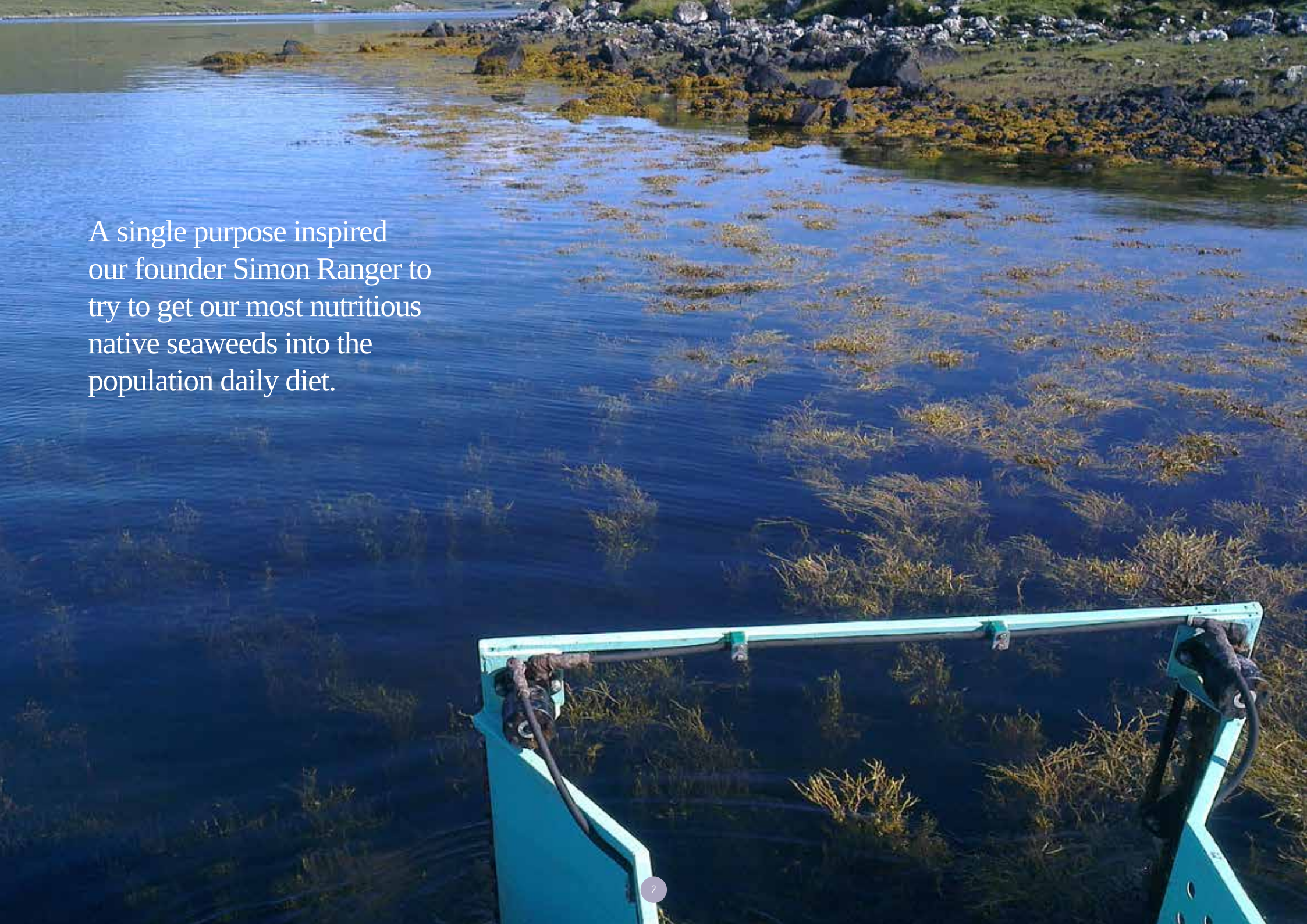

Seagreens®
An Obsession for Quality



A single purpose inspired our founder Simon Ranger to try to get our most nutritious native seaweeds into the population daily diet.

