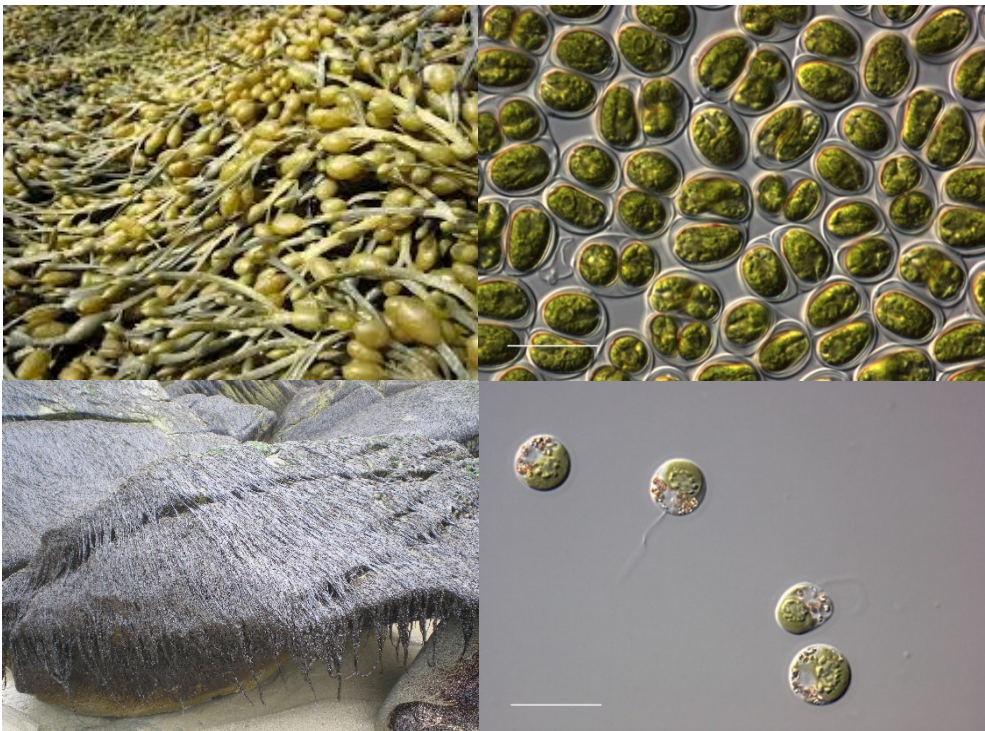


JRC TECHNICAL REPORT

Algae as food and food supplements in Europe



Araújo R., Peteiro C.

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Abstract

The use of algae biomass in food applications is still a growing market in Europe. One key consideration is the regulatory status of algae items potentially used as food and food supplements. In the European Union, foods classified as novel are subject to the pre-market authorisation requirements of the novel food regulation (EU) 2015/2283 before they can be freely placed in the European market without the need for pre-market novel food authorisation. In addition, novel and non-novel foods placed on the European market are subject to the requirements of all applicable food safety related EU Legislation. This technical report presents a comparative list of algae items (*sensu lato*) referred on the novel food catalogue, the Union list of authorized novel foods and official Member States' lists of food and food supplements. Additionally, other algae food and food supplement items referred in available non-official lists are included. A final table merging all the information included in the official lists is presented following the most updated species taxonomic designation.

1 Introduction

The novel food regulation establishes that any novel food requires a premarket authorisation before it can be placed in the European Union market. Article 4 of the Novel Food Regulation stipulates that a food business operator who wants to place a food on the EU market has the responsibility to assess and determine its novel food status based on the available evidence. In case of uncertainty the food business operator should consult the authorities of the Member States in which they intend to first place the food on the market according to the provisions of Commission Implementing Regulation (EU) 2018/456.

The Novel Food Regulation requires that all applications for the authorization of novel foods shall be submitted to the Commission who may then request a risk assessment to the European Food Safety Authority (EFSA) to evaluate if the food is liable to have an effect on human health. If the EFSA risk assessments are positive (=low risk), novel foods are authorised by the Commission to be placed in the Union market and are included in the Union list of authorised novel foods established by the Commission Implementing Regulation (EU) 2017/2470. The initial Union list included all novel foods previously authorized under Regulation (EC) 258/97 and subsequently was expanded to include those authorised under Regulation (EU) 2015/2283.

According to the Novel Food Regulation, foods that have been consumed to a significant degree in at least one Member State of the European Union before 15 May 1997 are non-novel (or traditional) and can be placed in the EU market without a novel food pre-market authorisation.

All foods both novel (after they have been authorised) and traditional (non novel) that are placed on the European Union market are also subject to the applicable European Union food safety requirements.

The Novel Food Catalogue (NFC) is a non-binding database that reflects the views of Member States on the novel food status of foods and that have been discussed and completed over the years. A food item listed in the Novel Food Catalogue may have one of the following status: novel, not novel, not novel in food supplements or subject to an ongoing novel food status consultation. If an algae is listed in the NFC as being not novel or not novel in Food Supplements, it can be placed on the market for the corresponding application (either as food or in Food Supplements). As the Novel Food Catalogue is not a comprehensive list, if a food is not included there it should not necessarily be considered as novel but only as an item whose status was either not previously discussed or to which an Article 4 consultation request has not been launched yet.

The algae industry is an emerging sector in Europe and the interest in healthy and sustainable diets has increased the demand for algae biomass used as food and food supplements (Araújo et al., 2021). On one hand algae foods must abide by the high food safety requirements that have been established in the European Union and they must have earned the consumer's trust. On the other hand, given the efforts and resources commitment of the Novel food application, up-to-date information is needed on the status of the algae species as food in Europe.

This report gathers information about the novel food status of different algae species according to their inclusion in national or European level lists of authorised food and food supplements. Following the European Committee for Standardisation (CEN 454) definition, the term algae refers to microalgae, macroalgae (or seaweeds), cyanobacteria and labyrinthulomycetes protists.

2 Methods and data sources

Information on algae groups used as food and novel food in Europe were gathered from the following sources:

- Novel food catalogue (NFC) (Table 1, Table 2);
- Union list of authorised novel food (ULNF) (Table 1, Table 2);
- Official national sources of information from France, Italy and Belgium (Table 1, Table 2);
- Draft list of algae items from Germany, Austria and Switzerland (D-A-CH) (Table 3);
- Portuguese association of producers' (PROALGA) list (Table 4).

The information contained in Table 1 referring to the algae items included in the NFC, ULNF and official national lists was critically reviewed to identify and delete repeated entries (the same species referred under different taxonomic designations) and, following the species currently accepted names, combined in a new table (Table 2). Table 2 represents a proposed list of species to support a future update of the NFC.

For the purpose of this study algae are used in a broad sense (i.e. *sensu lato*). The algae group (singular, alga) *sensu stricto* are a group of aquatic and photosynthetic eukaryotic organisms (autotrophic eukaryotes) that are generally divided into microalgae and macroalgae (or seaweeds used to refer to the common marine forms). The microalgae are microscopic photosynthetic organisms, typically unicellular forms only visible with magnification, and that mostly live-in suspension in the water column. The macroalgae are photosynthetic organisms visible to the naked eye and with most complex multicellular forms. Some have plant-like structures, which usually grow on the rocky bottom of coastal waters (Lee, 2008; Graham et al., 2009). Cyanobacteria or Cyanoprokaryota (commonly known as blue-green bacteria), previously classified as Cyanophyta or Cyanophyceae (so-called blue-green algae), are the only known group of prokaryotes containing chlorophylls that can perform oxygenic photosynthesis. They are a diverse and abundant group of ancient photosynthetic bacteria that are found in all habitats (Whitton & Potts, 2012; Papini et al., 2021). The labyrinthulomycete protists belong to Class Labyrinthulomycetes, also named as Class Labyrinthulea. According to the Zoological nomenclature (ICZN, 1999), this group corresponds to marine heterotrophic unicellular eukaryotes that were previously classified as microalgae or fungi. They are fungoid protists which lack chloroplasts and are independent from the true fungi (Leyland et al., 2017; Adl et al., 2019).

The currently accepted full names of the species, including common (i.e. frequently or used here) or recent (i.e. last 50 years) synonyms [=], are based on the Algaebase (Guiry & Guiry, 2021), Index nominum algarum (Silva, 2021), and Index Fungorum (CABI, 2021). For the species with uncertain names a search was conducted to clarify their taxonomic designation. The nomenclature used is based on the International Code of Nomenclature for algae, fungi, and plants (ICN) (Turland et al., 2018).

For Tables 1, 3 and 4, the entries corresponding to genera (where the identification is not done at the species level) are left blank in the field "currently accepted name". In Table 2 organisms not identified at the species level are highlighted in grey. The diversity of species included in a single genera might correspond to groups of species with heterogeneous characteristics which might prove to be relevant for their food safety assessment. In this report we recommend a cautious approach by assessing on a case to case basis the risks associated to the approval of the use of algae items identified at the genera level. Exceptional measures could be adopted for genera where identification based on morphological characteristics is difficult and misidentification with species potentially unsafe is highly unlikely.

3 Results and discussion

3.1 Official lists

Table 1 provides an overview of the algae species listed in the European (Novel Food Catalogue, Union list of authorized Novel Foods) and the official Member State (FR, BE, IT) lists.

Currently accepted full names are provided for species with outdated taxonomic designations (31 entries). The uncertainty in the status of some of the listed taxon names is also discussed (see the notes below Table 1). Some of the uncertain items are assigned to a currently accepted species name based on available evidence from recent studies and databases (*Ascophyllum laevigata*, *Erythrogloussum laciniatum* or *Porphyra laciniata*, *Laminaria latissima*, *Laminaria palmata*, *Porphyra palmata*) while others cannot be related to any known taxonomic designation (*Aphanizomenon flosaquae* var. *flosaquae*, *Eucheuma spiciforme*) or have not been identified to species level, because of the taxonomic complexity and uncertainty of some algal genus (*Chlorella* sp., *Schizochytrium* sp., *Spirulina* sp., *Ulkenia* sp., *Ulva* sp., *Enteromorpha* sp.). Additionally, some designations correspond to cryptic species, i.e., morphologically similar species that were traditionally classified as a single species (*Durvillea antarctica*, *Fucus spiralis*, *Gracilaria verrucosa*, *Porphyra umbilicalis*, *Pyropia leucosticta*).

The application of molecular techniques has greatly improved the taxonomic understanding of algae and brought clarity to the identification of some problematic genera and species. For example, the taxonomic revision based on molecular studies of the species from the *Chlorella* genus used in Europe for food found additional species to the ones listed in the Novel Food Catalogue (i.e. *Chlorella vulgaris*, *Chlorella pyrenoidosa*, and *Heterochlorella luteoviridis* (formerly *Chlorella luteoviridis*) (Bock et al., 2011; Champenois et al., 2014). According to the review by Champenois et al. (2014) the following *Chlorella*-like species have also been consumed in Europe: *Parachlorella kessleri* (formerly *Chlorella kessleri*), *Auxenchlorella protothecoides*, *Chlorella sorokiniana*, *Graesiella emersonii*, and *Jaagichlorella luteoviridis* (formerly *Heterochlorella luteoviridis*). All these species are included in Table 1 based on the information gathered for France. However, *Chloroidium saccharophilum* (formerly *Chlorella saccharophila*), and *Coelastrella vacuolate* (formerly *Chlorella fusca* var. *vacuolata*) which are also referred in the Champenois et al. (2014) revision are not part of Table 1 because they do not appear in any of the available official lists.

