

# UN Oceans Conference Side Event:

## Seaweed: Aquatic food solutions for people, climate and oceans



#Aquaticfoods  
#WorldFishXOceans 2022



# Keynote Presentation

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## VINCENT DOUMEIZEL

Senior Advisor, Ocean, United Nations, Global Compact  
&  
Director, Food Programme, Lloyd's Register Foundation

# A coalition to enable the potential of seaweed

Vincent Doumeizel



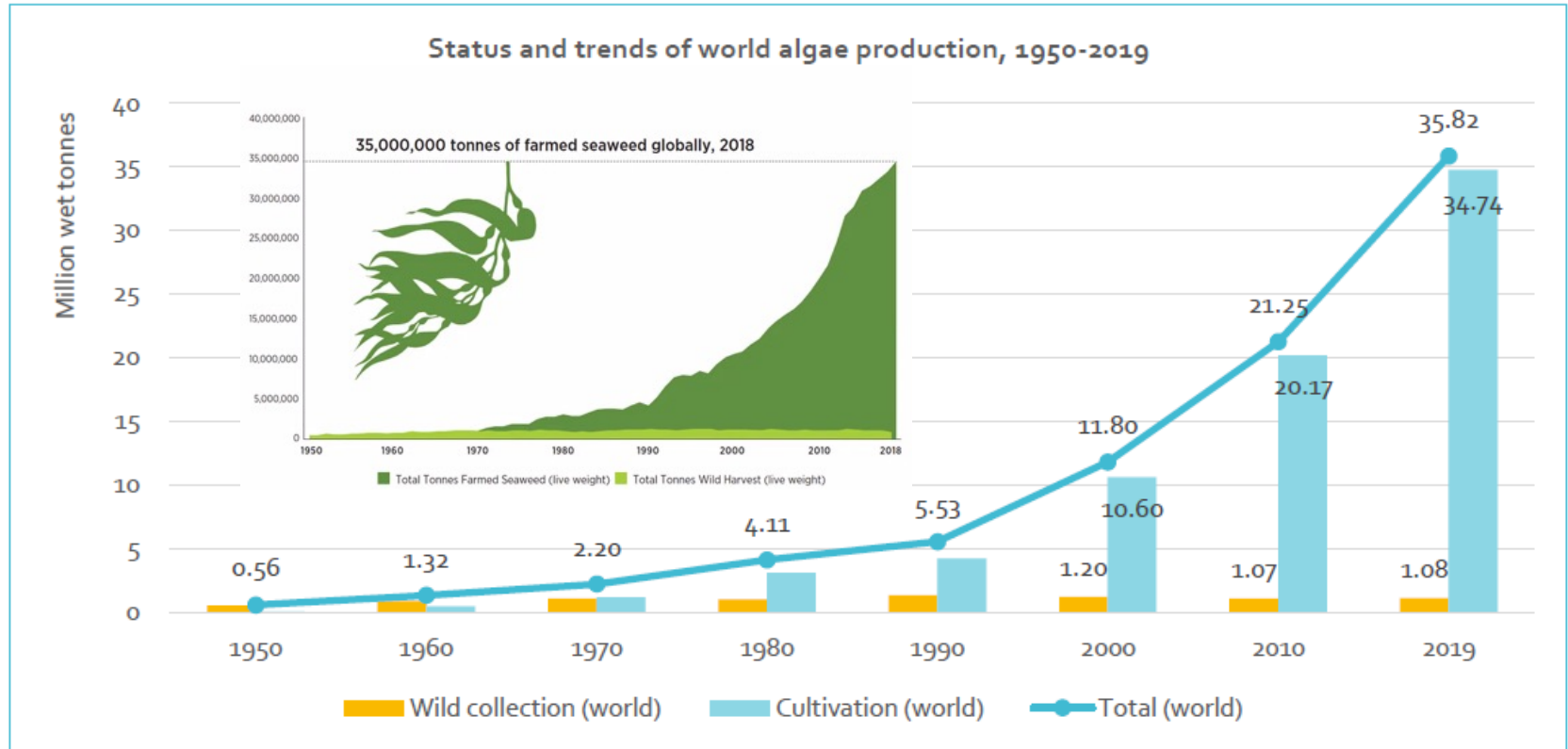
@doumeizel





# Algae production is growing fast.. But only in Asia

Global algae production (including cultivation and wild collection) increased over 60 times from 0.56 million (wet) tonnes in 1950 to 35.82 million tonnes in 2019; nearly all the growth was contributed by cultivation.



Data source: FAO 2021. FAO Global Fishery and Aquaculture Production Statistics (FishStatJ; March 2021; [www.fao.org/fishery/statistics/software/fishstatj/en](http://www.fao.org/fishery/statistics/software/fishstatj/en)).