Simon studied their nutritional value and pioneered the production of seawed for human consumption from the late 1990s in Norway and the British Isles. He understood they would best be delivered as ingredients, in food and drink, nutritional therapy and bodycare, even through the plants and livestock we eat. In this way, important ocean nutrients could be returned to the food chain.

Today we produce 15 ingredient products from 5 native seaweed species, to a consistent standard, supported by more than a decade of independent compositional analysis and applied nutrition research. Seagreens® are ‘country of origin’ Great Britain.

# Seagreens® Ascophyllum

## Very Fine, Fine, Medium, and Large Granules

### *Ascophyllum nodosum*: Knotted wrack

There are red, green, and brown seaweeds, brown overall being the most nutritious.

*Ascophyllum* is a native brown species, the most prolific of the ‘Wrack’ family.

It is adding *nutrient density and health benefits* to an ever-increasing range of nutrition and food products.

# Seagreens® Fucus

## Very Fine, Fine, and Medium Granules, and Large Pieces

### *Fucus vesiculosus:* Bladder wrack

The ancient Greeks called all seaweed *Phycos.*

Which is why until recently, all the Wrack species were called *Fucus*, because they are so *closely related.*

Bladder wrack is the highest in *antioxidants. Fucus Serratus* and *Fucus Spiralis* have similar organoleptic and nutritonal properties.


# Seagreens® Dulse

## Very Fine and Fine Granules, Medium Flakes, and Chopped Pieces

### *Palmaria palmata*: Dulse

Traditionally prized for its flavour, variously decribed as salty and smokey, it has a well balanced nutritional profile, *with very low iodine*.

Scientifically, it has low *umami*, but a ‘high roasted’, bitter taste and aroma.

‘Ruby Rich Dulse’, chopped and sold in sachets in Waitrose stores, is Seagreens® *Palmaria* from the western shores of Ireland and Scotland.

# Seagreens® Winged Kelp

## Very Fine and Fine Granules, Medium Flakes, and Chopped Pieces

### *Alaria esculenta*: Winged kelp, Dabberlocks

Similar to Japanese *Wakame* but a different species, Winged kelp has moderate *umami* flavour, and moderate iodine.

Unlike Dulse it has a *distinctly sweet, clean taste and aroma*, highly suitable for tea blends, fruit juices, and nutritious smoothies.

# Seagreens® Triblend
## Fine and Medium Granules

*Ascophyllum, Fucus, Pelvetia*:
Knotted, Bladder, and Channel wrack

Species can be blended to meet *nutritional and regulatory requirements, flavours, aromas and textures.*

A blend can add uniqueness to a high quality supplement or food formula, or help achieve desired nutrition and health claims.

Most blends are made for a customer requirement, but some well proven blends are available from stock.

# Seagreens® Wrack Blend
## Fine and Medium Granules

*Ascophyllum* and *Fucus*:
Knotted and Bladder wrack

This blend combines the benefits of *Fucus* high antioxidant profile and lower iodine, with *Ascophyllum* thyroid research and high polyphenols, and the *functional and health claims for both species.*

Seagreens® ingredients are harvested and processed under full **HACCP quality control procedures**, and are finished and packed in **British Retail Consortium** accredited A grade, **FDA Registered Food Facilities** for worldwide distribution and sales in more than 12 countries including Europe, North America and Australasia.

**Standard Operating Procedures** are directly supervised, including in-line processing checks and full metals detection and removal, to **Current Good Manufacturing Practice** (cGMP). SOPs and **Master File** include Customer Complaints, Recall Procedures and Retained Sampling, compliant with all relevant national and international regulations. Seagreens® are additionally certified **Organic**, Beth Din **Kosher for Passover**, and can be declared Non-allergenic, Raw, **Vegan** and Halal compliant.

# Nutritious Food Seaweed

BDA CERTIFICATION

When Seagreens® began in 1998, ‘Organic’ included dead seaweed collected on a clean beach, and it still does.

The need for quality assurance led Simon to work with the UKAS accredited certification body, the Biodynamic Association, to develop Nutritious Food Seaweed, the world’s first standard to a comprehensive minimum nutritional profile.