The unclear taxonomy of some macroalgae groups has also been clarified based on molecular evidence, and revealed considerable cryptic diversity at both the generic and specific level. This is the case of *Porphyra* sensu lato, *Gracilaria* sensu lato and *Ulva*, among many others (e.g. Sánchez et al. 2014, Gurgel et al., 2018; Steinhagen et al., 2019). The uncertainty in the definition of species groups used as food and food supplements also refers to the cyanobacteria of the species commercially known as “spirulina” (Vonshak & Tomaselli, 2000; Gantar & Svirčev, 2008). While *Arthrospira* has been recognised as the most commonly “spirulina” used for human consumption, the commercial name and the scientific name of the genus *Spirulina* often overlap, and the debate on the identity of these cyanobacteria is still ongoing. Based on recent reviews, the “spirulina” (commercial designation) has been considered to include mainly *Arthrospira platensis*, *Limnospira maxima* and *Limnospira fusiformis* (Vonshak & Tomaselli, 2000; Vardaka et al., 2016; Papini et al., 2021). *Arthrospira platensis* is already listed in the Novel Food Catalogue, while *Limnospira maxima* is referred in the official lists of France, Italy and Belgium. *Limnospira fusiformis* is listed in the French documents which also include the species *Limnospira indica* and *Spirulina major* (see Table 1) not referred by the works cited above. Regarding the labyrinthulomycetes protists, the oil from *Schizochytrium* sp. from strain FCC-1324 (parent strain of FCC-3204 and close to strain ATCC 20888) authorised for use in food supplements as a novel food was also recently specified, with the support of molecular data, to belong to the species *Schizochytrium limacinum* (Turck et al., 2021).

From the perspective of the algae biomass production industry the identification of taxonomically complex groups (e.g. morphologically similar or cryptic species) might be challenging since some species are very difficult to identify based only on morphological characteristics. In this situation consultation with experienced taxonomists and use of molecular techniques might be required. For these groups a risk assessment approach is suggested in order to understand if any of the existing/potentially commercialised species in Europe might represent a safety hazard. This is of particular concern for groups referred to include species which might produce toxins (Gantar & Svirčev, 2008; Vardaka et al., 2016; Chorus & Bartram, 2021).

Another important practical issue to consider is that the algae products for use in food and food supplements might contain a mixture of different species. For example, in some morphologically simple and cryptic groups such as *Ulva* it is generally assumed that the biomass collected from wild resources will most likely correspond to a mixture of different species (Roleda & Heesch, 2021).

Factors like the species identification and delimitation and the use of species names have important implications for the safety, nutritional quality, and functional attributes of the commercial application of algal products as food (Gantar & Svirčev, 2008; Borowitzka, 2016; Vardaka et al., 2016). Thus, species misidentifications, misassigned species names or taxonomic changes can be limiting to the use of algae as food and food supplements because their approval is generally based on one named species (Borowitzka, 2016; Roleda & Heesch, 2021).

In Table 1 the status of the species listed regarding their classification as native or produced in Europe is also detailed. A total of 74% of the species listed (after removing duplicate entries) are native/produced in Europe. For some algae species (mainly microalgae) this status might be difficult to determine with certainty. Some of the authorised species not produced in Europe could be easily replaced by similar native species (e.g. Asian *Neopyropia* species versus European *Porphyra* and *Neopyropia* species (formerly *Pyropia*), if the European production capacity would develop to meet the market demand for these species's biomass. If non-native species are authorised as food or food supplements in Europe a cautious approach should be adopted to avoid the cultivation of these species and their potential introduction in native communities which could carry unknown associated impacts. Although the impacts might be less evident in the case of microalgae or land based seaweed aquaculture which often involves cultivation in closed systems (e.g. more controlled risks of environmental contamination), the cultivation of non native species should be avoided by default.

Table 1. Comparative information contained in the Novel Food Catalogue (NFC), the Union list of Novel Food (ULNF) and the formal lists from France, Italy and Belgium. The species with taxonomic designations which do not correspond to the currently accepted name are highlighted in green and underlined. FS: If the algae item is authorized only as Food supplement; * in the algae group column if it is produced in Europe (even if some of the produced species are introduced in European waters).

Name according to source	Currently accepted full name	Taxonomic classification (Phylum, Class: Order, Family)	Algae Groups	NFC ¹	France ²	Italy ³	Belgium ⁴	ULNF ⁵
<i>Alaria esculenta</i>	<i>Alaria esculenta</i> (Linnaeus) Greville 1830	Ochrophyta, Phaeophyceae: Laminariales, Alariaceae	MA *	✓	✓			
<i>Alsidium helminthochorton</i>	<i>Alsidium helminthochorton</i> (Schwendimann) Kützing 1843	Rhodophyta, Florideophyceae: Cerariales, Rhodomelaceae	MA*		✓ FS	✓ FS		
<i>Aphanizomenon flosaquae</i>	<i>Aphanizomenon flosaquae</i> Ralfs ex Bornet & Flahault 1886	Cyanobacteria, Cyanophyceae: Nostocales, Aphanizomenonaceae	CY		✓ FS ¹	✓ FS ²	✓ FS ¹	
<i>Aphanizomenon flosaquae</i> var. <i>flosaquae</i> (UN ¹)	Unspecified species of <i>Aphanizomenon</i>	Cyanobacteria, Cyanophyceae: Nostocales, Aphanizomenonaceae	CY	✓				
<u>Arthrospira fusiformis</u>	<i>Limnospira fusiformis</i> (Voronichin) Nowicka-Krawczyk, Mühlsteinová & Hauer 2019 [= <i>Arthrospira fusiformis</i> (Voronichin) Komárek & J. W. G. Lund 1990; <i>Spirulina fusiformis</i> Woronichin 1934]	Cyanobacteria, Cyanophyceae: Oscillatoriales, Microcoleaceae	CY*		✓ FS			
<u>Arthrospira indica</u>	<i>Limnospira indica</i> (Desikachary & N. Jeeji Bai) Nowicka-Krawczyk, Mühlsteinová & Hauer 2019 [= <i>Arthrospira indica</i> Desikachary & N. Jeeji Bai 1992]	Cyanobacteria, Cyanophyceae: Oscillatoriales, Microcoleaceae	CY		✓ FS			
<u>Arthrospira maxima</u>	<i>Limnospira maxima</i> (Setchell & N. L. Gardner) Nowicka-Krawczyk, Mühlsteinová & Hauer 2019 [= <i>Arthrospira maxima</i> Setchell & N. L. Gardner 1917]	Cyanobacteria, Cyanophyceae: Oscillatoriales, Microcoleaceae	CY*		✓ FS			

<i>Arthrospira platensis</i>	Arthrospira platensis Gomont 1892 [= <i>Spirulina platensis</i> (Gomont) Geitler 1925]	Cyanobacteria, Cyanophyceae: Oscillatoriales, Microcoleaceae	CY*	✓	✓ FS			
<i>Ascophyllum laevigata</i> (UN) ²	Ascophyllum nodosum (Linnaeus) Le Jolis 1863 [= <i>Fucus nodosus</i> Linnaeus 1753; <i>Ascophylla laevigata</i> Stackhouse 1809]	Ochrophyta, Phaeophyceae: Fucales, Fucaceae	MA*	✓				
<i>Ascophyllum nodosum</i>	Ascophyllum nodosum (Linnaeus) Le Jolis 1863 [= <i>Fucus nodosus</i> Linnaeus 1753; <i>Ascophylla laevigata</i> Stackhouse 1809]	Ochrophyta, Phaeophyceae: Fucales, Fucaceae	MA*	✓	✓	✓ FS	✓ FS	
<i>Auxenochlorella protothecoides</i>	Auxenochlorella protothecoides (Krüger) Kalina & Puncová 1987	Chlorophyta, Trebouxiophyceae: Chlorellales, Chlorellaceae	MI*	✓	✓ FS			
<i>Auxenochlorella pyrenoidosa</i>	Auxenochlorella pyrenoidosa (H. Chick) Molinari & Calvo-Pérez 2015 [= <i>Chlorella pyrenoidosa</i> H. Chick 1903]	Chlorophyta, Trebouxiophyceae: Chlorellales, Chlorellaceae	MI*		✓ FS			
<i>Chlorella luteoviridis</i>	Jaagichlorella luteoviridis (Chodat) Darienko & Pröschold 2019 [= <i>Chlorella luteoviridis</i> Chodat 1913; <i>Heterochlorella luteoviridis</i> (Chodat) J. Neustupa, Y. Nemcova, M. Eliás & P. Skaloud 2009]	Chlorophyta, Trebouxiophyceae: Chlorellales, Oocystaceae	MI*	✓				
<i>Chlorella pyrenoidosa</i>	Auxenochlorella pyrenoidosa (H. Chick) Molinari & Calvo-Pérez 2015 [= <i>Chlorella pyrenoidosa</i> H. Chick 1903]	Chlorophyta, Trebouxiophyceae: Chlorellales, Chlorellaceae	MI*	✓				
<i>Chlorella sorokiniana</i>	Chlorella sorokiniana Shihira & R. W. Krauss 1965	Chlorophyta, Trebouxiophyceae: Chlorellales, Chlorellaceae	MI*		✓ FS			
<i>Chlorella vulgaris</i>	Chlorella vulgaris Beyerinck [Beijerinck] 1890 [= <i>Chlorella candida</i> Shihira & R. W. Krauss 1965]	Chlorophyta, Trebouxiophyceae: Chlorellales, Chlorellaceae	MI*	✓	✓ FS	✓ FS	✓ FS	
<i>Chlorella</i> sp. (UN) ³	Unspecified species of <i>Chlorella sensu lato</i>	Chlorophyta, Trebouxiophyceae: Chlorellales, Chlorellaceae	MI*		✓			
<i>Chondrus crispus</i>	Chondrus crispus Stackhouse 1797	Rhodophyta, Florideophyceae: Gigartinales, Gigartinaceae	MA*	✓	✓	✓ FS	✓ FS	