# From the Seaweed manifesto to The Safe Seaweed Coalition

Led by :



Lloyd's Register  
Foundation



United Nations  
Global Compact

Editorial team gathering experts from :



Food and Agriculture  
Organization of the  
United Nations

The Nature  
Conservancy



WORLD  
RESOURCES  
INSTITUTE



WWF



Scottish Association  
for Marine Science

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seaweed  
coalition



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# Our Global Governance

## Advisory Board

Alpha Impact  
Investment., USA

Ningbo Univ. China

Asia Affinity, Hapan

Cape Breton Univ., CN

Europ. Commission

Kelp Blue, Namibia

METRO, Germany

Unilever

Seadling, Malaysia

Seaweed Solution, NO

Systemiq, UK

Wageningen Univ, NL

ASC Standards

Los Lagos Univ. Chili

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The Nature Conservancy

## Steering Committee

Australian Seaweed Association

Korean Nori Association

Sea Grant, USA

FAO

The GEF

CNRS, France

Lloyd's Register Foundation

Nestlé

Riken Food, Japan

SAMS, United Kingdom

SINTEF, Norway

United Nation Global Compact

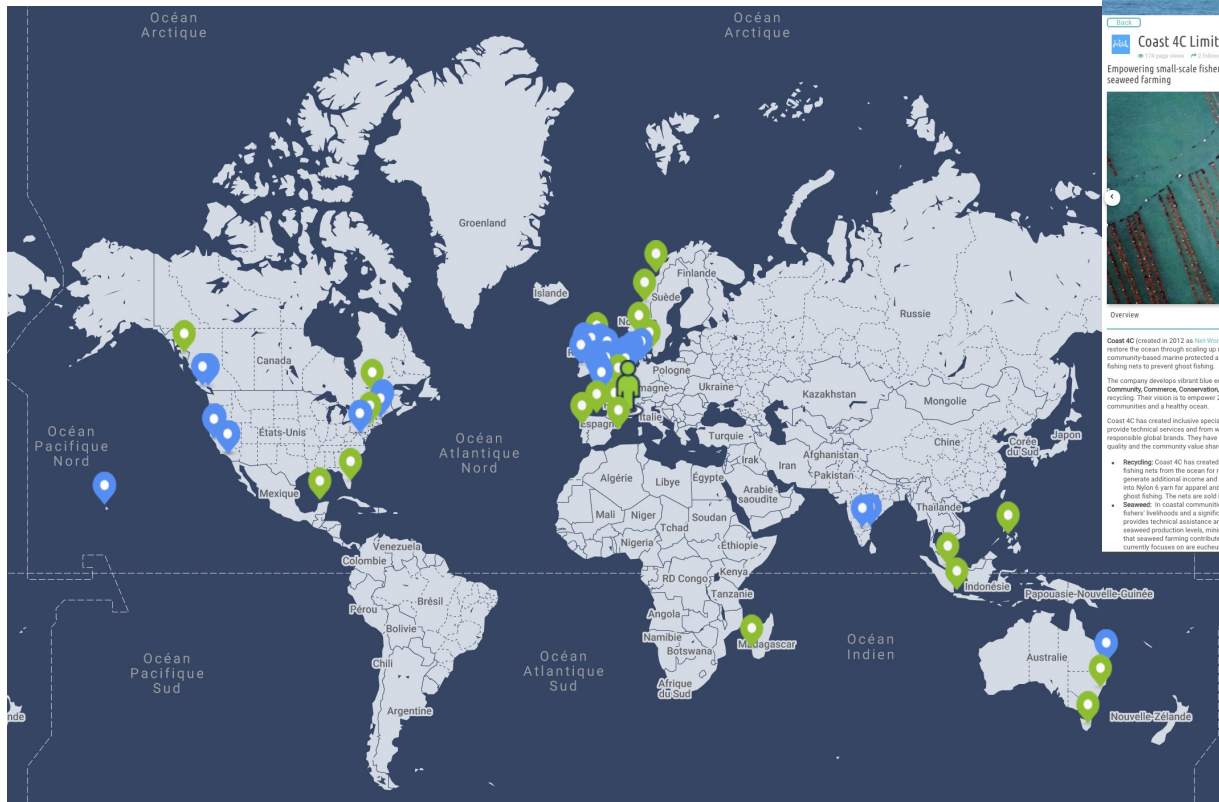
WWF

Zanzibar Seaweed Cluster,  
Tanzania



# Join the Seaweed Revolution !

## 600+ Seaweed stakeholders joined the coalition



**Coast 4C Limited**

Empowering small-scale fishers to restore the ocean through regenerative seaweed farming