*Successfully audited since 2016 by Clearspring, Unilever, Viridian, Waitrose, and others.*

Many seaweed species are rich in minerals, trace elements and other micronutrients. Some provide all the B vitamins including B12, a good ratio of fatty acids and soluble fibre. Generic compositional data for most seaweed is available from academic sources, *but many production factors affect the nutrient profile and product quality.*

## Comparison in foods using atomic absorption spectrophotometry

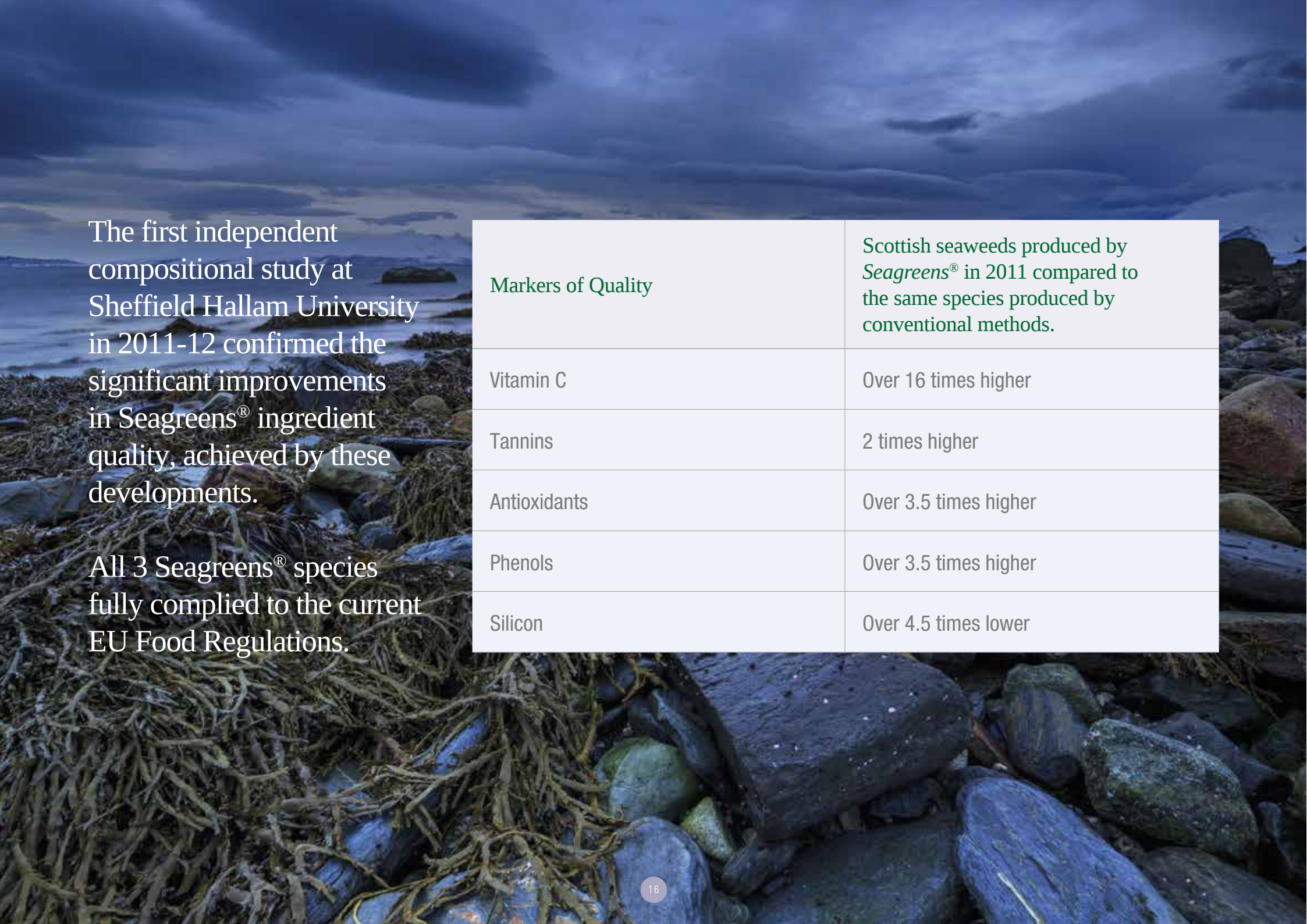
Minerals: Sodium, Potassium, Calcium, Magnesium
Trace elements: Iron, Zinc, Manganese, Copper

