PRODUCT
DOCUMENTATION

OCEAN
RAINFOREST
SUSTAINABLE NORDIC SEAWEED

GENERAL **INFORMATION**

Name of producer

Ocean Rainforest Sp/F
Mjólkargøta 20
FO-180 Kaldbak
Faroe Islands

Website
www.oceanrainforest.com

General email
info@oceanrainforest.com

Food Authorization no. 4000

Ocean Rainforest has authorization from the Faroese Food and Veterinary Agency to produce seaweed products according to paragraph 4 in regulation no. 128, dated on 28 December 2010 on authorizations and registrations of food producers, updated on March 18, 2022. We have implemented a Quality and Food Safety System based on HACCP analysis and have attained a Certificate of Approval of Own Check Programme through the Faroe Islands Food and Veterinary Agency. All staff members are trained to follow the HACCP.

CAPTURING CARBON WITH CULTIVATED SEAWEED

Seaweeds are primary producers. They make use of energy from the sun and nutrients from the water column to photosynthesize and grow. As they grow, both wild and cultivated seaweeds act as "carbon sinks" by removing carbon from the water column and storing it in their tissues. While wild seaweeds are likely to decompose in the water column, thus releasing their stored carbon, carbon stored in cultivated seaweeds is removed when harvested.

By cultivating seaweed, we can effectively remove carbon from the environment and replace fossil-based materials, such as packaging materials. Incorporating seaweed-based products into agricultural systems for both crops and livestock has the potential to reduce the carbon footprint of food production – a major global challenge.

POSITIVE IMPACT ON THE MARINE ECOSYSTEM

As atmospheric carbon dioxide increases, the ocean absorbs more and more carbon, which results in a decrease in the pH of the ocean a process known as ocean acidification. Ocean acidification can make it hard for organisms, such as mussels, oysters, and corals to build shells. However, seaweeds naturally increase the local pH during the daytime as they remove carbon from the water column and photosynthesize.

Some seaweeds can reach up to 50 meters in length, providing shelter and food for a whole host of marine life.

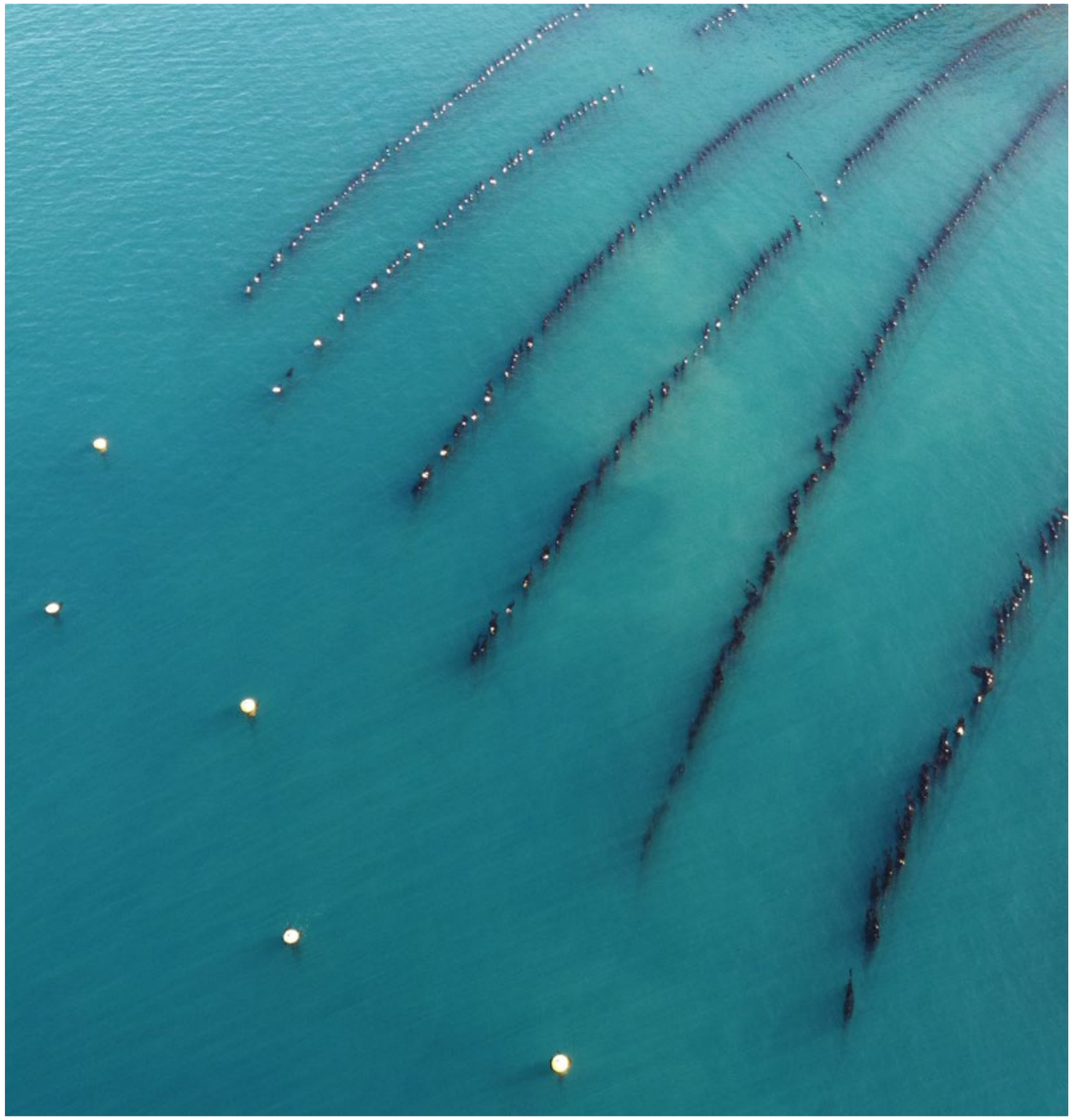
We keep our lines at sea for three years, which increases the local biodiversity significantly. Finally, we do not use any form of fertilization during the cultivation period - our seaweed gets all the nutrients it needs from the pristine waters in which it is cultivated.

ORIGIN OF PRODUCT

Ocean Rainforest operates in the Faroe Islands and in California, USA. We offer a variety of seaweed products cultivated and harvested at our licensed, open-ocean sites.

