

# Algae ecosystem in Europa: The stakeholders perspective through the European Algae Association

<u>D•A•CH Algen</u> <u>Summit</u>

11 October 2021





# The European Algae Biomass Association

Jean-Paul Cadoret
PRESIDENT

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EUROPEAN ALGAE BIOMASS ASSOCIATION 10 YEARS EABA – European Algae Biomass Association Viale Belfiore, 10 – 50144 Florence, Italy

Established in Florence on june 2009, EABA is the European association representing both research and industry in the field of algal technologies. www.eaba-association.org www.algaeworkshops.org www.algaeurope.org www.what-are-algae.com

European Transparency Register ID number: 973126833332-45



#### Vice-Presidents

Sammy Boussiba - Ben-Gurion University of the Negev (Israel)

Gabriel Acien - University of Almeria (Spain)

Alexandra Mosch - Growing SMEs (Germany)

**Honorary President** 

Mario Tredici - UNIFI / University of Florence (Italy)

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#### Secretariat

General Manager - Vítor Verdelho - A4F AlgaFuel, S.A. (Portugal)

Assistant Manager - Lisandra Meinerz - Individual Member (Germany / Brazil)



### JEAN-PAUL CADORET, PhD

- CSO ALGAMA (France)
- President of EABA European Algae Biomass Association (Europa)
- Co-funder and Head of Scientific Board **Iaso-Biotech** (France)  $IA\Sigma O$
- Advisor by **One.Five** (Germany) one five

35 years of experience in Research and Industry in the field of algae and marine biotechnology

- Former Managing Director of the private Marine Biotech Company GREENSEA. GREENSEA
- Former Researcher, Team leader, Lab Director and Unit Director in the governmental Institute IFREMEI

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# MICROALGAE



























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# MACROALGUES





### **OBJECTIVE**

Promote mutual interchange and cooperation in the field of algae biomass production and all their applications fields

### TARGET

To act as a catalyst for fostering synergies among scientists, industrialists and decision makers in order to promote the development of research, technology and industry



# https://www.eaba-association.org/en

### AIM

Creating, developing and maintaining solidarity and links between its Members and at defending their interests at European and international level



**EUROPEAN ALGAE** BIOMASS ASSOCIATION

# **BENEFIT OF BECOMING A MEMBER**

Influence the future of the sector with **specific positions** and contributions

Opportunities to participate on EABA **committees** and EABA policy initiatives

Access **unique network** to disseminate, scientific, industrial and commercial news

**Visibility** through the EABA of relevant news and advances by your organization







**Networking with members** to develop joint projects, proposals,...

Opportunity to participate in **on-going EABA** educational activities



Obtaining to **regular updates** on developments via member alerts and newsletter



Reduced fees for EABA activities and events, and those promoted by affiliated partners

Europe has a long tradition in algae knowledge development and innovation with European companies in the forefront of practical applications of algae for novel foods and feeds, biofuels and chemicals, specialty bioproducts and environmental services.



ALGAMA

All members

Jean-Paul Cadoret

General Assembly

President



	The Scientific Committee	Alison Smith	Cambridge University (UK)	as25@cam.ac.uk
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		Jean François Sassi	CEA (France)	jean-francois.sassi@cea.fr
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	Gabriel Acien	Almeria University (Spain)	facien@ual.es		Carlos Casanovas	Monzón Biotech, S.L. (Spain)	casanovas@salesmonzon.com
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	Mario Tredici	Florence University (Italy)	mario.tredici@unifi.it		João Navalho	Necton, S.A. (Portugal)	jnavalho@necton.pt
					Joe McDonald	Varicon Aqua Solutions Ltd. (UK)	JoeMcDonald@variconaqua.com
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	Richard van Kranenburg	Corbion Biotech (The Netherlands)	richard.van.kranenburg@corbion.com	Board of Auditors	Claudia Thomsen	Individual member (Germany)	c.thomsen@phytolutions.com
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EUROPEAN ALGAE BIOMASS ASSOCIATION



