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A REVIEW OF KAPPAPHYCUS FARMING IN BRAZIL

Miguel Sepulveda
Marine Biologist
Seaweed Farming Consultant
www.seaweedconsulting.com

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The success of commercial cultivation of Kappaphycus seaweed in several countries is directly related to the easy vegetative reproduction of this species, high growth rate, simple cultivation techniques and their uses in different segments of the food, pharmaceutical, cosmetic and agricultural industries.

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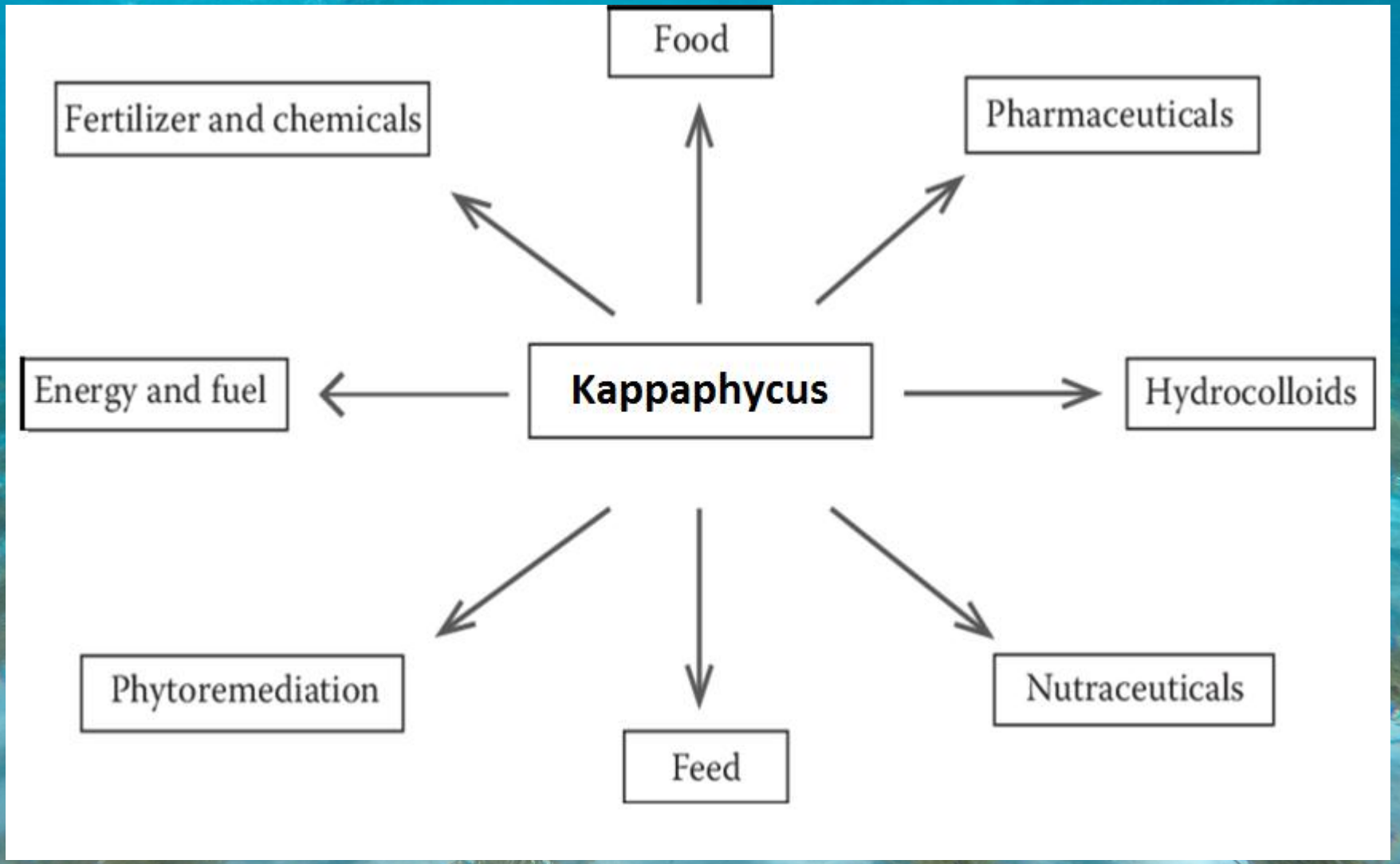
POTENTIAL USES OF KAPPAPHYCUS