ANALYSES BY INDEPENDENT LABORATORIES

All analyses presented in this document are made by third party laboratories including the National Food Institute at the Technical University of Denmark (**www.food.dtu.dk**), Matis (**www.matis.is**), Heilsufrøðiliga Starvsstova (**www.hfs.fo**) and Eurofins (**www.eurofins.dk**).



MEASUREMENT OF BIOCHEMICAL COMPOSITION

Ocean Rainforest has undertaken extensive data sampling over a two-year period with monthly samples from the cultivation lines at two sites in Funnings-fjørdur, Faroe Islands. More than 200 samples (with 3 replicate sampling) were analysed for chemical com-position, seasonal variation, variation in depths, as well as variation between species and sites. We aim to test samples from the entire harvest season in the Faroe Islands and in the US, considering the different sites and species. We are continuously increasing our understanding of the chemical composition of our seaweeds and are eager to hear from you if you have an interest in compounds that have not yet been included in our assessment program.

The statistical data treatment does not show any difference in composition when cultivated at different depths (from surface to 10 meters below sea surface), and no statistical difference between two cultivation sites in Funningsfjørdur. Furthermore, there was no significant difference between years of sampling, but indications of variation in composition based on the age of the seaweeds. The biochemical composition is presented in this document according to species and time of year (seasonality). Since the results presented are based on untreated biomass, we have included for Saccharina latissima the processing into storage stable conditions and how the content varies according to processing (dried, fermented, etc.).

To learn more about our seaweed, please feel free to contact us directly.

ABOUT US

Ocean Rainforest is a limited company located in the **Faroe Islands** and in **California**, **USA**.

Our operation spans an unbroken chain from seeding, cultivation, harvesting, processing, and sales to the business-to-business market.

For more than a decade Ocean Rainforest has successfully developed and tested several ocean cultivation units (OCUs) in nearshore sheltered and open-ocean exposed sites. This enables us to supply high quality, food-grade seaweed products to customers in both Europe and North America.

We are committed to sustainably upscaling our existing production and branching out into cultivation of new seaweed species in both sea- and land-based systems.

BECAUSE **WE CARE**

We know that the chemical composition of seaweed is crucial no matter the final product: food, feed, cosmetics, packaging materials or other.

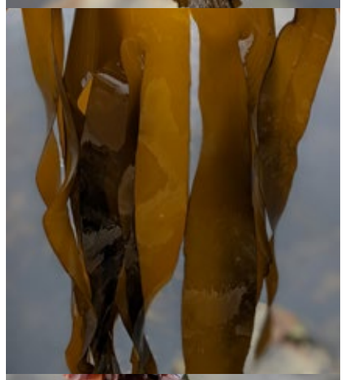
All the seaweed types we cultivate are grown in their natural habitat, thereby preserving their natural chemical composition, impacted only by the natural surroundings and change of seasons.

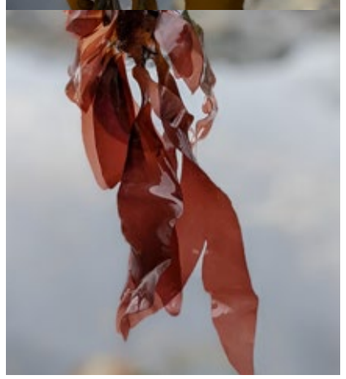
While our seaweed is not certified organic, it qualifies as it is **100% natural** with **no added fertilizers**. We are working with the Faroese Food and Veterinary Agency to obtain the EU Organic certification..

TRACEABILITY

At Ocean Rainforest we have developed a traceability system to record the origin, harvesting and processing dates of all the seaweeds cultivated and harvested by us. We happily share full traceability with every product sold. With this system, we can tell you when the seaweed was seeded and deployed, when it was harvested and processed and by whom.

OUR **PRODUCTS**





SACCHARINA LATISSIMA

Sugar kelp / Kombu / Breiðblöðkutur sukurtari

Harvest Season: April to October
Dried: From 1-10 kg bags
Flake Size: <2mm, 2-4mm, 4-6mm, >6mm, mixed size
Fermented: 1000L IBC containers
Min. Order Quantity: 1 kg dried / 1000 kg fermented

ALARIA ESCULENTA

Winged kelp / Wakame / Tang

Harvest Season: April to July
Dried: From 1-10 kg bags
Flake Size: <2mm, 2-4mm, 4-6mm, >6mm, mixed size
Min. Order Quantity: 1 kg dried

LAMINARIA DIGITATA

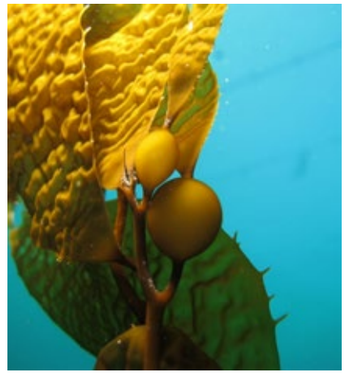
Oarweed / Tarablað

Harvest Season: May to October
Dried: From 1-10 kg bags
Flake Size: <2mm, 2-4mm, 4-6mm, >6mm
Min. Order Quantity: 1 kg dried

PALMARIA PALMATA

Dulse / Dilisk / Søl

Harvest Season: All year
Limited availability based on harvest from our ocean based cultivation units in the Faroe Islands and land based cultivation units in Iceland.



MACROCYSTIS PYRIFERA

Giant kelp

Harvest Season: June to August
Today only available for research purposes grown at our site outside Santa Barbara, CA, USA.

SACCHARINA LATISSIMA

Saccharina latissima, commonly known as sugar kelp, is a large brown seaweed species of the family Laminariaceae. It thrives in the stable, cold and nutrient-rich waters of the Faroe Islands and more generally throughout the North Atlantic and the North Pacific Oceans. Throughout its growth, *Saccharina latissima* accumulates a variety of highly nutritious and economically significant compounds of great relevance for food, feed, and pharmaceutical industries.

Compared to its sister kelp species *Saccharina japonica*, better known as Kombu, the cultivation of Saccharina latissima is still in its infancy whereas Kombu has been cultivated for many decades in Asia.

At Ocean Rainforest, we care for our *Saccharina latissima* from seed to product. The sugar kelp is seeded on lines and deployed during autumn at our unique ocean cultivation units in pristine waters. Due to our specific location in the North Atlantic Ocean, each cultivation unit is harvested twice a year, with continual regrowth without reseeding for up to three years. This gives us a total of five to six harvests over the lifetime of each seeded line, ensuring a sustainable and reliable supply.

