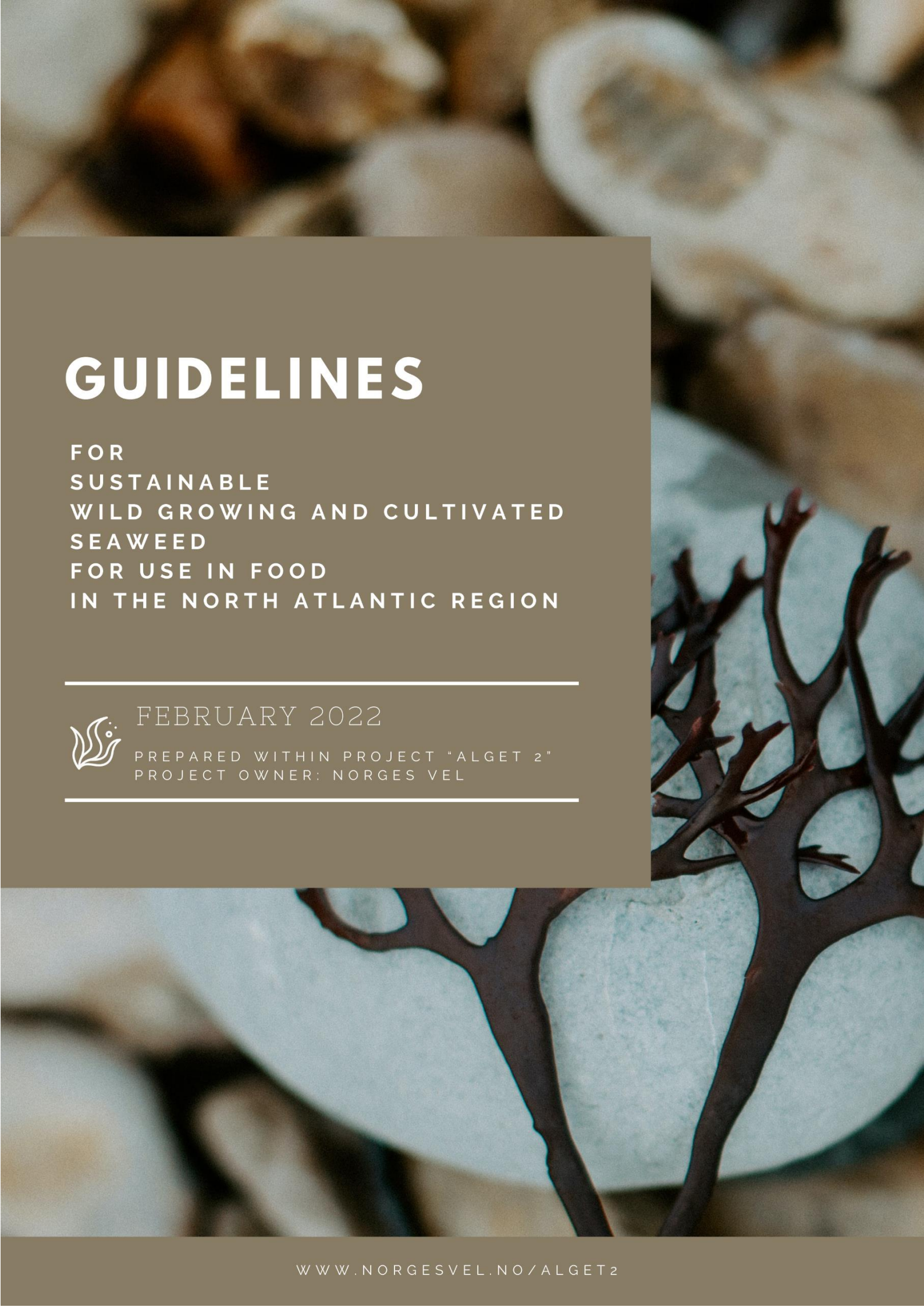

GUIDELINES

FOR SUSTAINABLE WILD GROWING AND CULTIVATED SEAWEED FOR USE IN FOOD IN THE NORTH ATLANTIC REGION

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PREPARED WITHIN PROJECT "ALGET 2"
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Content

1.0 Introduction

1.1 About ALGET 2

ALGET 2 – **ALG**ae **E**n**T**repreneurs - is a project with the objective to achieve a strengthened network for macroalgae entrepreneurs focusing on improved quality assurance from sea to consumer. The target group is small and medium Enterprises (SMEs) in the North Atlantic region basing their operations on wild harvested and cultivated macroalgae for food, cosmetics/skin care production or for ingredients in these industries.