<i>Corallina officinalis</i>	<i>Corallina officinalis</i> Linnaeus 1758	Rhodophyta, Florideophyceae: Corallinales, Corallineae	MA*		✓ FS	✓ FS	✓ FS	
<i>Dunaliella salina</i>	<i>Dunaliella salina</i> (Dunal) Teodoresco 1905	Chlorophyta, Chlorophyceae: Chlamydomonadales, Dunaliellaceae	MI*		✓ FS	✓ FS	✓ FS	
<i>Durvillea antarctica</i> (CS ¹)	<i>Durvillea antarctica</i> (Chamisso) Hariot 1892	Ochrophyta, Phaeophyceae: Fucales, Durvillaeaceae	MA		✓ FS	✓ FS	✓ FS	
<i>Ecklonia bicyclis</i>	<i>Eisenia bicyclis</i> (Kjellman) Setchell 1905 [= <i>Ecklonia bicyclis</i> Kjellman 1885]	Ochrophyta, Phaeophyceae: Laminariales, Lessoniaceae	MA	✓				
<i>Eisenia bicyclis</i>	<i>Eisenia bicyclis</i> (Kjellman) Setchell 1905 [= <i>Ecklonia bicyclis</i> Kjellman 1885]	Ochrophyta, Phaeophyceae: Laminariales, Lessoniaceae	MA		✓ FS	✓ FS	✓ FS	
<u><i>Enteromorpha</i> sp.</u>	Unspecified species of <i>Ulva</i>	Chlorophyta, Ulvophyceae: Ulvales, Ulvaceae	MA	✓	✓			
<u><i>Enteromorpha intestinalis</i></u>	<i>Ulva intestinalis</i> Linnaeus 1753 [= <i>Enteromorpha intestinalis</i> (Linnaeus) Nees 1820]	Chlorophyta, Ulvophyceae: Ulvales, Ulvaceae	MA*		✓ FS			
<u><i>ErythroGLOSSUM laciniatum</i></u> (UN ⁴)	<i>Porphyra dioica</i> J. Brodie & L. M. Irvine 1997 / <i>Porphyra purpurea</i> (Roth) C. Agardh 1824	Rhodophyta, Bangiophyceae: Bangiales, Bangiaceae	MA*		✓ FS			
<i>EuCheuma denticulatum</i>	<i>EuCheuma denticulatum</i> (N. L. Burman) Collins & Hervey 1917 [= <i>EuCheuma spinosum</i> J. Agardh 1847]	Rhodophyta, Florideophyceae: Gigartinales, Solieriaceae	MA		✓ FS			
<i>EuCheuma horridum</i>	<i>EuCheuma horridum</i> J. Agardh 1852	Rhodophyta, Florideophyceae: Gigartinales, Solieriaceae	MA		✓ FS	✓ FS	✓ FS	
<i>EuCheuma spiciforme</i> (UN ⁵)	Unspecified species of <i>EuCheuma</i>	Rhodophyta, Florideophyceae: Gigartinales, Solieriaceae	MA			✓ FS		

Eucheuma spinosum	Eucheuma denticulatum (N. L. Burman) Collins & Hervey 1917 [= <i>Eucheuma spinosum</i> J. Agardh 1847]	Rhodophyta, Florideophyceae: Gigartinales, Solieriaceae	MA		✓ FS	✓ FS	✓ FS	
Fucus nodosus	Ascophyllum nodosum (Linnaeus) Le Jolis 1863 [= <i>Fucus nodosus</i> Linnaeus 1753; <i>Ascophylla laevigata</i> Stackhouse 1809]	Ochrophyta, Phaeophyceae: Fucales, Fucaceae	MA*	✓				
<i>Fucus serratus</i>	Fucus serratus Linnaeus 1753	Ochrophyta, Phaeophyceae: Fucales, Fucaceae	MA*	✓	✓	✓ FS	✓ FS	
<i>Fucus spiralis</i> (CS ²)	Fucus spiralis Linnaeus 1753	Ochrophyta, Phaeophyceae: Fucales, Fucaceae	MA*	✓				
<i>Fucus vesiculosus</i>	Fucus vesiculosus Linnaeus 1753	Ochrophyta, Phaeophyceae: Fucales, Fucaceae	MA*	✓	✓	✓ FS	✓ FS	
<i>Gelidium amansii</i>	Gelidium amansii (J. V. Lamouroux) J. V. Lamouroux 1813	Rhodophyta, Florideophyceae: Gelidiales, Gelidiaceae	MA*		✓ FS	✓ FS	✓ FS	
<i>Gelidium corneum</i>	Gelidium corneum (Hudson) J. V. Lamouroux 1813 [= <i>Gelidium sesquipedale</i> (Clemente) Thuret 1876]	Rhodophyta, Florideophyceae: Gelidiales, Gelidiaceae	MA*		✓ FS			
Gelidium sesquipedale	Gelidium corneum (Hudson) J. V. Lamouroux 1813 [= <i>Gelidium sesquipedale</i> (Clemente) Thuret 1876]	Rhodophyta, Florideophyceae: Gelidiales, Gelidiaceae	MA*		✓ FS	✓ FS	✓ FS	
<i>Gracilaria gracilis</i>	Gracilaria gracilis (Stackhouse) Steentoft, L. M. Irvine & Farnham 1995	Rhodophyta, Florideophyceae: Gracilariales, Gracilariaceae	MA*		✓ FS	✓ FS	✓ FS	
Gracilaria verrucosa (CS ³)	Gracilariopsis longissima (S. G. Gmelin) Steentoft, L. M. Irvine & Farnham 1995 [= <i>Gracilaria verrucosa</i> (Hudson) Papenfuss 1950]	Rhodophyta, Florideophyceae: Gracilariales, Gracilariaceae	MA*	✓	✓			
<i>Gracilariopsis longissima</i>	Gracilariopsis longissima (S. G. Gmelin) Steentoft, L. M. Irvine & Farnham 1995 [=	Rhodophyta, Florideophyceae: Gracilariales, Gracilariaceae	MA*	✓	✓ FS			

	<i>Gracilaria verrucosa</i> (Hudson) Papenfuss 1950]							
<i>Graesiella emersonii</i>	<i>Graesiella emersonii</i> (Shihira & R. W. Krauss) H. Nozaki, M. Katagiri, M. Nakagawa, K. Aizawa & M. M. Watanabe 1995 [= <i>Chlorella emersonii</i> Shihira & R. W. Krauss 1965]	Chlorophyta, Chlorophyceae: Chlamydomonadales, uncertain family	MI		✓ FS			
Haematococcus pluvialis	<i>Haematococcus lacustris</i> (Girod-Chantrons) Rostafinski 1875 [= <i>Haematococcus pluvialis</i> Flotow 1844]	Chlorophyta, Chlorophyceae: Chlamydomonadales, Haematococcaceae	MI*		✓ FS	✓ FS	✓ FS	
Heterochlorella luteoviridis	<i>Jaagichlorella luteoviridis</i> (Chodat) Darienko & Pröschold 2019 [= <i>Heterochlorella luteoviridis</i> (Chodat) J. Neustupa, Y. Némecová, M. Eliáš & P. Skaloud 2009]	Chlorophyta, Trebouxiophyceae: Chlorellales, Oocystaceae	MI*		✓ FS			
<i>Himanthalia elongata</i>	<i>Himanthalia elongata</i> (Linnaeus) S. F. Gray 1821	Ochrophyta, Phaeophyceae: Fucales, Himanthaliaceae	MA*	✓	✓	✓ FS	✓ FS	
Hizikia fusiformis	<i>Sargassum fusiforme</i> (Harvey) Setchell 1931[= <i>Hizikia fusiformis</i> (Harvey) Okamura 1932]	Ochrophyta, Phaeophyceae: Fucales, Sargassaceae	MA	✓	✓ FS		✓ FS	
Laminaria cloustonii	<i>Laminaria hyperborea</i> (Gunnerus) Foslie 1885 [= <i>Laminaria cloustonii</i> Edmondston 1845]	Ochrophyta, Phaeophyceae: Laminariales, Laminariaceae	MA*			✓ FS		
<i>Laminaria digitata</i>	<i>Laminaria digitata</i> (Hudson) J. V. Lamouroux 1813	Ochrophyta, Phaeophyceae: Laminariales, Laminariaceae	MA*	✓	✓	✓ FS	✓ FS	
<i>Laminaria hyperborea</i>	<i>Laminaria hyperborea</i> (Gunnerus) Foslie 1885	Ochrophyta, Phaeophyceae: Laminariales, Laminariaceae	MA*		✓ FS	✓ FS	✓ FS	
Laminaria latissima (UN ⁶)	<i>Saccharina latissima</i> (Linnaeus) C. E. Lane, C. Mayes, Druehl & G. W. Saunders 2006 [= <i>Laminaria saccharina</i> (Linnaeus) J. V. Lamouroux 1813]	Ochrophyta, Phaeophyceae: Laminariales, Laminariaceae	MA*		✓ FS			

Laminaria japonica	Saccharina japonica (Areschoug) C. E. Lane, C. Mayes, Druehl & G. W. Saunders 2006 [= <i>Laminaria japonica</i> Areschoug 1851]	Ochrophyta, Phaeophyceae: Laminariales, Laminariaceae	MA	✓	✓	✓ FS	✓ FS	
Laminaria longicuris	Saccharina longicuris (Bachelot Pylaie) Kuntze 1891 [= <i>Laminaria longicuris</i> Bachelot Pylaie 1824]	Ochrophyta, Phaeophyceae: Laminariales, Laminariaceae	MA	✓				
Laminaria palmata (UN ⁷)	Laminaria digitata (Hudson) J. V. Lamouroux 1813	Ochrophyta, Phaeophyceae: Laminariales, Laminariaceae	MA*		✓ FS	✓ FS	✓ FS	
Laminaria saccharina	Saccharina latissima (Linnaeus) C. E. Lane, C. Mayes, Druehl & G. W. Saunders 2006 [= <i>Laminaria saccharina</i> (Linnaeus) J. V. Lamouroux 1813]	Ochrophyta, Phaeophyceae: Laminariales, Laminariaceae	MA*	✓				
Lithothamnion calcareum	Phymatolithon calcareum (Pallas) W. H. Adey & D. L. McKibbin ex Woelkerling & L. M. Irvine 1986 [= <i>Lithothamnion calcareum</i> (Pallas) Areschoug 1852]	Rhodophyta, Florideophyceae: Corallinales, Lithothamniaceae	MA*	✓	✓	✓ FS	✓ FS	
<i>Macrocystis pyrifera</i>	Macrocystis pyrifera (Linnaeus) C. Agardh 1820 [= <i>Macrocystis integrifolia</i> Bory 1826]	Ochrophyta, Phaeophyceae: Laminariales, Laminariaceae)	MA		✓ FS	✓ FS	✓ FS	
<i>Mastocarpus stellatus</i>	Mastocarpus stellatus (Stackhouse) Guiry 1984	Rhodophyta, Florideophyceae: Gigartinales, Phylloporaceae	MA*		✓ FS		✓ FS	
<i>Nannochloropsis oculata</i>	Nannochloropsis oculata (Droop) D. J. Hibberd 1981 [= <i>Nannochloris oculata</i> Droop 1955, <i>Picochlorum oculatum</i> (Droop) Henley, Hironaka, Guillou, M. Buchheim, J. Buchheim, M. Fawley, & K. Fawley 2004]	Ochrophyta, Eustigmatophyceae: Eustigmatales, Monodopsidaceae)	MI*		✓ FS			
<i>Odontella aurita</i>	Odontella aurita (Lyngbye) C. Agardh 1832	Bacillariophyta, Mediophyceae: Eupodiscales, Odontellaceae	MI*		✓			
<i>Padina pavonica</i>	Padina pavonica (Linnaeus) Thivy 1960	Ochrophyta, Phaeophyceae: Dictyotales, Dictyotaceae	MA*		✓ FS			