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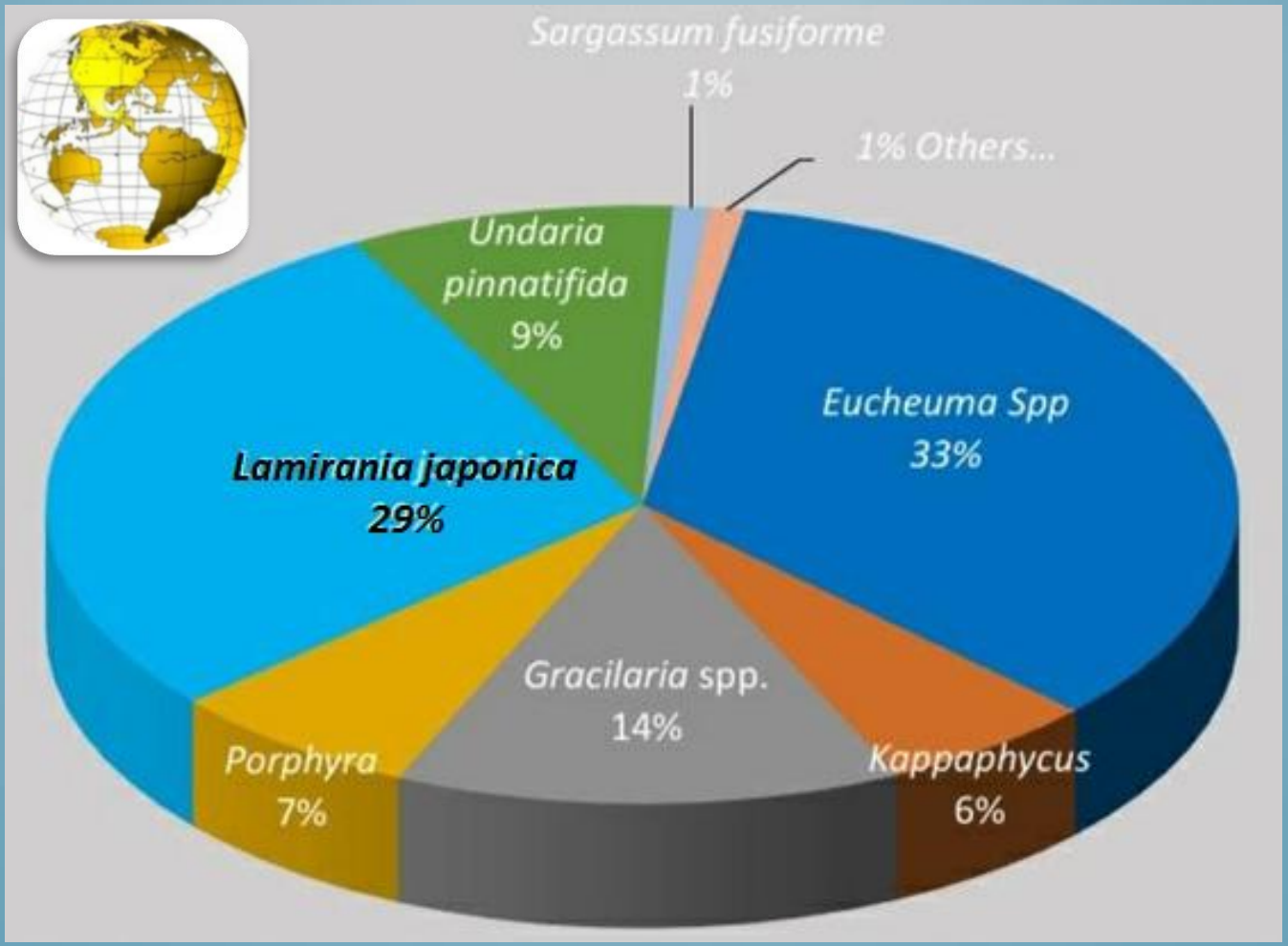
GLOBAL SEAWEED PRODUCTION



Gobal Seaweed Production was estimated at 31.1 million tons wet - FAO 2018

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Kappaphycus alvarezii, a species cultivated in at least 30 countries, is the main raw material for obtaining kappa CARRAGEENAN, an odorless, tasteless powder widely used in the food and cosmetics industry.

In 2017, Brazil imported about 2,500 tons of CARRAGEENAN valued at US $ 22 million.

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CARRAGEENAN BY APPLICATION

Today, the global seaweed industry is worth more than USD 6 billion per annum (approximately 12 million tonnes per annum in volume) of which some 85 % comprises food products for human consumption. Seaweed-derived extracts (**CARRAGEENAN**, agar and alginates) make up almost **40%** of the world's hydrocolloid market in terms of foods. The most important extract, **CARRAGEENAN**, is used in the pet food, dairy and meat industries and, to a lesser extent, the pharmaceutical industry.

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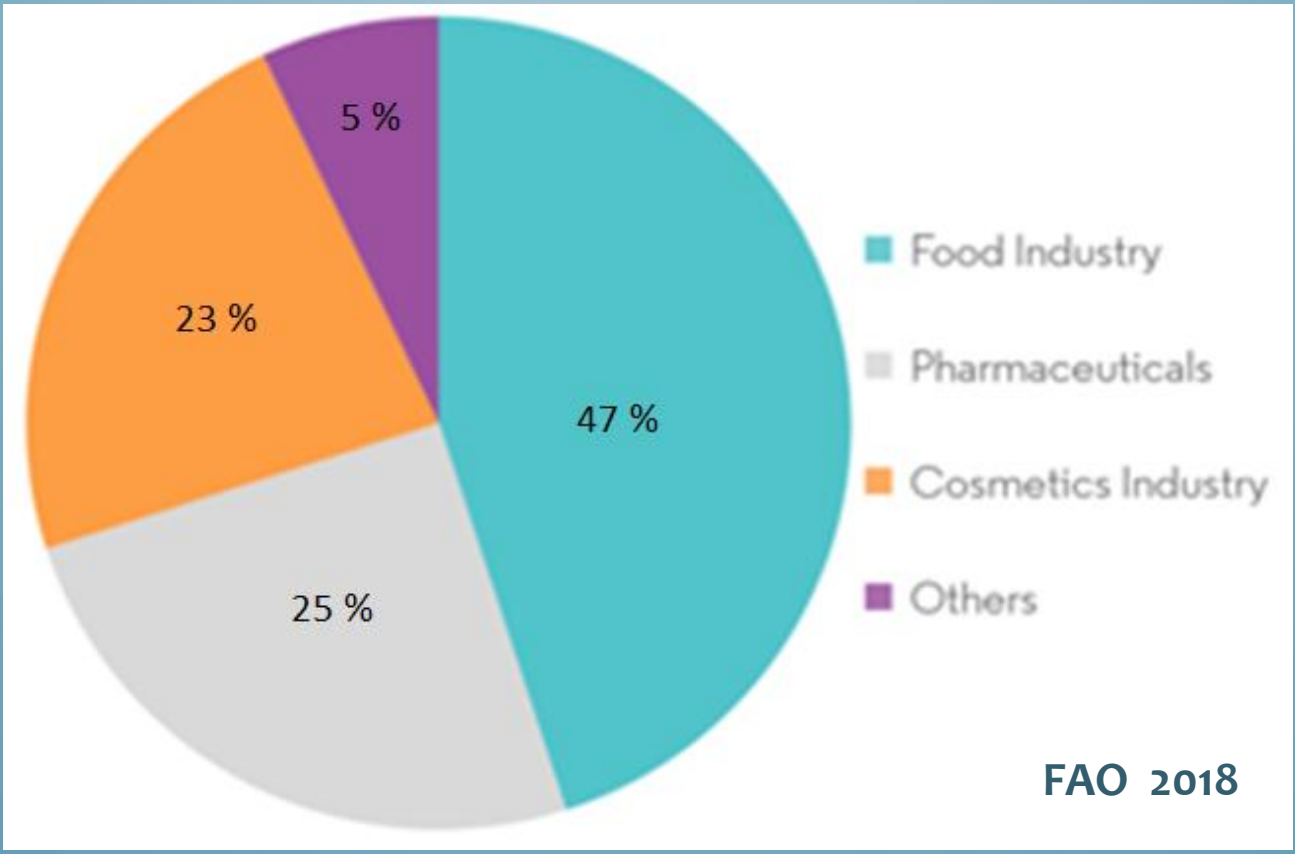
CARRAGEENAN MARKET BY APPLICATION