Expected results for ALGET 2 is to develop a Digital Knowledge Bank and a common quality guideline for sustainable seaweed **as important tools for macroalgae produced in accordance with the legislation and best practise**. This covers both wild harvested and cultivated seaweed which is used for food and cosmetics/skin care products, or ingredients to this segment. During the project period we have carried out workshops, webinars and the digital Algemania conference with topics and discussion within research and experience-based knowledge on growth and harvest quality, processing, food safety, legislation, product development, market, business development and commercialisation. The guidelines are developed based on this work.

Recordings and presentations from ALGET 2 workshops, webinars and conference are to be seen here: https://www.norgesvel.no/alget2

1.2 Purpose of the Industry Guidelines

The purpose of the industry guidelines is to contribute to the insurance of safe macroalgae used for food, cosmetics/skin care products or for ingredients to this. Chosen area due to the requirements of quality and safety are at the highest standard related to food and food products. Regulatory standards for application for skin care/cosmetics will with this also be reached in terms of quality and safe use.

The guidelines represent a minimum of common standards and are currently not limited to any species of macroalgae, nor is it not limiting for entrepreneurs to implement stricter practices.

This document provides guidance on good production practices and contributes to compliance with the regulatory standards managed by the authorities in Faroe Islands, Iceland and Norway. The industry guidelines are intended to encourage the work that contribute to ensuring, supporting and strengthen the sustainable profile of macroalgae.

The guidelines present added value and identity to industry players from producers to customers. Being a new seaweed industry - cold water seaweed – the communication on high standards, quality, and pureness of fresh cold water from the North-Atlantic region will be essential. Used as an important tool, the guidelines would provide the SMEs and their products improved competitive advantage in business and marketing.

The document is to be used and owned by the participants in ALGET 2, and to be shared and used by all SMEs in their representative countries as well as in coastal countries in the region of the North Atlantic.

1.3 Definition of sustainability

Seaweed is a key factor in a more sustainable future. According to the Brundtland Commission report (1987) sustainable use of resources is: economic growth and improved living conditions for people without destroying neither the natural resources, the environment generally or future generations' possibilities to ensure their needs.

2.0 Requirements for seaweed producers

The key principles in any strategies and legislations are to maintain clean, rich and productive ecosystems where natural diversity is taken care of. At the same time, aquaculture like all food production, has an impact on nature. The Regulations are intended to ensure that aquaculture of seaweed becomes profitable and competitive within the framework of sustainable development and contribute to value creation on the coast.

As for food safety, legislation in the food area contribute to ensure safe food, that the food does not harm the consumer when it is prepared and/ or consumed in accordance with intended use. Further, it shall be ensured that food is sold in an honest way with correct labelling, weight, sales and communication. It is the responsibility of the SMEs to be registered with the national Food Safety Authority, and to ensure that the products are safe.

No specific regulations about food safety and seaweed have currently been elaborated for seaweed in Faroe Islands, Iceland and Norway. However, knowledge about food safety and risk management for seaweed is constantly evolving.

3.0 Laws and regulations

The Guidelines are focused on regulations in Norway, Iceland and Faroe Islands in three main relevant areas:

- Sustainable harvested and cultivated seaweed
- Food safety
- Marketing, commercials, and advertising

The general laws and regulations in these areas are to be adhered. Relevant regulatory standards including all regulations mentioned in this guide are also to be find at the AGLET 2 Digital Knowledge bank: https://www.norgesvel.no/alget2a/regulatory-standards

3.1 Laws and regulation on sustainable harvested and cultivated seaweed

To ensure that the new macroalgae industry is built up in a viable and sustainable manner, the document list a range of legislation in Norway, Iceland and Faroe Islands which sets the frames for the SMEs when producing quality macroalgae in a sustainable way.