### **EABA MEMBERS**

INDUSTRIAL



#### INDIVIDUAL

Dr. Benemann. John Dr. Tzovenis, Ioannis Mr. Lukianov, Viacheslav Mrs. Meinerz, Lisandra I. Dr. Sakuragi, Yumiko Dr. Raobelina, Lionel Dr. Critchley, Alan Dr. Alyson Myers Dr. Poix, Nathalie de Dr. Hadiyanto, Hady Dr. Guest, Jeremy S. Mrs. Mosch, Alexandra Dr. Thomsen, Claudia MSc. Laake, Morten Dr. Tőzsér, Béla Ferenc Mr. Griffa, Cesare MSc. Markl, Katharina Dr. Kossalbayev, Bekzhan MSc. Guo, Sophie Dr. Bhatnagar, Amit Dr. Olguín, Eugenia J. Dr. Voogd, Ewoud de Dr. Bruno, Laura Dr. Van Den Hende, Sofie

2015\* 2016\* 2017\* 2018\*\* 2019 2020

EABA Full Members History 2015-2020 (Dec 31, 2020)



# **SOME FIGURES**

- Survey from the European Algae Biomass Association (EABA) (2020)
- Provides Algae Biomass estimates by strains
- Biomass figures difficult to obtain
  - Companies are reluctant to provide biomass capacity
  - Algae industry protected for economico-political reasons in some countries such as China
- Overall capacity larger than estimates

### Microalgae produced worldwide

	Kg DW/year
Arthrospira (spirulina), platensis, maxima	90 000 000
Chlorella,	30 000 000
Aphanizomenon,	2 000 000
Haematococcus,	500 000
Dunaliella,	500 000
Nostoc,	200 000
Euglena,	200 000
Nannochloropsis,	50 000
Crypthecodinium	50 000
Phaeodactylum	20 000
Botryococcus,	10 000



# **SOME FIGURES**



Courses Matioulous Dessarah analusia



FIGURE 2 | Number and relative distribution between macro- and microalgae (A) and Spirulina (B) production companies by country.

#### Earthrise Nutritionals LLC

A wholly owned subsidiary of DIC, Earthrise Nutritionals, headquartered in Irvine, California, is a Spirulina production and sales company with an annual yield of approximately 500 tons. The company's outdoor algae cultivation facility, which covers a total area of 180,000 square meters, is the world's largest. Earthrise is the only company in the continental United States to succeed in the mass cultivation of algae outdoors.



# MACROALGAE IN EUROPE 2016

COMPANIES &<br/>DIRECT JOBSNumber of companies with relevant business in the sector :132DIRECT JOBSNumber of workers across Europe in companies is estimated to be > 2 600<br/>Total turnover in the sector is estimated in 2015 to be> 700 M€Total biomass production in Europe dry weight< 100 000 ton.DW/Y</td>

RESEARCH	There are about research groups on microalgae in EU:	> 90
GROUPS	In other European countries (including Turkey, and Eastern Europe	) > 30
& DIRECT JOBS	Persons working in microalgae in Europe	> 4 000

\*Not included microalgae equipment suppliers (180 M€) and research funding & development (60 M€) 2016 – NOT PRECISE NUMBERS BUT ORDERS OF MAGNITUDE



# MICROALGAE IN EUROPE 2016

COMPANIES &Number of companies with relevant business in the sector :430DIRECT JOBSNumber of workers across Europe in companies is estimated to be > 4.600Total turnover in the sector is estimated in 2015 to be> 750 M€Total biomass production in Europe dry weight< 500 ton.DW/Y</td>

RESEARCHThere are about research groups on microalgae in EU:> 300GROUPSIn other European countries (including Turkey, and Eastern Europe)> 90& DIRECT JOBSPersons working in microalgae in Europe> 10.000



# **POSITIONS PAPERS**

#1 EABA - POSITION PAPER - JUNE 2019

What are Algae?

#### **EXECUTIVE SUMMARY**

Algae have become a multi-billion sector in terms of biotechnology development that is expected to grow rapidly, providing valuable goods and services in multiple applications. In spite of centuries of scientific and commercial interests, the term algae has not taxonomic meaning. In the light of rapidly growing business interests associated with the term algae, a clear, simple definition of algae is not only required, but essential for developing the necessary standards, regulatory and legal issues.

