AlgeCenter Danmark

14th Nordic Seaweed Conference

From Research to Industry

8-9th October 2025

ALGECENTER DANMARK IS:

- Aarhus University
- Danish Technological Institute
- The Kattegatcentre
- University of Copenhagen

WE WORK WITH:

- Green solutions
- Circular Bioeconomy
- Research
- Business development
- Dissemination

WE FOCUS ON CULTIVATION AND USE OF MACROALGAE FOR:

- Biomitigation of nutrients and CO_2
- Ecosystem Services
- Food
- Feed
- Energy
- Plant health & fertilizers
- Ingredients
- Bioactive components
- Materials
- Art

WE FOCUS ON THE ENTIRE VALUE CHAIN:

- Cultivation & cultivation technology
- Pre-treatment & processing
- Product development
- Legislation

ALGECENTER DANMARK FACTS:

- Established in 2010
- Active industrial network
- Laboratories in Aarhus, Taastrup and Sdr. Stenderup
- Annual international conference in Grenaa: Nordic Seaweed Conference – Macroalgae from Research to Industry
- National and international research and development projects ranging from small projects to large EU projects
- Collaboration with industrial partners ranging from SMEs to large industries, education and research institutions

Wifi: Kursist
Password: Education

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14th Nordic Seaweed Conference

From Research to Industry

Programme Wednesday 8th October:

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11.15 – 11.45 **Keynote:** Vincent Doumeizel, United Nations Global Compact, France.
A seaweed revolution to address the triple planetary crises.

Session 1: Feed
11:45 – 12:00 Mihai V. Curtasu, Aarhus University, Denmark.
Turning an invasive seaweed into a climate solution: the potential of Rugulopteryx okamurae as a methane mitigation strategy in dairy production.
12:00 – 12:15 Thomas Søndergaard Stenum, Maripure ApS, Denmark.
The potential of red seaweed Asparagopsis spp. in bioremediation of fish farm effluent water.
12:15 – 12:30 Klaus Herburger, University of Rostock, Germany.
Algae in ruminant feeding: Microbiological-functional foundations, prebiotic effects, and feasibility of algae cultivation in the German Baltic Sea (Alg4Nut).

12.30 – 13.30 Lunch

Session 2: High Value Compounds
13:30 – 13:45 Maria Paz García-García, Natalia Prieto Vidal, Aarhus University, Denmark.
Green extraction and purification of bioactive fucoxanthin from Nordic brown macroalgae.
13:45 – 14:00 Agus Agusman, Wageningen University, Germany.
Integration of cultivation and biorefinery approaches for sustainable protein production from Palmaria palmata.
14:00 – 14:15 Reina Rozentale, RTU Liepaja Academy, Latvia.
Effect of potassium ions on the properties of furcellaran gels.

Session 3: Consumer Acceptance, Food and Food safety
14:15 – 14:30 Gabriele Torma, Aarhus University, Denmark.
From awareness to adoption: Behavioural insights and the consumer journey for sustainable food innovations.
14:30 – 14:45 Madeleine Jönsson, Kristianstad University, Sweden.
Seaweed on the menu: Turning consumer insights into culinary appeal.
14:45 – 15:00: Trine Kastrup Dalsgaard, Aarhus University, Denmark.
R-phycoerythrin of different purities obtained from Furcellaria lumbricalis tested in extruded food applications.

15:00 – 15:30 Coffee break

Sesion 3: Consumer Acceptance, Food and Food safety, continued
15:30 – 15:45 Brian Andersen, Peninsula Nature, Denmark and Christian Koch, oceanBASIS GmbH, Germany.
How do you seafood?
15:45 – 16:00 Flore Vancoillie, KU Leuven – Laboratory of Food & Lipids, Belgium.
Seaweed as a functional food ingredient.
16:00 – 16:15 Evangelia Zioga, Technical University of Denmark, Denmark.
Taste-sea: Insights and emerging perspectives on seaweed fermentation.
16:15 – 16:30 Susan Løvstad Holdt, Technical University of Denmark, Denmark.
Potential toxic elements in seaweed: New EFSA threshold values and Nordic stakeholder perspectives.
16:30 – 16:45 Caroline Østergaard Klein, Technical University of Denmark, Denmark.
Food safety of lightly preserved kelp.
16:45 – 17:00 Morgan Ræ, Founder, L'eautelier, Belgium/USA.
Welcome to the Seaweed Suite.

17:00 – 18:30 Seaweed Happy Hour

19:00 – 23:00 Seaweed Conference Dinner at the Kattegatcentre, Færgevej 4, 8500 Grenaa
We meet at the hotel lobby at 19:00 and walk together to the Kattegatcentre.

Programme Thursday 9th October:

07.30 – 08.30 Choose between 3 options: Beach run with Teis / Seaweed Safari with Annette and Michael Bo/ PureAlgae company visit. All groups depart from the lobby at 7:30.

08.50 – 09.00 Welcome back
Please, remember to check out no later than 10 o'clock.

Session 4: Seaweed Production, Part 1

09:00 – 09:30 **Keynote:** Silje Forbord, SINTEF Ocean, Norway.
Development of the seaweed industry and R&D in Norway.

09:30 – 09:45 Kim Kristensen, CEO and Founder, Arctic Seaweed AS, Norway.
Leveraging disruptive technology to revolutionize the seaweed cultivation industry.

09:45 – 10:00 Sophie Koch, Sjókovin, Blue Resource, Faroe Islands.
Benefits for biodiversity with seaweed cultivation, a best practice example of Ocean Rainforest on the Faroe Islands.

10:00 – 10:15 Khalid Al Subhi, Sultan Qaboos University, Oman.
Exploring sustainable seaweed aquaculture: A pilot study on seaweed cultivation in Oman.

10.15 – 10.45 Coffee break

Session 4: Seaweed Production, Part 2

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Optimizing Ulva aquaculture for industry: From genes to ecosystems.

11:15 – 11:30 Mette Møller Nielsen, Technical University of Denmark, Denmark.
SMARTTang: Evaluating tube net systems for scalable Saccharina latissima production – From hatchery to harvest.

11:30 – 11:45 Manali Chakraborty, University of Copenhagen Denmark.
Comparative life cycle assessment and techno-economic assessment of coastal seaweed cultivation systems.

11:45 – 12:00 Esben Rimi Christiansen, Pure Algae, Denmark.
Advancing Land-Based Seaweed Hatcheries: The Development of the PUREHATCH Nursery Unit.

12.00 – 13.00 Lunch

Session 5, Seaweed and Environment

13:00 – 13:15 Kiara Franke, Aarhus University, Denmark.
Carbon allocation responses to warming in kelps vary with seasonal thermal regimes.

13:15 – 13:30 Luisa Düsedau, Aarhus University, Denmark.
From shores to sequences: Exploring seaweed diversity and distribution through molecular lenses.

13:30 – 13:45 Lilja Gunnarsdóttir, Marine and Freshwater Research Institute, Iceland.
Recovery of Ascophyllum nodosum after mechanical harvesting.

13:45 – 14:00 Annette Bruhn, Aarhus University, Denmark.
Cultivation of sugar kelp as a marine measure for mitigating eutrophication - Production in large-scale, nutrient removal efficiency, environmental impacts, and economy.

14:00 – 14:15 Jakob Munk Nielsen, Change Ventures, and Camilla Zacho, seabreak, Denmark.
Rethinking venture capital alongside marine restoration.

14.15 – 14:30 Goodbye for now followed by coffee and cake to go

A huge thanks to our sponsors!!

ABSTRACT #1

A seaweed revolution to address the triple planetary crises

Our food systems have reached maximum capacity on land and have now become the biggest contributor to global warming, soils depletion, biodiversity loss, water scarcity, etc.... Still, we have almost 1bn people starving, 215.000 mouths in addition to feeding every day on the planet whilst our land productivity keeps decreasing. Meanwhile our ocean covers 71% of our planet and contributes to less than 3% of our food in calory.

We should become civilized with ocean and stop acting as hunters-gatherers in the stone age. We must cultivate and protect the largest part of our blue planet! If we want to restore them instead of continuing to destroy them, algae, the lowest trophic level in the ocean and the origin of life on our planet is the best place to start.

Seaweed cultivation could be the way to provide sustainable food to our population and our livestock, replace fertilizers and plastics as well as provide innovation in medicine. It could also restore biodiversity in ocean by providing food and habitat to marine life, it can decarbonize our economy and sequester more carbon than any land forest. Eventually it can bring source of revenue, notably to women, in coastal community where fishing resources will keep declining.

With 12.000 very different types of seaweed, still unexplored and offering a wide range of applications, these organisms may well be the greatest untapped resource on our planet and a great source of hope for the next generations to address the most pressing challenges of our time!

For this, we will have to bridge the science gap, increase public and private investment, share knowledge globally and educate people so they understand using seaweed is good for our body and our planet. To achieve all of this, we will need a systemic and a “Neolithic” revolution.

A seaweed revolution!

SPEAKER

Vincent Doumeizel
Senior Advisor, United Nations Global Compact, USA/France.

Vincent is Senior Adviser for Ocean at United Nations Global Compact. After 20 years’ experience in Food systems, Vincent led in 2020 for United Nations, the “Seaweed Manifesto” and in 2024 the plankton Manifesto in a call to advance science on low tropic ocean ecosystems to support addressing the triple planetary crises. In 2021 Vincent co-founded the Global Seaweed Coalition (1st global platform of seaweed stakeholders, 2 000 + members worldwide).

In 2023, Vincent released “The Seaweed Revolution” (Legend Times), now a reference book on seaweed, awarded best environmental book of the year, adapted in comic & children book and translated in many languages. His new book on plankton is set to release in English early 2026 (Legend Times).

ABSTRACT #2

Turning an invasive seaweed into a climate solution: the potential of *Rugulopteryx okamurae* as a methane mitigation strategy in dairy production

Methane from dairy cattle production is a major challenge that requires effective mitigation strategies. Seaweeds are promising due to their bioactive compounds, yet many species remain unexplored. *Rugulopteryx okamurae* (RO), an invasive seaweed in European waters offers opportunity for both controlling an ecological threat and reducing methane emissions in dairy production.

Objective: To examine the anti-methanogenic effects of RO in an in-vitro system simulating the enteric methane fermentation processes.

Methods: Three seaweed samples were collected in Algeciras (Bay of Gibraltar): one *Dictyota dichotoma* (DD) and two RO from different locations (RO1, RO2). Dried biomass was incubated in an ANKOM in vitro system with maize silage (MS) or grass silage (GS) as substrates. Total gas production (TGP) was measured over 48 h, gas composition after 24 h, and volatile fatty acids (VFA) after 48 h.