You will find the most important laws and regulation as below:

3.1.1 Norwegian legislation on sustainable harvested and cultivated seaweed

Regulation on harvesting of macroalgae

Havressursloven/"The Marine Resources Act"
Law/ Act about management of wild living marine resources.

Landingsforskriften/"The Landing Regulation"
Regulation on landing- and end-declaration.

Naturmangfoldloven/"The Natural Diversity Act"
Law/ Act on management of natural diversity.

Økologiforskriften/Regulations on Organic Agricultural and Aquaculture Products
Regulation 18 March 2017 No 355 on organic production and labelling of organic agricultural products, aquaculture products, food and feed.

Regulatory standards for cultivated seaweed
In order to engage in the production and cultivation of aquatic plants as macroalgae, a permit is required.

Harvesting of seaweed in industrial scale
These regulations are limited to be valid for harvesting of macroalgae which is carried out with trawls or other mechanical tools. The Directorate of Fisheries assumes that the activity of manual cutting of macroalgae falls outside the scope of the regional harvesting regulations.

3.1.2 Icelandic legislation sustainable harvested and cultivated seaweed

Lög um stjórn fiskveiða
Fisheries management act. Chaper on wild harvested seaweed.

Reglugerð um öflun sjávargróðurs í atvinnuskyni
Regulation on harvesting of seaweed for commercial purposes.

Reglugerð um vigtun og skráningu sjávarafla
Regulation on weighing and registration of marine catch.

Reglugerð um skráningu og rafræn skil aflaupplýsinga
Regulation on registration and electronic submission of catch information.

3.1.3 Faroese legislation sustainable harvested and cultivated seaweed

To cultivate algae in the Faroe Islands, you need a permit.
The Faroese law that covers all aquaculture

Requirements that need to be met about how to run your algae farm, both on land and at sea.
Focus on prevention of the spread of infection, primarily on salmon diseases.

Convention of biodiversity

3.2 Laws and regulation on food safety

Legislation in the food area contributes to food safety for consumers. Legislation must ensure that food shall not do harm to, or mislead consumers when preparing and consuming the product in accordance with its intended use. Regulations shall also ensure that the food product is sold in an honest way with correct labelling, weight, etc. Regulations shall also cover advertising and other commercials activities.

All players who carry out food business operations must be registered at the Food Safety Authority (Mattilsynet in Norway, MAST in Iceland, Heilsufrøðliga Starvsstofan in the Faroe Islands). However, the producers are liable for their products to be safe.

Currently, no specific regulations have been elaborated for macroalgae for use in food in Norway, Iceland and the Faroe Islands. Until further notice everyone who wishes to cultivate or process macroalgae for food must adhere to the general food laws and regulations.

3.2.1 Norwegian legislation on food safety

Act (law) on food production and food safety etc. (the Food Law)

Regulation on food hygiene (the Food Hygiene Regulation)

Regulation on materials and objects in contact with food (the Food Contact Regulation)

Regulation on internal control to comply with the Food laws and regulations (IC-Food Regulation)

Regulation on novel foods (Regulation (EU) 2015/2283)

3.2.2 Icelandic legislation on food safety

Leiðbeiningar og reglur um vottun lífrænnar framleiðslu og náttúrunytja
Guidelines and rules on certification of organic production and natural uses. The organic certification office Tún publishes, in collaboration with Icelandic Food Safety Authority, an indicative handbook on requirements for organic methods in the production of agricultural products, in accordance with Icelandic and European legal rules in force in the area organic production at any given time.

Lög um matvæli nr 93/1995
Food Act no. 93/1995

Reglugerð um gildistöku reglugerðar Evrópuþingsins og ráðsins um hollustuhætti sem varða matvæli
Regulation on the entry into force of the Regulation of the European Parliament and of the Council on food hygiene no 103/2010

Reglugerð um gildistöku tiltekinnar gerðar Evrópusambandsins um efni og hluti sem ætlað er að komast í snertingu við matvæli no 298/2008
Regulation on the entry into force of certain acts of the European Union on substances and articles intended to come into contact with food.