Carrageenan it is a Hydrocolloid (natural polysaccharide) extracted from some red seaweeds species and used in a wide variety of applications in the food (Emulsifying Agents) and pharmaceutical industry



FAO 2018

Kappaphycus alvarezii

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In culture, *K. alvarezii* is propagated by vegetative cuttings.

In the Seaweed Farming the species *Kappaphycus sp.* have been only found to reproduce sexually reported reproduction by VEGETATIVE FRAGMENTATION.

At the tip of each branch is a cluster of apical cells in regenerative capabilities that are able to regenerate a new thallus after breaking off. This type of reproduction means that this species does not reproduce repeatedly without the assistance of man.

Once dispersed in the environment, *Kappaphycus* does not have a fixation structure to fix itself on substrates.

The variety/strain of *Kappaphycus* from farmed stock that has never shown any spore production over several years, and is assumed to be non-reproductive or sterile

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Commercial cultivation IN BRAZIL (Since 1998 until recently)

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SITE SELECTION

The installation of location for seaweed cultivation is dictated by some factors:

1. *Local environmental conditions e.g. temperature, light, waves salinity and depth;*

2. *Current uses and socio-economic context e.g. fishing, boat traffic, protected areas;*

3. *Operational considerations e.g. landing point, onshore facilities.*

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RIO DE JANEIRO STATE

Kappaphycus COMMERCIAL PRODUCTION REFERENCE CENTER

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State of Rio de Janeiro

"Prospects"

- AREAS LEGALIZED BY THE FEDERAL GOVERNMENT
- PROTECTED BAY (LOW HYDRODINAMISM)
- TEMPERATURE BETWEEN 23-30 DEGREES CELSIUS
- SALINITY BETWEEN 25 -35 psu
- 8 HARVESTS PER YEAR
- AVAILABLE COMMUNITIES FOR SEAWEED CULTIVATION

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Kappaphycus alvarezii

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Kappaphycus alvarezii

(Introduced species in Brazil in Rio de Janeiro State in 1998)


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Seedlings were imported from Venezuela in 1998
(PHYTOSANITARY CERTIFICATE)
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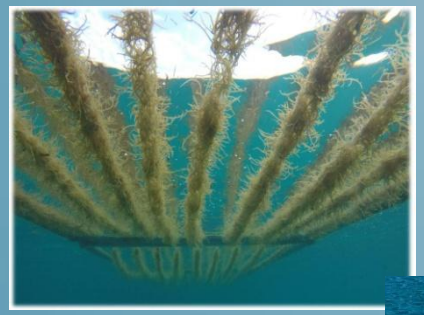
ACTIVITY APPROACH

In cooperation with the local government and private company we develop different *"Proof of Concepts"* which demonstrate the viability of the overall concept and validate the starting points for the deployment of Seaweed Farming the Long Term Vision.

1	2	3	4	5
Test & Validation	Definition & Exploration	Analysis & Evaluation	Scale Up	Roll out Operation



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INTERVENTION LOGIC

According to experience shared by a number of international institutions and experts over the last 30 years, a commercial seaweed cultivation program is to be successful, taking into account the following aspects:

- Government support including or granting of permits and licenses necessary for the development of the activity;

- Existence of a safe and reliable local company to purchase the product;

- Availability of the economic resources necessary for the operation of the program to reach commercial volumes;

- Competent design, management and execution of the project manager. This last point includes the linkage of technical and professional personnel to the field work, as well as the adequate identification of the barriers that prevent the entry of the farmers in the commercial activity and the development of strategies to overcome them.

- The appropriate selection of the place to establish the crop, in order to guarantee the success of the program in the community and justify the investment of time, effort and resources.

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INTERVENTION LOGIC

- Clear and precise identification of the main constraints for community members to join the project (investment capital for crops, training and technical assistance, business organization, basic services, etc.)

- Genetic resources: Availability of "seedlings" and implants that adapt to local ecological and environmental conditions, as well as cropping systems to be used.

- The Seaweeds must synthesize colloids of high quality and of commercial interest.

- Permanent technical and socio-business assistance, from the installation of seaweed farming to their commercial phase, including follow-up that can guarantee the sustainable production of raw material and generate enough incomes to meet the socio-economic needs and demands of the farmers.