<i>Palmaria palmata</i>	<i>Palmaria palmata</i> (Linnaeus) F. Weber & D. Mohr 1805	Rhodophyta, Florideophyceae: Palmariales, Palmariaceae	MA*	✓	✓	✓ FS	✓ FS	
<i>Parachlorella kessleri</i>	<i>Parachlorella kessleri</i> (Fott & Nováková) Krienitz, E. H. Hegewald, Hepperle, V. Huss, T. Rohr & M. Wolf 2004 [= <i>Chlorella kessleri</i> Fott & Nováková 1969]	Chlorophyta, Trebouxiophyceae: Chlorellales, Chlorellaceae	MI*		✓ FS			
<i>Phymatolithon calcareum</i>	<i>Phymatolithon calcareum</i> (Pallas) W. H. Adey & D. L. McKibbin ex Woelkerling & L. M. Irvine 1986 [= <i>Lithothamnion calcareum</i> (Pallas) Areschoug 1852]	Rhodophyta, Florideophyceae: Corallinales, Lithothamniaceae	MA*		✓ FS	✓ FS	✓ FS	
<i>Porphyra dioica</i>	<i>Porphyra dioica</i> J. Brodie & L. M. Irvine 1997	Rhodophyta, Bangiophyceae: Bangiales, Bangiaceae	MA		✓			
<i>Porphyra purpurea</i>	<i>Porphyra purpurea</i> (Roth) C. Agardh 1824	Rhodophyta, Bangiophyceae: Bangiales, Bangiaceae	MA*		✓			
Porphyra laciniata (UN ⁸)	<i>Porphyra dioica</i> J. Brodie & L. M. Irvine 1997 / <i>Porphyra purpurea</i> (Roth) C. Agardh 1824	Rhodophyta, Bangiophyceae: Bangiales, Bangiaceae	MA*		✓			
<i>Porphyra palmata</i> (UN ⁹)	Unspecified species of <i>Porphyra</i> sensu lato	Rhodophyta, Bangiophyceae: Bangiales, Bangiaceae	MA		✓ FS	✓ FS		
Porphyra tenera	<i>Neopyropia tenera</i> (Kjellman) L. E. Yang & J. Brodie 2020 [= <i>Pyropia tenera</i> (Kjellman) N. Kikuchi, M. Miyata, M. S. Hwang & H. G. Choi 2011; <i>Porphyra tenera</i> Kjellman 1897]	Rhodophyta, Bangiophyceae: Bangiales, Bangiaceae	MA	✓				
<i>Porphyra umbilicalis</i> (CS ⁴)	<i>Porphyra umbilicalis</i> Kützting 1843	Rhodophyta, Bangiophyceae: Bangiales, Bangiaceae	MA*		✓	✓ FS	✓ FS	
Pyropia leucosticta (CS ⁴)	<i>Neopyropia leucosticta</i> (Thuret) L. E. Yang & J. Brodie 2020 [= <i>Pyropia leucosticta</i> (Thuret) Neefus & J. Brodie 2011; <i>Porphyra leucosticta</i> Thuret 1863]	Rhodophyta, Bangiophyceae: Bangiales, Bangiaceae	MA*		✓			

Pyropia tenera	Neopyropia tenera (Kjellman) L. E. Yang & J. Brodie 2020 (= <i>Pyropia tenera</i> (Kjellman) N. Kikuchi, M. Miyata, M. S. Hwang & H. G. Choi 2011; <i>Porphyra tenera</i> Kjellman 1897)	Rhodophyta, Bangiophyceae: Bangiales, Bangiaceae	MA		✓	✓ FS	✓ FS	
Pyropia yezoensis	Neopyropia yezoensis (Ueda) L. E. Yang & J. Brodie 2020 [= <i>Pyropia yezoensis</i> (Ueda) M. S. Hwang & H. G. Choi 2011; <i>Porphyra yezoensis</i> Ueda 1932)	Rhodophyta, Bangiophyceae: Bangiales, Bangiaceae	MA		✓			
Rhodymenia palmata (UN ¹⁰)	Palmaria palmata (Linnaeus) F. Weber & D. Mohr 1805	Rhodophyta, Florideophyceae: Palmariales, Palmariaceae	MA*	✓				
<i>Saccharina japonica</i>	Saccharina japonica (Areschoug) C. E. Lane, C. Mayes, Druehl & G. W. Saunders 2006 [= <i>Laminaria japonica</i> Areschoug 1851]	Ochrophyta, Phaeophyceae: Laminariales, Laminariaceae	MA		✓ FS			
<i>Saccharina latissima</i>	Saccharina latissima (Linnaeus) C. E. Lane, C. Mayes, Druehl & G. W. Saunders 2006 [= <i>Laminaria saccharina</i> (Linnaeus) J. V. Lamouroux 1813]	Ochrophyta, Phaeophyceae: Laminariales: Laminariaceae	MA*	✓	✓	✓ FS	✓ FS	
<i>Saccharina longicuris</i>	Saccharina longicuris (Bachelot Pylaie) Kuntze 1891 [= <i>Laminaria longicuris</i> Bachelot Pylaie 1824]	Ochrophyta, Phaeophyceae: Laminariales, Laminariaceae	MA		✓ FS			
<i>Sargassum fusiforme</i>	Sargassum fusiforme (Harvey) Setchell 1931 [= <i>Hizikia fusiformis</i> (Harvey) Okamura 1932]	Ochrophyta, Phaeophyceae: Fucales, Sargassaceae	MA		✓ FS	✓ FS	✓ FS	
<i>Scenedesmus vacuolatus</i>	Scenedesmus vacuolatus (I. Shihira & R. W. Krauss) Kessler, Schäfer, Hümmer, Kloboucek & Huss 1999	Chlorophyta, Chlorophyceae: Sphaeropleales, Scenedesmaceae	MI*		✓ FS			
<i>Schizochytrium</i> sp. (UN ¹¹)	Unspecified species of <i>Schizochytrium</i> sensu lato	Bigyra, Labyrinthulomycetes: Thraustochytriales, Thraustochytriaceae	LP*		✓ FS		as in the Union List	
<i>Spirulina</i> sp. (CS ⁵)	Unspecified species of <i>Spirulina</i> sensu lato	Cyanobacteria, Cyanophyceae: Oscillatoriales, Microcoleaceae	CY*	✓	✓			

<i>Spirulina major</i>	<i>Spirulina major</i> Kützing ex Gomont 1892 [= <i>Arthrospira major</i> (Kützing ex Gomont) W. B. Crow 1927]	Cyanobacteria, Cyanophyceae: Spirulinales, Spirulinaceae	CY		✓ FS	✓ FS	✓ FS	
<i>Spirulina maxima</i>	<i>Limnospira maxima</i> (Setchell & N.L. Gardner) Nowicka-Krawczyk, Mühlsteinová & Hauer 2019 [= <i>Arthrospira maxima</i> Setchell & N. L. Gardner 1917, <i>Spirulina maxima</i> (Setchell & N. L. Gardner) Geitler 1932]	Cyanobacteria, Cyanophyceae: Oscillatoriales, Microcoleaceae	CY*		✓ FS	✓ FS	✓ FS	
<i>Spirulina platensis</i> (UN ¹²)	<i>Arthrospira platensis</i> Gomont 1892 [= <i>Oscillatoria platensis</i> (Gomont) Bourrelly 1970; <i>Spirulina platensis</i> (Gomont) Geitler 1925]	Cyanobacteria, Cyanophyceae: Oscillatoriales, Microcoleaceae	CY		✓ FS	✓ FS	✓ FS	
<i>Ulkenia</i> sp. (CS ⁶)	Unspecified species of <i>Ulkenia</i> sensu lato	Bigyra, Labyrinthulomycetes: Thraustochytriales, Thraustochytriaceae	LP		✓ FS			
<i>Ulva</i> sp. (CS ⁷)	Unspecified species of <i>Ulva</i>	Chlorophyta, Ulvophyceae: Ulvales, Ulvaceae	MA*		✓			
<i>Ulva lactuca</i> (CS ⁸)	<i>Ulva lactuca</i> Linnaeus 1753 [= <i>Ulva fasciata</i> Delile 1813, <i>Ulva lobata</i> (Kützing) Harvey 1855]	Chlorophyta, Ulvophyceae: Ulvales, Ulvaceae	MA*	✓	✓ FS	✓ FS	✓ FS	
<i>Undaria pinnatifida</i>	<i>Undaria pinnatifida</i> (Harvey) Suringar 1873	Ochrophyta, Phaeophyceae: Laminariales, Alariaceae	MA*	✓	✓	✓ FS	✓ FS	
Algal oil from <i>Ulkenia</i> sp. (CS ⁶)	Unspecified species of <i>Ulkenia</i> sensu lato	Bigyra, Labyrinthulomycetes: Thraustochytriales, Thraustochytriaceae	LP					✓
Astaxanthin-rich oleoresin from <i>Haematococcus pluvialis</i>	<i>Haematococcus lacustris</i> (Girod-Chantrons) Rostafinski 1875 [= <i>Haematococcus pluvialis</i> Flotow 1844]	Chlorophyta, Chlorophyceae: Chlamydomonadales, Haematococcaceae	MI*					✓
Fucoidan extract from <i>Fucus vesiculosus</i>	<i>Fucus vesiculosus</i> Linnaeus 1753	Ochrophyta, Phaeophyceae: Fucales, Fucaceae	MA*					✓