Our spring harvest is typically preferred by food producers whereas the autumn harvest is of greater interest to biorefineries and the nutraceutical industry as the seaweed contains higher levels of laminarin, beta-glucan and fucoidan and has a lower mineral content. *Saccharina latissima* is known for its high iodine content.

At Ocean Rainforest we have the opportunity to treat the seaweed with heated sea- or fresh water to reduce the iodine content.

ALARIA ESCULENTA

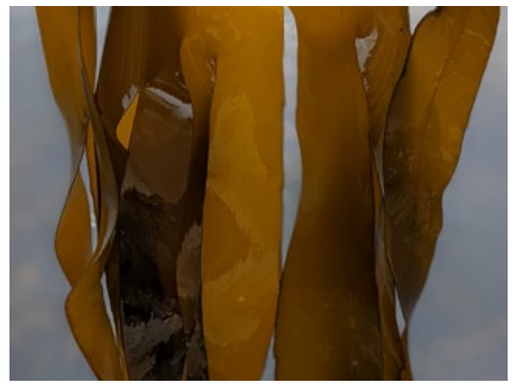
Alaria esculenta, also referred to as Atlantic wakame or winged kelp, is a large brown seaweed species of the family Alariaceae. It thrives along the Atlantic coastlines of Europe and North America in exposed sites and grows readily on our ocean cultivation units.

It is rich in sugars, proteins, vitamins, and other trace metals and contains up to 42% alginate (alginic acid).

In addition, the iodine content is lower than most other kelp species. The nutritional profile of *Alaria esculenta* makes it of particular interest for the food sector. In the Faroe Islands, we can harvest *Alaria esculenta* in spring until early summer and in 2-3 years without re-seeding the lines. At Ocean Rainforest we do not produce seeding material for this crop since it has natural settling on the upper part of our OCUs including mainlines and therefore it can be harvested next to *Saccharina latissima* that thrives further down the water column.

LAMINARIA DIGITATA

Laminaria digitata, also known as Oarweed or Finger Kelp, is a large brown seaweed species belonging to the family Laminariaceae. It is characterized by long, leathery fronds with multiple finger-like blades to which it owes its name. We harvest Laminaria digitata from our ocean cultivation units since it is natural settling on our vertical grow lines and out compete *Saccharina latissima* over time.

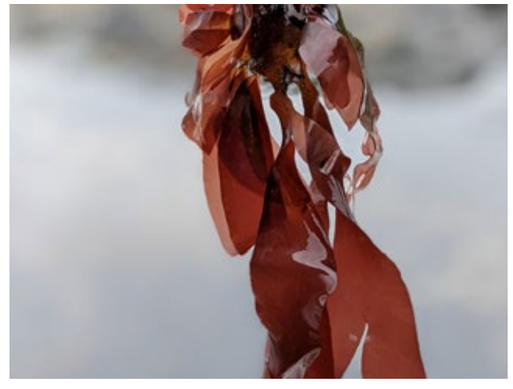


PALMARIA PALMATA

Palmaria palmata, commonly known as dulse, is a red seaweed species belonging to the family Palmariaceae. It is notably high in potassium, iron, iodine, and trace elements while being relatively low in sodium. Even a small portion of dulse can provide more than 100% of the daily recommended intake of Vitamin B6, 66% of Vitamin B12, iron, and fluoride.

This versatile seaweed is of interest for nutrition, cosmetic products, as fodder for various animals, and in biostimulant formulations for agricultural use.

Currently, Ocean Rainforest harvests dulse that is self-seeded to our OCUs while simultaneously scaling up cultivation efforts in both sea- and land-based systems, aiming for year-round production. Comprehensive product documentation for this species will be made available upon its commercialization.



MACROCYSTIS PYRIFERA

Macrocystis pyrifera, commonly known as giant kelp, is the largest of the brown algae and belongs to the family Laminariaceae. Individual blades can reach up to 50 m long and form vast ocean forests, home to a myriad of marine species.

Macrocystis pyrifera thrives in the coastal regions of the Pacific Ocean. In Santa Barbara, California, we are scaling cultivation of *Macrocystis pyrifera* and exploring different processing methods to extract bioactive compounds to harness *Macrocystis pyrifera's* unique potential as a biostimulant for agriculture use. Biostimulants are natural products stimulating plant nutrition processes by improving nutrient use efficiency, stress tolerance, quality traits and availability of confined nutrients in the soil. Such products are thus of great interest for high value crops grown in water-limited environments, such as California and southern Europe.

QUALITY ASSURANCE

Each batch of dried and fermented seaweed is checked in our in-house laboratory, and all results are available upon requests. Our checks include:

- Water activity (dried seaweed)
- pH (fermented seaweed)
- Enterobacteriaceae
- Escherichia coli
- Listeria spp.
- Listeria monocytogenes
- Staphylococcus aureus and other coagulase positive staphylococci
- Yeast and mold

PROCESSING METHODS

Our seaweed undergoes a variety of different processes depending on the final product and its end use. We take utmost care to ensure the integrity of the bioactive compounds that make our seaweed unique. These processes include but aren't limited to washing, blanching (heated water treatment), drying, fermenting, and ensiling. Details of some of these steps are outlined below.

BLANCHING

Exposing seaweed to heated salt or fresh water at a temperature of 45 degrees for 30-60 seconds is sufficient to reduce the iodine content significantly.

DRYING

We dry our seaweed at low temperatures (35-45 degrees Celsius), thereby ensuring that the quality of bioactive compounds is not compromised. Moisture contents are stated when exceeding 14%.

FERMENTATION

Fermentation is a preservation method utilizing microorganisms to reduce the pH of cut seaweed to a range between 3.5 and 4.5. This results in a seaweed mixture that is both prebiotic (providing fibers for the growth of beneficial intestinal microorganisms) and probiotic (contains live beneficial microorganisms).

In this process, the seaweed is first washed and blanched to remove impurities and excessive iodine.

The seaweed then passes through a series of cutters until it resembles a rough sludge. This mixture is inoculated with lactic acid bacteria, resulting in a pH drop over the course of about 3 days, thereby preserving the mixture and lending it its pre- and probiotic properties.