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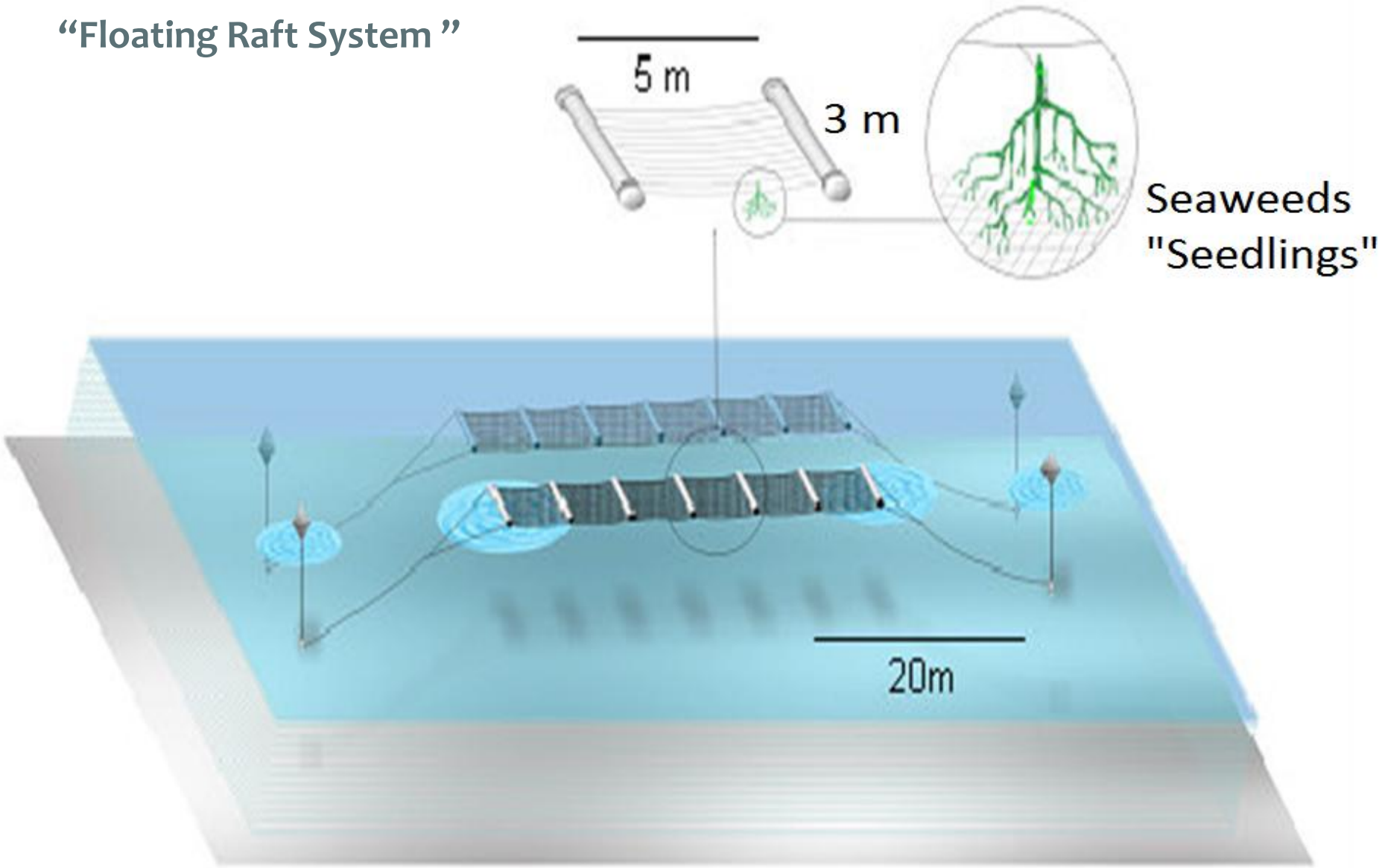
SEAWEED CULTIVATION SYSTEM

“Floating Raft System ”



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“FLOATING RAFT SYSTEM ”

Commercial cultivation model (150m x 3m = 450m2)

Production: 7 /8 tons fresh / 50 days

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Floating barrier against Herbivores

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PVC PIPE FLOATING SYSTEM

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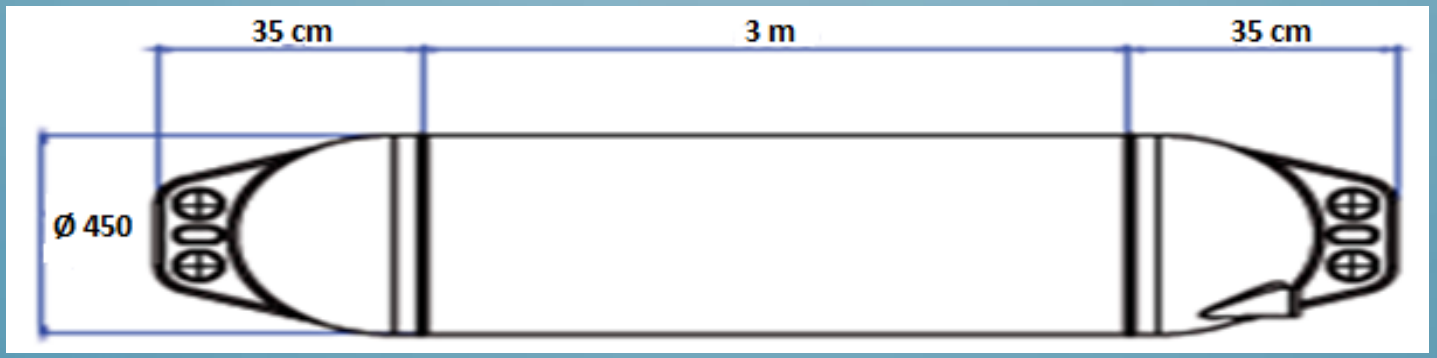
HIGH – DENSITY POLYETHYLENE RAFT

FLOAT (HIGH – DENSITY POLYETHYLENE)

Durability of 20 years

Dimensions



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The seedlings are introduced in Tubular Nets

Planting

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Seaweed Planting Machine


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TUBULAR NETS
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Protection net against herbivores (fish and turtles)