**Details**

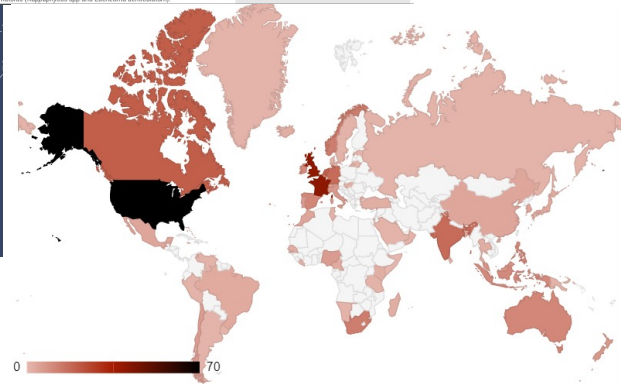
Headquarters: Canada/UK, Australia  
 Year Founded: 2019  
 Organization Type: Limited Liability Company  
 Stage of Development: P1, B, Scale Up  
 Value Chain Impact: Net-zero, Resilience, Collection / Recovery, Waste Management, Recycle, Advocacy  
 Topic: Ocean, Plastics, Seaweed, Waste  
 Seeking: Cooperative, Funding, Early Adopters, Partnerships  
 Value Chain: Tech & equipment, Animal &...  
 Application: Fertilizers/Biofertilizers, Others  
 Food consumption: Animal/Human/Other feed  
 Seaweed Type: Red  
 Company Size: 1-10  
 Links: Visit Website  
 Key Contacts: Nicholas Hill, Co-founder, CEO

Nicholas has expertise in biodiversity, conservation, sustainable coastal enterprises. He holds a PhD in Conservation Science and an M.Sc. in Marine Environmental Technology and Ecological Management from the Imperial College London and a B.Sc. Honours Degree in Ecology from the University of Edinburgh.

Promote  
your  
solution !



Join: <https://www.safeseaweedcoalition.org/members/>



# • CALL FOR PROPOSALS 2021

**71 high-level proposals across 33 countries on all continents (except Antarctica)**

**15 projects selected for funding, with a total value of about €700K.**

**Next in Spring 2022**

Bzeo's  
(Norway)

Bring to the  
market  
Seaweed  
Packaging

Alfred  
Wegener  
Institute  
(Germany)  
European-  
wide  
strategy to  
conserve  
genetic  
seaweed  
resources

Marine  
Environment and  
Resources  
Foundation  
(Philippines)  
Selection and  
curation of safe  
and healthy  
eucheumatoid  
seedlings

Universiti  
Malaya  
(Malaysia)  
A global  
taxonomic  
framework for  
the  
carrageenan  
industry

SUBMARINER  
Network  
(Germany)  
Baltic  
Seaweed  
Biosafety

Kelp Forest  
Foundation  
(Namibia)  
Biodiversity  
impact of  
Kelp  
cultivation

Notpla  
(UK)  
Pilot  
program  
for  
seaweed-  
based  
packaging

Ningbo  
University  
(China)  
Technical  
Training for  
Seaweeds  
Cultivation  
and Safe  
Production

Yunus  
Foundation  
(Thailand)  
A social  
business  
model for  
safe and  
sustainable  
growth of the  
seaweed  
industry

Ocean  
Farmers  
(Madaqascar)  
Identifying  
superior  
cultivars for  
commercial  
production

Fundación  
ULPGC  
(Spain)  
Culture  
Collection of  
seaweeds from  
the  
Macaronesian  
region

Universidad  
de Los  
Lagos  
(Chile)  
Coalition  
for Safe  
Seaweeds  
in the  
Americas

Sea Health  
(Australia)  
Introducing  
kelp farming  
aquaculture  
to NSW,  
Australia

Universidad Austral  
(Chile)  
Characterizatio  
n and  
biobanking of  
economically-  
relevant pests  
and pathogens  
of Agarophyton  
chilensis

Aber Actives  
(France)  
Algal  
biorefinery  
using  
natural  
marine  
bacteria.

Sea Power  
(Tanzania)  
Seaweed  
farming  
innovation  
for women's  
empowerme  
nt



coalition

[www.safeseaweedcoalition.org](http://www.safeseaweedcoalition.org)

  
safe  
seaweed  
coalition

IN PARTNERSHIP WITH:



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Station Biologique  
de Roscoff



Join the Seaweed  
Revolution



# Invited Panel Speaker

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## **MD ASADUZZAMAN**

Associate Professor,  
Department of Marine Bioresource Science, Faculty of  
Fisheries,  
Chattogram Veterinary and Animal Sciences University,  
Bangladesh

# ECOFISH approaches for seaweed farming: 1. Providing training to coastal communities

- A total of 400 fishermen and women received in-depth training on different aspect of seaweed farming in 2020-21



## ECOFISH approaches for seaweed farming-2. Providing input assistance



## ECOFISH seaweed farming: *Gracilaria* sp.



## ECOFISH seaweed farming: *Ulva* and *Enteromorpha* sp



Location: Rezu Khal, Sonapara

Floating long-line culture: promising technology



# Livelihood Improvement and Women Empowerment

Among 400 beneficiaries, 242 were women (>60%) who were otherwise fully dependent on their husband income