PRODUCT DELIVERY

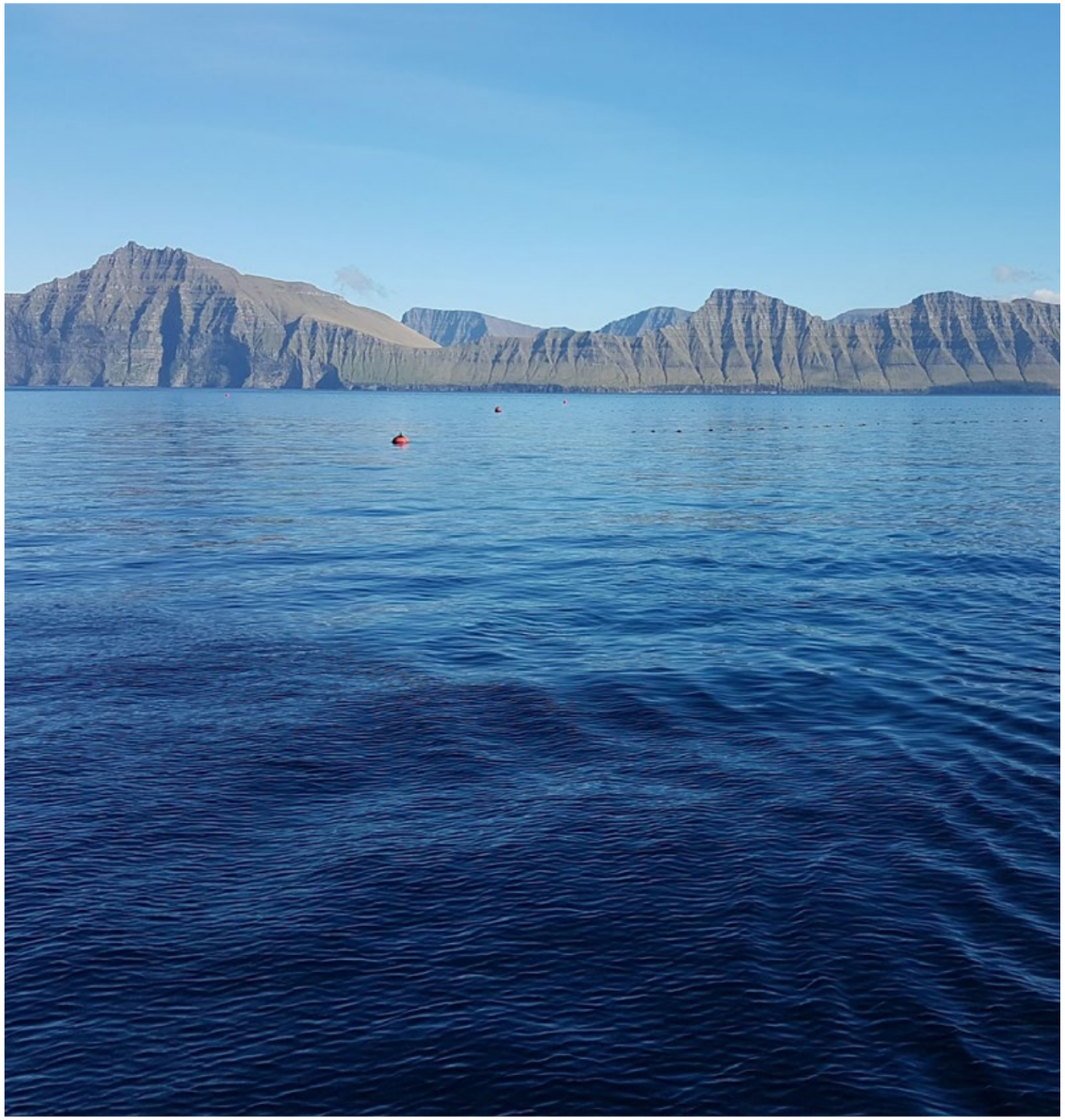
We deliver products in the form and quantities to our customers´ preference, both food and feed grade. All our suppliers of containers, bags and other packaging material are certified, **ISO 9001**.

DRIED SEAWEED:

- Powder < 2mm
- Small flakes 2-4 mm
- Larger flakes 4-6 mm
- Whole leaves
- Larger mixed sizes

FERMENTED SEAWEED:

- 1000 L IBCs



SACCHARINA LATISSIMA

Seasonal Variation Of *Saccharina latissima*

		All (Mar-Nov)		**Spring** (Mar-May)		**Summer** (Jun-Aug)		**Fall** (Sep-Nov)	
Compounds	**Unit**	**Mean**	**SD** [1]	**Mean**	**SD** [1]	**Mean**	**SD** [1]	**Mean**	**SD** [1]
Dry matter	% of ww[2]	**11.62**	2.57	**10.85**	0.73	**11.90**	3.95	**13.21**	6.66
Major 4 components									
Ash	% of dw[3]	**39.90**	5.94	**41.98**	4.71	**39.16**	5.32	**34.92**	6.18
Lipids	% of dw	**2.68**	1.48	**3.33**	2.18	**2.12**	0.25	**2.18**	0.22
Crude protein (N*6.25)	% of dw	**13.76**	2.22	**13.85**	1.98	**13.83**	1.25	**13.43**	1.36
Carbohydrates (calc)	% of dw	**46.31**	5.45	**44.54**	4.47	**47.45**	4.25	**48.59**	4.35
Metals and elements)									
Total arsenic (As)	ppm of dw	**53.31**	18.66	**56.37**	19.34	**48.12**	10.95	**53.68**	0.91
Inorganic arsenic (Ias)	ppm of dw	**0.18**	0.05	**0.20**	0.03	**0.18**	0.02	**0.13**	ND
Cadmium (Cd)	ppm of dw	**2.39**	0.97	**2.23**	0.65	**2.70**	1.58	**2.33**	0.89
Mercury (Hg)	ppm of dw	**0.01**	0.01	**0.01**	0.01	**0.00**	0.01	**ND**	ND
Lead (Pb)	ppm of dw	**0.21**	0.13	**0.26**	0.12	**0.13**	0.04	**0.23**	0.21
Iodine (I)	% of dw	**0.32**	0.17	**0.27**	0.06	**0.31**	0.03	**0.52**	0.02
Carbon (C)	% of dw	**21.62**	2.46	**20.27**	2.34	**22.61**	1.44	**25.80**	ND
Nitrogen (N)	% of dw	**2.14**	0.41	**2.13**	0.57	**2.20**	0.16	**1.98**	0.06
Phosphorus (P)	% of dw	**0.48**	0.35	**0.47**	0.19	**0.56**	0.59	**0.19**	ND
Bioactives									
Alginate & fibers (calc)	% of dw	**23.09**	10.81	**25.86**	10.10	**22.73**	ND	**17.72**	6.24
Mannitol	% of dw	**5.51**	3.51	**3.47**	2.99	**6.57**	1.44	**10.05**	3.61
Fucose	% of dw	**1.98**	1.11	**1.54**	0.84	**1.80**	0.35	**3.55**	2.05
Galactose	% of dw	**0.80**	0.76	**0.98**	0.97	**0.43**	0.15	**ND**	ND
Glucose	% of dw	**4.61**	3.50	**4.61**	3.69	**2.90**	4.00	**7.20**	4.67
Xylose	% of dw	**0.71**	0.88	**0.18**	0.20	**0.40**	ND	**1.65**	1.48
Total amino acids	% of dw	**5.98**	1.03	**6.63**	1.22	**5.48**	1.03	**5.90**	ND
Total fatty acids	% of dw	**2.68**	1.48	**3.33**	2.18	**2.12**	0.25	**2.18**	0.22
Omega-3 fatty acids	% of dw	**0.68**	0.58	**1.02**	0.87	**0.28**	0.09	**0.54**	0.15
Omega-6 fatty acids	% of dw	**0.24**	0.14	**0.34**	0.15	**0.18**	0.08	**0.15**	0.10
Omega-9 fatty acids	% of dw	**0.40**	0.37	**0.63**	0.53	**0.29**	0.02	**0.23**	0.10
ß-carotene	ppm of dw	**9.92**	0.25	**8.45**	0.22	**10.80**	0.18	**10.20**	ND
D-vitamin	ng/g	**<5**	ND	**<5**	ND	**<5**	ND	**<5**	ND