Reglugerð um nýfæði no 735/2017
Regulation on novel foods

3.2.3 Faroese legislation on food safety

Approval of food businesses

Appliance of food businesses

Labelling of foodstuffs in the Faroe Islands

Translations in English of some of the above laws and regulations

Food safety, including Macroalgae used for food

3.3 Laws and regulation on marketing, commercials, and advertising

Marketing is all types of communication designed for, or which leads to, increased recognition, and consumption of certain products or services. It includes all activities which promote a product or service.

If we are exposed to misleading marketing, labelling, or in other way untruthful or misleading information, we make other choices than we would do otherwise. When these choices affect for example health and development in a negative sense, it is both ethically and legally problematic.

3.3.1 Norwegian legislation on marketing, commercials, and advertising

Regulation on control with marketing and contract terms (The Marketing regulation)

Regulation on food information to the consumers (the Food Information Regulation)

Regulations on nutrition and health claims on food stuffs

3.3.2 Icelandic legislation on marketing, commercials, and advertising

Reglugerð um miðlun upplýsinga um matvæli til neytenda
Regulation on the dissemination of food information to consumers no 1294/2014.

Reglugerð um gildistöku reglugerðar Evrópusambandsins nr. 1924/2006 um næringar- og heilsufullyrðingar er varða matvæli
Regulation on the entry into force of EU Regulation no. 1924/2006 on nutrition and health claims concerning foodstuffs.

3.3.3 Faroese legislation on marketing, commercials, and advertising

General law on marketing

4.0 Sustainable management of marine resources

Sustainable production and harvesting of macroalgae and other living marine resources, both from cultivated and wild stocks, are a principle in the aquaculture management for the Nordic authorities.

It is a prerequisite for sustainable management that the marine ecosystems are in balance. Ecosystem-based management requires knowledge about population dynamic and structure, as well as knowledge of the ecosystems that populations are part of.

Ensuring a functional ecosystem is therefore fundamental for all activities related to fishing, harvesting and aquaculture. All relevant population of commercial value are regulated through quotas and/or control of access governed by law and regulations. This includes Seaweed as well, both cultivation and harvest from wild stocks.

Harvesting following principles of organic productions

The regulation for organic production specifies that the harvesting should be carried out in such a way that the amount which is harvested does not have any significant impact on the aquatic environment. It also ensures that the macroalgae plants can renew themselves when harvested from wild stocks. Such harvesting can be carried out by keeping a record on list of species and the history of the activities (harvesting) for each population within the area. Furthermore, assessment of each population and sustainable annual harvest for each of them within each area and in total are to be implemented.

Additionally, following the principle of organic production will also include applying gentle harvesting methods which take into consideration the properties of each individual plants, such as size, age, and reproduction cycles in order to leave a sustainable size of remaining macroalga plant.

ASC-MSC Seaweed Standard

The Aquaculture Stewardship Council (ASC) is the leading certification system for farmed seafood. The joint ASC-MSC is a standard for Seaweed and sets strict requirements for responsible cultivating. By promoting environmentally sustainable and socially responsible use of seaweed resources, the standard encourages seaweed producers to minimize the key environmental and social impacts of the aquaculture.

https://www.asc-aqua.org/what-we-do/our-standards/seaweed-standard/

5.0 Internal control and HACCP

HACCP means Hazard Analysis and Critical Control Points. It is a method of ensuring that all hazards (microbiological, chemical, physical and allergens) have been mapped at every stage of production, from raw material production to consumer.

The HACCP system is an internationally recognized system for hazard analysis and risk assessment within the food industry, particularly with regard to contamination of microorganisms, harmful substances and foreign objects.

The requirements for establishment of internal control covers all food companies which produce, package, store or sell food. The requirement does not apply to primary producers, that is, if you only produce and deliver directly to a receiving point without further handling such as for example packaging and storage, the requirements in the IC-Food regulation (see chap. 3.2 above) do not apply. Primary producers must however follow the regulation on food hygiene. Refers to the following citation from the Food Hygiene Regulation about primary production: "It is commonly not yet possible to apply the principles of hazard and critical control points (HACCP) in the primary production. Guides for good practice should however facilitate the use of relevant hygienic practices in the operating unit."