| | | Minerals mg/100g | Trace elements mg/100g |
|---|---|---|---|
| Bladderwrack | *Fucus vesiculosus* | 8,000 - 17,900 | n/a |
| Kelp | *Laminaria digitata* | | |
| Wakame | *Undaria pinnifitada* | | |
| Carragheen | *Chondrus crispus* | | |
| Laver | *Porphyra tenera* | | |
| Spinach | | 9,700 | |
| Tomatoes | | 6,000 | |
| Potatoes | | 3,400 | |
| Carrots | | 3,300 | |
| Green peas | | 1,450 | |
| Sweet corn | | 1,350 | |

- Ruperez. P., 2002. Mineral content of edible marine seaweeds. Food Chemistry 79: 23-26

Prototype electric harvester with ‘soft’ cutter and automatic bagging. Patents applied for.

Seagreens developed very precise selection and harvesting methods, clean handling and low temperature drying to ensure the integrity of these valuable nutrients, through consistency and quality in production.



The first independent compositional study at Sheffield Hallam University in 2011-12 confirmed the significant improvements in Seagreens® ingredient quality, achieved by these developments.

All 3 Seagreens® species fully complied to the current EU Food Regulations.

| Markers of Quality | Scottish seaweeds produced by *Seagreens*® in 2011 compared to the same species produced by conventional methods. |
|---|---|
| Vitamin C | Over 16 times higher |
| Tannins | 2 times higher |
| Antioxidants | Over 3.5 times higher |
| Phenols | Over 3.5 times higher |
| Silicon | Over 4.5 times lower |

Over the years, the collection of consistent, independent analytical data from each harvested batch, continues to guide production and improvements continue to be made.

*Nutrient improvements over 10 years*

Vitamin C up a further 131%

Polyphenols up a further 6.5%

Nutrient Data averages over 10 years from 2008-2018

| | Specification | Measure | All *Ascophyllum* to 2016 | All *Fucus vesiculosus* | All Scotland *Ascophyllum* | *Ascophyllum since* 2016 |
|---|---|---|---|---|---|---|
| **Nutrients - markers** | | | | | | |
| Iodine | 700 | µg/g | 781.750 | 424.714 | 735.222 | 921.33 |
| **Vitamin C** | >6 | mg/100g | **12.320** | 7.650 | 5.490 | **28.475** |
| **Polyphenols** | >1500 | mg/kg | **27,954.833** | 26,596.667 | 25,780.000 | **29,784.500** |
| Tannins | TBA | g/100g | 3.667 | 4.000 | 4.500 | - |
| Silicon | TBA | mg/kg | 75.116 | 123.597 | 83.283 | - |
| Moisture | <14 | % | 11.591 | 11.056 | 12.715 | 5.970 |
| Total phenolics (Gallic Acid equiv) | TBA | mg/g | 29.343 | 144.495 | 28.850 | - |
| Antioxidant capacity ORAC | TBA | µmole/TE/g | 72.455 | 244.495 | 201.667 | - |
| *Particle size* | TBA | % <0.6mm | - | - | - | - |
| **Amino acids** | | | | | | |
| Alanine | TBA | g/kg | 0.177 | 0.241 | - | - |
| Arginine | TBA | g/kg | 0.115 | 0.150 | - | - |
| Asparagine | TBA | g/kg | - | 0.250 | - | - |
| Aspartic acid | TBA | g/kg | 0.327 | 0.417 | - | - |
| Cystine | TBA | g/kg | 0.073 | 0.295 | - | - |
| Cystathionine (free) | TBA | g/kg | - | - | - | - |
| Glutamic acid | TBA | g/kg | 0.400 | 0.579 | - | - |
| Glutamine (free) | TBA | g/kg | - | - | - | - |
| Glycine | TBA | g/kg | 0.154 | 0.193 | - | - |