Results: When incubated with GS, all samples reduced TGP at 24 h and 48 h. RO1 and RO2 lowered CH_4 by 32% and 30%, while DD achieved a 23% reduction. On MS, DD reduced CH_4 by 25%, whereas RO1 and RO2 only by 7% and 5%. Total VFA content did not change upon the addition of DD or RO. Butyric acid was found higher in DD and RO1, while caproic acid was increased in DD, RO1 and RO2.

Conclusion: These preliminary findings suggest RO could be used as a novel feed stuff in dairy cattle, however further research is required for the identification of compounds in RO with anti-methanogenic bioactivity.

SPEAKER

Mihai V. Curtasu
Assistant professor tenure-track, Department of Animal Science, Aarhus University Denmark.

Mihai-Victor Curtasu is an assistant professor tenure-track at Aarhus University Campus Viborg (Denmark). He graduated from AU in 2019 with a Ph.D. degree in animal science where he has focused on molecular nutrition and nutritional metabolomics research. Using non-targeted metabolomics techniques, he has examined the effects of dietary interventions on the nutrition and health status of animals by studying small molecules and metabolic pathways in cells, biofluids, and tissues. Using the same techniques, he is currently examining marine macroalgae and their potential use in animal nutrition and feed additives for methane reduction in cattle.

Authors:
Mihai V. Curtasu[1], Jørgen Ulrik Graudal Levinsen[2], Ricardo Bermejo Lacida[3], Annette Bruhn[2,4]

[1]Department of Animal Science, Aarhus University, Denmark; [2]Department of Ecosciences, Aarhus University, Denmark;[3] Department of Geology and Ecology, University of Malaga, Spain; [4]Center for Circular Bioeconomy, Aarhus University, Denmark

ABSTRACT #3

The potential of red seaweed *Asparagopsis spp.* in bioremediation of fish farm effluent water

SPEAKER

Thomas Søndergaard Stenum
Maripure ApS, Denmark.

Thomas finished his PhD on molecular microbiology at Copenhagen University in 2019. Before joining Maripure in 2024, he worked 4 years as a postdoc at Uppsala University, Sweden. As a senior scientist at Maripure, he is responsible for coordination of all R&D activities as well as communication with external collaborators such as DTU, AU, DTI and Force Technology. As a scientist, he is motivated by answering fundamental questions about nature by also by making a difference in the green transition in food production.

One of the key challenges in land-based fish farming, is the treatment of wastewater high in nitrogen and phosphate. At Maripure we use fish farm effluent water to cultivate red macroalgae. In doing so, we remove nutrients from the water, while at the same time producing high-value products.

One interesting group of red seaweed cultivated by Maripure is the *Asparagopsis*. *Asparagopsis* spp. have a well-proven ability to reduce methane emission from ruminants when added as a supplement in the feed. At the same time, the sporophyte life-stage offers the advantage that it is fast growing, and it is relatively simple to cultivate in land-based tumble culture and to harvest.

We aim at quantifying the nutrient uptake of *Asparagopsis* and at the same time we seek to optimize the culture condition for faster growth and higher yield.

By measuring nutrient content in cultivation water in batch cultures over time, we can estimate the removal rate and quantity. We show that we are able to remove close to all phosphate and in excess of 40% of the nitrogen from the effluent water without any chemical modifications of the water.

Based on the above, we believe that *Asparagopsis* is a strong candidate for bioremediation of fish farm wastewater.

ABSTRACT #4

Algae in ruminant feeding: Microbiological-functional foundations, prebiotic effects, and feasibility of algae cultivation in the German Baltic Sea (Alg4Nut)

SPEAKER

Klaus Herburger
Junior Professor, University of Rostock, Institute of Biological Sciences, Germany.

Since 2023, Klaus Herburger has been a Junior Professor at the Institute of Biosciences at the University of Rostock, Germany. His research focuses on the cell walls of green algae and land plants, particularly their enzymatic remodeling during cell growth and great potential as a sustainable resource. He is also interested in storage polysaccharides and developing imaging techniques for non-invasive glycan detection.

Seaweed farming is a rapidly growing industry as it can yield large amounts of high-quality biomass and has a relatively low carbon footprint.

Recent studies show that supplementing certain macroalgae in ruminant nutrition has health-promoting effects and can reduce rumen-specific methane emissions. Algae contain unique sulphated polysaccharides and other compounds that are converted by microorganisms in the rumen into short-chain fatty acids and bioactive substances. However, the underlying physiological and biochemical processes of algal biomass conversion in the rumen are largely unknown.

Within the Alg4Nut project launched in 2025, we have gathered a multi-institutional consortium to explore the effects of feeding Baltic Sea native algae (*Ulva* sp., *Porphyra* sp.) to cows during the calving period with regard to animal health, nutrient utilization, milk quality, and methane emissions.

A central focus of the project is the systematic and in-depth elucidation of the function of the rumen microbiome in relation to the degradation of algal constituents and the production of health-promoting substances. To identify key organisms and characterize relevant metabolic pathways and metabolites, a wide range of metagenomic and metaproteomic methods will be applied, in combination with classical biochemistry, microbiological cultivation, and high-resolution polysaccharide analysis. Selected key microorganisms and enzymes will be tested for their biotechnological suitability in the conversion of algal polysaccharides.

Moreover, the project will conduct a large-scale feasibility study on open-field algal cultivation in the German Baltic Sea. The project results will form the basis for a new branch of the bioeconomy in the coastal and agricultural region of Mecklenburg-Western Pomerania.

Authors:
Klaus Herburger, Azam Omidi, Fernanda Miyagi Pita, [Alg4Nut consortium]

University of Rostock, Institute of Biological Sciences, Germany.

ABSTRACT #5

Green extraction and purification of bioactive fucoxanthin from Nordic brown macroalgae

SPEAKER

Maria Paz García-García
Postdoctoral researcher,
Aarhus University, Denmark.

Maria Paz García-García is a postdoctoral researcher in the Department of Food Science at Aarhus University. She has a background in Biocatalysis, Green Chemistry, Microbiology, and Biotechnology. Her research focuses on developing greener and more sustainable processes, coupled with the revalorization of biomass within a circular bioeconomy, to reduce the environmental impact of human activities. Her current work centers on algae biotechnology, particularly the green extraction and characterization of bioactive compounds for applications in nutraceuticals and functional foods. She combines laboratory research with teaching and entrepreneurial projects, aiming to translate scientific discoveries into practical solutions.

Brief Introduction: Fucoxanthin, a high-value carotenoid predominantly found in brown seaweeds possesses substantial biological activity and applications in nutraceuticals and pharmaceuticals. Due to its structural complexity, the chemical synthesis of fucoxanthin in industry is not pursued, and its production is mainly focused on extraction from brown algae. Conventional solvent-based extraction methods possess environmental and operational drawbacks including the use of high amounts of organic solvents, generation of hazardous and toxic waste, as well as elevated energy use and time-consuming extraction times. Advanced extraction methods using polar green solvents offer a cleaner and sustainable alternative to extract fucoxanthin while preserving its bioactivity and minimizing the ecological impact.

Objective: This study aims to compare the extraction efficiency and purification strategies for bioactive fucoxanthin from *Saccharina latissima* and *Sargassum muticum*, brown alga found in Danish coasts, by using three different advanced, eco-friendly extraction methodologies.

Methods: Hence, ultrasound-assisted extraction (UAE), microwave-assisted extraction (MAE) and bead-mill extraction (BME) using ethanol as green solvent were used and the total carotenoid content, fucoxanthin content and bioactivity was compared to traditional extraction by using a multimodal approach of spectrophotometric and chromatographic (HPLC-DAD) techniques.

Results: For all the extractions, downstream processing and fucoxanthin purification was developed using solid phase extraction (SPE) obtaining purified extracts with high amounts of fucoxanthin. This purified fucoxanthin was tested for antioxidant capacity by DPPH assay, with promising results compared to traditional extraction method.

Conclusion: Integrating eco-friendly extractions and purification steps within a biorefinery framework enables the valorization of algae biomass, contributing to circular economy principles and sustainable production of bioactive compounds. This holistic approach not only maximizes the recovery of fucoxanthin but also unlocks new opportunities for the sustainable exploitation of marine resources.

Authors:
Paz García-García, Natalia Prieto Vidal,
Aarhus University, Denmark

ABSTRACT #6

Integration of Cultivation and Biorefinery Approaches for Sustainable Protein Production from *Palmaria palmata*

SPEAKER

Agus Agusman
Wageningen University, The Netherlands.

Agusman, originally from Indonesia, has a strong passion for seaweed utilization. He earned a Master's degree in Marine Biotechnology from Xiamen University, focusing on *Ulva*. Agusman have over five years of experience in tropical seaweed research (*Kappaphycus, Ulva, Gracilaria, Sargassum*) for hydrocolloid. He has worked as a junior researcher at the Research and Innovation Agency of Indonesia. He is currently pursuing a Ph.D. in Bioprocess Engineering at Wageningen University, focusing on *Palmaria palmata* as a sustainable vegan protein source and improving protein extraction processes.

Introduction: *Palmaria palmata* (dulse) holds promise as a sustainable marine vegan protein source. However, efficient protein extraction remains challenging due to its dense cellular structure and complex cell walls. Our microscopy studies suggest that these structural barriers, shaped during biomass development, can potentially be manipulated through targeted cultivation strategies to enhance protein recovery.

Objective: This study investigates whether upstream cultivation conditions can influence biomass quality and improve protein extraction efficiency by assessing the effects of nutrient regimes and cultivation duration.

Methods: Gametophytes of *P. palmata* were cultivated under controlled conditions with varying nitrogen-to-phosphorus (N/P) ratios (250:1, 24:1, 8:1) over an eight-week period. Growth rates, protein content, and sugar composition were monitored. Biomass harvested at weeks 4, 6, and 8 underwent enzyme-assisted and alkaline extraction, with wild-harvested biomass serving as a control.

Results: Nutrient conditions significantly impacted both growth and biochemical composition. Lower N/P ratios (24:1 and 8:1) promoted higher specific growth rates, while a higher N/P ratio (250:1) enhanced protein content. Shorter cultivation periods yielded biomass more amenable to protein extraction via both enzymatic and alkaline methods. In contrast, prolonged cultivation led to reduced extractability, likely due to increased cell wall complexity and cell density.

Conclusion: This study demonstrates that upstream cultivation strategies directly affect the downstream biorefinery potential of *P. palmata* for protein production. Integrating optimized cultivation practices with targeted extraction processes is key to developing sustainable, seaweed-based protein supply chains.

ABSTRACT #7

Effect of potassium ions on the properties of furcellaran gels

SPEAKER

Reina Rozentale
RTU Liepaja Academy, Latvia.