# Unemployed youth involvement in seaweed farming

- ECOFISH focusing on entrepreneurship development in seaweed farming through involving coastal unemployed youths



Promotion of seaweed as food



# Invited Panel Speaker

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**JAKIA HASAN**

Senior Scientific Officer,  
Bangladesh Fisheries Research Institute (BFRI),  
Bangladesh



# Scale up seaweed farming in Bangladesh coast



Jakia Hasan, BFRI



# Seaweed Research & Development

Seaweed species in Bangladesh coast >

148

## Commercial Important species 28



Green seaweed (*Caulerpa racemosa*, *Enteromorpha intestinalis*, *Enteromorpha compressa*, *Codium fragile*, *Ulva lactuca*)

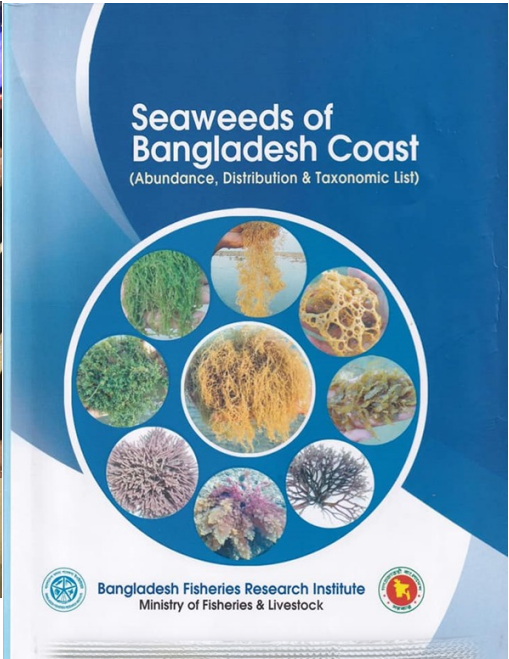
Brown seaweed (*Colpomenia sinuosa*, *Dictyota dichotoma*, *Hydroclathrus clathratus*, *Padina tetrastromatica*, *Padina gymnospora*, *Sargassum oligocystum*, *Sargassum ilicifolium*, *Sargassum myriocystum*)

Red seaweed (*Hypnea musciformis*, *Hypnea valentiae*, *Asparagopsis taxiformis*, *Kappaphycus alvarezii*, *Porphyra indica*)