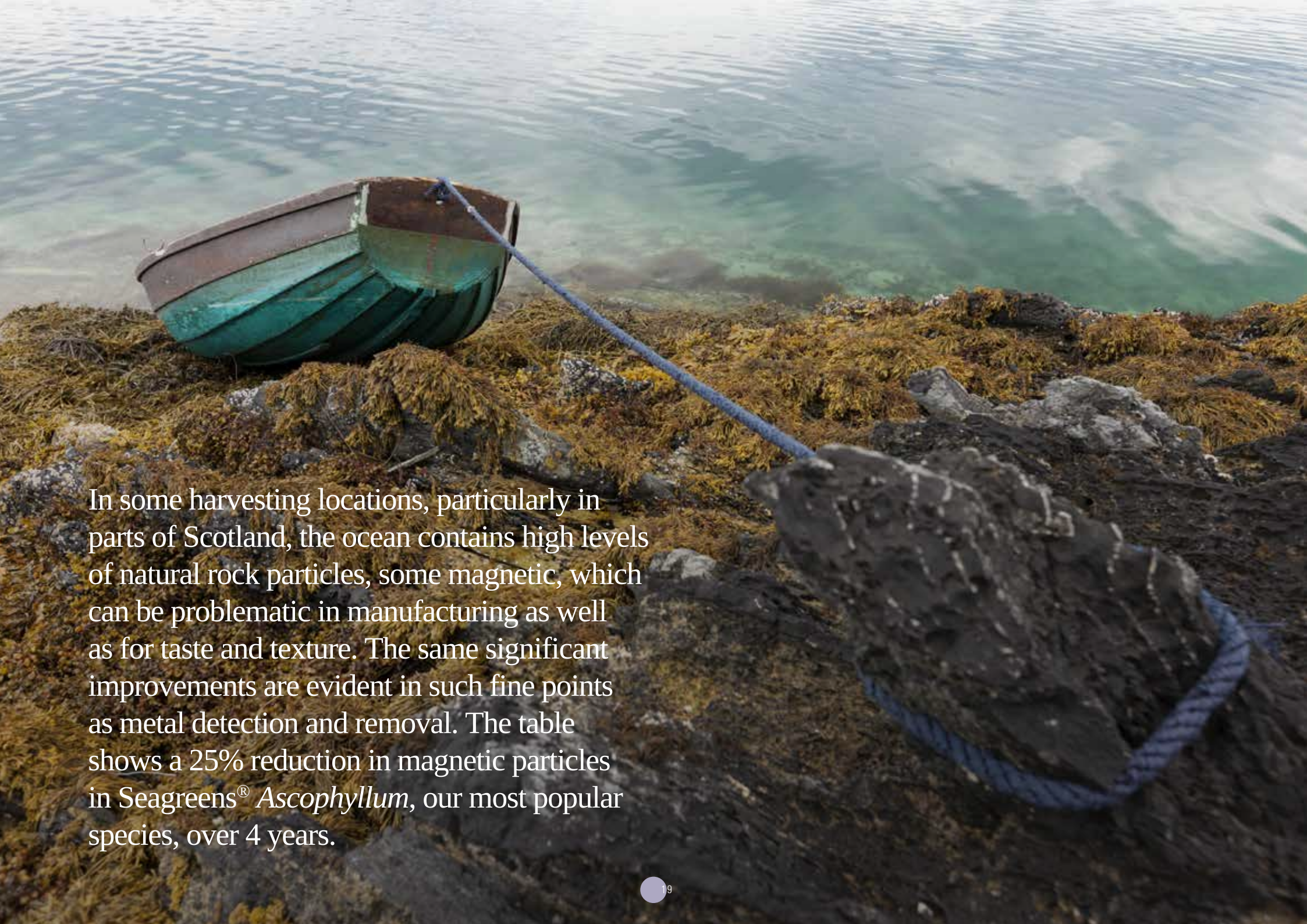
Our analytical data covers not only nutrients but contaminants, microbials, allergens, moisture, particle size and other determinants of production quality. Removing fossil fuels in 2016, reduced polyaromatic hydrocarbons, often found in dried or smoked foods and already well below EU regulatory levels, over 60%.