Reina Rozentale is a bachelor's student at Riga Technical University Liepaja Academy. She is currently involved in a project focused on the application of algae-based materials, with emphasis on *F. lumbricalis*. Her work explores the modification and enhancement of furcellaran gel properties through the use of additives, such as potassium ions.

Furcellaran is a natural polysaccharide extracted from the red algae *Furcellaria lumbricalis* of the Baltic Sea. It is a hybrid carrageenan consisting of κappa (κ) and beta (β) carrageenans. Due to its unique gelling properties, furcellaran is widely used in the food, cosmetic, pharmaceutical, and biotechnology industries. Modification of these properties can expand its application potential as a renewable and locally available resource.

This study investigates the influence of potassium ions on the rheological properties of furcellaran gels.

Furcellaran was extracted from *F. lumbricalis* collected along the Liepāja coast and compared with industrially produced Est-Agar furcellaran. Gel samples (1% w/v) were prepared with potassium chloride at concentrations of 0.2%, 0.6% and 1%. Rheological properties were measured using a SmartPave 102 rheometer at 20 °C by evaluating storage (G′) and loss (G″) moduli to determine gel stiffness and viscosity depending on added concentration of ions.

Est-Agar gels became progressively stronger with a higher KCl concentration, while local furcellaran showed maximum strength at 0.2% KCl, declining at higher concentrations.

Potassium concentration influenced gel stiffness and viscosity differently in industrial and local furcellaran. These differences suggest that potassium concentration and environmental origin of the *F. lumbricalis* influence its gel behavior. These results highlight the potential to tailor gel properties through added ions.

ABSTRACT #8

From Awareness to Adoption: Behavioural Insights and the Consumer Journey for Sustainable Food Innovations

Brief Introduction: Seaweed holds great potential for sustainable food systems, yet consumer adoption remains limited. As with many novel, unknown or unfamiliar food innovations, success depends not only on product development, but on understanding how people perceive, engage with, and ultimately adopt unfamiliar foods over time.

Objective: This presentation introduces selected concepts and methods from recent projects on consumer behavior and multifunctional land-use innovations, with the aim of informing future research and strategy development for seaweed-based foods.

Methods: I draw on three conceptual lenses: (1) the innovation adoption curve and its implications for early vs. mainstream consumers; (2) the COM-B model, emphasizing capability, opportunity, and motivation in behavior change; and (3) the consumer journey approach, which explores how repeated exposure and product experience shape acceptance. These frameworks have been applied in studies on upcycled food and agrivoltaic systems.

Results: While not based on a seaweed-specific study, findings from related domains show that adoption is influenced by perceived familiarity, trialability, and alignment with existing habits. Methodologically, consumer journeys offer powerful tools for identifying drivers and barriers and tailoring communication.

Conclusion: By adapting proven theories and participatory methods, we can better support the market integration of regenerative food innovations like seaweed. We plan future studies to explore these approaches in seaweed contexts to design more targeted and scalable consumer strategies.

SPEAKER

Gabriele Torma
Assistant professor, Department of Management, Aarhus BSS, Aarhus University, CBIO & MAPP Centre, Denmark.

Gabriele Torma, PhD, is a researcher at Aarhus University's Department of Agroecology. Her work bridges consumer behavior, stakeholder engagement, and innovation adoption in the context of the green transition. With a background in business engineering and a PhD in Social Sciences, she has led research in EU, Innovation Fund Denmark, and GUDP-funded projects on multifunctional land use, biodiversity metrics, and upcycled food. She combines experimental and qualitative methods—including virtual reality, AI-assisted chatbots, and persona-based consumer journeys—to investigate how social acceptance can accelerate sustainable system change. Currently, she is developing a network to understand consumer adoption of seaweed-based products.

ABSTRACT #9

Seaweed on the Menu: Turning Consumer Insights into Culinary Appeal

SPEAKER

Madeleine Jönsson
Postdoctoral researcher,
Kristianstad University, Sweden.

Madeleine is a Post Doctoral researcher in Food and Meal Science at Kristianstad University, Sweden. Her research delves into how novel foods are perceived through sensory and consumer analysis. Food perception is a multifaceted area, shaped not only by organoleptic characteristics, but also by cultural, traditional, ideological, physiological, and environmental factors.

Madeleine has gained valuable insights from studying seaweed in Sweden, Iceland, and Japan. Her doctoral research at Lund University explored seaweed as food in emerging markets, from production to consumption. Madeleine's favorite seaweed dish is breaded tofu with mashed potatoes and roasted seaweed chips!

Despite growing interest in seaweed as a food in Western societies, it is still not part of everyday meals for most people. By combining consumer insights with sensory perceptions, this presentation aims to explore consumers' knowledge and attitude toward seaweed and demonstrate how small culinary tweaks can make a big difference in its sensory qualities.

A cross-sectional online survey (n=199) was conducted to assess awareness, attitudes, and usage of seaweed among Swedish adult consumers. Subsequently, sensory profiling using a trained panel (n=5; Quantitative Descriptive Analysis) and GC-MS were used to evaluate the effects of gentle preparation techniques, including pickling and brining, on the sensory attributes of *Ulva fenestrata.*

Findings revealed strong consumer interest in seaweed, driven by perceptions of good taste, quality, sustainability, and texture. Seaweed was commonly associated with saltiness, umami, and fresh sea notes, and was preferred in savory dishes from South/East Asian, Nordic, or Mediterranean cuisines.

However, consumers expressed a need for better availability, advertising, and knowledge about seaweed and preparation techniques, including hands-on recipes. In response, pickled and brined preparations were developed. While brined samples resembled untreated controls, those treated with acetic acid or apple cider vinegar showed reduced "fishy" and green notes, bitterness, and chewiness—enhancing overall palatability.

These consumer insights can guide the algae sector toward improved food innovation, consumer education, and market strategies. Mild culinary treatments can improve the sensory appeal of seaweed, making it more accessible and acceptable to a broader range of consumers and food contexts.

ABSTRACT #10

R-phycoerythrin of different purities obtained from *Furcellaria lumbricalis* tested in extruded food applications

SPEAKER

Trine Kastrup Dalsgaard

Professor, Department of Food Science, Aarhus University, Denmark.

Trine Kastrup Dalsgaard is Professor in sustainable food systems. She is heading a group working with alternative protein and natural colorants at the Department of Food Science at Aarhus University where seaweed has been a part of the strategy both within protein and natural colorants.

Brief Introduction: The unique spectral visual properties and water solubility makes R-phycoerythrin a promising natural colorant for food applications.

Objective: The objective was to understand how different purification and staining strategies of R-phycoerythrin affect its color and stability in stained plant extrudates.

Methods: Plant extrudates were stained with different purities of R-PE from *F. lumbricalis* and evaluated with respect to color stability of different purities of R-PE during cold storage in light and dark conditions. Furthermore, the color stability of R-PE during extrusion and in stained meat analogs before and after frying was investigated. The storage stability was evaluated based on the staining with R-PE (crude extract, membrane filtration and multi-step ammonium sulphate precipitation) with beetroot pigment as a reference and at different hydration temperatures (40 and 60 °C).

Results: R-phycoerythrin stained extrudates preserved their structure and color throughout storage without light exposure, unlike beetroot-stained ones, which displayed color changes ($\Delta E^*ab > 5$) while keeping their structure intact. The storage stability of R-PE stained extrudates differed based on the R-PE purity, both in light and dark conditions, and also varied with hydration temperature during light exposure. The addition of different purities of R-PE and beetroot pigment during extrusion with expansion resulted in lower color retention in all the resulting extrudates except in the extrudates without expansion.

Conclusion: R-phycoerythrin stained extrudates showed higher color stability during storage than beetroot color stained extrudates.

ABSTRACT #11

How do you seafood?

Christian Koch
Managing director, oceanBASIS GmbH, Germany.

Brian Andersen
Peninsula Nature, Denmark.

We are facing a growing global population and must change our consumer habits to move in the right direction. Seaweed is a key player in this shift. Our mission is to raise awareness of seaweed in the culinary world and to influence Danish and German food cultures. While changing food cultures takes time, we believe that by introducing seaweed as a nutritious and sustainable alternative, we are taking a meaningful step.

Our objectives include exploring the nutritional benefits of local algae species, enhancing food security, and reducing the environmental footprint of food production. We are also focused on public engagement. Our primary method involves collaboration with local and regional stakeholders, including chefs, food entrepreneurs, and educational institutions, to introduce and test algae-based dishes. So far, we have successfully developed a leaflet in both German and Danish to introduce the public to the potential of algae as a sustainable food source. Additionally, we have developed educational materials, data collection is currently underway at Kerteminde Seafarm where we are gathering information on algae growth, production capacity, and ecosystem impacts, and alongside these efforts we have created accessible content for the public.

The AlgaeFood project has already made strides in laying the groundwork for increasing public awareness and acceptance of algae as food. We have attend conferences and food festivals, we collaborate with schools and nature guides, focus on research-based measures for the sustainability of local farms, and create educational and outreach materials for multiple purposes.

Christian Koch, MBA and Msc. Mechanical Engineering. After 15 years in various positions iwith large corporations Co-founder and managing director of oceanBASIS GmbH. Responsible for Finance and trying to contribute to the meaning, community and financial scope in our company.

Brian Andersen, is a seasoned Merchant, entrepreneur, and founder of Peninsula Nature, as well as a partner at Havsmag. A passionate advocate for both food and nature. His work in Algaefood includes participating in cooking workshops and educational programs in both Denmark and Germany, where he helps promote the integration of algae into regional food cultures.

ABSTRACT #12

Seaweed as a functional food ingredient

Brief Introduction: Seaweed, a rich source of antioxidants and structuring compounds, is increasingly being explored as a sustainable food ingredient. In the European Union Novel Food Catalogue, more than 20 seaweed species are categorized as “not novel in food” and are therefore permitted for human consumption without additional regulatory approval. While mainly seaweed extracts are already added to food products for nutritional and techno-functional enhancement, this study focused on the potential use of full biomass as a food ingredient.

Objective: Given the diversity of edible seaweed species, including green (Chlorophyta), brown (Phaeophyta) and red (Rhodophyta) algae, this research aimed to characterize the techno-functional (i.e., antioxidant and structuring) properties of multiple seaweed species across different batches.

Methods: The study systematically mapped antioxidative compounds, including phenolic compounds and carotenoids, as well as their antioxidative activity, such as additional ferrous iron chelating activity (aFICA) and structuring properties, such as emulsifying, foaming, water and oil binding capacity.

Results: Significant inter- and intraspecies variability was observed. Based on these findings, several promising seaweed candidates were identified for different techno-functional purposes in food systems.

Conclusion: This research established a framework to guide the targeted use of full biomass seaweed in specific food applications, supporting the development of innovative, sustainable and more stable food solutions.