This paper aims to explain 'what are algae' and how to answer the most relevant questions to different players interested in the field, including: academia, industry, trade organizations, consumers, business investors, local, national authorities, international organizations and any other interested parties or stakeholders. This position paper represents the position of EABA as the Algae Biomass sector Association from a European perspective and summarizes information from science, technology and business dealing with 'algae' biomass, biotechnology and bioproducts.



#### EUROPEAN ALGAE BIOMASS ASSOCIATION

Document coordinated by Alison G. Smith (University of Cambridge, UK) with Mario R. Tredici (University of Florence, Italy) and Sammy Boussiba (Ben-Gurion University, Israel) and support from Vítor Verdelho (A4F / EABA General Manager), Jean-Paul Cadoret (Algama / EABA President) and key contributions from Matthew P. Davey, Maria Huete- Ortega (University of Cambridge), Francisco Gabriel Acien (University of Almeria), Ulrike Schmid-Staiger (Frauenhofer Institute IGB), Herminia Rodriguez (University of Seville), John Benemann (MicroBio Engineering), Stefan Leu (Ben-Gurion University), Liliana Rodolfi (University of Florence), Natascia Biondi (University of Florence), and Lisandra Meinerz (EABA Secretariat).



#1 EABA - POSITION PAPER - JUNE 2019

What are Algae?



EUROPEAN ALGAE BIOMASS ASSOCIATION

# Webinars & Conferences 2021



#### **TECHNICAL WEBINARS**

Maxi webinar: all about EABA workshops 2019 and webinars 2020 APRIL 7

Production technologies for algae, including harvesting MAY 7

The use of algae biomass in cosmetic products JUNE 1 Novel proteins and applications from algae biomass JUNE 17

Algae for aquafeeds JULY 22

Biorefineries for algae biomass SEPTEMBER 23

High value products from microalgae OCTOBER 14

#### FLASH WEBINARS

Algae for cooking – Cooking algae not a mystery anymore APRIL 15

Open calls for EC Programmes including Green Deal MAY 25

Toxic algae blooms: from environment problem to biotech potential JULY 8

#### CONFERENCES

Young Algaeneers Symposium 2021 MAY 10, 11, 12

Seaweed Valorization in Europe Conference: learning from Asia JULY 1, 2

European Chlorella Conference 2021 SEPTEMBER 14, 15

Algae Europe 2021 DECEMBER 7, 8, 9

#### + INFO & REGISTRATION

www.algaeworkshops.org www.eaba-association.org www.what-are-algae.com

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# AN ANNUAL CONFERENCE





#### WHAT TO EXPECT IN 2020





### EUROPEAN ALGAE BIOMASS ECOSYSTEM

INFOGRAPHIC MINDMAP

#### **Representing:**

More than 150 members including companies, academia and other stakeholers from Research to Industry and Services including: Macro and Microalgae, technology neutral, worldwide networking & collaboration Global conference: Algae Europe • https://algaeurope.org

Thematic Conferences Seaweed Valorisation Conference Young Algeneers Symposium (YAS) European Chlorella Conference European Spirulina Conference (2022)

Technical Webinars www.algaeworkshops.org

Working Groups Position and Info papers

www.what-are-algae.com

Networking initiatives

**European Commission** 

DG-MARE, DG-AGRI, DG-

FAO

Codex

CEN/TC 454 Algae and Algae products

uropean Committee for Standardization

Alimentarius

ENVI, DG-HEALTH, DG-

Food and Agriculture Organization of the

backbone for the

cer

ALGAE sector in

**Sted Nations** 

RTD, JRC...

EABA is the

Europe

Seaweed Manifesto 

### safe seaweed

www.safeseaweedcoalition.org

AB

ASC ASC

www.asc-aqua.org

Standards

International Networking

ISAI

All to the total t

www.abes.tsukuba.ac.jp/er

ASC – Aquaculture Stewardship Council MSC – Marine Stewardship Council



# EUROPEAN KEY PLAYERS

# **EXAMPLES** Not including wastewater

treatment plants and Spiruliniers





FRANCE

- Algosolis-– Univ. Nantes
- Heliobiotech CEA Cadarach

AstaReal began as a **spin-off from the University of Uppsala**, Sweden in the mid 1980s and evolved from AstaCarotene and Bioprocess. AstaReal is a company with extended expertise in the field of microalgal production and natural astaxanthin.