Fucoidan extract from <i>Undaria pinnatifida</i>	<i>Undaria pinnatifida</i> (Harvey) Suringar 1873	Ochrophyta, Phaeophyceae: Laminariales, Alariaceae	MA*					✓
<i>Odontella aurita</i>	<i>Odontella aurita</i> (Lyngbye) C. Agardh 1832	Bacillariophyta, Mediophyceae: Eupodiscales, Odontellaceae	MI*					✓
<i>Schizochytrium</i> sp. oil rich in DHA & EPA (UN ¹¹)	Unspecified species of <i>Schizochytrium</i> sensu lato	Bigyra, Labyrinthulomycetes: Thraustochytriales, Thraustochytriaceae	LP*					✓
<i>Schizochytrium</i> sp. (strain ATCC PTA-9695) oil (UN ¹¹)	Unspecified species of <i>Schizochytrium</i> sensu lato	Bigyra, Labyrinthulomycetes: Thraustochytriales, Thraustochytriaceae	LP*					✓
<i>Schizochytrium</i> sp. (strain WZU477) oil (UN ¹¹)	<i>Aurantiochytrium limacinum</i> (D. Honda & Yokochi) R. Yokoy. & D. Honda 2007 [= <i>Schizochytrium limacinum</i> D. Honda & Yokochi 1998]	Bigyra, Labyrinthulomycetes: Thraustochytriales, Thraustochytriaceae	LP*					✓
<i>Schizochytrium</i> sp. (strain T18) oil (UN ¹¹)	Unspecified species of <i>Schizochytrium</i> sensu lato	Bigyra, Labyrinthulomycetes: Thraustochytriales, Thraustochytriaceae	LP*					✓
<i>Schizochytrium</i> sp. oil (UN ¹¹)	Unspecified species of <i>Schizochytrium</i> sensu lato	Bigyra, Labyrinthulomycetes: Thraustochytriales, Thraustochytriaceae	LP*					✓
Dried <i>Tetraselmis chui</i>	<i>Tetraselmis chui</i> Butcher 1959	Chlorophyta, Chlorodendrophyceae: Chlamydomonadales, Haematococcaceae	MI*					✓
<i>Ecklonia cava</i> phlorotannins	<i>Ecklonia cava</i> Kjellman 1885	Ochrophyta, Phaeophyceae: Laminariales, Lessoniaceae	MA					✓
Dried biomass of <i>Galdieria sulphuraria</i>	<i>Galdieria sulphuraria</i> (Galdieri) Merola 1982 [= <i>Cyanidium sulphurarium</i> (Galdieri) F. D. Ott 1994]	Rhodophyta, Cyanidiophyceae: Cyanidiales, Galdieriaceae	MI*					✓ UA
EPA-rich oil from <i>Phaeodactylum tricornutum</i>	<i>Phaeodactylum tricornutum</i> Bohlin 1898	Bacillariophyta, Mediophyceae: Eupodiscales, Odontellaceae	MI*					✓ UA
Extract of the microalgae <i>Phaeodactylum tricornutum</i>	<i>Phaeodactylum tricornutum</i> Bohlin 1898	Bacillariophyta, Mediophyceae: Eupodiscales, Odontellaceae	MI*					✓

								UA
<i>Laminaria digitata</i> ash	Laminaria digitata (Hudson) J. V. Lamouroux 1813	Ochrophyta, Phaeophyceae: Laminariales, Laminariaceae	MA*					✓ UA
<i>Schizochytrium</i> sp. oil fruit & vegetable purees (UN ¹¹)	Unspecified species of <i>Schizochytrium</i> sensu lato	Bigyra, Labyrinthulomycetes: Thraustochytriales, Thraustochytriaceae	LP*					✓ UA
<i>Schizochytrium</i> sp. Oil infant & follow-on formulae (UN ¹¹)	Unspecified species of <i>Schizochytrium</i> sensu lato	Bigyra, Labyrinthulomycetes: Thraustochytriales, Thraustochytriaceae	LP*					✓ UA
<i>Schizochytrium</i> strain ATCCPTA9695 extension (UN ¹¹)	Unspecified species of <i>Schizochytrium</i> sensu lato	Bigyra, Labyrinthulomycetes: Thraustochytriales, Thraustochytriaceae	LP*					✓ UA
<i>Schizochytrium</i> strain ATCCPTA9695 labelling (UN ¹¹)	Unspecified species of <i>Schizochytrium</i> sensu lato	Bigyra, Labyrinthulomycetes: Thraustochytriales, Thraustochytriaceae	LP*					✓ UA
<i>Schizochytrium</i> sp. oil (Bio DHA oil in infant & follow up formulae) (UN ¹¹)	Unspecified species of <i>Schizochytrium</i> sensu lato	Bigyra, Labyrinthulomycetes: Thraustochytriales, Thraustochytriaceae	LP*					✓ UA
<i>Schizochytrium</i> sp. strain WZU477 strain (UN ¹¹)	Aurantiochytrium limacinum (D. Honda & Yokochi) R. Yokoy. & D. Honda 2007 [= <i>Schizochytrium limacinum</i> D. Honda & Yokochi 1998]	Bigyra, Labyrinthulomycetes: Thraustochytriales, Thraustochytriaceae	LP*					UA

¹ Novel Food Catalogue (EC, 2021a); ² France (CSHPF, 1990; 1992; 1997; DGCCRF, 2009, 2019; JOFR, 2014); ³ Italy (GURI, 2018); ⁴ Belgium (MB, 2017); ⁵ Union list of novel foods (EC, 2021b).

Abbreviations: **CY:** Cyanobacteria; **LP:** Labyrinthulomycete protists; **MA:** Macroalgae (seaweeds); **MI:** Microalgae; **FS¹:** Extra requirement: analysis must show that the preparation does not contain detectable marine toxins. The content of microcystine shall be lower than 1 µg/g; **FS²:** The content of microcystine and other cyanotoxins shall be lower than 1 µg/g; **UA:** Under approval in the Union list of novel foods.

UN: Uncertain status of taxon name or its identity.

UN¹: The variety (var.) *flosaquae* is not recognised in Algaebase (Guiry & Guiry, 2021), thereby the species with this variety is not included here.

UN²: The original name of *Fucus nodosus* Linnaeus 1753 was transferred to *Ascophylla laevigata* Stackhouse 1809, but is an illegitimate name due to unwarranted change of epithet. The combination *Ascophyllum nodosum* was made by Le Jolis in 1863 (Pereira et al., 2020; Guiry & Guiry, 2021).

UN³: The species of the original genus *Chlorella* Beyerinck [Beijerinck] are now classified in a distinct genus. The original genus *Chlorella* sensu lato (Chlorella-like) includes different distinct generic names that were traditionally designated as *Chlorella* genus (Guiry & Guiry, 2021; Champenois et al., 2014).

UN⁴: *Porphyra laciniata* (Lightfoot) C. Agardh 1824 is considered in this report as a synonymous of *Porphyra dioica* and/or *Porphyra purpurea* according to the work of Brodie and Irvine (1997, 2003).

UN⁵: This is an uncertain species name that cannot be assigned to any of the *Eucheuma*'s species. To be noted that *Eucheuma* and *Kappaphycus* are often misidentified as a result of morphological plasticity and the widespread and often indifferetiated use of colloquial, commercial and local names (Lim et al., 2017).

UN⁶: It is an uncertain species name (Guiry & Guiry, 2021) that might be assigned to *Saccharina latissima*. The original name of *Fucus saccharinus* var. *latissimus* Turner 1811 (as *Fucus saccharinus latissimus*) that is now accepted as synonym of *Saccharina latissima* (Guiry & Guiry, 2021) was previously transferred to *Laminaria latissima* (Turner) S. F. Gray 1821 (Silva, 2008).

UN⁷: It is an uncertain species name (Guiry & Guiry, 2021) that might be assigned to *Laminaria digitata*. The original name of *Laminaria palmata* Bory de St.-Vincent 1826 was transferred to *Laminaria digitata* var. *palmata* Duby 1830, which is considered as a synonym of *Laminaria digitata* var. *ligulata* Despréaux 1834 (Silva, 2008). In spite of the uncertainty in the designation of *Laminaria palmata* Bory (Guiry and Guiry 2021), it could be assigned with a reasonable degree of confidence to *Laminaria digitata*.

UN⁸: *Porphyra laciniata* (Lightfoot) C. Agardh 1824 is now known as *Erythrogloussum lacinatum* (Lightfoot) Maggs & Hommersand 1993 (Guiry and Guiry 2021). However, this species has been considered to be misidentified and the previous records of *Porphyra laciniata* are considered to represent in fact records of *Porphyra dioica* and/or *Porphyra purpurea* (Brodie and Irvine, 1997, 2003).

UN⁹: This is an uncertain species name, which currently has been used as vernacular name for *Porphyra* in Europe (Hartley, 2009) and is currently not recognized taxonomically (Guiry & Guiry, 2021).

UN¹⁰: A number of varieties (var.) and forms (f.) of *Rhodymenia palmata* are regarded as synonyms of *Palmaria palmata* (Guiry & Guiry, 2021). Although this species name is not of an entity that is accepted taxonomically a correspondence to *Palmaria palmata* can be established with certainty.

UN¹¹: Identity and classification of *Schizochytrium* sp. used as food supplements in novel food has been subject to discussion. *Schizochytrium* Goldstein & Belsky, 1964 is currently considered a complex of genera and species and thus in this work we generally refer to it as *Schizochytrium* sensu lato (Yokoyama & Honda, 2007; Yokoyama et al., 2007a; Nakai et al., 2013). Based on morphological and molecular analyses the *Schizochytrium* group was amended and rearranged into the genus *Schizochytrium* sensu stricto and new genera such as *Aurantiochytrium* and *Oblongichytrium* have been established. Recent studies show that the strains *Schizochytrium* FCC-3204 (parent strain of FCC-1324 and close to strain ATCC 20888) and *Schizochytrium* WZU477 correspond to the species *Aurantiochytrium limacinum* (Turck et al., 2020, 2021).

UN¹²: This name is of an entity that is currently accepted taxonomically (Guiry & Guiry, 2021). However, based on revision by Komárek (2016) on the taxonomy and nomenclature of *Arthrospira* species, it is also recommended the replacement of the commercial species name *Arthrospira platensis* with the name of *Arthrospira fusiformis* (currently regarded as a synonym of *Limnospira fusiformis*) (Guiry & Guiry, 2021)..

CS: Cryptic species (i.e., morphologically similar species that were traditionally classified as a single species, although recent studies support the existence of multiple species under the original taxonomic designation).

CS¹: This specific name includes other species as *Durvillaea poha* C. I. Fraser, H. G. Spencer & J. M. Waters 2012 that have recently been recognized from *D. antarctica* (Fraser et al., 2019; Velásquez et al., 2020).

CS²: *Fucus guiryi* Zardi, Nicastro, E. S. Serrão & G. A. Pearson 2011 has recently been recognized as distinct species from some populations of *Fucus spiralis* in European waters (Zardi et al., 2011; Guiry & Guiry, 2021).

CS³: This specific name is considered currently a synonym of *Gracilariopsis longissima*. However, *Gracilaria verrucosa* traditionally reported in Europe has also been transferred to other species such as *Gracilaria gracilis*, *Gracilaria dura*, *Gracilaria bursa-pastoris*, *Gracilaria vermiculophylla* and *Crassiphycus corneus* (as *Hydropuntia cornea*) (Steentoft et al., 1995; Rueness, 2005; Destombe et al., 2010; Lim et al., 2017; Gurgel et al., 2018).

CS⁴: Recent studies based on molecular and morphological data have revealed a cryptic species complex within the traditional species reported in the European coasts as *Porphyra umbilicalis* and *Pyropia leucosticta* (= *Porphyra leucosticta*) (Vergés et al., 2013a,b; Mols-Mortensen et al. 2014; Sánchez et al. 2014).

CS⁵: There is an overlap between the commercial name “Spirulina”, commonly used for cyanobacteria cultivated for human use, and the scientific name of the genus *Spirulina* Turpin ex Gomont 1892. The species name of commercially called “Spirulina” is generally considered to be mainly *Arthrospira platensis*, *Limnospira fusiformis* and *Limnospira maxima* (Vonshak & Tomaselli, 2002; Vardaka et al., 2016; Papini et al., 2021). However, in a molecular study of “Spirulina” used as dietary supplement in the greek market, *Arthrospira platensis* was identified as the predominant species (Vardaka et al., 2016).