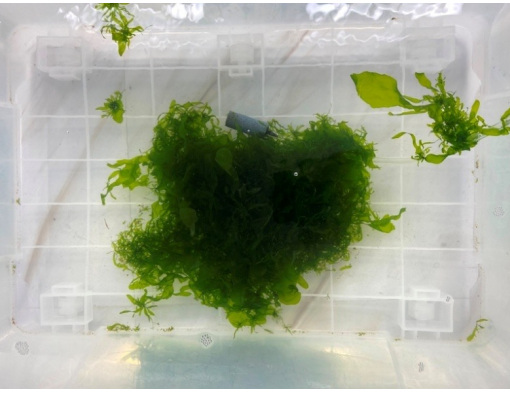
# Harvesting, Processing & Marketing



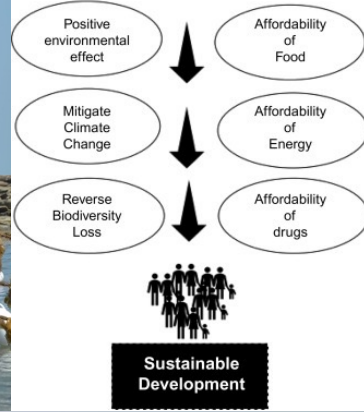
# Popularization



# Intervention needed



## Seaweed farming



# Invited Panel Speaker

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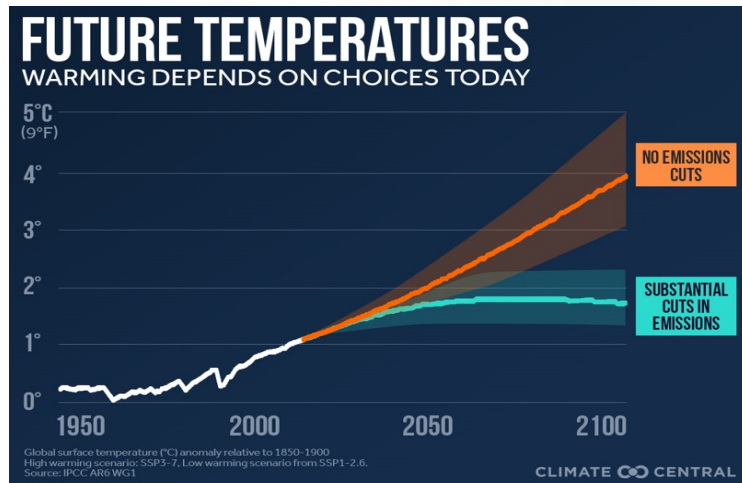
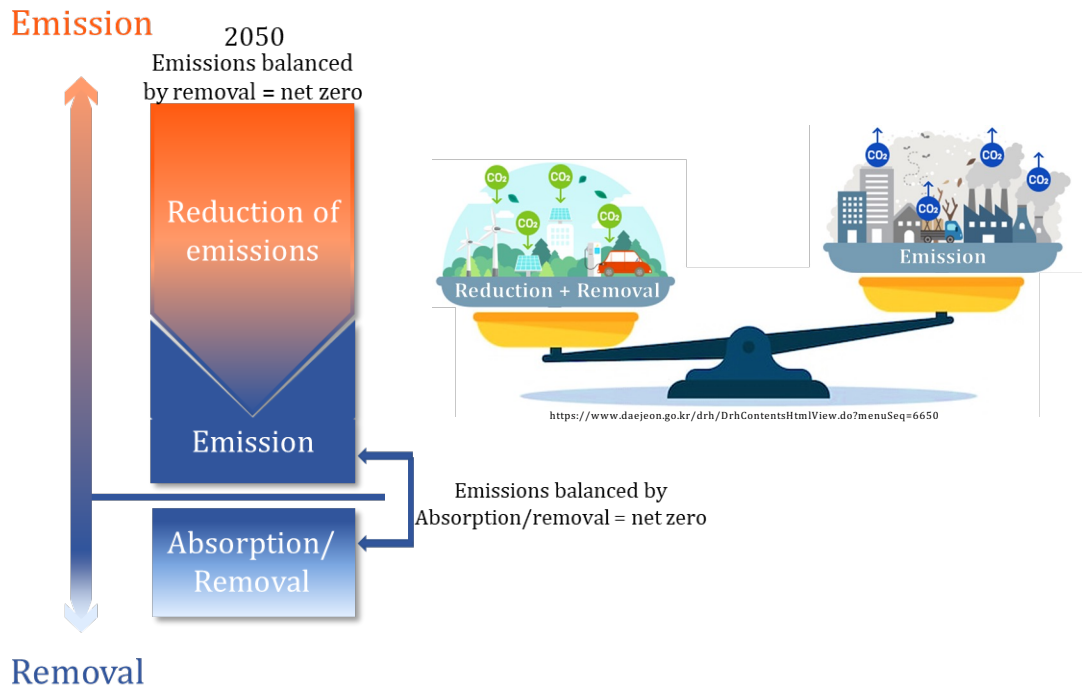


**JANG K. KIM**

Associate Professor,  
Department of Marine Science, Incheon National University,  
South Korea

# Seaweed for climate resilience

- **Blue Carbon = Carbon that is Captured by Marine Ecosystem including Sediments on the Marshes or Beaches, or Plants**



COP26: positioning seaweed as a powerful ocean-based climate solution

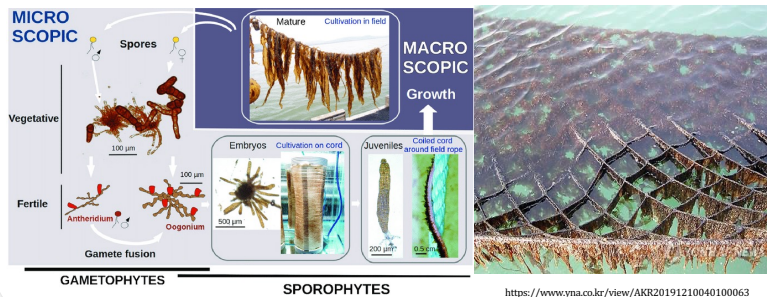
Nov 16, 2021 | Climate Change



# Seaweed for climate resilience

## Limitation

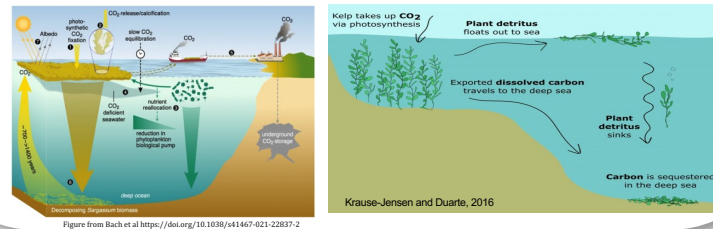
Short life span: weeks to years  
↓  
short-term carbon storage