*Contaminant improvements over 10 years*

Polyaromatic hydrocarbons reduced by more than 60%

Contaminant Data averages over 10 years from 2008-2018

| | Specification | Measure | All *Ascophyllum* to 2016 | All *Fucus vesiculosus* | All Scotland *Ascophyllum* | *Ascophyllum since* 2016 |
|---|---|---|---|---|---|---|
| **Heavy metals** | | | | | | |
| Arsenic (total) | None | mg/kg | 28.375 | 47.008 | 28.771 | 26.594 |
| Arsenic (inorganic) | ≤1 | mg/kg | 0.324 | 0.291 | 0.360 | 0.310 |
| Cadmium (EU Reg is ≤3) | ≤1 | mg/kg | 0.551 | 0.820 | 0.385 | 0.686 |
| Lead | ≤3 | mg/kg | 0.675 | 0.891 | 0.785 | 0.534 |
| Mercury | ≤0.1 | mg/kg | 0.026 | 0.014 | 0.030 | 0.020 |
| Aluminium | None | mg/kg | - | - | - | - |
| **Microbiology** | | | | | | |
| Total Plate Count | ≤10000 | cfu/g | 231.875 | 29.091 | 287.273 | 183.333 |
| Coliforms | ≤100 | cfu/g | 12.733 | 16.364 | 17.000 | 7.000 |
| Yeast and mould | ≤1000 | cfu/g | 63.875 | 73.636 | 74.545 | 67.333 |
| Enterobacteriaceae | ≤10 | cfu/g | 6.867 | 16.364 | 8.100 | 7.333 |
| Escherichia coli | ≤10 | cfu/g | 6.067 | 8.182 | 7.000 | 7.000 |
| Staphylococcus aureus | ≤10 | cfu/g | 8.000 | 25.455 | 9.000 | 10.000 |
| Salmonella | ND | cfu/25g | - | - | - | - |
| Vibrio species | ND | cfu/25g | - | - | - | - |
| **Contaminants** | | | | | | |
| Pesticide residues | ≤0.01 | mg/kg | 0.001 | 0.003 | 0.003 | - |
| **Aromatic hydrocarbons PAH4** | ≤50 | µg/kg | **12.350** | 9.160 | 27.000 | **6.700** |
| *Radioactivity* | | | | | | |
| Activity in Cesium 134 | TBA | Bq/kg | - | - | - | - |
| Activity in Cesium 137 | TBA | Bq/kg | - | - | - | - |



In some harvesting locations, particularly in parts of Scotland, the ocean contains high levels of natural rock particles, some magnetic, which can be problematic in manufacturing as well as for taste and texture. The same significant improvements are evident in such fine points as metal detection and removal. The table shows a 25% reduction in magnetic particles in Seagreens® *Ascophyllum*, our most popular species, over 4 years.