AstaReal AB, subsidiary of BioReal Inc., Hawaii, wholly owned by the pharmaceutical **Group Fuji Chemical** Industry Co., Ltd, Japan is involved in research and marketing ventures in many countries around the world. AstaReal's sales office and manufacturing unit is located in Gustavsberg, Sweden and our research laboratory in Uppsala, Sweden.







# AlgaSpring

Nannochloropsis in The Netherlands



AlgaSpring is the European number one producer of the marine micro-algae or marine phytoplankton Nannochloropsis gaditana. AlgaSpring has a 1.3 hectare (4 acres) photobioreactor system. Our production facility is in Flevoland in the Netherlands.



Chlorella fermentation in The Netherlands



Nutress has grown into Europe's biggest and most innovative algae food company. It manufactures and markets essential nutrients for feed, food and pharma and focuses primarily on the food segment.

Phycom BV

Cuneraweg 9A 4051 CE OCHTEN The Netherlands +31.88.5250000

This is realized by cultivating, developing and commercializing algae. By continuously working toward innovative solutions Nutress will contribute to feed the world sustainably.



35

Algae Orange focuses on the research and (business) development of algae solutions. Selecting the right algae strains meeting the market demands and making them axenic are a number of research activities.

Cultivating algae strains, developing divers hardware solutions for a variety of market segments belong to the development activities.

Phycom, B.V. • www.phycom.eu





#### ROQUETTE KLÖTZE GMBH & CO. KG

Klötze / Germany















#### **State-of-the-art Cultivation Facility**

Our cGMP-compliant cultivation and ingredient facility in Iceland was designed from top to bottom to deliver high yields of premium quality natural astaxanthin, with full contamination control, and no supply disruptions.



#### Latest Technology

A designated scale up clean room

Separate custom-built inoculation photobioreactors

Custom-built indoor, enclosed photobioreactor cultivation system

Proprietary lighting system



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Haematococcus in Iceland

algalif







Nannochloropsis, Phaeodactylum, Isochrysis, ... in Portugal





#### BUGGYP©WER Microalgae life creators

Buggypower pursued, from the beginning, strategic alliances with companies that shared the will to explore this technology, understanding its decisive role to the future, and a strong commitment with sustainability.

As a result, **Buggypower developed** a partnership with the portuguese Madeira Island electricity company, Electricidade de Madeira, starting at 2011 one of the largest projects worldwide producing microalgae in closed photobioreactors: the "CO2 Capture Unit and subsequent energy recovery of Porto Santo, Madeira".







#### Nannochloropsis in Portugal



### Microalgae production towards the 10HA scale ALGATEC ECO BUSINESS PARK

The tour will enable conference participants to experience the first phase construction of what will be the largest algae park in Europe, and learn about the potential of microalgae biomass as a sustainable raw-material for food, feed, cosmetics, pharma, bio fibers, fertilizers, wastewater treatment, soil remediation, and biofuel.

#### ALGATEC ECO BUSINESS PARK

The ALGATEC Eco Business Park, promoted by the A4F – Algae for Future group in collaboration with LusoAmoreiras and Solvay, envisions the installation of a 14.2 ha integrated platform with microalgae production and industrial biorefinery



14 ha

units, in an excellent geographical location in Europe, with high solar radiation, water sources and raw materials availability.

ALGATEC Eco Business Park, based in Portugal, started its construction in 2017, and will be one of the largest microalgae production centres in Europe. Currently, has in the pipeline the development and implementation of three innovative projects with cutting-edge technologies, for the production of microalgae and microalgae extracts to be used in the feed and food industry.









Fitoplancton Marino is a company with professionals who are highly qualified in microalgae production systems, conservation systems and nutrition.

Fitoplancton Marino was established in 2002 focused on satisfying the market needs of various sectors including aquaculture, aquarium keeping, cosmetics, health and nutrition, guaranteeing the best standards in quality and experience.