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Daily growth rate of 7%


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Tie – Tie system


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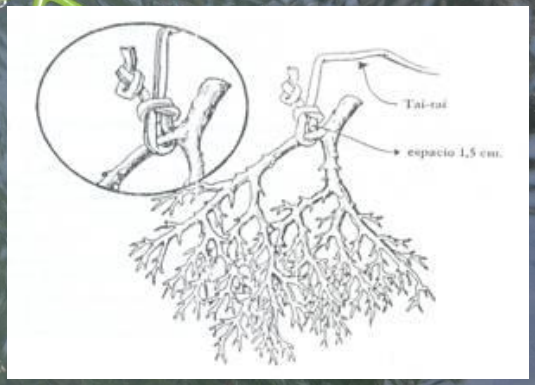

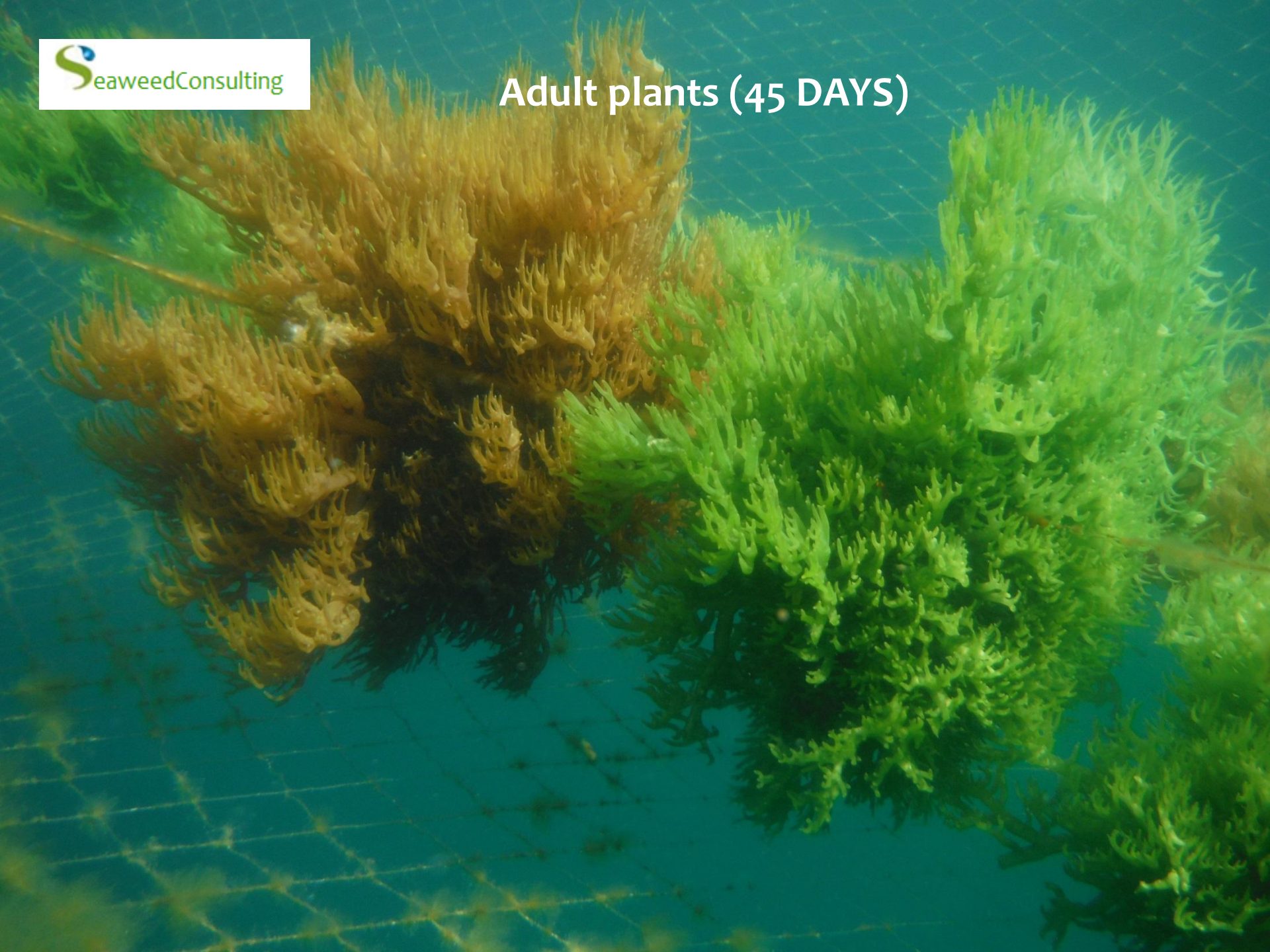
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Adult plants (45 DAYS)

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FLOATING BASE TO WORK

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PILOT CULTIVATION

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PVC FLOATING SYSTEM

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PVC Floating System

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PVC FLOATING SYSTEM

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COMMERCIAL KAPPAPHYCUS FARMING

(150 STRUCTURES OF 450 m^2)


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STATE OF RIO DE JANEIRO
ANNUAL PRODUCTION OF
KAPPAPHYCUS (FRESH)
BETWEEN 4,000 and 5000
TONS.