## Metal Detection and Removal Log - since 2015

| ASCO batch | Batch volume processed kg | Whittaker volume as sample rec'd kg | Removed volume expressed as % | Date processed | Harvest | Average % by harvest location | Average % by total harvest |
|---|---|---|---|---|---|---|---|
| AFG.027.1702 | 1,050 | 0.5936 | **0.0565** | 15.06.2015 | Scotland | 0.0565 | 0.0565 |
| AMG.027.2002 | 1,045 | 0.1517 | **0.0145** | 15.06.2015 | Scotland | 0.0355 | 0.0355 |
| AFG.027.1602 | 1,050 | 0.7652 | **0.0729** | 15.06.2015 | Scotland | 0.0480 | 0.0480 |
| AFG.027.1902 | 1,075 | 0.6758 | **0.0629** | 15.06.2015 | Scotland | 0.0517 | 0.0517 |
| AFG.027.1802 | 963 | 0.7075 | **0.0735** | 15.06.2015 | Scotland | 0.0561 | 0.0561 |
| AFG.027.0415 | 1,275 | 0.7142 | **0.0560** | 15.06.2015 | Scotland | 0.0560 | 0.0560 |
| AFG.029.0806 | 1,000 | 0.9430 | **0.0943** | 23.04.2015 | Scotland | 0.0615 | 0.0719 |
| AFG.029.1206 | 1,000 | 1.0560 | **0.1056** | 23.04.2016 | Scotland | 0.0670 | 0.0670 |
| AFG.029.0906 | 1,000 | 0.8884 | **0.0888** | 23.04.2016 | Scotland | 0.0694 | 0.0694 |
| AFG.029.1006 | 1,000 | 1.1250 | **0.1125** | 23.04.2016 | Scotland | 0.0738 | 0.0738 |
| AFG.029.1106 | 1,000 | 0.8814 | **0.0881** | 23.04.2016 | Scotland | 0.0751 | 0.0751 |
| SMM.030.1002 | 1,000 | 0.3880 | **0.0388** | 07.03.2016 | Scotland | 0.0720 | 0.0720 |
| SMM.030.1102 | 1,000 | 0.1795 | **0.0180** | 07.03.2016 | Scotland | 0.0679 | 0.0679 |
| SMM.030.0902 | 1,000 | 0.8416 | **0.0842** | 07.03.2016 | Scotland | 0.0690 | 0.0690 |
| AFG.031.2103 | 1,000 | 1.0545 | **0.1055** | 01.05.2016 | Scotland | 0.0715 | 0.0715 |
| AFG.031.2203 | 1,000 | 1.4092 | **0.1409** | 01.05.2016 | Scotland | 0.0758 | 0.0758 |
| AFG.031.2303 | 1,000 | 0.9809 | **0.0981** | 01.05.2016 | Scotland | 0.0771 | 0.0771 |
| AMG.032.3101 | 1,000 | 0.1077 | **0.0108** | 06.09.2016 | Iceland | 0.0734 | 0.0734 |
| AMG.032.3201 | 1,000 | 0.1410 | **0.0141** | 06.09.2016 | Iceland | 0.0703 | 0.0703 |
| AMG.032.3301 | 1,000 | 0.1216 | **0.0122** | 06.09.2016 | Iceland | 0.0674 | 0.0674 |
| AMG.032.3401 | 1,000 | 0.1378 | **0.0138** | 06.09.2016 | Iceland | 0.0648 | 0.0648 |
| AFG.033.2603 | 1,000 | 0.3595 | **0.0360** | 25.10.2017 | Iceland | 0.0635 | 0.0635 |
| AFG.033.2703 | 1,000 | 0.2425 | **0.0243** | 25.10.2017 | Iceland | 0.0301 | 0.0618 |
| AFG.033.2803 | 1,000 | 0.2457 | **0.0246** | 25.10.2017 | Iceland | 0.0603 | 0.0603 |
| AFG.033.2903 | 1,000 | 0.2431 | **0.0243** | 25.10.2017 | Iceland | 0.0588 | 0.0588 |
| AMG.033.3501 | 1,000 | 0.1021 | **0.0102** | 25.10.2017 | Iceland | 0.0570 | 0.0570 |
| AMG.033.3601 | 1,000 | 0.0000 | **0.0000** | 25.10.2017 | Iceland | 0.0549 | 0.0549 |
| AMG.033.3701 | 1,000 | 0.2136 | **0.0214** | 25.10.2017 | Iceland | 0.0537 | 0.0537 |
| AMG.033.3801 | 1,000 | 0.1158 | **0.0116** | 25.10.2017 | Iceland | 0.0522 | 0.0522 |
| AFG.034.1003 | 1,000 | 0.2070 | **0.0207** | 15.12.2019 | Iceland | 0.0512 | 0.0512 |
| AFG.034.1004 | 1,000 | 0.1715 | **0.0172** | 15.12.2019 | Iceland | 0.0501 | 0.0501 |
| AFG.034.1000 | 1,000 | 0.2534 | **0.0253** | 15.12.2019 | Iceland | 0.0493 | 0.0493 |
| AFG.034.1001 | 1,000 | 0.2540 | **0.0254** | 15.12.2019 | Iceland | 0.0486 | 0.0486 |
| AFG.034.1002 | 1,000 | 0.1965 | **0.0197** | 15.12.2019 | Iceland | 0.0477 | 0.0477 |
| AFG.035.1008 | 1,000 | 0.2851 | **0.0285** | 25.07.2019 | Iceland | 0.0189 | 0.0472 |
| AFG.035.1009 | 1,000 | 0.1960 | **0.0196** | 25.07.2019 | Iceland | 0.0189 | 0.0464 |
| AFG.035.1010 | 1,000 | 0.4796 | **0.0480** | 25.07.2019 | Iceland | 0.0204 | 0.0464 |
| AFG.035.1011 | 1,000 | 0.4899 | **0.0490** | 25.07.2019 | Iceland | 0.0217 | 0.0465 |
| AFG.035.1012 | 1,000 | 0.2063 | **0.0206** | 25.07.2019 | Iceland | 0.0217 | 0.0458 |
| AFG.035.1013 | 1,000 | 0.3288 | **0.0329** | 25.07.2019 | Iceland | 0.0222 | 0.0455 |
| AFG.035.1014 | 1,000 | 0.4906 | **0.0491** | 25.07.2019 | Iceland | 0.0233 | 0.0456 |
| **Totals** | **41,458** | **18.9446** | **0.0457** | - | - | - | - |
| **Averages** | **1,011** | **0.4621** | **0.0512** | - | - | - | - |
| **Total average** | - | - | **0.0457** | - | - | - | - |