CS⁶: *Ulkenia* sensu lato were rearranged into *Ulkenia* sensu stricto, *Botryochytrium*, *Parietichytrium*, and *Sicyoidochytrium* (Yokoyama et al., 2007b).

CS⁷: *Ulva* taxonomy has a long history of cryptic species due to the lack of obvious morphological characters, high degree of plasticity and hybridization between genetically similar species (Wolf et al., 2012; Hughey et al., 2019; Steinhagen et al., 2019; Fort et al., 2020). This has led to uncertainty and misidentification of *Ulva* species. To be noted that the genus *Ulva* includes currently both foliose/ flattened species and tubular species (formerly *Enteromorpha* spp.) (Hayden et al., 2003).

CS⁸: A recent molecular study indicates that most of the specimens of *Ulva lactuca* from Europe correspond to *Ulva fasciata*. Moreover, it is considered that the specimens of *U. lactuca* in Europe probably came from the Indo-Pacific region (Hughey et al. 2019).

3.2 Proposal for update of the Novel Food Catalogue

As a result of the work of mapping, comparing and updating the algae items authorized as food or food supplements in Europe a list was elaborated (Table 2). This list is based on the merging of information from Table 1 which was organized according to the currently accepted name and authorized application (food/food supplements) of each item. The list contains 54 species from which 31 are not currently included in the novel food catalogue as food, food supplements or both (Table 2). The genera listed are proposed to be considered with caution since some can correspond to a high diversity of species.

Table 2. Proposed updated Novel Food Catalogue list. The category to which each algae item corresponds is identified and highlighted in a different colour depending on their status in the formal lists referred in Table 1: yellow: items authorized as food; green: items authorized as food supplement; blue: items authorized both as food and food supplements. The items new to the Novel Food Catalogue are underlined. The items corresponding to genera and not single species are highlighted in red.

Currently accepted full name	Category
<i>Alaria esculenta</i> (Linnaeus) Greville 1830	Food/Food supplement
<u><i>Alsidium helminthochorton</i></u> (Schwendimann) Kützing 1843	Food supplement
<u><i>Aphanizomenon flosaquae</i></u> Ralfs ex Bornet & Flahault 1886	Food/Food supplement
<i>Arthrospira platensis</i> Gomont 1892 [= <i>Oscillatoria platensis</i> (Gomont) Bourrelly 1970; <i>Spirulina platensis</i> (Gomont) Geitler 1925]	Food/Food supplement
<i>Ascophyllum nodosum</i> (Linnaeus) Le Jolis 1863 [= <i>Fucus nodosus</i> Linnaeus 1753; <i>Ascophyllum laevigata</i> Stackhouse 1809]	Food/Food supplement
Unspecified species of the genus <i>Arthrospira</i> Sitzenberger ex Gomont 1892 / <i>Limnospira</i> Nowicka-Krawczyk, Muhlsteinová & Hauer 2019	Food
<i>Auxenochlorella protothecoides</i> (Krüger) Kalina & Puncochárová 1987	Food supplement
<i>Auxenochlorella pyrenoidosa</i> (H. Chick) Molinari & Calvo-Pérez 2015 [= <i>Chlorella pyrenoidosa</i> H. Chick 1903]	Food/Food supplement
<u><i>Chlorella sorokiniana</i></u> Shihira & R. W. Krauss 1965	Food supplement
<i>Chlorella vulgaris</i> Beyerinck [Beijerinck] 1890	Food/Food supplement
Unspecified species of the genus <i>Chlorella</i> Beyerinck [Beijerinck] 1890	Food
<i>Chondrus crispus</i> Stackhouse 1797	Food/Food supplement
<u><i>Corallina officinalis</i></u> Linnaeus 1758	Food supplement
<u><i>Dunaliella salina</i></u> (Dunal) Teodoresco 1905	Food supplement
<u><i>Durvillaea antarctica</i></u> (Chamisso) Hariot 1892	Food supplement

<i>Eisenia bicyclis</i> (Kjellman) Setchell 1905 [= <i>Ecklonia bicyclis</i> Kjellman 1885]	Food/Food supplement
Unspecified species of the genus <i>Eucheuma</i> J. Agardh, 1847	Food supplement
<i>Eucheuma denticulatum</i> (N. L. Burman) Collins & Hervey 1917 [= <i>Eucheuma spinosum</i> J. Agardh 1847]	Food supplement
<i>Eucheuma horridum</i> J. Agardh 1852	Food supplement
<i>Fucus serratus</i> Linnaeus 1753	Food/Food supplement
<i>Fucus spiralis</i> Linnaeus 1753	Food
<i>Fucus vesiculosus</i> Linnaeus 1753	Food/Food supplement
<i>Gelidium amansii</i> (J. V. Lamouroux) J. V. Lamouroux 1813	Food supplement
<i>Gelidium corneum</i> (Hudson) J. V. Lamouroux 1813 [= <i>Gelidium sesquipedale</i> (Clemente) Thuret 1876]	Food supplement
<i>Gracilaria gracilis</i> (Stackhouse) Steentoft, L. M. Irvine & Farnham 1995	Food supplement
<i>Gracilariopsis longissima</i> (S. G. Gmelin) Steentoft, L. M. Irvine & Farnham 1995 [= <i>Gracilaria verrucosa</i> (Hudson) Papenfuss 1950]	Food/Food supplement
<i>Graesiella emersonii</i> (Shihira & R. W. Krauss) H. Nozaki, M. Katagiri, M. Nakagawa, K. Aizawa & M. M. Watanabe 1995 [= <i>Chlorella emersonii</i> Shihira & R.W. Krauss 1965]	Food supplement
<i>Haematococcus lacustris</i> (Girod-Chantrons) Rostafinski 1875 [= <i>Haematococcus pluvialis</i> Flotow 1844]	Food supplement
<i>Himanthalia elongata</i> (Linnaeus) S. F. Gray 1821	Food/Food supplement
<i>Jaagichlorella luteoviridis</i> (Chodat) Darienko & Pröschold 2019 [= <i>Chlorella luteoviridis</i> Chodat 1913; <i>Heterochlorella luteoviridis</i> (Chodat) J. Neustupa, Y. Nemcova, M. Eliás & P. Skaloud 2009]	Food/Food supplement
<i>Laminaria digitata</i> (Hudson) J. V. Lamouroux 1813	Food/Food supplement
<i>Laminaria hyperborea</i> (Gunnerus) Foslie 1885 [= <i>Laminaria cloustonii</i> Edmondston 1845]	Food supplement
<i>Limnospira fusiformis</i> (Voronichin) Nowicka-Krawczyk, Mühlsteinová & Hauer 2019	Food supplement
<i>Limnospira indica</i> (Desikachary & N. Jeeji Bai) Nowicka-Krawczyk, Mühlsteinová & Hauer 2019	Food supplement
<i>Limnospira maxima</i> (Setchell & N. L. Gardner) Nowicka-Krawczyk, Mühlsteinová & Hauer 2019 [= <i>Arthrospira maxima</i> Setchell & N. L. Gardner 1917, <i>Spirulina maxima</i> (Setchell & N. L. Gardner) Geitler 1932]	Food supplement
<i>Macrocystis pyrifera</i> (Linnaeus) C. Agardh 1820 [= <i>Macrocystis integrifolia</i> Bory 1826]	Food supplement
<i>Mastocarpus stellatus</i> (Stackhouse) Guiry 1984	Food supplement

<i>Nannochloropsis oculata</i> (Droop) D. J. Hibberd 1981 [= <i>Nannochloris oculata</i> Droop 1955, <i>Picochlorum oculatum</i> (Droop) Henley, Hironaka, Guillou, M. Buchheim, J. Buchheim, M. Fawley, & K. Fawley 2004]	Food supplement
<i>Neopyropia leucosticta</i> (Thuret) L. E. Yang & J. Brodie 2020 [= <i>Pyropia leucosticta</i> (Thuret) Neefus & J. Brodie 2011; <i>Porphyra leucosticta</i> Thuret 1863]	Food/Food supplement
<i>Neopyropia tenera</i> (Kjellman) L. E. Yang & J. Brodie 2020 (= <i>Pyropia tenera</i> (Kjellman) N. Kikuchi, M. Miyata, M. S. Hwang & H. G. Choi 2011; <i>Porphyra tenera</i> Kjellman 1897]	Food/Food supplement
<i>Neopyropia yezoensis</i> (Ueda) L. E. Yang & J. Brodie 2020 [= <i>Pyropia yezoensis</i> (Ueda) M. S. Hwang & H. G. Choi 2011; <i>Porphyra yezoensis</i> Ueda 1932]	Food/Food supplement
<i>Padina pavonica</i> (Linnaeus) Thivy 1960	Food supplement
<i>Palmaria palmata</i> (Linnaeus) F. Weber & D. Mohr 1805	Food/Food supplement
<i>Parachlorella kessleri</i> (Fott & Nováková) Krienitz, E. H. Hegewald, Hepperle, V. Huss, T. Rohr & M. Wolf 2004	Food supplement
<i>Phymatolithon calcareum</i> (Pallas) W. H. Adey & D. L. McKibbin ex Woelkerling & L. M. Irvine 1986 [= <i>Lithothamnion calcareum</i> (Pallas) Areschoug 1852]	Food/Food supplement
<i>Porphyra dioica</i> J. Brodie & L. M. Irvine 1997	Food/Food supplement
<i>Porphyra purpurea</i> (Roth) C. Agardh 1824	Food/Food supplement
<i>Porphyra umbilicalis</i> Kützing 1843	Food/Food supplement
<i>Saccharina japonica</i> (Areschoug) C. E. Lane, C. Mayes, Druehl & G. W. Saunders 2006 [= <i>Laminaria japonica</i> Areschoug 1851]	Food/Food supplement
<i>Saccharina latissima</i> (Linnaeus) C. E. Lane, C. Mayes, Druehl & G. W. Saunders 2006 [= <i>Laminaria saccharina</i> (Linnaeus) J. V. Lamouroux 1813]	Food/Food supplement
<i>Saccharina longicuris</i> (Bachelot Pylaie) Kuntze 1891 [= <i>Laminaria longicuris</i> Bachelot Pylaie 1824]	Food/Food supplement
<i>Sargassum fusiforme</i> (Harvey) Setchell 1931 [= <i>Hizikia fusiformis</i> (Harvey) Okamura 1932]	Food/Food supplement
<i>Scenedesmus vacuolatus</i> (I. Shihira & R. W. Krauss) Kessler, Schäfer, Hümmer, Kloboucek & Huss 1999	Food supplement
<i>Spirulina major</i> Kützing ex Gomont 1892 [= <i>Arthrospira major</i> (Kützing ex Gomont) W. B. Crow 1927]	Food supplement
Unspecified species of <i>Ulkenia</i> sensu lato	Food supplement
Unspecified species of the genus <i>Ulva</i> Linnaeus 1753	Food
<i>Ulva lactuca</i> Linnaeus 1753 [= <i>Ulva fasciata</i> Delile 1813, <i>Ulva lobata</i> (Kützing) Harvey 1855]	Food/Food supplement
<i>Ulva intestinalis</i> Linnaeus 1753 [= <i>Enteromorpha intestinalis</i> (Linnaeus) Nees 1820]	Food supplement
<i>Undaria pinnatifida</i> (Harvey) Suringar 1873	Food/Food supplement

Odontella aurita and *Schizochytrium* sp. were not included in the above list because these items are approved as novel food in the Union list of novel foods.