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AVERAGE PRODUCTION OF 100 TONS FRESH PER HECTARE

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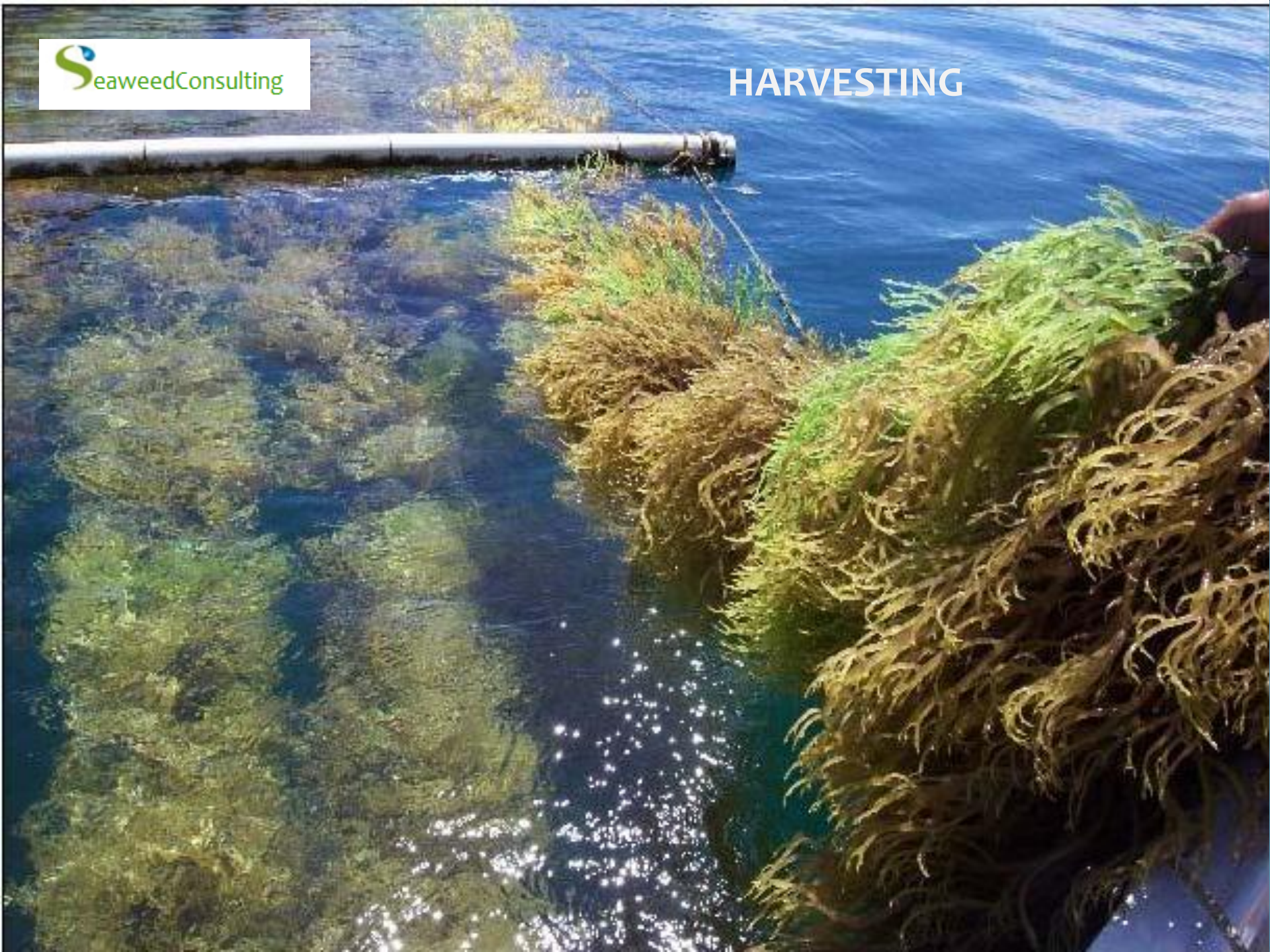
HARVESTING

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7% GROWTH RATE PER DAY

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HARVESTING CYCLE IN 50 DAYS


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CULTIVATION DEVELOPED ON THE SURFACE


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Kappaphycus with 10 kilos (3 months of cultivation)

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SEPARATION OF SEEDLINGS


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HARVESTING

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HARVESTING

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WORK BOAT

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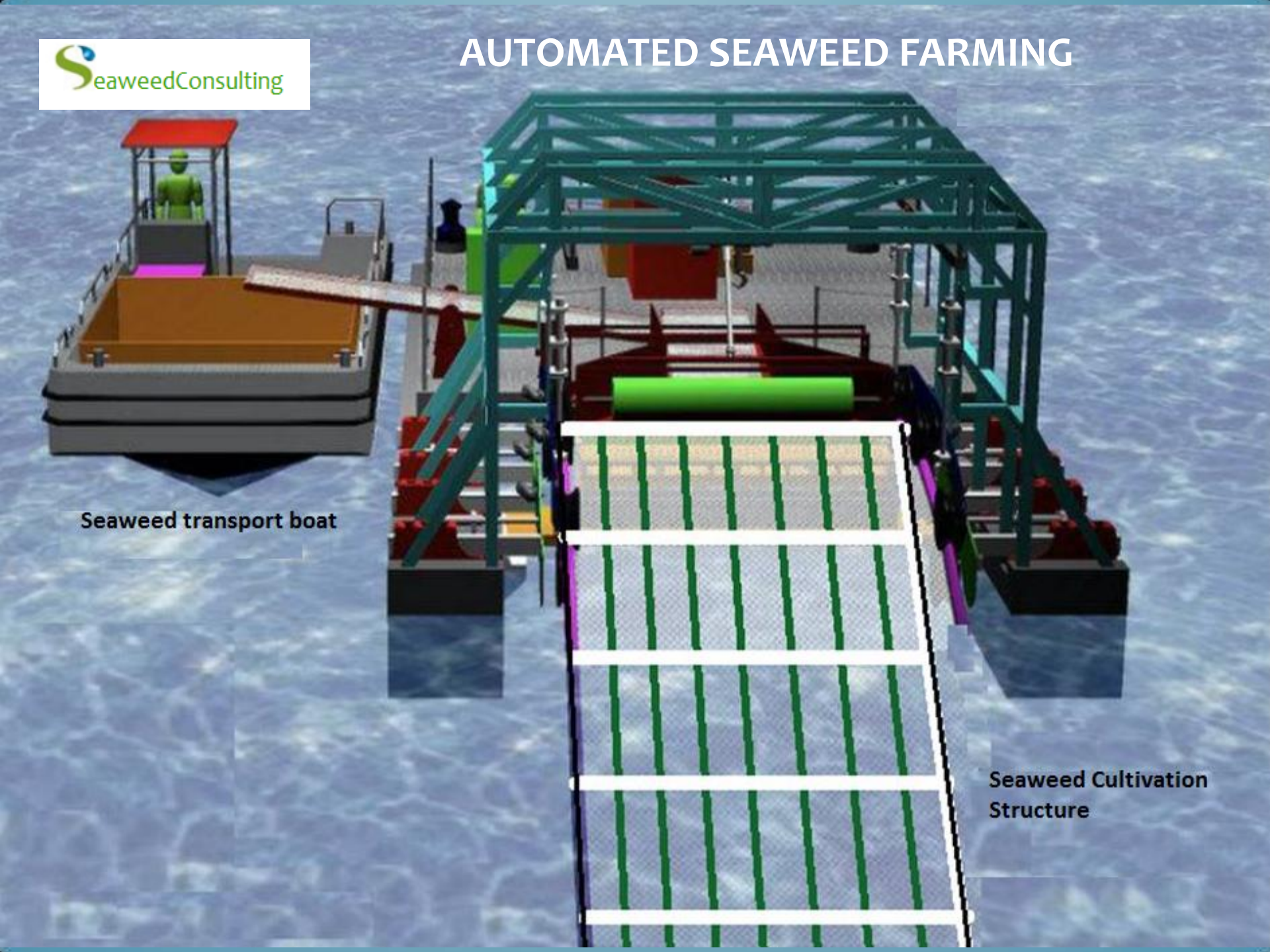
AUTOMATED SEAWEED FARMING