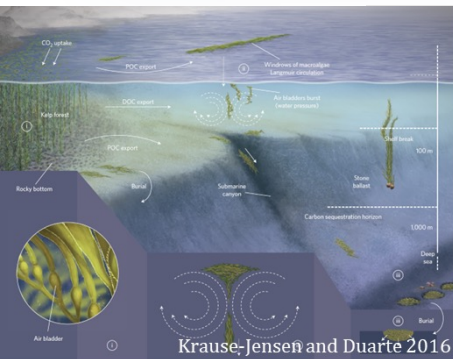
(Charrier et al.  
2017)

## Potential

- Seaweed forest and blooms, and nearby sediment
- Carbon sequestration in soil below seaweed farms
- Deep ocean carbon storage via sinking seaweed
- Reduction of methane emission via seaweed feed additive to ruminant
- Bioenergy, biochar, seaweed-based polymers



# Seaweed forest and blooms, and nearby sediment



**Seaweed forests: 7.2 million km<sup>2</sup>**

**Productivity: 1.3 Pg C yr<sup>-1</sup> (Duarte et al. 2022)**



**Seaweed forest restoration in Korea: 54,000 ha by 2030  
(FIRA, 2021; Kim et al. 2022)**



**Carbon removal by seaweed blooms  
(Samanta, Kim et al. 2019; Wu, Kim et al. 2018)**

- Seaweed
- Sediment
- e-DNA meta barcoding

# Carbon dioxide removal (CDR) by seaweed farming and in soil below seaweed farms

- The amount of CDR by global seaweed aquaculture:  $\sim 2,800,000 \text{ tons yr}^{-1}$  (Kim et al. 2017, 2019)
- The amount of CDR by seaweed aquaculture in Korea:  $> 160,000 \text{ tons yr}^{-1}$
- (= 6% of  $\text{CO}_2$  discharged from all wastewater treatment plants in Korea (Park, Kim et al. 2021; Kim et al. 2022))
- **HOWEVER**, a short life span is an issue  $\rightarrow$  focusing on sediment

OCEANS·2050  
GLOBAL SEAWEED PROJECT  
BLUE CARBON

We're leading the global effort to  
quantify seaweed carbon  
sequestration.

Through a groundbreaking study, we will deliver evidence and the methodology to validate  
and monetize the carbon sequestration impact of ocean farming.



nature sustainability  
A seaweed aquaculture imperative to meet global  
sustainability targets

Carlos M. Duarte, Annette Bruhn & Dorte Krause-Jensen

## Seaweed and Blue Carbon



- 21 farms around the world
- 1.6 – 3.0 giga tons of  $\text{CO}_2$  sequestered below farm per year

OCEANS·2050



Monaco Oceanographic Institute - 2-7pm 24 March 2022

<https://youtu.be/kv5vCHnew6Q>

# Seaweed sinking, feed additive to ruminant, bioenergy, biochar, seaweed-based polymers

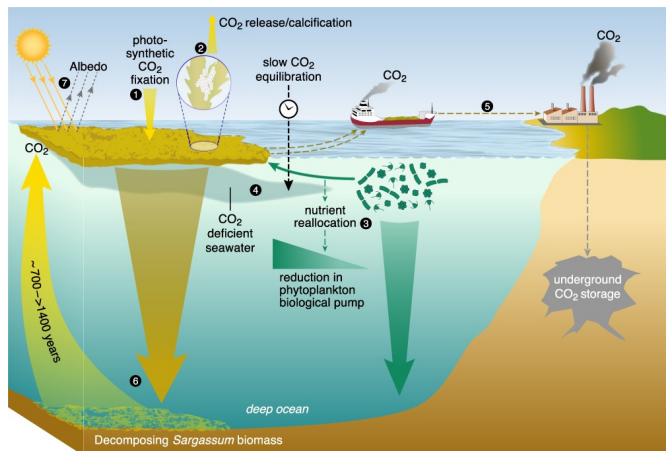
<https://doi.org/10.5194/esd-2021-104>  
Preprint. Discussion started: 14 January 2022  
© Author(s) 2022. CC BY 4.0 License.



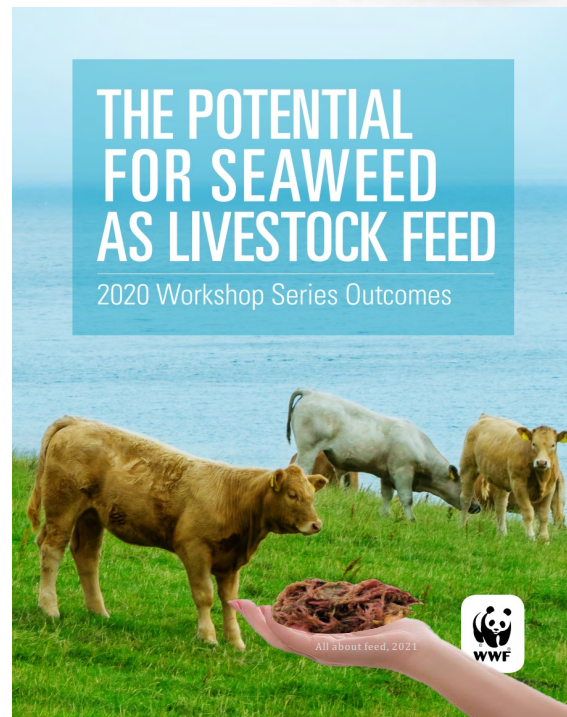
## Carbon Dioxide Removal via Macroalgae Open-ocean Mariculture and Sinking: An Earth System Modeling Study