SPEAKER

Flore Vancoillie
Researcher, KU Leuven – Laboratory of Food & Lipids, Belgium.

Dr. Flore Vancoillie is a postdoctoral researcher at KU Leuven, working in the labs of Prof. Imogen Foubert (Food & Lipids) and Prof. Ilse Fraeye (Meat Technology & Protein-Rich Foods). She investigates how seaweed can be implemented in a variety of food products, thanks to its unique technofunctional, nutritional, and sensory properties. With a PhD in Bioscience Engineering and strong expertise in food processing, she is exploring how tailored processing techniques can unlock new applications for seaweed, contributing to the development of future-proof, sustainable food systems.

Authors:
Flore Vancoillie, Liselot De Vlieger, Ilse Fraeye, Imogen Foubert.

KU Leuven – Laboratory of Food & Lipids – Laboratory of Meat Technology & Science of Protein-Rich Foods (MTSP), Belgium.

ABSTRACT #13

Taste-sea: Insights and Emerging Perspectives on Seaweed Fermentation

Seaweeds are increasingly recognized as a sustainable source of nutrition; yet their broader use as food ingredients is limited by challenges related to taste, texture, and nutritional profile. Fermentation provides a promising strategy to address these barriers by altering the sensory characteristics and improving nutrient bio-accessibility. Aiming to improve and establish this process for seaweed, we have explored how different microbial approaches—using different microbial species and their combinations—can transform Saccharina latissima. Additionally, it is hypothesized that fermentation will influence the accessibility of certain nutritional elements.

Within the Taste-sea project, the controlled fermentation trials were carried out at 30 °C and were monitored through pH and organic acid production. The starter cultures comprised of lactic acid bacteria (LAB) and Bacillus subtilis. Selected samples were further characterized for changes in free amino acids and volatile compounds. Then the samples were digested following the INFOGEST protocol and a mineral analysis of the accessible fractions was performed.

Across these studies, several insights have emerged. Selected lactic acid bacteria can acidify seaweed substrates, driving safety and flavor development, while Bacillus subtilis introduces distinct enzymatic activities that may enhance the flavor complexity. Fermentation modified the mineral profile, leading to increases in some elements and decreases in others. Co-cultures highlight both synergies and challenges, revealing the importance of strain selection in seaweed applications.

The presentation will summarize the main lessons learned so far and discuss emerging perspectives on how microbial fermentation may support the development of safe, nutritious, and appealing seaweed-based foods.

SPEAKER

Evangelia Zioga
National Food Institute, Technical University of Denmark, Denmark and SEED, KTH, Royal Institute of Technology, Sweden.

Evangelia (Eve) Zioga is a shared PhD student between DTU (DK) and KTH (SE). She has studied chemistry but was then introduced to the world of seaweeds and microbes. She is working with seaweed fermentation processes with the aim of optimizing and creating more diverse seaweed-based products. She is also interested in sustainability and through her work she envisions contributing to more sustainable food by incorporating seaweed into food products. Her ideal future plans are full of algae and creating more collaborations within Europe to explore and create a culture around seaweed on our plates.

Authors:
Evangelia Zioga[1,2], Susan L. Holdt[2], Fredrik Gröndahl[1], Claus H. Bang-Berthelsen[2]

[1]SEED, Department of Sustainable Development, Environmental Science and Engineering, ABE, School of Architecture and the Built Environment, KTH, Royal Institute of Technology, Stockholm, Sweden
[2]National Food Institute, Technical University of Denmark, Kgs. Lyngby, Denmark

ABSTRACT #14

Potential Toxic Elements in Seaweed: New EFSA Threshold Values and Nordic Stakeholder Perspectives

Seaweed is increasingly recognized as a sustainable food source in the Nordic region, providing valuable nutrients and supporting the bioeconomy. However, potential toxic elements such as inorganic arsenic, cadmium, lead, mercury, and excessive iodine remain key safety concerns. The European Food Safety Authority (EFSA) has recently proposed new threshold values for contaminants in seaweed and related products (still under discussion), representing an important step toward harmonized regulation across Europe.

This presentation will summarize the proposed EFSA thresholds and discuss their potential implications for Nordic seaweed production and market access. Furthermore, results from a recent workshop bringing together Danish seaweed stakeholders and national food authorities will be presented. The workshop highlighted both challenges—such as compliance feasibility, analytical costs, and knowledge gaps on bioaccessibility—and opportunities for risk reduction through species selection, seasonal harvesting, and processing methods.

By integrating regulatory updates with stakeholder perspectives, the presentation aims to provide a timely overview of the evolving food safety landscape for seaweed in Europe. It will also point to priority areas for research, monitoring, and dialogue needed to ensure consumer protection while supporting sustainable development of the Nordic seaweed sector.

SPEAKER

Susan Løvstad Holdt
Associate Professor, National Food Institute, Technical University of Denmark, Denmark.

Susan Løvstad Holdt is an Associate Professor at the National Food Institute, Technical University of Denmark (DTU Food). Her research centers on seaweed as food, focusing on safety evaluation, bioactive compounds, and EU food regulations. She has led and participated in numerous national and international projects on seaweed, microalgae, and sustainable food systems, including also industry and authorities. She is an active contributor to national and international seaweed research and stakeholder community.

ABSTRACT #15

Food safety of lightly preserved kelp

SPEAKER

Caroline Østergaard Klein
National Food Institute, Technical University of Denmark.

Caroline is a PhD student in the research group for Food Microbiology and Hygiene at the Technical University of Denmark, National Food Institute. She holds an MSc in Food Technology with a focus on food microbial safety. Her PhD studies are conducted as a part of the project ValueKelp in collaboration with Royal Greenland Seafood A/S, Nordic Marine Nutrition, the Technical University of Denmark and the University of Copenhagen. The project's aim is to apply sustainable methods to stabilise and utilise cultivated kelp in high-quality and safe food products.

There is an increased interest in using seaweeds as food and for food applications. However, once harvested, the naturally occurring microbiota shortens seaweed's shelf-life to a week. Further, seaweeds may accumulate various, both beneficial and unwanted, chemical compounds from their surroundings, which may affect food safety and quality. Brown seaweed has been shown to accumulate iodine to very high levels (up to 8 g/kg dry mass), which compromises food safety and sets a market barrier. Hence, there is a need to identify suitable immediate post-harvest treatments to prolong refrigerated shelf-life of seaweed, controlling the microbiota and reducing the iodine content.

The aim of my study is to test low-energy-intensive post-harvest treatments, such as salt-pickling and acid brining, to stabilise seaweed for long-term refrigerated storage, focusing on food safety and quality. Freshly harvested Swedish and Greenlandic kelp was salt-pickled and/or acidic brine-treated. Throughout one year of refrigerated storage, microbiota was characterised using Matrix-Assisted Laser Desorption-Ionization Mass Spectrometry and Sanger sequencing to identify >1000 randomly selected colonies, and in addition, microbiota from kelp samples were sequenced (16s rRNA gene, V3-V4 region). Iodine level was measured by Inductively Coupled Plasma Triple Quadrupole Mass Spectrometry.

Overall, addition of salt and/or acid-brines lowered or ceased microbial activity, thus extending the shelf-life to >1 year. The remaining microorganisms were psychrotolerant, spore-forming bacteria dominating the culturable microbiota regardless of location, treatment, and kelp species. While psychrotolerant, non-spore-forming bacteria dominated based on 16s rRNA gene sequencing. Over time, a shift happened, and yeasts dominated. Depending on location, Mrakia spp. were found in Swedish kelp, while Debaryomyces spp. and Metschnikowia spp. were present in Greenlandic kelp. Visible moulds, e.g., Penicillium commune, were on some brined Greenlandic winged kelp. Salt-pickling decreased iodine levels by app. 50%.

Optimal post-harvest treatments must be designed for seaweed species to be safe to consume. Salt-pickling and acid brining extended the refrigerated shelf-life to >1 year and lowered the iodine content.

Authors:
Caroline Østergaard Klein[1], Nikoline Ziemer[2], Niels Bøknæs[2], Jens Jørgen Sloth[1], Claus Heiner Bang-Berthelsen[1], Susan Løvstad Holdt[1], and Lisbeth Truelstrup Hansen[1]

[1]The National Food Institute, Technical University of Denmark, Kongens Lyngby, Denmark
[2]Royal Greenland Seafood A/S, Svenstrup J., Denmark and Nuuk, Greenland.

ABSTRACT #16

Welcome to the Seaweed Suite

SPEAKER

Morgan Ræ
Founder & Director, L'EAUTELIER, USA.

Morgan Ræ is a four-time award-winning designer with 25+ years of global experience shaping regenerative guest experiences across 100+ projects in 13 countries. As founder of L'eautelier, the first marine-based design studio in hospitality, she works at the confluence of regenerative travel, circular design, and the blue economy.

Her career spans roles from creative lead at AvroKO to co-owning NYC plant-based restaurants, and collaborations with global icons like Royal Atlantis, One&Only, BMW's Mini Living, and Westin.

Ræ's pioneering concepts—from underwater eco-suites to climate-adaptive island living—have earned her acclaim at Milan Design Week, Climate Week NYC, and the UN Ocean & Water Conferences. With degrees from the Art Institute, Domus Academy and Yale, she now applies marine innovation and bespoke design to seaweed start-ups, airlines, and futureforward hospitality.

Seaweed offers an extraordinary opportunity to reimagine the way we live, travel, and host — yet its potential remains underutilized outside of food, feed, and bioplastics. The Seaweed Suite is a design-led exploration into how algae-based materials can redefine hospitality environments, creating spaces that are regenerative, circular, and deeply connected to the ocean.

The objective of this work is to present a living laboratory concept where guests experience marine-based innovations firsthand—from seaweed-derived textiles and dyes to bio-based amenities and spatial design inspired by water. Unlike traditional models of hospitality, the Seaweed Suite positions seaweed not only as a material substitute but as a design philosophy, encouraging visitors to reflect on their relationship with the sea.

Our approach integrates design prototyping, material testing, and systems thinking within circular economy principles. Collaborations with marine biologists, designers, and hospitality partners ensure that the prototypes are not only aesthetically compelling but also feasible for real-world application in hotels, airlines, and travel experiences.

Preliminary results show that seaweed-based materials can achieve performance, comfort, and beauty comparable to synthetics, while offering the added benefit of biodegradability and local resource regeneration. Early guest feedback from immersive events demonstrates curiosity, delight, and openness to marine-based alternatives.

The Seaweed Suite suggests that by embedding seaweed into hospitality's material culture, we can shift from extractive models to regenerative ones. This work invites the travel and design sectors to embrace algae as both a resource and a narrative—transforming hospitality into a tide that leaves places better than we found them.