Internationally, an increasing number of customers require businesses to use the HACCP principles from raw material production, procurement and handling, to processing, distribution and consumption of the finished product. Internal control system and HACCP plan will be documented on demand.

HACCP is a management system so that the companies can prevent failures in routines and ensure safe products. This is also a strategi for delivering high quality product consistently. By performing a risk assessment in relation to probability and consequence (the use of risk matrix), the producer will be able to map possible critical checkpoints or important basic assumptions that may occur during production.

Seaweed producers should be updated on internal control and associated HACCP. If there is a change in the regulations, recommendations or on new knowledge on seaweed, or changes in own business, new production lines, equipment is purchased, or other expansion of the business, the producer should undertake a reflective analysis of own practice.

6.0 Potential Hazards

6.1 Identified hazards

In 2020 the Institute of Marine Research (IMR) produced an important report on behalf on the Norwegian Food Authority. The knowledge-updates on food safety in macroalgae for use in food, food ingredients and feed products in Norway were provided:
https://www.hi.no/hi/nettrapporter/rapport-fra-havforskningen-en-2020-44

Chemical hazards
The knowledge update confirms previous conclusions that macroalgae can have a problematic high level of metals and iodine, and it can set limits on the use of seaweed as food. The specie oarweed (*Laminaria digitata*) show high content of iodine and inorganic arsenic and it is issued a warning eating oarweed by the Norwegian Food Safety Authority. Currently there are no warning regarding consumption of oarweed in Iceland and Faroe Islands.

The Institute of Marine Research's knowledge-update points out that the brown algae sugar kelp (*Saccharina latissimi*) and winged kelp (*Alaria esculenta*), which are the most commonly used species in aquaculture production in the Nordic countries, have little inorganic arsenic, medium amount of cadmium and relatively high levels of iodine. Red and green algae generally have much lower levels of iodine than brown algae. The content of lead and mercury is generally low.

There are currently no upper limit values in the Nordic countries or in EU for arsenic, cadmium, lead, and iodine in macroalgae for use in food, except for some on dietary supplements. It is therefore currently difficult to define what can be considered low, medium, high, or acceptable levels.

Furthermore, see also chap. 6.2 below on the Commission recommendations (EU) 2018/464 on the monitoring of metals and iodine in seaweed, halophytes and products based on seaweed.

Methods for reducing iodine content
The report points to research suggesting that iodine content can be significantly reduced in kelps by methods such as drying, boiling and frying. This may have an impact on the application of species that have a high content of iodine. Research on rats on bioavailability of iodine from kelp indicates that 80% may be taken up in the animals.

Note that, when processing to reduce iodine content, other desirable nutrients can be reduced as well.

Microbiology
The report cites new knowledge about microbiology that suggests that precautions should be taken with good cooling of heat-treated products of macroalgae, because of the possible occurrence of trace-forming bacteria. Trace-forming bacteria pose little risk in fresh or dried products that are used directly, are not treated with heat or stored after heat treatment.

Other microbiological data showed low values of total aerobic germ count as well as low incidence of cold and trace-forming bacteria. Furthermore, no detected indicators of fecal contamination such as enterococci and coliform bacteria, or pathogenic vibrio or Listeria monocytogenes.

Kainic acid
New to the report is also analysis of Kainic acid, which can be a problem for food safety in algae, and especially in the species dulse (*Palmaria palmata*). Kainic acid is a natural toxin that can cause brain damage when ingested by excessive amounts. Analysis results show that the content of Kainic acid is relatively low in Norwegian dulse.

Allergen
Seaweed is not known to pose a significant allergenic risk to consumers. However, due to the marine origin, it is possible that edible seaweed could carry debris from fish, mollusks and crustaceans, constituting a relatively minor and indirect allergenic risk. Due to seaweed may contain traces of the mentioned allergens, labelling seaweed products is recommended. See chap 7.3 for checklist on labelling pre-packaged end products to consumers.

Need for more knowledge
The Institute of Marine Research writes that more knowledge about food safety aspects in seaweed and kelp is still needed. For example, several analyses of metals are needed in some species where the data basis is inadequate.

