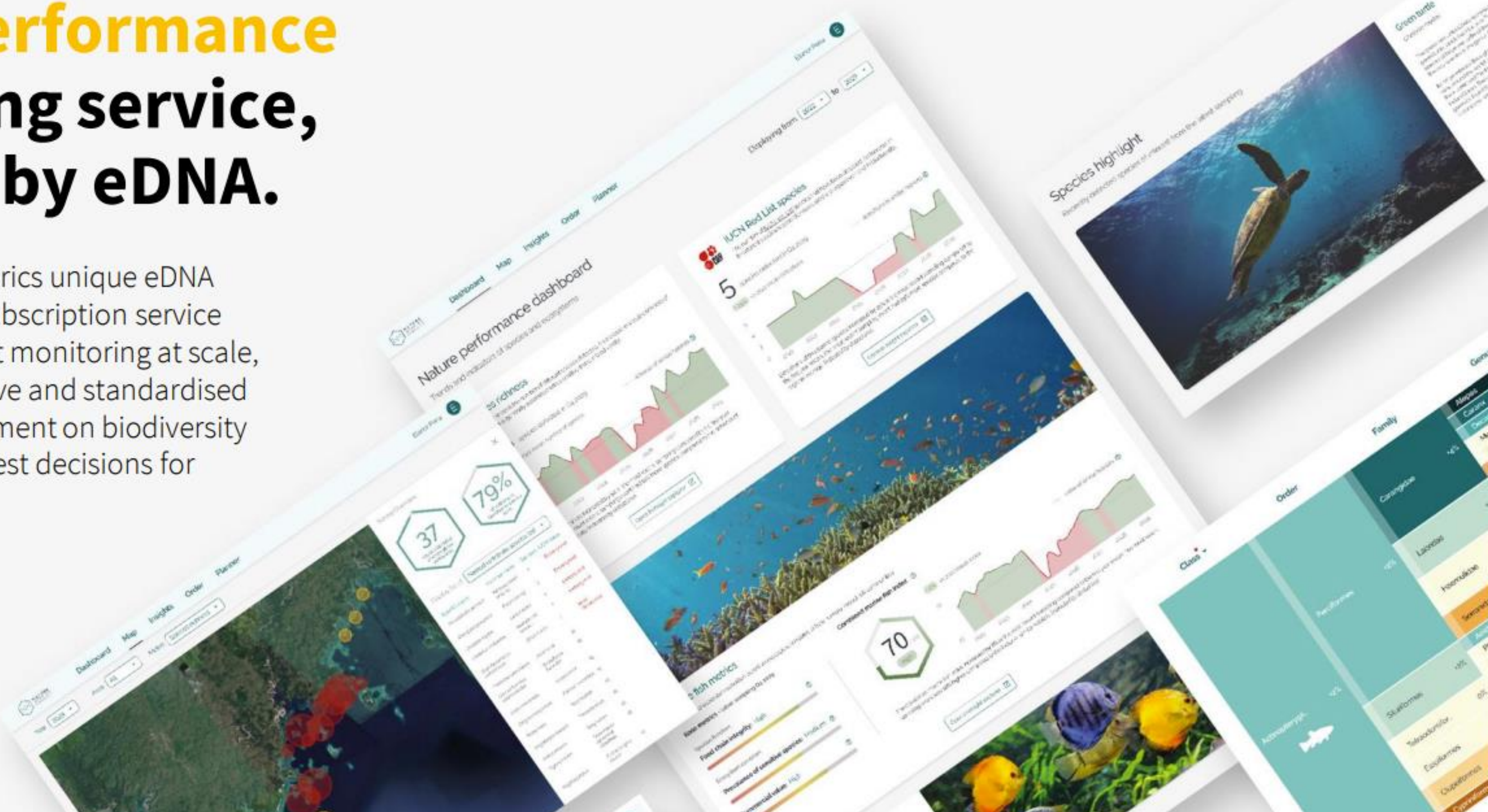
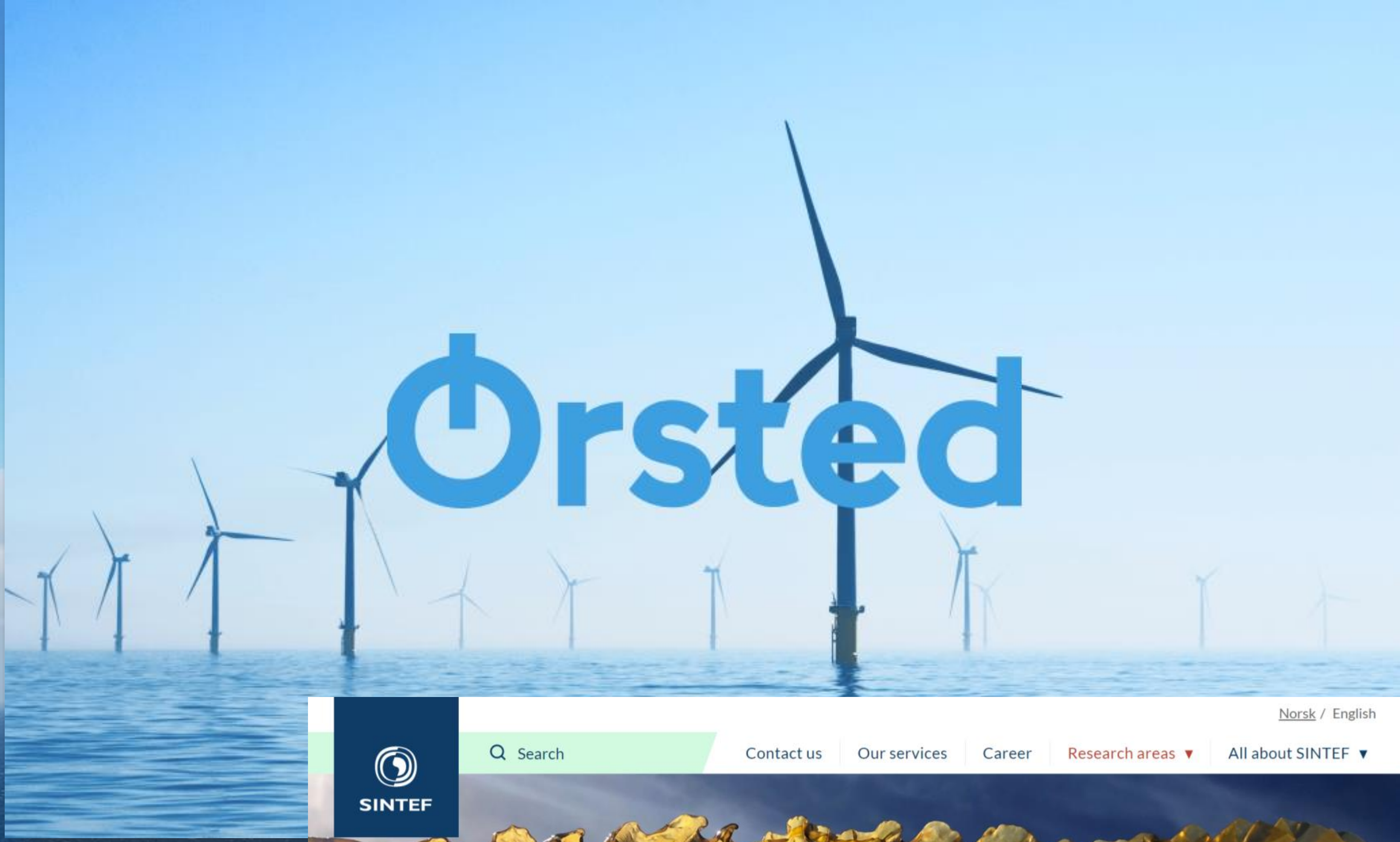
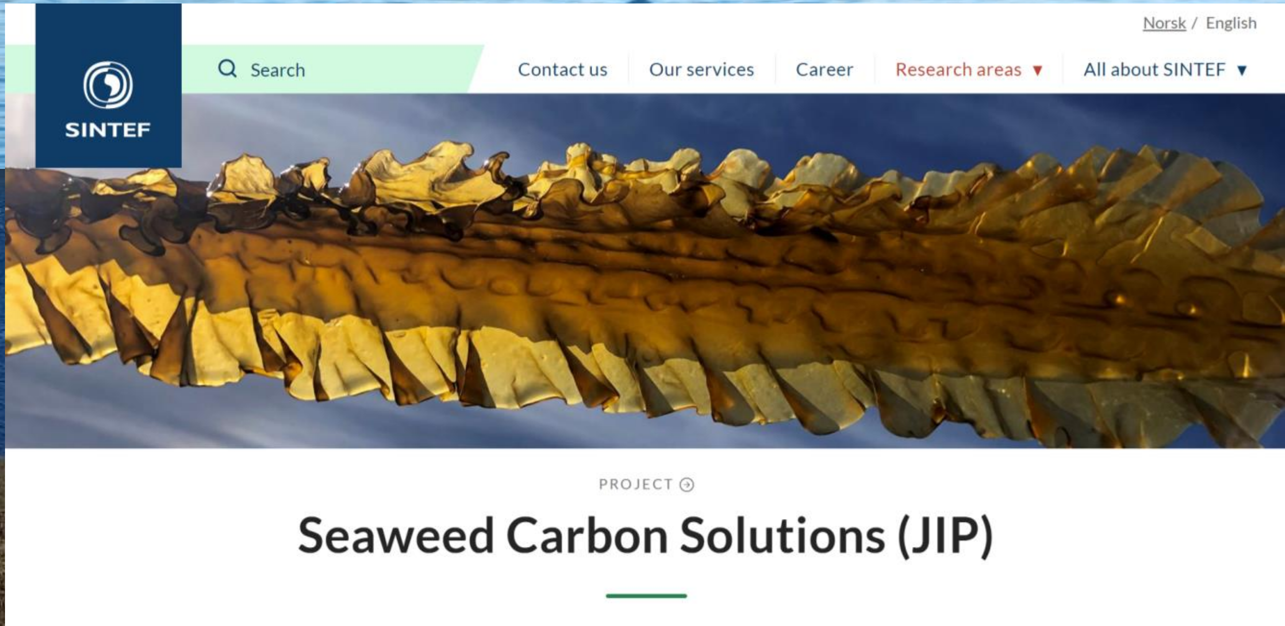
Powered by NatureMetrics unique eDNA technology, the new subscription service provides nature impact monitoring at scale, enabling comprehensive and standardised performance measurement on biodiversity health, to inform the best decisions for business and nature.



The concept of Multiuse





Conclusion

- In general, no negative impact on the marine ecosystem
- Potential positive impact on the marine biodiversity and biostimulants
- Development of measurement procedures in process
- Need of cost effective monitoring and dissemination tools on quantification and valorization of ecosystem services related to seaweed cultivation

Contact

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