ABSTRACT #17

Development of the seaweed industry and R&D in Norway

SPEAKER

Silje Forbord
Research Manager, SINTEF Ocean Norway.

Silje Forbord is the Research Manager for the Seaweed Technology group at SINTEF Ocean and has 17 years' seaweed cultivation experience from land-based nursery and sea cultivation. She is also the project leader for The Norwegian Seaweed Centre, a national dedicated research infrastructure that promotes research and facilitates the development of new technologies for industrial cultivation and use of kelp. She holds a PhD in cultivation of sugar kelp with a focus on nitrogen uptake kinetics, growth characteristics and chemical composition. She has a broad company network and is active in the Norwegian Seaweed Cluster.

The seaweed cultivation industry in Norway, like the rest of Europe, is relatively young but holds significant potential for value creation and is gaining momentum. The first licenses to cultivate kelp in Norway were granted in 2014. Since then, the number has increased significantly, to 566 licenses distributed across 117 sites in 2024. Of these, 197 licenses are currently registered as being in operation by 24 different companies. Sugar kelp (*Saccharina latissima*) and winged kelp (*Alaria esculenta*) are the two species cultivated commercially in Norway, where the latter one has the highest production volumes.

The amount of cultivated kelp in Norway has steadily increased, despite annual variations. In 2023 as much as 770 tons of kelp were harvested, however production declined again in 2024 to 470 tons due to low market demand. We also see a shift from companies controlling operations along the whole value chain towards a specialization into different steps; production (seeds and/or sea cultivation), processing, products or market.

Over the past 17 years SINTEF has conducted numerous national and international projects covering various aspects of seaweed cultivation and utilization. In 2022 they established The Norwegian Seaweed Centre, a national research infrastructure that promotes research and facilitates the development of new technologies for industrial cultivation and use of seaweed. There is a trend towards upscaling and multiuse of ocean space, and an overview of the most relevant ongoing projects is given touching upon IMTA, carbon capture, offshore farms and technology development.

ABSTRACT #18

Leveraging disruptive technology to revolutionize the seaweed cultivation industry

Seaweed is destined to happen. It is one of the most sustainable feedstocks on the planet and has an important role to play in the transition towards a more sustainable future across multiple key verticals.

But how do we get from here to there? At Arctic Seaweed we strongly believe that the missing piece of the puzzle is a scalable technology platform and that we have just that solution ready for deployment on a global scale.

SPEAKER

Kim Kristensen
CEO and Founder, Arctic Seaweed AS, Norway.

Kim is a purpose driven manager with a broad background from multiple industries. Kim has spent the last 8 years of his career building a seaweed technology champion from scratch.

Arctic Seaweed was established in 2016 with a clear vision and purpose to develop technology and solutions for large scale seaweed cultivation and production.

The company has succeeded in developing a complete, end2end platform that can be implemented in any coastal location. Systems have already been delivered to clients in Norway, Greenland and in the UK.

ABSTRACT #19

Benefits for biodiversity with seaweed cultivation, a best practice example of Ocean Rainforest on the Faroe Islands

SPEAKER

Sophie Koch
Sjókovin, Blue Resource, Faroe Islands .

Sophie's main research focus is on seaweed cultivation, aiming at quantifying and valuing its ecosystem services as well as the carrying capacity a coastal ecosystem has for aquaculture, particularly seaweed cultivation. She is currently finalizing her doctoral thesis and has gained, for this, experience in marine data collection as well as vast literature searches including the socio-economic and ecological dimension of aquaculture. Her main research questions are on the restorative aspect of aquaculture and how to upscale sustainably. Prior to this marine research she built a career in development cooperation with GIZ and worked there for 5 years, mainly in Cameroon and Madagascar.

Open water seaweed aquaculture is often referred to as a marine activity with positive effect on sea and environment, even called a restorative form of aquaculture. But due to its short term deployment it is questioned if for the local marine biodiversity it is providing similar benefits as natural seaweed populations regarding habitat provisioning, nursery grounds and shelter for various species.

Assessments of these impacts are complex, with a marine system that has no clear boundaries and species moving in and out of the cultivation units.

We investigated how the unique cultivation method of the Ocean Rainforest company in the Faroe Islands, cultivating *Saccharina latissima*, affects biodiversity and compare it to conventional cultivation methods. We sampled species directly associated with S. latissima in an attempt to quantify sessile as well as mobile animal species inside the farm. Sampling was done using a 2 m2 diameter net (mesh size: 1cm2), capturing all sessile and larger mobile species of a vertically hanging cultivation line.

Our data allowed to compare the biodiversity of sites with different exposure, different seasons and of cultivation lines being in the water 1, 2 or 3 years.

Results show an increase of biodiversity over the years, reaching a maximum of diversity in the third year. The organisms identified have large overlap with organisms in natural seaweed and consumed by commercially important fish, indicating that the cultivation might provide shelter for the fish's prey. This presentation will show our main findings and reflections.

ABSTRACT #20

Exploring Sustainable Seaweed Aquaculture: A Pilot Study on Seaweed Cultivation in Oman

The global seaweed farming industry is experiencing rapid growth, driven by its capacity to address critical challenges, including climate change, biodiversity loss, and food security.

This study assesses the feasibility of establishing a sustainable seaweed farming sector in Oman, where the industry is currently underdeveloped despite the country's vast coastal resources. We identify optimal seaweed species for cultivation in Omani waters and evaluate advanced farming techniques using systems such as Recirculating Aquaculture Systems (RAS) and Integrated Multi-Trophic Aquaculture (IMTA).

Our findings suggest that seaweed cultivation in Oman, utilizing RAS and IMTA, holds significant promise and demonstrates the potential of seaweed cultivation in Oman. Recommendations are provided to guide policymakers and stakeholders in fostering a resilient and scalable seaweed industry.

SPEAKER

Khalid Al Subhi
Center of Excellence in Marine Biotechnology, Sultan Qaboos University, Oman.

Dr. Khalid Al Subhi is a fisheries and marine researcher with a distinguished career in fisheries management and development in Oman. He holds a PhD in Marine Science and Fisheries from Newcastle University in the UK in 2018. Currently, Dr. Khalid Al Subhi is engaged in many research projects at the Center of Excellence in Marine Biotechnology at Sultan Qaboos University, such as "Cultivation trials of two most abundant seaweed species" 2023- 2024 as a Principal Investigator, "Assessing the Potential for Seaweed Cultivation in Marine Omani Waters through an Integrated Modeling Approach" 2025-2026 as a Principal Investigator. Revealing properties of twenty Omani seaweeds for the future management and utilization, 2021-2024 (Investigator).

ABSTRACT #21

Optimizing *Ulva* Aquaculture for Industry: From Genes to Ecosystems

SPEAKER

Sophie Steinhagen
Associate Professor, Tjärnö Marine Laboratory, University of Gothenburg, Sweden; University of Bergen, Norway.

The aquaculture of *Ulva* species is expanding rapidly due to their high productivity, environmental adaptability, and diverse applications across multiple industries.

However, large-scale and sustainable cultivation remains a challenge, as the genetic diversity and systems biology of *Ulva* are still poorly understood. To develop resilient and high-yielding crop strains, fundamental research is needed to unravel the genetic mechanisms underlying key traits such as growth, reproduction, and stress tolerance. Particularly, large-scale *Ulva* cultivation requires a deeper understanding of strain selection, physiological responses, life-cycle, and ecological interactions to optimize yield and biochemical composition while ensuring environmental sustainability.

This talk will highlight the importance of integrating molecular, ecological, and physiological studies to optimize *Ulva* aquaculture and establish a scientifically informed foundation for industrial-scale production.

Sophie Steinhagen is Associate Professor at the University of Bergen (Norway) and docent at the University of Gothenburg (Sweden). After conducting her PhD in Molecular Ecology (GEOMAR Helmholtz Centre for Ocean Research, Germany) she investigated the green seaweed biodiversity, their phylogenetic relationships, and species-specific traits. Her current research explores the interplay between environmental factors and genomic set up of seaweeds, unraveling the secrets behind the content of high-value compounds and setting baselines for breeding programs in European seaweed crop strains to support a sustainable seaweed aquaculture and flourishing Blue Economy.

ABSTRACT #22

SMARTtang: Evaluating tube net systems for scalable *Saccharina latissima* production – from hatchery to harvest

SPEAKER

Mette Møller Nielsen
Senior Researcher, Technical University of Denmark, Denmark.

Mette Møller Nielsen is a Senior Researcher at DTU Aqua, specializing in seaweed cultivation and low-trophic aquaculture. Her work focuses on developing scalable farming methods and protocols for a diverse range of seaweed species, with the goal of supporting the growth of a sustainable seaweed industry. Based at the Danish Shellfish Centre in Nykøbing Mors, Mette contributes to national and international projects exploring seaweed's role in the green transition and climate adaptation.

Mette Møller Nielsen[1], Teis Boderskov[2], Oakley Robertson[1], Peter Schmedes[1], Annette Bruhn[2]

[1]Technical University of Denmark, National Institute of Aquatic Resources, Denmark.
[2]Aarhus University, Department of Ecoscience, Denmark.

Achieving profitable and scalable cultivation of *Saccharina latissima* in Europe requires mechanized methods that optimize biomass yield per area, alongside efficient downstream processing systems. The SMARTTANG project explores these aspects by adapting tube net systems—originally developed for large-scale mussel farming in Denmark—for seaweed cultivation.

We tested multiple seeding strategies, including direct seeding and nursery-based approaches using gametophytes and spores. Trials in the Limfjorden demonstrated that a nursery phase is essential for achieving commercially viable yields. While substrate type had minimal impact, hydroid fouling consistently challenged the production of clean biomass.

In the final year of the project, 250 meters of cultivation net were seeded and deployed to evaluate hatchery protocols, growth potential, and different farm setup configurations. Biomass yields reached approximately 12 kg/m^2 net. Hatchery operations were a key component, focusing on optimizing nursery conditions and seeding techniques to support large-scale deployment.

Harvesting and machine modification trials demonstrated the potential for mechanized seaweed harvest and revealed key practical requirements for effective mechanical handling. In parallel, pilot-scale processing and fermentation trials of the harvested biomass provided valuable insights into biomass utilization. Together, these results contribute to a clearer understanding of current limitations and highlight areas for further development to enable scalable, mechanized seaweed farming.

Project partners: Aarhus University, Technical University of Denmark, Blue Biomass AS, Fermentation Experts AS, Kost Studio, Wavy Wonders and Copenhagen University.

The project is funded by the Green Development and Demonstration Program Denmark, GUDP.