[1] Standard deviation [2] ww = wet weight [3] dw = dry weight

VARIATIONS IN STORAGE STABLE CONDITIONS

Of *Saccharina latissima*

		All	Dried	Dried fermented	Fermented	Liquid fermented	Frozen
Compounds	**Unit**	**Mean**	**Mean**	**Mean**	**Mean**	**Mean**	**Mean**
Energy	kcal	160	167	171	189	4	178
Ash	g/100g dw	29.46	31.87	30.47	34.19	2.73	31.61
Carbohydrates	g/100g dw	38.13	43.03	40.10	40.33	0.60	45.25
Of which sugars	g/100g dw	0.39	0.13	0.00	0.03	0.00	1.70
Of which fibers	g/100g dw	32.40	40.00	37.00	31.00	0.00	37.00
Protein	g/100g dw	14.24	14.67	17.00	17.67	0.40	14.00
Fat	g/100g dw	1.67	1.77	1.80	2.17	0.00	1.55
Of which saturated	g/100g dw	0.58	0.57	0.70	0.77	0.00	0.55
Of which unsaturated	g/100g dw	0.35	0.40	0.40	0.33	0.00	0.45
Of which poly unsaturated	g/100g dw	0.44	0.63	0.40	0.50	0.00	0.30
Salt (NaCl)	g/100g dw	5.80	5.47	5.20	6.70	0.58	7.85
Salt (Na)	g/100g dw	2.33	2.20	2.10	2.67	0.23	3.20
Metals and elements							
Total arsenic (As)	ppm of dw	58.97	65.80	52.00	62.67	5.60	64.00
Cadmium (Cd)	ppm of dw	2.56	2.92	2.90	2.73	0.03	2.00
Mercury (Hg)	ppm of dw	0.02	0.02	0.01	0.01	0.01	0.01
Lead (Pb)	ppm of dw	0.23	0.23	0.33	0.27	0.02	0.26
Iodine (I)	% of dw	0.42	0.37	0.42	0.53	0.07	0.87
Phosphorus (P)	% of dw	0.90	1.08	1.20	0.85	0.08	0.97
Sodium (Na)	% of dw	2.33	2.20	2.10	2.67	0.23	3.20
Sample size		n=10	n=3	n=1	n=3	n=1	n=2

SACCHARINA LATISSIMA **FATTY ACIDS**

Fatty acids (FA)	Unit	Mean	SD[1]
Total fatty acids	% of dw	2,59	1,48
Butyric acid C4:0	% of FA	ND	ND
Caproic acid C6:0	% of FA	ND	ND
Caprylic acid C8:0	% of FA	ND	ND
Capric acid C10:0	% of FA	0,35	0,14
Lauric acid C12:0	% of FA	0,40	0,25
Dodecenoic acid C12:1 (c11) ω1	% of FA	ND	0,00
Tetradecanoic C13:0	% of FA	ND	0,00
Myristic acid C14:0	% of FA	9,28	2,27
Myristoleic acid C14:1 (c9) ω5	% of FA	0,46	0,19
Pentadecanoic acid C15:0	% of FA	0,52	0,25
Pentadecenoic acid C15:1 (c10) ω5	% of FA	2,84	7,13
Palmitic acid C16:0	% of FA	18,22	4,59
Palmitoleic acid C16:1 (c9) ω7	% of FA	5,99	2,15
Hexadecadienoic C16:2n4 (c9,c12) ω4	% of FA	0,00	0,71
Hexadecatrienoic C16:3n4 (c6,c9,c12) ω4	% of FA	0,00	0,08
Margaric acid C17:0	% of FA	0,19	0,11
Heptadecenoic acid C17:1 (c10) ω7	% of FA	0,11	0,06
Stearic acid C18:0	% of FA	2,20	2,14
Oleic acid C18:1 (c9) ω9	% of FA	13,08	4,92
Vaccinic acid C18:1 (c11) ω7	% of FA	2,88	6,59
Linoleic acid C18:2 (c9,c12) ω6	% of FA	4,76	1,71
γ-Linolenic acid C18:3 (c6, c9, c12) ω6	% of FA	0,97	1,18
a-Linolenic acid C18:3 (c9, c12, c15) ω3	% of FA	4,20	1,32
Octadecatrienoic acid c18:3n4 (c8,c11,c14)	% of FA	0,00	0,15
Stearidonic acid C18:4 (c6, c9, c12, c15) ω3	% of FA	5,41	1,87