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TRANSPORT TO THE FACTORY


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TRANSPORT TO THE FACTORY

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SUN DRYING (30% FINAL MOISTURE)
433 / 2015 07 31

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DRYING IN THE SUN FOR 3 DAYS

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1% IMPURITIES


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10 KILOS FRESH / m²

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10 TON FRESH = 1 TON DRY

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PROTECTION FROM RAIN TO NOT AFFECT THE QUALITY OF SEAWEEDS


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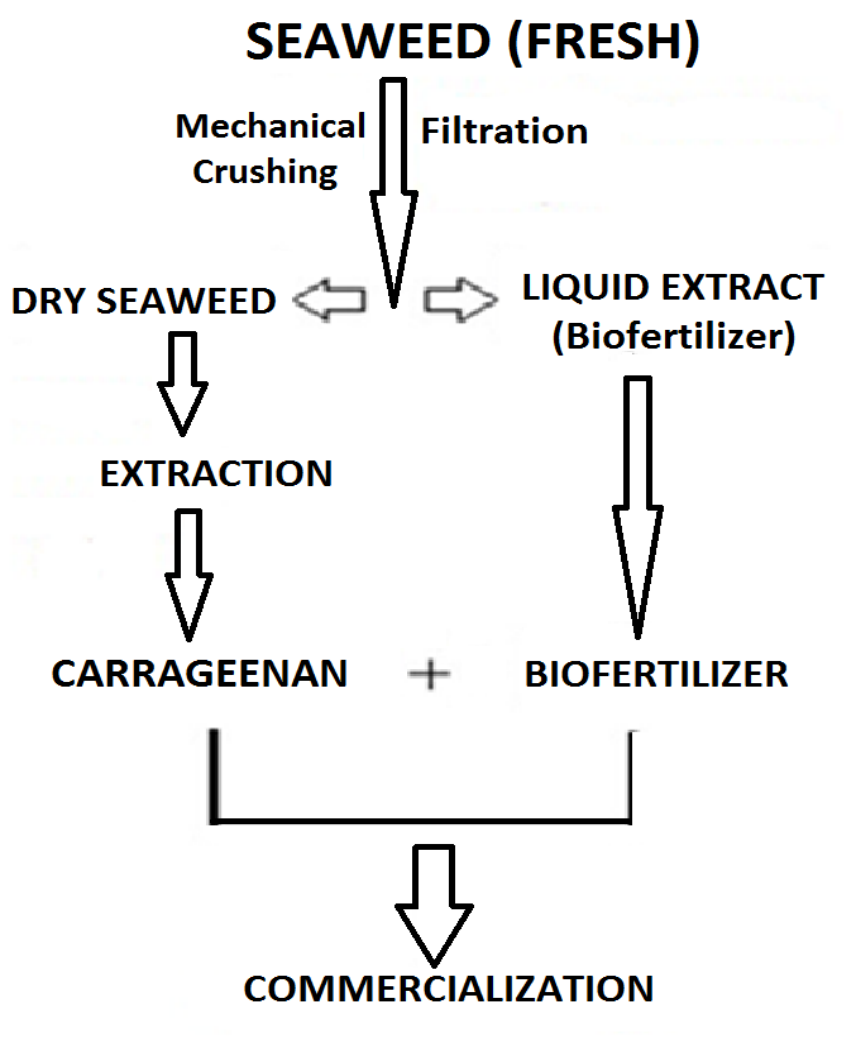
MANUFACTURING PROCESSING



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SEAWEED PROCESSING FACTORY

WWW.CARRAGENABRASIL.COM.BR

Our mission is to develop Seaweed Farming , process Seaweeds and its derivatives, in a qualitative, efficient, socially responsible and ecologically correct way.