ABSTRACT #23

Comparative Life Cycle Assessment and Techno-Economic Assessment of Coastal Seaweed Cultivation Systems

Brief Introduction: Seaweed cultivation is a promising, sustainable strategy contributing to climate-change mitigation. Besides, harvested biomass can be used as feed, nutritious food, and bioproduct. This study intends to evaluate how integrated seaweed farming removes nutrients and supplies low-carbon biomass as raw material, quantifying net environmental benefits and trade-offs.

Objective: This study aimed to compare the environmental and techno-economic performances of coastal cultivation of Saccharina latissima using a traditional long line setup and a tube-net setup which is currently being used in mussel production.

Methods: Life cycle assessment was applied in Simapro v9.1 following the ISO guidelines set in ISO 14040 and ISO 14044 (ISO, 2006a; ISO, 2006b), to evaluate environmental performance of the coastal seaweed cultivation systems. Economic modelling is performed via Net Present Value calculations over a 10-year horizon using a 7% discount rate.

Results: In comparison with the net setup, the longline setup showed much lower environmental footprint. This observation could be due to the difference in spatial and material demands observed in the line setup compared to the net setup. These impacts are predominantly driven by nylon nets, high-density polyethylene (HDPE) pipes and polypropylene ropes; all of them characterized by energy-intensive production processes and persistent environmental emissions. Economically, the net setup showed a higher Net Present Value, while the longline setup returned moderate count.

Conclusion: Integrating different seaweed cultivation approaches can effectively remove excess nutrients while providing a stable supply of seaweed for food and other potential applications. The obtained data in this study provides insights into the sustainability and scalability of the coastal seaweed cultivation system.

SPEAKER

Manali Chakraborty
Postdoc, University of Copenhagen, Denmark.

Manali Chakraborty is working as a postdoctoral researcher (University of Copenhagen) under Professor Marianne Thomsen, focusing on sustainable aquaculture. She is working on Life cycle assessment of Low trophic aquaculture. She worked at the Indian Institute of Technology Bombay in advancing sustainable horticulture and food technology. With a PhD in circular economy and agricultural waste valorisation, she specializes in sustainability research, striving to drive meaningful progress toward the Sustainable Development Goals (SDGs), aiming to foster environmental resilience and social equity.

Authors:
Manali Chakraborty (Speaker), Arrate Sainz de la Maza Larrea, Teis Boderskov, Mette Møller Nielsen, Annette Bruhn, Marianne Thomsen

ABSTRACT #24

Advancing land-based seaweed hatcheries: The development of the PUREHATCH Nursery Unit

SPEAKER

Esben Rimi Christiansen
Founder & Leader, Pure Algae, Denmark.

Esben Christiansen is the Founder and Leader of Pure Algae, a Danish biosolutions and cleantech company pioneering land-based seaweed cultivation systems. With a background in sustainable aquaculture and bioeconomy innovation, Esben has spent the past seven years transforming Pure Algae from an idea into a technology partner for research institutions, hatcheries and industrial players worldwide. He is passionate about creating scalable, circular solutions that convert nutrient-rich side streams into high-value seaweed biomass, bridging the gap between research, technology and commercial production.

Esben will be presenting the development of the PUREHATCH Nursery Unit, which epitomizes the path from idea to market in cutting-edge seaweed cultivation technology. Conceived in November, the concept aimed to solve one major problem in the seaweed nursery stage – how to get homogenous growth on the seeded twine. By January, we filed a patent application to protect the core innovations in spool rotation that ensures complete light distribution and nutrient exposure.

In March, the first prototype was delivered to a client, allowing direct evaluation under operational conditions. Over the following months, we refined the design, and by June we secured a favorable assessment of the patent's robustness and novelty. In July, we celebrated our first commercial sale, and in September the first field installations of the final product were commissioned.

In this presentation, Esben will trace the technical, biological, and commercial challenges encountered at each stage; spore settlement uniformity, hydrodynamics and scale transfer – and describe how Pure Algae overcame them. Esben will share performance data, lessons learned, and decisions that enabled the product to move from TRL 3/4 into the operational milestones of TRL 7/8 in less than a year!

Attendees will gain insight into systematic product development in seaweed technologies and how to align R&D, IP, and market entry under tight timelines.

ABSTRACT #25

Carbon allocation responses to warming in kelps vary with seasonal thermal regimes

The NE Atlantic kelp species *Laminaria hyperborea* is considered an important carbon sink, but ocean warming is already reducing its abundance at the southern European distribution edge. However, the physiological consequences of a year-round warming on natural populations remain understudied.

We investigated the net primary production (NPP) and release of particulate and dissolved organic carbon (POC, DOC) of *L. hyperborea* in the German Bight (Helgoland). In six-days experiments, blade discs were subjected to seasonal mean ambient (spring: 7°C, summer: 16°C, autumn: 14°C, winter: 6°C) and elevated temperatures (delta +4°C) at simulated in situ irradiances in all four seasons (n=6). Annual NPP was 347 g C m^{-2} yr–1 and 303 g C m^{-2} yr^{-1} under warming and ambient conditions, respectively, without a significant difference.

Nevertheless, warming exacerbated significant seasonal differences, resulting in NPP rates being twice as high in spring and three times lower in autumn than under ambient temperature conditions. The release of carbon as either POC or DOC was significantly higher by 6x and 3x times, respectively, in warm seasons (summer and autumn) than in spring and winter.

On an annual base, warming resulted in a 217% higher DOC release rate than under ambient conditions. This will possibly negatively affect the standing stock of the kelp, its carbon sequestration potential and the associated microbial food webs and thereby affect the whole kelp ecosystem.

Our study demonstrates the importance of considering year-round effects of warming on carbon allocation in kelp species and not just single time-points.

SPEAKER

Kiara Franke
Post Doc., Aarhus University, Denmark.

Kiara Franke is a postdoctoral fellow at Aarhus University, using her knowledge of kelp physiology to optimize the aquaculture of seaweed. She holds a PhD in investigating the seasonal primary production and carbon allocation of a kelp species under different temperature scenarios. In addition, she investigated the temperature tolerance of gametophytes and sporophytes of two Arctic kelp species in her Master's degree and the salinity tolerance of *Fucus vesiculosus* in her Bachelor's thesis.

Authors:
Kiara Franke[1,2], Concepción Iñiguez[3], Ulf Karsten[1], Inka Bartsch[4], Angelika Graiff[1]

[1]Department of Applied Ecology and Phycology, Universtiy of Rostock, Germany
[2]Department of Ecoscience – Marine Ecology, Universtiy of Aarhus, Denmark
[3]Department of Ecology, University of Malaga, Spain
[4]Alfred Wegener Institute, Helmholtz-Centre for Polar and Marine Research, Bremerhaven, Germany

ABSTRACT #26

From Shores to Sequences: Exploring Seaweed Diversity and Distribution Through Molecular Lenses

SPEAKER

Luisa Düsedau
Postdoc, Aarhus University, Denmark.

Luisa Düsedau is a marine biologist specializing in coastal marine communities. She focuses on macroalgal biodiversity and community structure in the context of climate change. As a postdoctoral researcher at Aarhus University, she investigates the role of Arctic macroalgae in carbon cycling and storage (Blue Carbon). Her work integrates traditional monitoring methods—quantitative and qualitative field surveys—with advanced molecular tools such as DNA barcoding, eDNA metabarcoding, and ddPCR to study kelp forests and intertidal habitats. With a background in experimental ecology and certification as a research diver, she combines hands-on field expertise with cutting-edge lab techniques to explore marine ecosystems.

Global warming is a major driver of change across the Arctic and worldwide, shaping the community structure, distribution range, and species richness of macroalgae along rocky coastlines.

Traditionally, macroalgal assessments are based on morpho-anatomical identification, a method prone to misidentification. The advent of molecular techniques provides novel and powerful tools to uncover overlooked species and detect macroalgal DNA in environmental samples.

Yet, the identification of environmental DNA (eDNA e.g. from water or sediment) fundamentally relies on valuable baseline knowledge provided through classical DNA fingerprinting (barcoding) and the morphological species description. In this context, Arctic macroalgae are one of the many examples of genetically highly understudied groups.

Each macroalgal lineage (red, green, brown) requires a specific technique as the resolution achieved with universal molecular methods is often insufficient. The first DNA barcode library for macroalgae from the European Arctic revealed high hidden biodiversity and showed that the Arctic marine flora is unique and distinct from that of lower latitudes. Through targeted identification using droplet digital PCR (ddPCR), we are now, for the first time, able to quantify macroalgal DNA in environmental samples.

We successfully traced and identified the DNA of six biomass-dominant macroalgal species in fjord- and offshore sediment cores from Greenland and the Faroe Islands. Our results indicate higher quantities of macroalgal DNA in fjord sediments. The rarity of both quantitative and molecular datasets of Artic macroalgal communities highlights a notable gap in our understanding of these important marine habitats with their considerable primary productivity and thereby CO_2 binding capacity.

ABSTRACT #27

Recovery of *Ascophyllum nodosum* after mechanical harvesting

SPEAKER

Lilja Gunnarsdóttir
Marine biologist, Marine and Freshwater, Iceland.

Lilja Gunnarsdóttir is a marine biologist at the Marine and Freshwater Research Institute in Iceland researching seaweed and associated ecosystems. Her work is mainly focused on the effects of harvesting *Ascophyllum nodosum* and advising on the harvestable amounts of *Ascophyllum* and kelp species.

Brief Introduction: *Ascophyllum nodosum* has been mechanically harvested for over 40 years in Breiðafjörður, Iceland. Most research on recovery of *Ascophyllum* after harvesting has not used a real life simulated experimental harvest and few have used mechanical harvesters.

Objective: Studies of the *Ascophyllum* stands following harvesting are important for understanding the effects on the resource, the stock structure and recovery.

Methods: Three plots (50-meter wide) were laid out on the shore at 4 different locations, 2 controls and 1 experimentally plot harvested by the commercial harvesters. Biomass and cover of all fucoids and plant height of *Ascophyllum* plants were monitored yearly from 2016-2021 (harvested plot before and after harvesting in 2016) with two random transects in each plot.

Results: *Ascophyllum* harvesting was most efficient in the middle and lower parts of the shore due to mechanical and tidal constraints in the upper part. The efficiency of the harvesting ranged from 13-66% in the affected zone of the shore. *Ascophyllum* biomass recovered in 4-5 years at all locations, while plant height has not recovered within the 5-year study period. *Ascophyllum* cover reached initial values in 3 years at all locations. There was no pattern detected in the presence of other fucoids on the shore. Harvesting efficiency varied in all four locations due to topographic complexity of the shores.

Conclusion: Despite the large biomass removed it is difficult to distinguish between the effect of harvesting and natural disturbance and patchiness.