Jiajun Wu<sup>1</sup>, David P. Keller<sup>1</sup>, and Andreas Oschlies<sup>1,2</sup>

Macroalgae open-ocean mariculture and sinking: 3.38 - 5.56 Pg C yr<sup>-1</sup>



(Bach et al. 2021)



# Invited Panel Speaker

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## **ARTATI WIDIARTI**

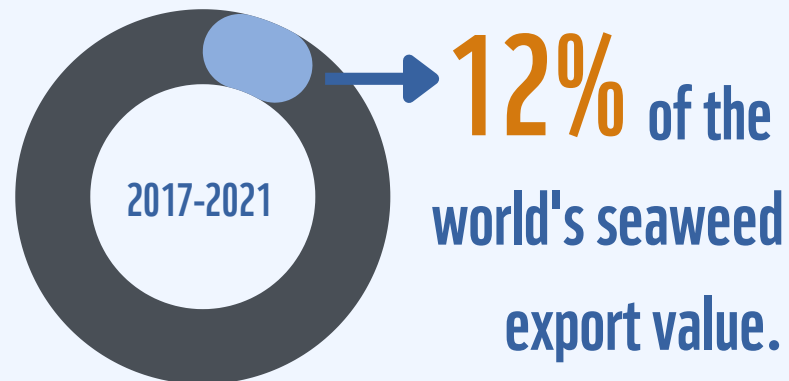
**Director General, Product Competitiveness,  
Ministry of Marine Affairs and Fisheries (MMAF),  
Republic of Indonesia**

# INDONESIA SEAWEED

## CONTRIBUTION TO THE GLOBAL



Average value of Indonesia's exports



Indonesian seaweed has been traded internationally in three products:

**Dried seaweed**



**Carrageenan**



**Agar**



Indonesia exports seaweed mainly to China, USA, UK, and Japan.

**Contributed**

**5.73%**

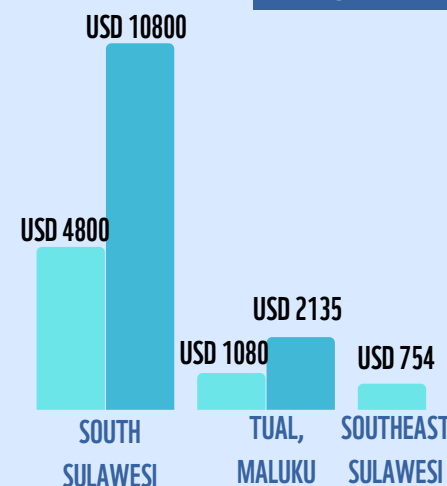
Last 5 years

to the total value of Indonesian fisheries' export.

## LIVELIHOOD OF SEAWEED FARMING HOUSEHOLD

Gracilaria, Eucheuma and Kappaphycus are produced along the coastline including South Sulawesi, Central Sulawesi, Southeast Sulawesi, East Nusa Tenggara, West Nusa Tenggara, Maluku, North Maluku, East Java and North Kalimantan involving more than 267,000 coastal households depending their livelihood on seaweed production.

## ANNUAL INCOME FROM SEAWEED FARMING



Annual income of seaweed farming in Indonesia **varies among seaweed-producer regions**. Chart shows the difference of income between South Sulawesi, Tual (Maluku), and Southeast Sulawesi.

# INDONESIA SEAWEED

## PROCESSING INDUSTRY

Derivative products such as fertilizer, livestock feed, degradable packaging materials are now developed in Indonesia, and one has successfully cosmetics products (e.g. facial wash, face cleanser, day cream, face mask, shampoo, infused collagen, and collagen powder).



At least 36 processing plants are operated in Indonesia where the majority exist in **East Java, South Sulawesi, Banten and West Java** Mostly for carrageenan (ATC, ATS, SRC, RC) and Agar.



SMEs produce foods/snacks, beverages, and sea vegetables.



Processing plant



Household production

# INDONESIA SEAWEED

## PRODUCTION AND FARMING

Indonesia has 89 family, 268 genus and 903 species.  
This are the 5 top commodities export.