Fatty acids (FA)	Unit	Mean	SD[1]
Arachinic acid C20:0	% of FA	0,43	0,16
Gadoleic acid C20:1 (c9) ω11	% of FA	1,12	2,77
Gondoic acid, Eicosenoic acid C20:1 (c11) ω9	% of FA	0,25	0,14
Eicosadiene acid C20:2 (c11, c14) ω6	% of FA	0,15	0,07
Dihomo-γ-Linolenic acid C20:3 (c8, c11, c14) ω6	% of FA	1,04	2,54
Eicosatrienoic acid C20:3 (c11,c14,c17) ω3	% of FA	10,40	3,90
Arachidonic acid C20:4 (c5,c8,c11,c14) ω6	% of FA	5,34	4,28
Eicosatetraenoic acid (ETA) C20:4 ω3	% of FA	0,94	1,76
Eicosapentaenoic acid (EPA) C20:5 ω3	% of FA	6,36	1,89
Heneicosanic acid C21:0	% of FA	0,23	ND
Heneicosapentaenoic acid (HPA) C21:5 ω3	% of FA	ND	ND
Behenic acid C22:0	% of FA	ND	ND
Erucic acid C22:1 (c13) ω9	% of FA	0,31	0,26
Docosenoic acid C22:1 (c11) ω11	% of FA	1,43	4,61
Docosadienic acid C22:2 (c13,c16) ω6	% of FA	0,41	ND
Docosatriic acid C22:3 (c13,c16,c19) ω3	% of FA	ND	ND
Docosatetraenoic acid C22:4 ω6	% of FA	0,10	0,02
Docosapentaenoic acid (DPA) ω3 C22:5 ω3	% of FA	0,37	0,36
Docosapentaenoic acid C22:5 ω6	% of FA	ND	ND
Docosahexaenoic acid (DHA) C22:6 ω3	% of FA	1,31	2,19
Tricosanoic acid C23:0	% of FA	ND	ND
Lignoceric acid C24:0	% of FA	ND	ND
Nervonic acid C24:1 (c15) ω9	% of FA	0,28	0,37
Total fatty acids analysed	% of FA	91,09	2,95
Unidentified fatty acids	% of FA	8,91	2,95
Sum of Omega 3	% of FA	21,44	7,60
Sum of Omega 6	% of FA	8,49	4,22
Sum of Omega 9	% of FA	12,03	6,12

[1] Standard deviation

SACCHARINA LATISSIMA **AMINO ACIDS**

Amino acids (AA)	Unit	Mean	SD[1]
Total amino acids	% of dw	5,83	1,03
Lysin	% of AA	5,71	1,99
Alanin	% of AA	12,95	4,16
Arginin	% of AA	3,30	2,26
Cystin	% of AA	0,40	0,19
Leusin	% of AA	6,79	2,06
Methionin	% of AA	2,90	0,61
Phenylalanin	% of AA	4,67	1,16
Prolin	% of AA	4,84	1,38
Theronin	% of AA	4,52	0,94
Tyrosin	% of AA	2,69	0,57
Aspartic acid	% of AA	13,20	1,89
Serine	% of AA	4,15	1,76
4-Hydroxuprolin	% of AA	0,78	0,83
Glutamin	% of AA	15,85	4,24
Valin	% of AA	5,17	2,50
Histidin	% of AA	1,08	0,27
Thryptofan	% of AA	0,06	0,10
Isoleusin	% of AA	3,06	1,24
Glycin	% of AA	6,92	2,50

[1] Standard deviation

CHOLESTEROL IN SACCHARINA LATISSIMA

	Unit	Mean
Cholesterol ChGC	µg/mg	0,02
Brassicasterol Brass	µg/mg	0,01
24-methylidecholesterol	µg/mg	0,04
Fucosterol Fuco	µg/mg	0,36
Saringosterol 24R,S-Saringo	µg/mg	0,01
Sample size		n=7

[1] Standard deviation

PESTICIDES IN SACCHARINA LATISSIMA

No pesticides detected by GCMS/MS and LCMS/MS Pesticide Screening.

ALARIA ESCULENTA

Seasonal Variation Of *Alaria esculenta*

		All (Mar-Nov)		Spring (Mar-May)		Summer (Jun-Aug)		Fall (Sep-Nov)	
Compounds	**Unit**	**Mean**	**SD** [1]	**Mean**	**SD** [1]	**Mean**	**SD** [1]	**Mean**	**SD** [1]
Dry matter	% of ww[2]	**16,43**	3,36	**13,87**	1,98	**17,24**	2,97	**19,69**	2,62
Major 4 components									
Ash	% of dw[3]	**25,84**	4,44	**28,37**	3,30	**26,00**	4,20	**22,02**	2,58
Lipids	% of dw	**3,05**	0,84	**3,60**	0,87	**2,99**	0,65	**2,40**	0,57
Crude protein (N*6.25)	% of dw	**17,60**	2,80	**19,48**	2,95	**15,60**	2,04	**17,31**	1,01
Carbohydrates (calc)	% of dw	**52,83**	5,68	**49,36**	3,29	**52,11**	9,03	**56,66**	4,77
Metals and elements									
Total arsenic (As)	ppm of dw	**43,77**	5,73	**43,01**	8,35	**44,29**	5,53	**43,91**	3,64
Inorganic arsenic (Ias)	ppm of dw	**0,25**	0,07	**0,29**	ND	**0,21**	0,07	**0,34**	ND
Cadmium (Cd)	ppm of dw	**3,42**	1,12	**4,13**	0,65	**3,39**	1,41	**2,51**	0,32
Mercury (Hg)	ppm of dw	**0,06**	0,13	**0,01**	0,01	**0,08**	0,16	**ND**	ND
Lead (Pb)	ppm of dw	**0,26**	0,16	**0,33**	0,16	**0,14**	0,03	**0,40**	0,24
Iodine (I)	% of dw	**0,02**	0,01	**0,02**	0,00	**0,02**	0,00	**0,03**	0,01
Carbon (C)	% of dw	**ND**	ND	**ND**	ND	**ND**	ND	**ND**	ND
Nitrogen (N)	% of dw	**ND**	ND	**ND**	ND	**ND**	ND	**ND**	ND
Phosphorus (P)	% of dw	**ND**	ND	**ND**	ND	**ND**	ND	**ND**	ND
Bioactives									
Alginate & fibers (calc)	% of dw	**33,96**	7,37	**33,66**	6,58	**30,13**	10,47	**38,40**	8,49
Mannitol	% of dw	**5,09**	3,01	**3,68**	2,96	**6,16**	1,75	**6,29**	5,07
Fucose	% of dw	**0,77**	0,44	**0,68**	0,50	**1,06**	0,32	**0,52**	0,45
Galactose	% of dw	**0,59**	0,31	**0,69**	0,42	**0,56**	0,15	**0,44**	0,33
Glucose	% of dw	**4,69**	2,73	**3,42**	2,07	**4,85**	3,65	**7,00**	1,70
Xylose	% of dw	**1,44**	2,63	**2,56**	3,58	**0,40**	0,00	**0,24**	0,19
Total amino acids	% of dw	**9,29**	2,16	**11,19**	ND	**8,47**	1,94	**9,01**	ND
Total fatty acids	% of dw	**3,05**	0,84	**3,60**	0,87	**2,99**	0,65	**2,40**	0,57
Omega-3 fatty acids	% of dw	**1,06**	0,32	**1,15**	0,36	**0,98**	0,50	**1,06**	0,14
Omega-6 fatty acids	% of dw	**0,22**	0,13	**0,30**	0,20	**0,19**	0,03	**0,19**	0,11
Omega-9 fatty acids	% of dw	**0,28**	0,10	**0,23**	0,00	**0,39**	0,09	**0,21**	0,01
ß-carotene	ppm of dw	**22,85**	0,82	**26,70**	ND	**20,95**	1,48	**22,80**	ND