ABSTRACT #28

Cultivation of sugar kelp as a marine measure for mitigating eutrophication: Production in large-scale, nutrient removal efficiency, environmental impacts, and economy

Brief Introduction: The cultivation of sugar kelp has been suggested as a marine mitigation measure for the uptake and removal of nutrients from the marine environment.

Objective: In 2022–2023, sugar kelp was cultivated in the Limfjorden in a 12-hectare experimental facility to document 1) biomass yields, 2) uptake of nitrogen, phosphorus, and carbon, and 3) effects on the environment by large-scale cultivation.

Methods: The cultivation lines were traditionally seeded and deployed in a long-line system. Biomass growth, quality, and fundamental environmental parameters were followed over the season. Intensive sampling of environmental parameters was performed at three environmental campaigns: at deployment, mid-growth season, and just prior to harvest at maximum standing-stock biomass.

Results: The results show that large-scale cultivation of sugar kelp can remove up to 23 g N m-1 line year-1, corresponding to an annual nutrient removal potential of 23 kg N ha-1 and 0.8 kg P ha-1 in a standard cultivation system with 1000 m cultivation line ha-1. Yields and potentials for nitrogen removal in Danish waters vary and are highest in areas with high salinity and nutrient availability. The cost of nutrient removal varies accordingly, with the lowest cost of DKK 2805 kg N-1. Modelling scenarios indicate that a significant upscaling of sugar kelp cultivation is required to achieve any effect on the key environmental indicators for Good Environmental Status (GES): ”summer chlorophyll-a” and ”light attenuation”.

Conclusion: Cultivation of sugar kelp enables the capture of nutrients from the marine environment and through harvest the return of the nutrients to the food system on land, supporting the circular blue bioeconomy. The effect, however, remains a supplement to reducing emissions from land in order to accelerate the process towards GES. At high biomass densities, the environmental effects include 1) a negligible reduction of light to the seabed, 2) altered water flow, 3) reduced sedimentation rates, 4) limited periodic increases in pH and oxygen concentration under, in, and near the seaweed cultivation site. Harvesting in April reduces the loss of carbon from the seaweed to the marine environment, and it is unlikely that seaweed cultivation can contribute to carbon sequestration in the inner Danish waters.

SPEAKER

Annette Bruhn
Senior researcher, Aarhus University, Denmark.

Annette Bruhn (AB) works as a senior researcher at the Department of Ecoscience at Aarhus University, Denmark. Her research focus is cultivation of macroalgae for emission capture and utilisation, optimising the use of macroalgae as a bio-resource and a solution for mitigating eutrophication and climate change. AB works in the cross-field between biological oceanography and macroalgae ecophysiology, and always in transdisciplinary teams in cooperation with authorities and industry/SMEs. AB is co-founder of AlgaeCenter Denmark and the annual international Nordic Seaweed Conference, and leads the Marine Bioresource platform of the Aarhus University Center for Circular Bioeconomy.

Authors:
Bruhn A[1] (speaker), Boderskov T[1], Nielsen MM[2], Schmedes PS[2], Taylor D2, Høgslund S[1], Hermannsen L2, Holding J[1], Mostovaya A[1], Christiansen FS[1], Pedersen SG[1], Vinbæk SJ[1], Holst N[3], Christiansen SL[1] & Ehrenreich JL[1]

[1]Aarhus University (AU), Department of Ecoscience, Denmark; [2]DTU Aqua, National Institute of Aquatic Resources, Department of Coastal Ecology, Denmark; [3]AU, Department of Agroecology, Denmark.

ABSTRACT #29

Rethinking venture capital alongside marine restoration

SPEAKERS
Camilla Zacho
Project Manager, Seabreak, Denmark.

Jakob Munk Nielsen
Executive assistant, Change Ventures, Denmark.

Change ventures, earthbreak and seabreak are initiatives established to drive positive impact toward a more sustainable future.

Change venture is an investment company supporting innovative green startups with patient capital.

At earthbreak and seabreak we strive to protect and restore the terrestrial and marine nature in Denmark.

Earthbreak transforms conventional farmland into forests and open meadows to restore biodiversity and to reduce runoff of e.g. nitrogen into streams and the ocean.

Seabreak supports marine restoration and research in marine species and ecosystems by donations to Danish NGOs and universities.

Camilla Zacho holds a master's degree in biology combined with mathematics. She has developed activities for elementary and high school to motivate interest in STEM (Science, Technology, Engineering & Mathematics). She teaches part time at a high school.

Jakob Munk Nielsen holds a master's degree in finance from Aarhus University and has experience as an active investor from change ventures, KIRKBI and The Lundbeck Foundation.

Posters

Removal of potentially harmful elements in cultivated *Saccharina latissima* and *Alaria esculenta*
Katharina Nøkling-Eide, Inthuja Manickam, Øystein Arlov, Helle Bratsberg Holte, Debora Foppiano, Håvard Sletta.

Cadmium (Cd) is a heavy metal that accumulates in body tissues and can cause kidney damage, cancer, and osteoporosis. Thus, the European Food Safety Authority (EFSA) recommends that the total weekly intake (TWI) should not exceed 2.5 µg/kg body weight/week. Seaweed accumulates cadmium from the sea, and cultivated *Alaria esculenta* (AE) and *Saccharina latissima* (SL) have quite high cadmium levels, 1230-2820 and 480-810 µg/kg dried seaweed, respectively. With future food applications in mind, it is advantageous to develop cadmium removal technologies since cadmium is not removed in commercial blanching for iodine removal (heating seaweed in fresh water at 80°C in 120 seconds). In a project at SINTEF, SIP Sustainable Food and Feed, a method for removing cadmium from freshly harvested cultivated SL and AE, while avoiding alginate extraction in the process, has been developed. Alginate is one of the structural components in brown seaweed, and ions such as Cd2+ and Ca2+ are associated with the alginate within the seaweed. Alginate has a pKa of approximately 3.6, and pH below this value will lead to the alginate being on its undissociated form (alginic acid), and the associated ions will be released. The release of ions is the principle behind the developed cadmium removal method, which successfully reduced cadmium levels from 1700 to 700 µg/kg dried seaweed in AE, and from 700 to 200 µg/kg in SL. Furthermore, an 80% decrease in inorganic arsenic content was achieved during the process.

Optimization yield and energy consumption of landbased *Ulva compressa* cultivation using different LED light spectra
Teis Boderskov[12], Kristoffer Larsen-Ledet[12], Mathilde Hebsgaard Knudsen[12], Isabel Zako Groth Anderson[12], Birgit Olesen3 & Annette Bruhn[12]
[1]Department of Ecoscience – Marine Ecology, Aarhus University, Denmark, [2]CBIO – Centre for Circular Bioeconomy, Aarhus University, Denmark
3Department of Biology, Aarhus University, Denmark

Light quality and efficiency are an essential part of land-based production of macroalgae. With the use of LED lights, the spectral composition can be optimized to improve biomass yield, quality, and reduce watt use. This study aimed to investigate the effect of different ratios of blue and red light on growth and pigment content of *Ulva compressa*. The experiment was conducted in a steady-state indoor cultivation system over a two-week growth period following one week of acclimation. Growth was assessed by measuring fresh and dry weight and maximum quantum yield (Fv/Fm). Additionally, pigment concentrations (chlorophyll a, b, and total carotenoids) and light attenuation of the cultures were measured. The biomass yield of treatments receiving only red light was 0.092 – 0.122 g DW L-1 day-1 being 36-42 % higher than treatments receiving only blue light. Consequently, energy use g DW-1 was highest under blue light and lowest under red light. Pigment concentrations were lower under red light compared to blue and red/blue light. In conclusion, red LED light showed the highest potential for enhancing the yield of *Ulva compressa* and energy efficiency in land-based systems, however also with a trade off with lower pigment contents, contributing to a landbased cultivation with a possible lower energy consumption.

Sustainable macroalgae biorefinery for co-production of phycoerythrin
Praveen Kumar Ramasamy
Danish Technological Institute Denmark

This research focuses on developing sustainable cultivation of macroalgal tetrasporophytes in photobioreactors at DTI. The project optimizes biomass production for dual applications: phycoerythrin extraction as a valuable pigment product and residual biomass utilization for anti-methanogenic compounds. Current work demonstrates 250 L photobioreactor cultivation with green extraction protocols.

The effect of herring process waters as cultivation media on *P. palmata* as a source of dietary protein

Klara Helgesson[2], Kristoffer Stedt[1], Moa Skagerlind[1], Henrik Pavia[1] and Ingrid Undeland[2]
[1]Department of Marine Sciences, University of Gothenburg, Sweden
[2]Department of Life Sciences, Division of Food and Nutrition Science, Chalmers University of Technology, Sweden

The red seaweed *Palmaria palmata* is known for its relatively high protein content compared to other seaweeds. It has a favorable amino acid profile and a unique color and aroma. However, for *P. palmata* to become a competitive protein source, its protein content needs to be further increased, and it must be confirmed that the proteins are digestible. The aim of this study was to investigate how herring production process water (HPPW) as cultivation media for the red seaweed *P. palmata* would affect the protein content, amino acid profile and in vitro protein digestibility of the produced biomass. Briefly, *P. palmata* was tank cultivated in seawater with added HPPW, and as controls, with seawater or seawater with added artificial nutrients. HPPW and artificial nutrients were diluted based on a normalized level of ammonia. Crude protein content and amino acid composition were analyzed. The in vitro protein digestibility was evaluated using the Infogest static in vitro digestion protocol, followed by analysis of degree of hydrolysis. Preliminary results indicate that the content of total amino acid and crude protein increased in HPPW-cultivated samples compared to controls, and that crude protein was similar to the control with artificial nutrients. Analysis of protein digestibility is ongoing. These preliminary findings reveal a new circular cultivation procedure for raising the protein content of *P. palmata*. They also indicate the importance of considering digestibility when discussing seaweed as a potential protein source. Future research will continue to explore the link between on the one hand protein digestibility and on the other, species, cultivation conditions and biomass processing.

The Norwegian Seaweed

Silje Forbord
Sintef Ocean, Norway.

The Norwegian Seaweed Centre provides modern equipment for research and innovation in an integrated full-scale technology platform run by interdisciplinary research environments at SINTEF and NTNU in close cooperation with the industrial sector. Its infrastructure consists of onshore and offshore facilities for macroalgae cultivation at coastal and exposed sites and integrated production with salmon in integrated multi-trophic aquaculture (IMTA). The offshore facilities and surrounding areas are visualised using mathematical ocean models connected to sensor networks for monitoring environmental conditions, the uptake of nutrients and CO2 and macroalgae growth. The centre will establish an automation and robotics laboratory for onshore and offshore facilities, a mobile system for pre-processing, stabilization and storage solutions for harvested raw materials, as well as laboratories for processing, product development and quality assessments.
https://norwegianseaweedcentre.com/

Cell wall remodeling in the green macroalgae *Ulva* in response to desiccation

Yunyun Pan
University Rostock Germany.