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Commercial products from Kappaphycus produced in Brazil

Carrageenan

Powder

Biofertilizer

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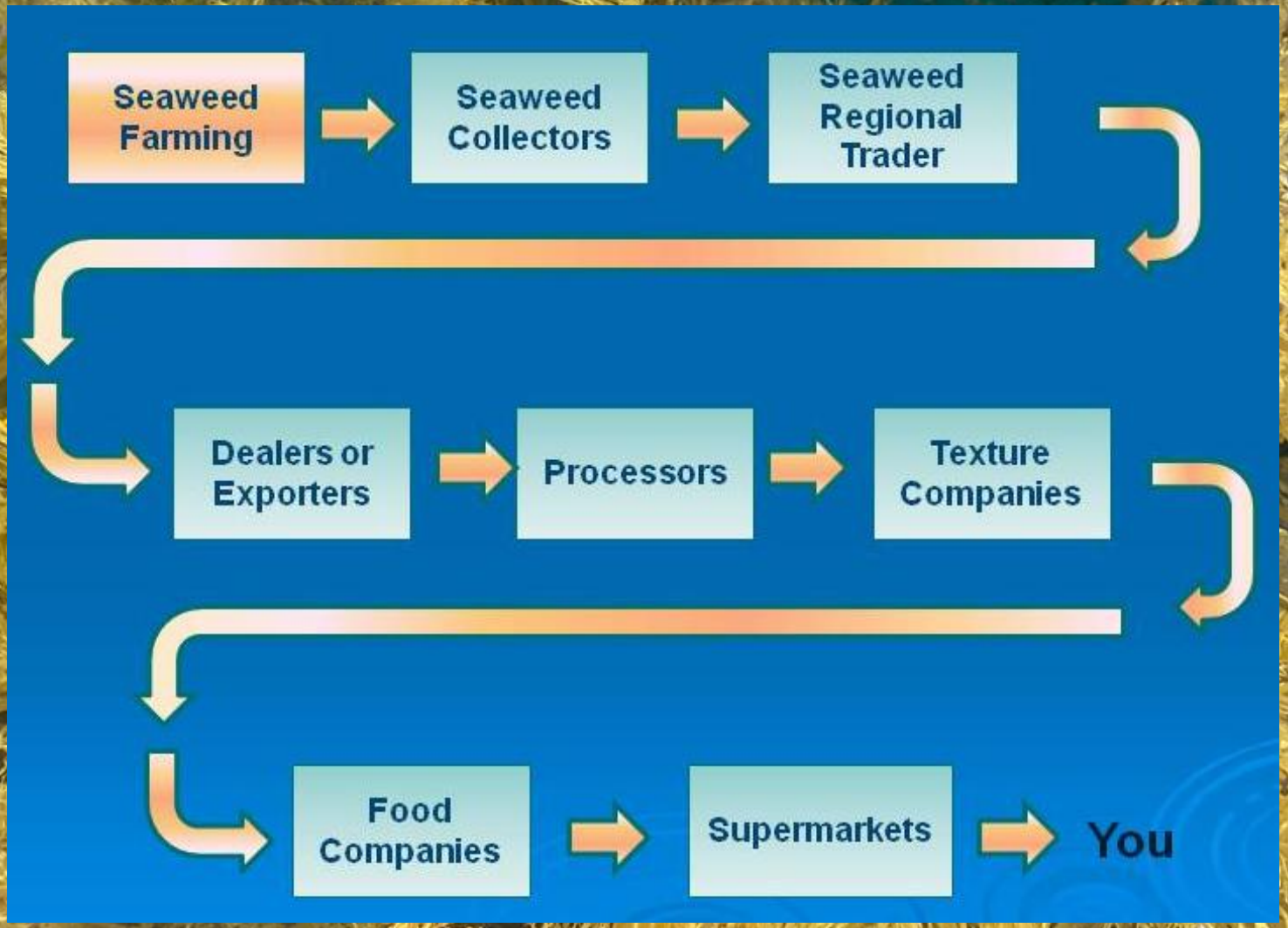
PRODUCTIVE CHAIN



SOCIAL BENEFITS

Seaweed farming is a labour-intensive activity.

In a family operation, spouses, children and immediate family members work together on the farm.

They prepare and seed the lines, harvest the crop, and provide maintenance.

In general 4 people operate on every 1 hectare

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EMPLOYMENT AND LIVELIHOODS

In Brazil, we can estimated that the seaweed industry could involved 100.000 seaweed farmers, 50.000 local consolidators, and more than 20.000 small traders.

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ENVIRONMENTAL BENEFITS

- Relief of pressure on traditional fisheries.
- The Seaweed Farming is a habitat of a wide variety of invertebrates , mollusc and fish, providing high productivity and biodiversity (Creation of new ecological reefs);
- They are used as spawning areas, larval settlement,
- Because they are organisms are photo synthesizers, they use sunlight transforming it into chemical energy, releasing oxygen to important marine animals.
- Seaweed farming is an alternative economic activity that reduces fishing pressure inshore as more people become involved in farming (4/5 people/Hect.)

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GOALS AND CHALLENGES FOR 2022

- *Installation of Pilots Farms*
- *Encourage the production*
- *Organizing the producers*
- *Financial support to producers*
- *Technical assistance to producers*
- *Guaranteed purchase of raw materials*

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Investments

DESCRIPTION (Kappaphycus Farming of 10 HECTARES)	INVESTMENT US$
Seaweed Farming Material (System with the latest technology), Equipment, Machinery (Harvesting, plant and drying machine) Boats, Vehicles and Warehouse	5.000.000
Processing Factory	5.000.000
TOTAL INVESTIMENT (2 YEARS)	**US$ 10.000.000**

Profitability

PRODUCT	TONS/HECT./YEAR	(SALES/YEAR) US$
Fresh Seaweed	500	500.000
Liquid Biofertilizers	250	1.000.000
Dry Seaweed	50	100.000
Carrageenans	20	200.000

This projectwas supported by:

- Ministry of Fisheries and Aquaculture
- Institute of the Environment (Ibama)

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THANK YOU !

www.seaweedconsulting.com

seaweedconsulting@gmail.com