The Norwegian Food Safety Authority advises consumers not to eat too much seaweed, especially certain species and products, particularly because of high iodine levels. Some vulnerable groups of the population are advised to be extra careful (Norwegian Food Safety Authority, 2016).

6.2 Commission Recommendation (EU) 2018/464

In 2018 the EU Commission recommended monitoring of metals and iodine in seaweed, halophytes and products based on seaweed. Published in the Official Journal of the European Union, the Commission recommendations (EU) 2018/464 of 19 March 2018 proposed collection of data on the need for new or corrected limit values on arsenic, cadmium and lead, as well as handling the high iodine level in some products.

Currently there are no maximum levels established for these substances in seaweed and halophytes, except for the maximum levels established for food supplements consisting exclusively or mainly of seaweed or products derived from seaweed.

The goal is that incidence data for arsenic, cadmium, iodine, lead and mercury in different species of macroalgae and halophytes should support an exposure assessment. It is to consider whether the contribution of these substances from macroalgae and halophytes to the total exposure of these substances will necessitate the establishment of maximum levels for arsenic, cadmium and lead for these raw materials. Or even change the maximum residue level (MRL) for mercury for algae and prokaryotic organisms. For mercury the MRL is established at the default level of 0,01 mg/kg.

The Norwegian Food Safety Authority participates in the discussions and the Institute of Marine Research has submitted analysis data to the EU.

See also: EU recommendation on monitoring for seaweed

Official Journal of the European Union

6.3 Voluntary arrangement on labelling of iodine

Due to high content of iodine in seaweed, the association for the Norwegian seaweed farms prepared a recommendation for labelling pre-packaged end products to consumers containing seaweed. The recommendation included:

- Labeling pre-packaged end products containing pure seaweed/macroalgae
- Labeling pre-packaged end products containing seaweed/macroalgae as an ingredient

Labeling pre-packaged end products containing pure seaweed/macroalgae:

The nutritional values overview must state how much iodine there is per 100 g.

Additionally, statement of high content of iodine as in following labelling:
The seaweed/kelp species* has a naturally high iodine content. The recommended daily intake of iodine is 0.15mg. Excessive iodine intake over time can affect the thyroid gland.

*Seaweed/kelp species is to be replaced with the actually name of the species used in the product (e.g. sugar kelp, winged kelp, etc.).

Labeling pre-packaged end products containing seaweed/macroalgae as an ingredient

For mixed products, the manufacturer must calculate and label the amount of iodine in milligrams per. 100 grams of the whole product.

6.4 Novel Food

Novel (new) food is foods that have not been substantially used for human consumption in the Nordic or the other EEA/EU countries before 15th of May 1997. Certain species of macroalgae might fall into this term.

The Novel food regulations require that new food must be pre-approved before sales. If a species of a macroalgae is Novel food, it is prohibited to sell this without approval, - neither sold in pure form nor used as an ingredient in foodstuffs. In doubt, documentation must be provided stating use for human consumption in one or more EEA countries before 15th of May 1997.

Useful information published in ScienceDirect, volume 130 in December 2021, and provides good overview of the novel food status of algae species:
https://www.sciencedirect.com/science/article/pii/S0956713521004746?via%3Dihub

The Food Safety Authorities in the Nordic countries will provide more information.

See also: Norwegian Food Safety Authority - Novel Food

7.0 Checklist and Process Flow

7.1 Checklist

Self-assessment related to what considered best practise. Checklist for harvesting of wild growing and cultivated macroalgae for food this procedure is to be followed:

Step 1: Ensure that the needed approvals and permits which cover the company's business are in place:

- Companies must be registered with the Food Safety Authorities to produce food or cosmetics/skin care.
- Check for further approval needed for:
  - Novel Food
  - Production of foodstuff by the Food Safety Authorities in the Nordic countries if you include other than plant-based ingredients.
- For cultivating of macroalgae:
  - Check regulations relating to permits for cultivation of aquatic plants such as macroalgae.
- For harvesting of wild growing macroalgae:
  - Check regulations relating to duty to report and trade at sales organisation for wild growing seaweed.
  - Check regulations relating to permits for turnover of own production.