Many seaweeds are ideal sources of iodine, with regulatory, QA and NPD implications. Good data is vital to purchasing, food technicians and formulators. Seagreens® has published international data based on analytical studies over more than a decade. Unique data, unique support, and *guaranteed parameters in our ingredients*.

| Iodine levels mg/kg (µg/g) | Actual levels | Variance | Average 2020 |
|---|---|---|---|
| **Species** | | | |
| Alaria | 108-1070 | 962 | 589 (mean*) |
| Ascophyllum | 604-1480 | 876 | 870 |
| Fucus | 270-522 | 252 | 425 |
| Palmaria | 72-292 | 220 | 200 |
| Pelvetia | 185-316 | 131 | 262 |

*more data required to establish average, probably higher

These are the kind of details which also concern our Technical Director, **Jeremy Stephens**, for they are the essence of unvarying quality and helping others do their work effectively.

*“We make mistakes, we are honest, we put things right. Working with our customers is the way we learn and achieve, it is always a step forward, the most rewarding thing.”*

The most recent international review of seaweed nutrition research* identifies 35 species as candidates for human food and health. But today only a handful are commercially available with:

- A known comprehensive profile of nutrients and contaminants.
- Full documentation over 10 years of sustainable production.
- Independently certified status as non-allergenic and compliant with international food safety regulations.
- In use in a wide range of food and nutrition products for well over a decade.

These are the 5 native species which are the focus of Seagreens® production spanning 5 remote locations in the British isles and Nordic region.

*Cornish ML, Critchley AT, and Mouritsen OG. *A role for dietary macroalgae in the amelioration of certain risk factors associated with cardiovascular disease.* Phycologia, Vol 54 (6), 649-666, 2015.





Seagreens business model is a consortium of production, management, and distribution partners. From harvest to our customers, and to the end use of these ingredients, **batch coding** is allocated at selection and provides full **traceability** throughout the **chain of custody**. More than 75% of our customers are ‘brand partners’, who identify their Seagreens® ingredient in their product and have open access to our know-how - *testimony to an integrated partnership that works*.

**Geoff Van Hurst** is our Director of Operations and the catalyst of productive activities and relationships with all our partners and customers.

*"I am very much in service to the group. Seldom a day without fresh demands, or a week without fresh achievements. I think it was Churchill who said that 'success is not final, failure is not fatal, it is the courage to continue that counts'!"*

- 20 years in production specifically for human consumption
- 10 years leading nutrition research and compositonal data
- Awarded for sustainable production, products and research
- 15 nutritious ingredients from 5 seaweed species

- 1kg to 5,000kg available from stock with global distribution
- Price consistency and equivalence in worldwide markets
- Respected international brand name for use by customers
- First British seaweed producer certified Organic in 1998
- First certified to Nutritious Food Seaweed Standard 2016

**Paul Hoole** is our Director of Seagreens Trade Direct, our overall quality control and warehousing centre in West Sussex, from where Seagreens® ingredients, whether samples or orders, are shipped *"to (almost) the four corners of the globe, an anomaly if ever I heard one. Apart from this, we try to keep everything to a very high standard and running smoothly. Above all, we are here to help!"*

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*Administered in the interests of our Partners and Customers by Seagreens Trust.*

*Known for nutrition*