**INDUSTRIAL PLANT "ARCOS"** 







# ec@duna

The hanging garden bioreactor technology since 2008

- Patented vertical PBR-technology 2.0
- Continuous production system
- Resource/energy efficient closed production system







www.tologreen.com









10 raceway ponds

#### New spirulina cultivation facilities in Sardinia, with C-LED lamps

The world of algae is full of discoveries and C-LED is studying the effect of light on the growth of these photosynthetic microorganisms.C-LED technologies have also been on the news programme TG1 following their use in the cultivation of "spirulina" microalgae.

c₌led

700 m3

780 m<sup>3</sup> PBR
 in 1 ha glass house
 currently the largest
 PBR in Europe







# **APPLICATIONS**

#### Human nutrition

Spirulina Diatom Chlorella



Nutraceuticals	
PUFAs	
DHA, EPA, AA	



### Health

Antiradicals Exopolysaccharids Antiproliferatives Antivirals Cell factory



### Energy

Hydrogen Biodiesel Biogaz



#### **Animal nutrition**

Oysters Fishes Crustaceans Poultry Porcs

#### Cosmetics

Skin care Hair care



#### Industry

Colors Enzymes Adhesives Fltration



#### Environment

Carbon capture Depollution Remediation



# **ICE ALGAE**





Photo: G. Dieckmann.





# **ALGAE THE SOURCE OF OMEGA 3**



# **ALGAE THE SOURCE OF OMEGA 3**

# VERY ORIGINAL MOLECULES AND SOME VISIBLE COMPANIES





# Make a positive impact on the world by reshaping the food industry

Alvyn Severien and Gaëtan Gohin had originally planned careers in finance or consulting. The first is a fan of natural dietary supplements, while the second discovered algae following an operation. This was the starting point for their idea to become partners and launched a new business, Algama in 2013 to make microalgae, up to now nothing more than a dietary supplement, a food source in its own right. Today, by its proven capacity to develop and market healthy, tasty, sustainable food for everyone, ALGAMA is the only company able to make microalgae mainstream in the Food & Beverage industry and bring microalgae in our plates.





# **GLOBAL CONTEXT**

### CHANGING THE FOOD INDUSTRY IS A GLOBAL EMERGENCY.

The population is growing fast, and our planet is running out of resources



- Sustainability
- No wild harvest
- Controlled cultures



- Curri.
- No antibiotics
- No zoonosis
- Good nutritional qualities

Plant-Based food market in 2026 \$31.4B 31% growth



- Environment friendly
- Animal friendly
- Good production practices

New plant-based products launched in January 2020 +1200

# THE FUTURE OF PLANT-BASED IS ALGAE

# **WHY ?** Everything the terrestrial plants offer but ...

- High density in **protein** (up to **70%**)
- Excellent amino-acids balance
- Highly **digestible** and **hypoallergenic**
- Best quality **unsaturated fatty-acids**
- Clean and sustainable



- Low GHG emission
- Incredible **biodiversity**
- No competition with agro-land
- Low water consumption





- High **productivity** /  $m^2$
- High level of control of quality
- European relocation







# ALGAMA'S FLAGSHIP INNOVATION

# **TAMALGA<sup>TM</sup>**

### ALGAE-BASED

The full range egg-replacer for food end-products (bakeries, white, yolk...)

### TAMALGA™ Dressing



**INGREDIENT** Egg-replacer The first egg replacer made from microalgae -Replacement of whole egg (liquid or powder)

- > 100% Algae and Plant-Based
- > Up to 50% less fat and less sugar
- > No cholesterol
- **Free-from:** GMO, Soy, Gluten and Preservatives
- > Excellent texture and taste
- Versatile ingredient (multiple applications)
- > Affordable price
- Sustainable food: Low carbon footprint

PATENT PENDING

# SUCCESSFUL BUSINESS CASE

**Development of the first vegan mayonnaise brand available in supermarkets** 

The Good Spoon : Algama's Spin-off commercializing the mayonnaise



Carrefour

### 100% PLANT-BASED ALGAMA PRODUCTS















**ALGAMA TODAY** 



An expert Team in Food and Biotechnology dedicated to harnessing the potential of algae in the food industry





# THANK YOU

### Jean-Paul CADORET

*CSO ALGAMA President EABA Advisor One.Five CST President IASO-Biotech* 



Created with Algama Algae Pre-Mix