Ulva produces large amounts of coastal biomass and serves as a promising biological resource for various applications. The Ulva cell wall is composed of various polysaccharides and glycoproteins, protecting the sensitive algal protoplasts against external environmental challenges such as wave action, desiccation, osmotic fluctuations, and biotic stress. Exploring the cell wall-based survival strategies of *Ulva* offers insights into evolutionary adaptations to harsh coastal habitats and how algal bulk biomass responds to environmental input. This project focuses on the effects of desiccation stress on *Ulva* by exposing thalli to desiccation-rehydration cycles under controlled laboratory conditions. Polysaccharides distribution during desiccation-rehydration cycles is analyzed using antibody immunolabeling, click chemistry, comprehensive microarray polymer profiling (CoMPP) and other tools from glycobiology. *Ulva* strains isolated from the Baltic Sea were identified as *Ulva lactuca*. Cell wall polymers—including pectin, cellulose, and hemicelluloses—were visualized with differential in situ-stainings and digital microscopy before and after thalli underwent desiccation treatment. Next, several diagnostic enzymes were applied to selectively remove targeted polysaccharides from the cell walls of living thalli, followed by assessing the physiological state of algae via PAM photosynthetic activity measurements. Enzymically digested glycan

Posters

Pilot study on scalable seaweed farming in the German Baltic Sea for ruminant nutrition (Alg4Nut)

Azam Omidi, Fernanda Miyagi Pita, [Alg4Nut consortium], Klaus Herburger
Institute of Biological Sciences, Department of Cell Biology of Phototrophic Marine Organisms, University of Rostock, Rostock, Germany.

Recent studies indicate that seaweeds can serve as ruminant feed to improve animal health and reduce methane emissions, which is due to the unique algal cell wall polysaccharides and other bioactive compounds. Considering this potential, the Alg4Nut project explores the use of native Baltic Sea algae (Ulva spp., Porphyra spp.) as dietary supplements for dairy cows.
A key aspect of this multidisciplinary project is to screen and select native algal strains that exhibit high growth rates and broad environmental tolerance through laboratory cultivation in photobioreactors. The most promising candidates will be the basis for a 4-year feasibility study assessing the potential of scalable seaweed farming in the German Baltic Sea for the first time. Seaweed farms will be set up in a two-kilometer-long and ~50 -wide m canal directly connected to the Baltic Sea, located in the state of Mecklenburg-Western Pomerania.
Algal growth performance in the field will be monitored using a broad set of biochemical analyses, with particular emphasis on the algal polysaccharide pools. This will explore how environmental factors affect the algal polysaccharide composition. Additionally, in collaboration with project partners, the consequences of algal feeding on rumen microbiota resulting in methane reduction, alongside the impacts on animal health and milk yield, will be explored. Altogether, our consortium aims to help develop an algae-based marine bioeconomy in Northeastern Germany.

Enzymatically functionalized bioplastic made from regionally sourced green polysaccharides

Wenxin Liang, Fernanda Miyagi, Klaus Herburger
Universität Rostock Germany.

Plastics are indispensable materials in modern society, however, petroleum-based plastics hardly degrade and pollute the environment. The accumulation of microplastics and nanoplastics has become a global problem. The development of sustainable, biodegradable, and functional bioplastics has become an urgent need. Mecklenburg-Western Pomerania, situated on the German Baltic coast, boasts abundant agricultural resources and diverse algal biomass, providing unique regional advantages for the development of bioplastics from green biomass. Using winter wheat starch and green algae polysaccharides aligns with the principles of a circular bioeconomy, offering opportunities for sustainable regional value chains and new applications in environmentally friendly biomaterials. We aim to develop a low-energy, chemical-free bioplastic production process using winter wheat starch and cell wall polysaccharides from Baltic green algae (Ulva spp.). We will functionalize these bioplastics using glycan active enzymes extracted from plants, aiming to enhance the plastic's mechanical properties and to attach valuable cargo (such as dyes, fluorescent groups, and pH sensors). This will prepare the plastics for various applications. The study consisted of three phases: (1) extracting and characterizing polysaccharides; (2) mixing with plasticizers to prepare a biodegradable bioplastic film; (3) covalently immobilizing functional cargo molecules within the polysaccharide matrix using enzymes. The films will be characterized for their composition, nanostructure, mechanical and barrier properties, and degradability. We aim to demonstrate a new pathway toward sustainable, regionally based, and multifunctional bioplastics that contribute both to environmental protection and to the advancement of the regional bioeconomy in Northeastern Germany.

Effects of marine algal polysaccharides on the human gut microbiome and implications for gut health

Qian Wang
University of Rostock, Germany.

Macroalgae are an abundant source of high-quality marine algal polysaccharides (MAPs), which might serve as a healthy component of the human diet. Investigating the modulatory effects of MAPs on gut microbiota homeostasis, composition and microbial metabolites is key to understand MAPs' benefits for human (gut) health and their potential nutritional significance. Here we investigate the effects of major MAPs on the composition and metabolite production of human gut microbiomes sourced from 3 European donors. We are comparing effects of high-amylose maize starch (α-glucan from embryophytes) and three MAPs: green algal starch (α-glucan), soluble laminarin(β-glucan) and hardly soluble laminarin (β -glucan) and discuss beneficial alterations in microbiome composition in light of qualitative and quantitative shifts in MAP fermentation products. The effects of four polysaccharides on gut microbiota and metabolites are assessed using in vitro colon model followed by in-depth metabolic profiling and metagenomic analyses.
Interestingly, we found that feeding maize and Ulva starch has similar consequences for the gut microbiome composition and metabolite profile, e.g. short chain fatty acids (SCFAs) spectrum. Laminarin (hardly soluble) produced the highest total concentration of SCFAs during the fermentation process of 48 hours. Moreover, our results suggest that microbiome donor, substrate, and sampling time point have a significant impact on microbial community composition and the metabolite profile produced.
Although from vastly different sources, both starches triggered highly similar shifts in the human gut microbiome (in vitro). As high amylose starch is considered a valuable fiber due to its resistance to fermentation in the short intestine, Ulva starch naturally high in amylose may represent a promising source of "healthy" starch. The relationship between metabolites and gut microbiome data remains to be further explored.

Does morphological instability in the crop *Ulva fenestrata* results from polyploidy?

Inga Hellige
Department of Marine Sciences, University of Gothenburg, Tjärnö Marine Laboratory, Sweden.

Ulva fenestrata is gaining attention as a promising future crop for aquaculture in the Northern Hemisphere, sparking interest in methods to improve its growth and maintain morphological consistency. One potential strategy involves selecting fast-growing "giant" individuals. However, it remains unclear whether this distinctive trait —enabling them to outcompete others in growth— emerges randomly or is associated with polyploidy. Here, we sampled 39 individuals of Ulva fenestrata along the Swedish West coast and further included 7 long-term cultivated crop strains. All algae were incubated to induce fertility, swarmers were isolated and cultured to generate an F1 generation. This generation was screened for individuals displaying the giant phenotype. Selected F1 ganetophytic giants will be parthenogenetically propagated and the inheritance of the trait will be assessed while in parallel, we aim to determine ploidy levels in giant individuals.
Our findings may inform strain selection in future Ulva aquaculture by clarifying the role of polyploidy in morphological stability and genetic diversity. This knowledge is essential for identifying robust traits in cultivated strains and advancing our understanding of Ulva biology at both molecular and physiological levels.

Posters

Seaweed in the Netherlands; view on food safety.

J.W.H. Steenbergen-Biesterbos & S. Marca Schrap
The Office for Risk Assessment and Research of the Netherlands Food and Product Safety Authority (NVWA).

Europe has identified the potential of seaweed farming and is promoting aquaculture of seaweed, including in the Netherlands. In this study, we assessed the risks of seaweed for Dutch consumers after the consumption of seaweed (Sea lettuce and Sugar kelp) cultivated in the Netherlands.
The risk assessment is based on the chemical (contaminants) analyses of seaweed samples from Dutch farmed seaweed from open waters and following the risk assessment method of Codex Alimentarius and the working method of the European Food Safety Authority (EFSA).
Seaweed cultivated in the Netherlands (Sea lettuce and Sugar kelp) contains iodine, metals and other contaminants such as dioxins, PAHs and PFAS. When considering the risks to consumer health for individual contaminants, it was concluded that the presence of cadmium, mercury, nickel and PAH-4 does not lead to a risk. Furthermore, it was concluded that daily consumption of this unprocessed wet and dry seaweed farmed in the Netherlands may lead to a risk to consumer health due to the presence of iodine, lead, arsenic and PFAS. However, the treatment and processing of seaweed prior to consumption (such as washing, blanching, drying, salting, fermenting) show reduction of the presence of chemical hazards. And because the most seaweed will be processed before consumption, the risks of consuming processed seaweed are therefore expected as low.

Seaweed in the Netherlands; view on non-indigenous species.

Marca Schrap[1], Marjan Bovers[1] & Arjan Gittenberger[2]
[1] The Office for Risk Assessment and Research of the Netherlands Food and Product Safety Authority (NVWA), The Netherlands
[2] Gittenberger Marine Research Inventory Strategy (GiMaRIS), The Netherlands

Europe has identified the potential of seaweed farming and is promoting aquaculture of seaweed. In this study, we assessed the risks of seaweed farming in the Netherlands, focusing on non-indigenous species. A field study was conducted in 2019 to investigate the presence of non-indigenous species in Dutch seaweed farming. Non-indigenous seaweed (n=15) and animal species (n=20) were found. Farmed non-indigenous seaweeds were *Agardhiella subulata*, *Sargassum muticum*, *Ulva australis*, *Undaria pinnatifida*. These species are also non-indigenous to Northwestern Europe. Several other non-indigenous species (potential hitchhikers) were found as well. Farming of these seaweed species did not pose an additional risk to the environment as they had already established themselves and were widespread in the area where they were farmed. This was also the case for the other non-indigenous species which were found. As the risk of farming non-indigenous seaweed strongly depends on the local circumstances and the species involved, it is important to conduct a risk assessment before granting a site-specific licence to farm non-indigenous seaweed. In addition, the use of locally-collected starting material is preferred to prevent hitchhicking and introduction of non-indigenous species currently not present in the area.
Interestingly, a strong increase in the number of non-indigenous seaweed species new to the Netherlands was observed in recent years (>15 species instead of 2 to 3 species over a 5-year period). The high number of species (n=9) farmed in other areas of the world is noteworthy and signifies the importance of closely monitoring seaweed farming.

AlgeCenter Danmark