[1] Standard deviation [2] ww = wet weight [3] dw = dry weight

ALARIA ESCULENTA **FATTY ACIDS**

Fatty acids (FA)	Unit	Mean	SD[1]
Total fatty acids	% of dw	3.05	0.84
Butyric acid C4:0	% of FA	ND	ND
Caproic acid C6:0	% of FA	ND	ND
Caprylic acid C8:0	% of FA	ND	ND
Capric acid C10:0	% of FA	0.20	0.03
Lauric acid C12:0	% of FA	0.20	0.11
Dodecenoic acid C12:1 (c11) ω1	% of FA	ND	0.00
Tetradecanoic C13:0	% of FA	ND	0.00
Myristic acid C14:0	% of FA	4.93	1.00
Myristoleic acid C14:1 (c9) ω5	% of FA	0.46	0.07
Pentadecanoic acid C15:0	% of FA	0.28	0.10
Pentadecenoic acid C15:1 (c10) ω5	% of FA	0.16	0.04
Palmitic acid C16:0	% of FA	13.37	2.51
Palmitoleic acid C16:1 (c9) ω7	% of FA	4.38	3.42
Hexadecadienoic C16:2n4 (c9,c12) ω4	% of FA	0.00	0.53
Hexadecatrienoic C16:3n4 (c6,c9,c12) ω4	% of FA	0.00	0.07
Margaric acid C17:0	% of FA	0.10	0.06
Heptadecenoic acid C17:1 (c10) ω7	% of FA	0.56	0.39
Stearic acid C18:0	% of FA	0.90	0.28
Oleic acid C18:1 (c9) ω9	% of FA	7.65	1.61
Vaccinic acid C18:1 (c11) ω7	% of FA	0.50	0.33
Linoleic acid C18:2 (c9,c12) ω6	% of FA	3.85	0.72
γ-Linolenic acid C18:3 (c6, c9, c12) ω6	% of FA	0.93	0.19
a-Linolenic acid C18:3 (c9, c12, c15) ω3	% of FA	8.25	1.94
Octadecatrienoic acid c18:3n4 (c8,c11,c14)	% of FA	0.00	3.33
Stearidonic acid C18:4 (c6, c9, c12, c15) ω3	% of FA	16.00	ND

Fatty acids (FA)	Unit	Mean	SD[1]
Arachinic acid C20:0	% of FA	0.06	0.12
Gadoleic acid C20:1 (c9) ω11	% of FA	0.39	0.00
Gondoic acid, Eicosenoic acid C20:1 (c11) ω9	% of FA	1.66	3.58
Eicosadiene acid C20:2 (c11, c14) ω6	% of FA	0.23	0.20
Dihomo-γ-Linolenic acid C20:3 (c8, c11, c14) ω6	% of FA	0.33	0.20
Eicosatrienoic acid C20:3 (c11,c14,c17) ω3	% of FA	8.24	3.53
Arachidonic acid C20:4 (c5,c8,c11,c14) ω6	% of FA	8.35	2.38
Eicosatetraenoic acid (ETA) C20:4 ω3	% of FA	0.45	0.07
Eicosapentaenoic acid (EPA) C20:5 ω3	% of FA	13.85	0.87
Heneicosanic acid C21:0	% of FA	ND	ND
Heneicosapentaenoic acid (HPA) C21:5 ω3	% of FA	ND	ND
Behenic acid C22:0	% of FA	ND	ND
Erucic acid C22:1 (c13) ω9	% of FA	0.05	0.07
Docosenoic acid C22:1 (c11) ω11	% of FA	0.13	0.21
Docosadienic acid C22:2 (c13,c16) ω6	% of FA	ND	ND
Docosatriic acid C22:3 (c13,c16,c19) ω3	% of FA	ND	ND
Docosatetraenoic acid C22:4 ω6	% of FA	ND	ND
Docosapentaenoic acid (DPA) ω3 C22:5 ω3	% of FA	0.12	0.01
Docosapentaenoic acid C22:5 ω6	% of FA	ND	ND
Docosahexaenoic acid (DHA) C22:6 ω3	% of FA	0.32	0.24
Tricosanoic acid C23:0	% of FA	ND	ND
Lignoceric acid C24:0	% of FA	ND	ND
Nervonic acid C24:1 (c15) ω9	% of FA	ND	ND
Total fatty acids analysed	% of FA	90.22	1.40
Unidentified fatty acids	% of FA	9.78	1.40
Sum of Omega 3	% of FA	34.59	10.57
Sum of Omega 6	% of FA	6.85	3.63
Sum of Omega 9	% of FA	8.58	3.17

[1] Standard deviation

ALARIA ESCULENTA **AMINO ACIDS**

Amino acids (AA)	Unit	Mean	SD[1]
Total amino acids	% of dw	8.58	2.16
Lysin	% of AA	5.76	3.79
Alanin	% of AA	13.89	7.50
Arginin	% of AA	3.71	1.10
Cystin	% of AA	2.98	8.39
Leusin	% of AA	6.71	3.46
Methionin	% of AA	2.38	0.58
Phenylalanin	% of AA	4.12	1.85
Prolin	% of AA	4.24	1.65
Theronin	% of AA	4.57	2.34
Tyrosin	% of AA	2.70	0.89
Aspartic acid	% of AA	12.07	3.90
Serine	% of AA	4.96	1.26
4-Hydroxuprolin	% of AA	0.37	0.19
Glutamin	% of AA	14.68	7.23
Valin	% of AA	6.36	5.64
Histidin	% of AA	1.17	0.71
Thryptofan	% of AA	ND	ND
Isoleusin	% of AA	3.47	2.60
Glycin	% of AA	5.85	4.08