3.3 Non-official list

In addition to the information gathered from the official lists and included in Table 2 the data available from other European countries were screened (but not considered in the elaboration of Table 2).

Some countries such as Norway, Iceland and Estonia indicated that they do not have agreed national lists of algae items authorized as food and food supplements.

3.3.1 D-A-CH List

Germany, Austria and Switzerland are working on a list of algae items to be approved as novel food at the national level (D-A-CH list of substances). The provisional list resulting from these efforts is included below (Table 3).

The D-A-CH Lists of Substances were drawn up and mutually agreed by experts from national authorities and universities of Germany, Austria and Switzerland as guidance documents for the legal classification of plants and plant parts as well as fungi intended to be placed on the market as food. The lists are applicable for foods including food supplements and fortified foods. They do not claim to be complete and are not legally binding, but provide an orientation for food business operators and food control authorities. Any deviation from the classification made there, must be well justified to the competent authority. Classification is made under the assumption that the relevant substance is used as documented in the list. Any other use, e.g., in higher doses or as an extract, can lead to effects that may require a different classification.

The working group is currently working on a list of algae. Like the list on plants and plant parts and the list on fungi, this will serve as a guideline for the classification of algae in food. The working group is currently compiling the necessary information and agreeing on a draft of the list of algae internally. Following this, a public consultation is expected to take place. During this consultation, changes to the classifications may still be made or additional algae may be added to the list. The final publication of the list of algae will follow this consultation phase. This is therefore currently a preliminary classification. Information on the public consultation and publication will be posted on the website of the WG List of Substances: www.bvl.bund.de/stofflisten.

This list contains 31 items not included yet in the novel food catalogue. Most of these items are already included in the comparative table between the official lists (Table 2) but in some cases (5 entries) the approval of this list by the national authorities could lead to a further future update of Table 2.

Table 3. Common draft list of algae items from Germany, Austria and Switzerland (D-A-CH) (under approval). FS: If the algae item is authorized only as Food supplement. # the approval of these items under the D-A-CH list will result in changes in the category of the items identified in table 2.

Name according to source	Currently accepted full name	NFC	D-A-CH
<i>Alaria esculenta</i>	Alaria esculenta (Linnaeus) Greville 1830	✓	✓
<i>Aspidium helminthochorton</i>	Aspidium helminthochorton (Schwendimann) Kützing 1843		✓ FS
<i>Arthrospira platensis</i>	Arthrospira platensis Gomont 1892 [= <i>Oscillatoria platensis</i> (Gomont) Bourrelly 1970; <i>Spirulina platensis</i> (Gomont) Geitler 1925]	✓	✓
<i>Ascophyllum nodosum</i>	Ascophyllum nodosum (Linnaeus) Le Jolis 1863 [= <i>Fucus nodosus</i> Linnaeus 1753; <i>Ascophylla laevigata</i> Stackhouse 1809]	✓	✓
<i>Auxenochlorella pyrenoidosa</i>	Auxenochlorella pyrenoidosa (H. Chick) Molinari & Calvo-Pérez 2015 [= <i>Chlorella pyrenoidosa</i> H. Chick 1903]		✓
<i>Chlorella vulgaris</i>	Chlorella vulgaris Beyerinck [Beijerinck] 1890 [= <i>Chlorella candida</i> Shihira & R. W. Krauss 1965]	✓	✓
<i>Chondrus crispus</i>	Chondrus crispus Stackhouse 1797	✓	✓
<i>Corallina officinalis</i>	Corallina officinalis Linnaeus 1758		✓ FS
<i>Dunaliella salina</i>	Dunaliella salina (Dunal) Teodoresco 1905		✓ FS
<i>Durvillea antarctica</i>	Durvillea antarctica (Chamisso) Hariot 1892		✓ #
<i>Euचेuma denticulatum</i>	Euचेuma denticulatum (N. L. Burman) Collins & Hervey 1917 [= <i>Euचेuma spinosum</i> J. Agardh 1847]		✓ FS
<i>Euचेuma horridum</i>	Euचेuma horridum J. Agardh 1852		✓ FS
<i>Erythroglóssum laciniatum</i>	Erythroglóssum laciniatum (Lightfoot) Maggs & Hommersand 1993		✓
<i>Fucus serratus</i>	Fucus serratus Linnaeus 1753	✓	✓
<i>Fucus spiralis</i>	Fucus spiralis Linnaeus 1753	✓	✓
<i>Gelidium amansii</i>	Gelidium amansii (J. V. Lamouroux) J. V. Lamouroux 1813		✓ FS
<i>Gelidium corneum</i>	Gelidium corneum (Hudson) J. V. Lamouroux 1813 [= <i>Gelidium sesquipedale</i> (Clemente) Thuret 1876]		✓ FS

<i>Gracilaria gracilis</i>	Gracilaria gracilis (Stackhouse) Steentoft, L. M. Irvine & Farnham 1995		✓ FS
<i>Gracilariopsis longissima</i>	Gracilariopsis longissima (S. G. Gmelin) Steentoft, L. M. Irvine & Farnham 1995 [= <i>Gracilaria verrucosa</i> (Hudson) Papenfuss 1950]	✓	✓
<i>Graesiella emersonii</i>	Graesiella emersonii (Shihira & R. W. Krauss) H. Nozaki, M. Katagiri, M. Nakagawa, K. Aizawa & M. M. Watanabe 1995 [= <i>Chlorella emersonii</i> Shihira & R. W. Krauss 1965]		✓ FS
<i>Haematococcus lacustris</i>	Haematococcus lacustris (Girod-Chantrons) Rostafinski 1875 [= <i>Haematococcus pluvialis</i> Flotow 1844]		✓ #
<i>Himanthalia elongata</i>	Himanthalia elongata (Linnaeus) S. F. Gray 1821	✓	✓
<i>Jaagichlorella luteoviridis</i>	Jaagichlorella luteoviridis (Chodat) Darienko & Pröschold 2019 [= <i>Chlorella luteoviridis</i> Chodat 1913; <i>Heterochlorella luteoviridis</i> (Chodat) J. Neustupa, Y. Nemcova, M. Eliás & P. Skaloud 2009]	✓	✓
<i>Laminaria digitata</i>	Laminaria digitata (Hudson) J. V. Lamouroux 1813	✓	✓
<i>Laminaria hyperborea</i>	Laminaria hyperborea (Gunnerus) Foslie 1885		✓ FS
<i>Limnospira maxima</i>	Limnospira maxima (Setchell & N. L. Gardner) Nowicka-Krawczyk, Mühlsteinová & Hauer 2019 [= <i>Arthrospira maxima</i> Setchell & N. L. Gardner 1917, <i>Spirulina maxima</i> (Setchell & N. L. Gardner) Geitler 1932]		✓ #
<i>Macrocystis pyrifera</i>	Macrocystis pyrifera (Linnaeus) C. Agardh 1820 [= <i>Macrocystis integrifolia</i> Bory 1826]		✓ FS
<i>Mastocarpus stellatus</i>	Mastocarpus stellatus (Stackhouse) Guiry 1984		✓ FS
<i>Nannochloropsis oculata</i>	Nannochloropsis oculata (Droop) D. J. Hibberd 1981 [= <i>Nannochloris oculata</i> Droop 1955, <i>Picochlorum oculatum</i> (Droop) Henley, Hironaka, Guillou, M. Buchheim, J. Buchheim, M. Fawley, & K. Fawley 2004]		✓ FS
<i>Neopyropia leucosticta</i>	Neopyropia leucosticta (Thuret) L. E. Yang & J. Brodie 2020 [= <i>Pyropia leucosticta</i> (Thuret) Neefus & J. Brodie 2011; <i>Porphyra leucosticta</i> Thuret 1863]		✓
<i>Padina pavonica</i>	Padina pavonica (Linnaeus) Thivy 1960		✓ FS
<i>Palmaria palmata</i>	Palmaria palmata (Linnaeus) F. Weber & D. Mohr 1805	✓	✓
<i>Phymatolithon calcareum</i>	Phymatolithon calcareum (Pallas) W. H. Adey & D. L. McKibbin ex Woelkerling & L. M. Irvine 1986 [= <i>Lithothamnion calcareum</i> (Pallas) Areschoug 1852]	✓	✓
<i>Porphyra dioica</i>	Porphyra dioica J. Brodie & L. M. Irvine 1997		✓
<i>Porphyra purpurea</i>	Porphyra purpurea (Roth) C. Agardh 1824		✓

<i>Porphyra umbilicalis</i>	Porphyra umbilicalis Kützting 1843		✓
<i>Pyropia tenera</i>	Neopyropia tenera (Kjellman) L. E. Yang & J. Brodie 2020 [= <i>Pyropia tenera</i> (Kjellman) N. Kikuchi, M. Miyata, M. S. Hwang & H. G. Choi 2011; <i>Porphyra tenera</i> Kjellman 1897]	✓	✓
<i>Pyropia yezoensis</i>	Neopyropia yezoensis (Ueda) L. E. Yang & J. Brodie 2020 [= <i>Pyropia yezoensis</i> (Ueda) M. S. Hwang & H. G. Choi 2011; <i>Porphyra yezoensis</i> Ueda 1932]		✓
<i>Saccharina japonica</i>	Saccharina japonica (Areschoug) C. E. Lane, C. Mayes, Druehl & G. W. Saunders 2006 [= <i>Laminaria japonica</i> Areschoug 1851]		✓
<i>Saccharina latissima</i>	Saccharina latissima (Linnaeus) C. E. Lane, C. Mayes, Druehl & G. W. Saunders 2006 [= <i>Laminaria saccharina</i> (Linnaeus) J. V. Lamouroux 1813]	✓	✓
<i>Saccharina longicuris</i>	Saccharina longicuris (Bachelot Pylaie) Kuntze 1891 [= <i>Laminaria longicuris</i> Bachelot Pylaie 1824]		✓
<i>Sargassum fusiforme</i>	Sargassum fusiforme (Harvey) Setchell 1931 [= <i>Hizikia fusiformis</i> (Harvey) Okamura 1932]		✓ #
<i>Scenedesmus vacuolatus</i>	Scenedesmus vacuolatus (I. Shihira & R. W. Krauss) Kessler, Schäfer, Hümmer, Kloboucek & Huss 1999		✓ FS
<i>Schizochytrium</i> sp.	Unspecified species of <i>Schizochytrium</i> sensu lato		✓ FS
<i>Spirulina major</i>	Spirulina major Kützting ex Gomont 1892 [= <i>Arthrospira major</i> (Kützting ex Gomont) W. B. Crow 1927]		✓ #
<i>Ulkenia</i> sp.	Unspecified species of <i>Ulkenia</i> sensu lato		✓ FS
<i>Ulva lactuca</i>	Ulva lactuca Linnaeus 1753 [= <i>Ulva fasciata</i> Delile 1813, <i>Ulva lobata</i> (Kützting) Harvey 1855]	✓	✓
<i>Undaria pinnatifida</i>	Undaria pinnatifida (Harvey) Suringar 1873	✓	✓

3.3.2 PROALGA list

Portugal made available a list of species based on information gathered by the Portuguese association of algae producers (PROALGA) from different sources about the consumption of a number of algae items before May 1997 (Table 4). Several entries of this list refer to genera groups and thus, for the reasons pointed out above, the tab corresponding to the currently accepted name is left blank for these entries. Some species (14) are not referred to in any of the other Member State official or non official lists or in the novel food catalogue or the Union list.