Step 2: Area description and zone division:

- Check regulations relating to the harvesting areas.
- Make yourself acquainted with the ownership status of the harvesting area.
- Request permit to harvest on private grounds (landowner).
- Request map from the municipality or other authorities.
- Make an overview of harvesting areas and risk areas.
- Carry out an environmental assessment of the harvesting area:
  - Pollution
  - Hazard analysis relating to water quality (pollution, agglomerations, shipwrecks, sewage discharges etc.).
  - Protection regulations or other rules from the County Governor's environmental departments or other authorities.
  - Protected habitats: avoid disturbing animal life such as birds and seals – stay at an appropriate distance.
- Harvesting following principles of organic productions Debio.

Step 3: Harvesting techniques and methods

Harvesting techniques, methods and tool will be adapted to the species and local variations within sustainable frameworks.

- For detailed information "Macroalgae Fact sheets" should be made.

7.2 Process flow

Process steps	Method
1.In the sea	- Cultivated and wild growing macroalgae must grow in environments accordance with regulatory standards and of ensuring quality seaweed biomass. - The macroalgae should be harvested before biological fouling if the intended market is human consumption. - At the time of harvesting, the biomass shall appear delicate with a fresh smell and natural colour.
2.Harvesting and transport	- The method of harvesting should be carried out so that the quality of the biomass is preserved: o Exposed to as little sun and wind as possible. o Avoid cross-contamination from boots, dirty equipment or birds' droppings. o Avoid contact with the ground or supply ship flooring during transport. o While cutting from the cultivation substrate, contamination of substrate (e.i. rope fibre) should be avoided. - Stored and transported in a way that preserve the quality of the biomass.
3. Receipt and inspection of macroalgae	- Control checkpoints: o Sort out macroalgae that do not meet the quality standard for human consumption. o Sort for seaweed species and/or sort out unwanted seaweed species, small fish and other organisms. o Sampling for analysis (define method and method).
4. Rinsing and water off-running	- The biomass should be rinsed in clean water. - Water quality shall be in accordance with the regulatory standards for food and foods products. - The choice of water source (fresh or seawater) is to be selected according to the customer's requirements. - If the end-product is fresh macroalgae, recommendation is to rinse with seawater. - If the end-product is dry macroalgae, freshwater can also be used for rinsing.
5. Processing	- After sorting, whether the macroalgae should be frozen, dried, smoked, fermented or used in fresh supply, the procedures will follow each entrepreneur's individual flowchart for internal quality and safety control system.
6. Packaging	- Sampling for analysis (define method and batch). - The inner packaging shall be appropriate for packing foodstuffs (This can be an EC certificate if it contains the information which the Food control regulation requires for a declaration of conformity.
7. Labelling	- Marked in accordance with the "Food Information Regulations". - See point 4.3 for checklist for labelling consumer ready products.

8. Storage	- The producer determines the storage temperature based on a hazard assessment. - Other factors to be considered: routines for storage, cleaning and personal hygiene. Warehouse and storage where food is handled should be kept free of insects and pests.
9. Shipping	- Quality assurance of the macroalgae in accordance with the requirements to the nature of the goods (fresh, frozen, smoked, dried or fermented).

The table above shows an example of a checklist. Each producer that processing seaweed (dries, freezes, or ferments), will follow their individual flow chart or internal quality and safety control system to ensure good quality during the processes.

7.3 Checklist for labelling pre-packaged end products to consumers

Eksempel checklist for marking pre-packaged end product:

- Product name
- Ingredient list
- Net content (weight)
- Expiration date
- Special conditions for storage or use (e.g. temperature and advice on meal sizes)
- Company name and address
- Nutrition declaration:
    - Energy KJ/kcal
    - Fat, (is the amount below 1%, it is sufficient to indicate this). In the case of content above 1%, the share shall be stated:
        - Saturated fats
        - Polyunsaturated fats
    - Carbohydrates, of which
        - Sugars, (starch, sugar)
        - Fibre
    - Protein
    - Salt
    - Iodine
- May contain traces of shellfish and fish
- Iodine labelling according to chap. 6.3 Voluntary arrangement on labelling of iodine