[1] Standard deviation

CHOLESTEROL IN ALARIA ESCULENTA

	Unit	Mean
Cholesterol ChGC	µg/mg	0.15
Brassicasterol Brass	µg/mg	0.03
24-methylidecholesterol	µg/mg	0.06
Fucosterol Fuco	µg/mg	0.29
Saringosterol 24R,S-Saringo	µg/mg	0.00
Sample size		n=4

[1] Standard deviation

LAMINARIA DIGITATA

Seasonal Variation Of *Laminaria digitata*

		All (Mar-Nov)	Spring (Mar-May)	Summer (Jun-Aug)	Fall (Sep-Nov)
Compounds	**Unit**	**Mean**	**Mean**	**Mean**	**Mean**
Dry matter	% of ww[2]	**16.17**	**12.68**	**17.08**	**18.75**
Major 4 components					
Ash	% of dw[3]	**32.21**	**37.93**	**26.18**	**32.87**
Lipids	% of dw	**1.53**	**1.77**	**1.43**	**1.50**
Crude protein (N*6.25)	% of dw	**15.79**	**15.57**	**14.08**	**19.43**
Carbohydrates (calc)	% of dw	**52.06**	**45.37**	**58.33**	**46.20**
Metals and elements					
Total arsenic (As)	ppm of dw	**51.06**	**51.06**	**ND**	**ND**
Inorganic arsenic (Ias)	ppm of dw	**ND**	**ND**	**ND**	**ND**
Cadmium (Cd)	ppm of dw	**2.40**	**2.40**	**ND**	**ND**
Mercury (Hg)	ppm of dw	**ND**	**ND**	**ND**	**ND**
Lead (Pb)	ppm of dw	**0.22**	**0.22**	**ND**	**ND**
Iodine (I)	% of dw	**0.51**	**0.48**	**0.60**	**0.43**
Carbon (C)	% of dw	**ND**	**ND**	**ND**	**ND**
Nitrogen (N)	% of dw	**ND**	**ND**	**ND**	**ND**
Phosphorus (P)	% of dw	**ND**	**ND**	**ND**	**ND**
Bioactives					
Alginate & fibers (calc)	% of dw	**18.85**	**18.85**	**ND**	**ND**
Mannitol	% of dw	**10.45**	**10.45**	**ND**	**ND**
Fucose	% of dw	**4.25**	**4.25**	**ND**	**ND**
Galactose	% of dw	**3.35**	**3.35**	**ND**	**ND**
Glucose	% of dw	**ND**	**ND**	**ND**	**ND**
Xylose	% of dw	**2.50**	**2.50**	**ND**	**ND**
Total amino acids	% of dw	**ND**	**ND**	**ND**	**ND**
Total fatty acids	% of dw	**1.53**	**1.77**	**1.43**	**1.50**
Sample size		n=9	n=4	n=3	n=2

[2] ww = wet weight [3] dw = dry weight

PALMARIA PALMATA

Seasonal Variation Of *Palmaria palmata*

		All (Mar-Nov)	Spring (Mar-May)	Fall (Sep-Nov)
Compounds	**Unit**	**Mean**	**Mean**	**Mean**
Dry matter	% of ww[2]	**19.38**	**16.36**	**22.40**
Major 4 components				
Ash	% of dw[3]	**17.90**	**20.30**	**15.50**
Lipids	% of dw	**1.64**	**ND**	**1.64**
Crude protein (N*6.25)	% of dw	**18.80**	**27.30**	**10.30**
Carbohydrates (calc)	% of dw	**72.56**	**ND**	**72.56**
Metals and elements				
Total arsenic (As)	ppm of dw	**8.82**	**8.82**	**ND**
Inorganic arsenic (Ias)	ppm of dw	**ND**	**ND**	**ND**
Cadmium (Cd)	ppm of dw	**1.45**	**1.45**	**ND**
Mercury (Hg)	ppm of dw	**ND**	**ND**	**ND**
Lead (Pb)	ppm of dw	**0.29**	**0.29**	**ND**
Bioactives				
Alginate & fibers (calc)	% of dw	**0.07**	**0.07**	**ND**
Mannitol	% of dw	**0.01**	**0.01**	**ND**
Fucose	% of dw	**0.00**	**0.00**	**ND**
Galactose	% of dw	**0.06**	**0.06**	**ND**
Glucose	% of dw	**0.11**	**0.11**	**ND**
Xylose	% of dw	**0.22**	**0.22**	**ND**
Total amino acids	% of dw	**ND**	**ND**	**ND**
Total fatty acids	% of dw	**1.64**	**ND**	**1.64**
Sample size		n=5	n=4	n=1

[2] ww = wet weight [3] dw = dry weight

PRODUCT LABELING

BATCH NUMBER

Our traceability system has been developed to trace the origins and processing of all seaweed from Ocean Rainforest.

In this system, every harvest is assigned a 5-digit batch number. A batch is defined as any seaweed collected between departure and arrival at the dock.

The batch number is composed of 5 numbers:

- Digit 1-2 indicate the year;
- Digit 3 identifies the vessel used to harvest;
- Digit 4-5 is the harvest trip number.

For example, the first harvest of 2023 has batch number 23201, where 23 is the year, 2 is the vessel "Breiðbløka," and 01 us the harvest trip number.

In addition to the batch number, ORF registers a variety of information, among others, where the seaweed has been harvested *(OCU specifications)*, how old the seaweed is *(the date of seeding and how many times the seaweed has been harvested before)*, and handling specifications *(crew on board the vessel, handling time and processing details)*.

PRODUCT NUMBER

The finished product gets a 5-digit product number, which traces additional information:

- Digit 1 defines the type of seaweed;
- Digits 2-3 define how it was pre-treated;
- Digits 4-5 define how the seaweed is made storage stable and in what form.

For example, product number 10303 indicates that this package contains *Saccharina latissima* (1) which is washed in fresh water (03) and thereafter dried in mixed sizes (03).

OCEAN
RAINFOREST
SUSTAINABLE NORDIC SEAWEED

CONTACT US

FAROE ISLANDS
Mjólkargøta 20
FO-180 Kaldbak
Faroe Islands

CALIFORNIA
7 W Figueroa St. Fl 3.
Santa Barbara
CA 93101

Phone: +298 310700 / +298 233080
Email: info@oceanrainforest.com
Web: **www.oceanrainforest.com**