**98%** came from farming

**Sargassum**  
**0.7%**  
1,244,550 tons



**Gelidium**  
**0.026%**  
45,860 tons

*Euchema denticulatum*

**Spinosum**  
**13.7%**  
23,240,113.1 tons

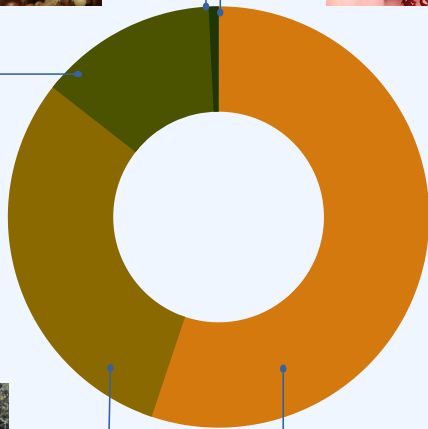


*Kappaphycus alvarezii*



**Cottonii**  
**55.1%**  
93,728,599.38 tons

**Gracilaria**  
**30.4%**  
51,631,932.1 tons

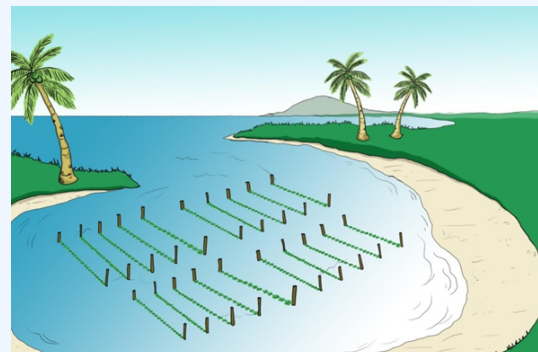


the rest from wild harvest  
(Sargassum, Gelidium,  
Caulerpa, Ulva, and Halymenia).

**2.25% from 272.336 hectares**  
of potentially sea-based areas exist  
has been utilized for seaweed culture.



Sea based farming with **long-line and off-bottom**  
methods are dominated in Indonesia.



# INDONESIA SEAWEED

## INTERVENTION TO STRENGTHEN THE NATIONAL ECONOMY



**a. Strengthening Indonesia Seaweed Brand in the global market.**

**Indonesia is not only the source of raw material but also various derivative products.**



**b. Optimizing the role of Tropical Seaweed Innovation Network (TSIN): a digital platform to bridge commercial needs with the research. (please visit: seaweednetwork.id)**



**c. Supporting global initiative to provide incentive seaweed farmers for their role in climate change mitigation.**



**THANK YOU**  
Terima Kasih

# Invited Panel Speaker

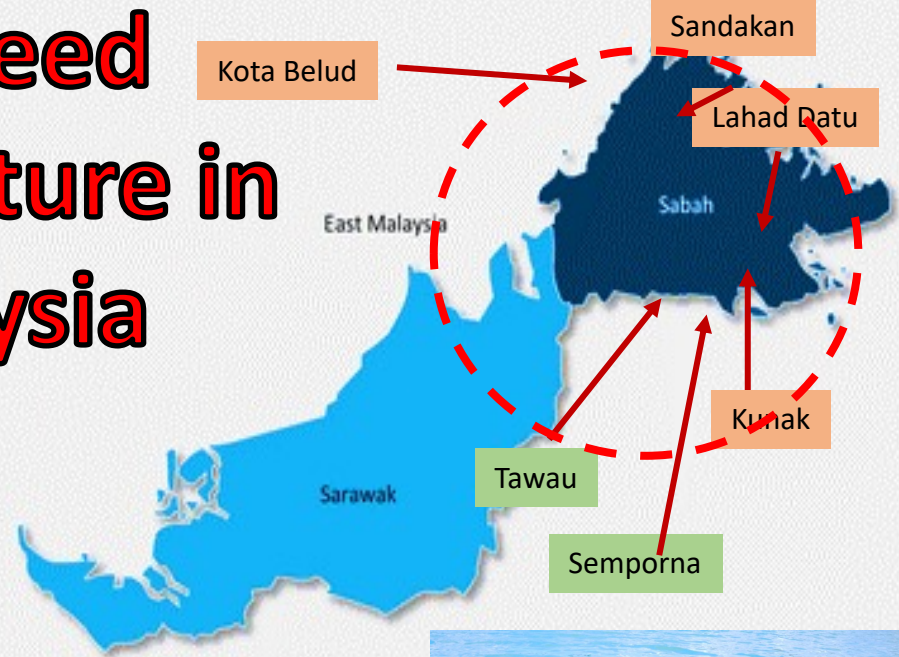
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**LIM PHAIK EEM**

Professor & Deputy Director,  
Institute of Ocean and Earth Sciences, University of Malaya,  
Malaysia

# Seaweed Aquaculture in Malaysia



# Cultivation, Harvesting & Processing



# Common Products/Uses



# Diversification of Product



# Pest & Disease – Climate Change





THANK YOU!

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# Thank You