Table 4. List provided by the Portuguese association of producers (PROALGA) which refers to a compilation of information from different sources on the consumption of these species before May 1997. No distinction between food and food supplements is made. # Species not referred to in any of the other Member State official or non official lists or in the novel food catalogue or the Union list.

Name according to source	Currently accepted full name	NFC	PROALGA
<i>Alaria esculenta</i>	<i>Alaria esculenta</i> (Linnaeus) Greville 1830	✓	✓
<i>Ascophyllum nodosum</i>	<i>Ascophyllum nodosum</i> (Linnaeus) Le Jolis 1863 [= <i>Fucus nodosus</i> Linnaeus 1753; <i>Ascophylla laevigata</i> Stackhouse 1809]	✓	✓
<i>Asparagopsis</i> sp.	Unspecified species of <i>Asparagopsis</i>		✓
<i>Chondracanthus acicularis</i>	<i>Chondracanthus acicularis</i> (Roth) Fredericq 1993		✓ #
<i>Chondracanthus teedei</i>	<i>Chondracanthus teedei</i> (Mertens ex Roth) Kützing 1843		✓ #
<i>Chondrus crispus</i>	<i>Chondrus crispus</i> Stackhouse 1797	✓	✓
<i>Codium</i> sp.	Unspecified species of <i>Codium</i>		✓
<i>Codium tomentosum</i>	<i>Codium tomentosum</i> Stackhouse 1797		✓ #
<i>Ecklonia bicyclis</i>	<i>Eisenia bicyclis</i> (Kjellman) Setchell 1905 [= <i>Ecklonia bicyclis</i> Kjellman 1885]	✓	✓
<i>Enteromorpha</i> sp.	Unspecified species of <i>Ulva</i>	✓	✓
<i>Eucheuma</i> spp.	Unspecified species of <i>Eucheuma</i>		✓
<i>Fucus serratus</i>	<i>Fucus serratus</i> Linnaeus 1753	✓	✓
<i>Fucus</i> sp.	Unspecified species of <i>Fucus</i>		✓
<i>Fucus vesiculosus</i>	<i>Fucus vesiculosus</i> Linnaeus 1753	✓	✓
<i>Gelidium corneum</i>	<i>Gelidium corneum</i> (Hudson) J. V. Lamouroux 1813 [= <i>Gelidium sesquipedale</i> (Clemente) Thuret 1876]		✓
<i>Gelidium microdon</i>	<i>Gelidium microdon</i> Kützing 1849		✓ #
<i>Gelidium sesquipedale</i>	<i>Gelidium corneum</i> (Hudson) J. V. Lamouroux 1813 [= <i>Gelidium sesquipedale</i> (Clemente) Thuret 1876]		✓
<i>Gelidium</i> sp.	Unspecified species of <i>Gelidium</i>		✓
<i>Gelidium spinosum</i>	<i>Gelidium spinosum</i> (S. G. Gmelin) P. C. Silva 1996		✓ #
<i>Gigartina pistillata</i>	<i>Gigartina pistillata</i> (S. G. Gmelin) Stackhouse 1809		✓ #
<i>Gigartina</i> spp.	Unspecified species of <i>Gigartina</i>		✓
<i>Gracilaria</i> spp.	Unspecified species of <i>Gracilaria</i>		✓

<i>Gracilariopsis longissima</i>	Gracilariopsis longissima (S. G. Gmelin) Steentoft, L. M. Irvine & Farnham 1995 [= <i>Gracilaria verrucosa</i> (Hudson) Papenfuss 1950]	✓	✓
<i>Grateloupia</i> spp.	Unspecified species of <i>Grateloupia</i>		✓
<i>Himanthalia elongata</i>	Himanthalia elongata (Linnaeus) S. F. Gray 1821	✓	✓
<i>Hizikia fusiformis</i>	Sargassum fusiforme (Harvey) Setchell 1931 [= <i>Hizikia fusiformis</i> (Harvey) Okamura 1932]	✓	✓
<i>Iridae</i> spp.	Unspecified species of <i>Iridae</i>		✓
<i>Kallymenia reniformis</i>	Kallymenia reniformis (Turner) J. Agardh 1842		✓ #
<i>Laminaria cloustonii</i>	Laminaria hyperborea (Gunnerus) Foslie 1885 [= <i>Laminaria cloustonii</i> Edmondston 1845]		✓
<i>Laminaria digitata</i>	Laminaria digitata (Hudson) J. V. Lamouroux 1813	✓	✓
<i>Laminaria hyperborea</i>	Laminaria hyperborea (Gunnerus) Foslie 1885		✓
<i>Laminaria japonica</i>	Saccharina japonica (Areschoug) C. E. Lane, C. Mayes, Druehl & G. W. Saunders 2006 [= <i>Laminaria japonica</i> Areschoug 1851]	✓	✓
<i>Laminaria ochroleuca</i>	Laminaria ochroleuca Bachelot Pylaie 1824		✓ #
<i>Laminaria saccharina</i>	Saccharina latissima (Linnaeus) C. E. Lane, C. Mayes, Druehl & G. W. Saunders 2006 [= <i>Laminaria saccharina</i> (Linnaeus) J. V. Lamouroux 1813]	✓	✓
<i>Laminaria</i> sp.	Unspecified species of <i>Laminaria</i>		✓
<i>Laurencia</i> spp.	Unspecified species of <i>Laurencia</i>		✓
<i>Laurencia viridis</i>	Laurencia viridis Gil-Rodríguez & Haroun 1992		✓ #
<i>Mastocarpus stellatus</i>	Mastocarpus stellatus (Stackhouse) Guiry 1984		✓
<i>Nemalion elminthoides</i>	Nemalion elminthoides (Vellay) Batters 1902		✓ #
<i>Odontella aurita</i>	Odontella aurita (Lyngbye) C. Agardh 1832		✓
<i>Osmundea pinnatifida</i>	Osmundea pinnatifida (Hudson) Stackhouse 1809 [= <i>Laurencia pinnatifida</i> (Hudson) J. V. Lamouroux 1813]		✓
<i>Palmaria palmata</i>	Palmaria palmata (Linnaeus) F. Weber & D. Mohr 1805	✓	✓
<i>Palmaria</i> sp.	Unspecified species of <i>Palmaria</i>		✓
<i>Porphyra dioica</i>	Porphyra dioica J. Brodie & L. M. Irvine 1997		✓
<i>Porphyra purpurea</i>	Porphyra purpurea (Roth) C. Agardh 1824		✓
<i>Porphyra laciniata</i>	Porphyra dioica J. Brodie & L. M. Irvine 1997 / Porphyra purpurea (Roth) C. Agardh 1824 (UN [®])		✓

<i>Porphyra linearis</i>	<i>Porphyra linearis</i> Greville 1830		✓ #
<i>Porphyra palmata</i>	Unspecified species of <i>Porphyra</i>		✓
<i>Porphyra tenera</i>	<i>Neopyropia tenera</i> (Kjellman) L. E. Yang & J. Brodie 2020 (= <i>Pyropia tenera</i> (Kjellman) N. Kikuchi, M. Miyata, M. S. Hwang & H. G. Choi 2011; <i>Porphyra tenera</i> Kjellman 1897)	✓	✓
<i>Porphyra umbilicalis</i>	<i>Porphyra umbilicalis</i> Kützing 1843		✓
<i>Porphyra</i> spp.	Unspecified species of <i>Porphyra</i> sensu lato		✓
<i>Pyropia leucosticta</i>	<i>Neopyropia leucosticta</i> (Thuret) L. E. Yang & J. Brodie 2020 [= <i>Pyropia leucosticta</i> (Thuret) Neefus & J. Brodie 2011; <i>Porphyra leucosticta</i> Thuret 1863]		✓
<i>Pyropia tenera</i>	<i>Neopyropia tenera</i> (Kjellman) L. E. Yang & J. Brodie 2020 [= <i>Pyropia tenera</i> (Kjellman) N. Kikuchi, M. Miyata, M. S. Hwang & H. G. Choi 2011; <i>Porphyra tenera</i> Kjellman 1897]	✓	✓
<i>Pyropia yezoensis</i>	<i>Neopyropia yezoensis</i> (Ueda) L. E. Yang & J. Brodie 2020 [= <i>Pyropia yezoensis</i> (Ueda) M. S. Hwang & H. G. Choi 2011; <i>Porphyra yezoensis</i> Ueda 1932]		✓
<i>Saccharina latissima</i>	<i>Saccharina latissima</i> (Linnaeus) C. E. Lane, C. Mayes, Druehl & G. W. Saunders 2006 [= <i>Laminaria saccharina</i> (Linnaeus) J. V. Lamouroux 1813]	✓	✓
<i>Saccorhiza polyschides</i>	<i>Saccorhiza polyschides</i> (Lightfoot) Batters 1902		✓ #
<i>Saccorhiza</i> sp.	Unspecified species of <i>Saccorhiza</i>		✓
<i>Sargassum fusiforme</i>	<i>Sargassum fusiforme</i> (Harvey) Setchell 1931 [= <i>Hizikia fusiformis</i> (Harvey) Okamura 1932]	✓	✓
<i>Sargassum muticum</i>	<i>Sargassum muticum</i> (Yendo) Fensholt 1955		✓ #
<i>Schizymenia dubyi</i>	<i>Schizymenia dubyi</i> (Chauvin ex Duby) J. Agardh 1851		✓ #
<i>Ulva intestinalis</i>	<i>Ulva intestinalis</i> Linnaeus 1753 [= <i>Enteromorpha intestinalis</i> (Linnaeus) Nees 1820]		✓

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List of tables

- Table 1.** Comparative information contained in the Novel Food Catalogue, the Union list of Novel Food and the formal lists from France, Italy and Belgium. The species with taxonomic designations which do not correspond to the currently accepted name are highlighted in green and underlined. FS: If the algae item is authorized only as Food supplement; * in the algae group column if it is produced in Europe (even if some of the produced species are introduced in European waters). 7
- Table 2.** Proposed updated Novel Food Catalogue list. The category to which each algae item corresponds is identified and highlighted in a different colour depending on their status in the formal lists referred in Table 1: yellow: items authorized as food; green: items authorized as food supplement; blue: items authorized both as food and food supplements. The items new to the Novel Food Catalogue are underlined. The items corresponding to genera and not single species are highlighted in red. 20
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