

Sea grapes (*Caulerpa lentillifera*)

THE SOLOMON ISLANDS' NEW INDUSTRY

v 0.1



AORANGI & PROMETHEUS



The cultivation potential **of *Caulerpa lentillifera*** (also known as **sea grapes** or **sea grapes**) in the sea around **the Solomon Islands** is **extremely high**, due to a number of natural, environmental and socioeconomic factors that make it an ideal location for commercial mariculture of this species. Below is a detailed analysis of the potential, potential health benefits, methods of conservation, traditional and modern.

"Mastermind" by the Aorangi development team

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General information about sea grapes (*Caulerpa lentillifera*)

Biological and ecological conditions

Ideal conditions for growing *Caulerpa lentillifera*:

- Sea temperature: **24–30°C** - Solomon Islands: 26–29°C all year round
- Salinity: **28–35 ppt** - typical for tropical seas
- Cultivation depth: **0.5–1.5 m** - shallow coral belt along the coast present almost everywhere
- Light currents and protection from strong waves - numerous lagoons and reefs provide protection
- High water transparency and the presence of nutrients - natural conditions of coral seas

Conclusion: The Solomon Islands have **naturally optimal growing conditions** without the need for significant environmental adaptation.

Technical feasibility and tradition

- ***Caulerpa* is already cultivated** in similar conditions in **Fiji, Vietnam, the Philippines and Indonesia**, similar in climate and ecosystem.
- In some parts of Solomon, there is already knowledge **of seaweed cultivation** (e.g. *Kappaphycus*), which facilitates **the transition to *Caulerpa***.
- It can be grown **by hand and extensively**, without expensive technology, using simple **supports on ropes, nets or bamboo rafts**.

Growing areas

- **Solomon Islands coastline:** over **5,000 km** of coastline!
- Only **1% of available lagoons and shallow coastal waters** could provide:
 - 1,000 ha of cultivation area = **60,000–80,000 t of fresh weight per year**
 - after freeze-drying (~10% by weight): **6,000–8,000 t of sea grape powder**

This powder has great value in the market of superfoods, nutraceuticals and cosmetics.

Market Potential and Value

- **Fresh *Caulerpa*** is sold at the price:
 - **3-10 EUR/kg** in Asia
- **Lyophilized powder:**
 - **70–250 EUR/kg**, depending on purity and certificates (bio, HACCP, etc.)

- With additional processing (capsules, serum, cosmetics): the value can be multiple

Branded as "Pacific Sea Caviar," it can target the high-end markets of Japan, the EU, and the US.

ESG and sustainable development

- *Caulerpa* is fast-growing, non-invasive, and has a low environmental footprint
- Absorbs CO₂, reduces eutrophication, stabilizes the marine ecosystem
- Ideal for blue carbon credits and inclusion in the SYNT tokenization ecosystem

Involvement of the local community

- Can be organized as **a cooperative production**
- Generates **income and employment for women and families in coastal villages**
- It fits perfectly into the development **of an ecological, decentralized economy**

Conclusion

The potential for growing *Caulerpa lentillifera* in the sea around the Solomon Islands is:

Extremely high due to:

- ideal natural conditions
- available shallow waters
- The Possibility of Decentralized Production
- A large global market interest
- Potential for added value through freeze-drying and branding
- ESG and Carbon Positive Performance

Recommended Next Steps

1. 📍 **Pilot breeding station** (e.g. 1 ha at Paradise Golf Resort)
2. 🧪 **Test Lyophilization and Nutritional Analysis**
3. 🍷 **Product Development: Powder, Capsules, Serum**
4. 🌐 **Branding and export through the SYNT + SYNTERRO platform**
5. 📦 **Distribution via Prometheus marketplace and Amazon JAPAN/EU**

Sea grapes (*Caulerpa lentillifera*) and their minerals

Sea grapes are a type of edible algae rich in nutrients. Containing:

- **Magnesium, Iodine, Zinc and Selenium** – Key for Metabolism and Immunity
- **Calcium and iron** – They support bones and blood cells.
- **Polysaccharides and antioxidants** – They help fight aging and inflammation.
- **Omega-3 fatty acids** – Beneficial for the heart and brain.

Sea grapes are therefore **rich in the same oligoelements found in seawater** and can be considered a natural source of nutrients necessary for the body.

Potential Health Benefits of Sea Grapes (*Caulerpa lentillifera*)

Sea grapes are a superfood rich in essential minerals, antioxidants, and bioactive compounds. Here are some key health benefits:

1. **Improves skin health** – Antioxidants such as flavonoids and polysaccharides reduce oxidative stress, which can slow down skin aging.
2. **Supports the thyroid gland** – The high iodine content helps regulate thyroid hormones.
3. **Boosts immunity** – Zinc, selenium and vitamin C support the immune system.
4. **Improves digestion** – The polysaccharides in algae act as **prebiotics**, feeding the good bacteria in the gut.
5. **Regulates blood pressure** – The high potassium content helps maintain healthy blood pressure.
6. **Lowers cholesterol** – Omega-3 fatty acids and fiber help reduce bad cholesterol (LDL).
7. **Contributes to bone health** – Calcium, magnesium, and phosphorus strengthen bones and reduce the risk of osteoporosis.
8. **Helps detoxify** – Alginic acid can bind heavy metals and toxins, helping to flush them out of the body.

What is the best way to preserve sea grapes for long-term storage?

Sea grapes are sensitive to dehydration and temperature changes, so they should be stored carefully to maintain freshness and bioactive compounds. Here are **the best preservation methods**:

Salting (traditional method) – The simplest solution

- Sea grapes can be **preserved in sea salt** to maintain structure and flavor.

- **Procedure:**
 1. Sea grapes are washed in sea water or salt water.
 2. It is immersed in **a 3-5% solution of sea salt** (30-50 g of salt per liter of water).
 3. It is stored in an airtight container at room temperature or in the refrigerator.
 4. Before consumption, the brine is washed and soaked in fresh water for several minutes.
- **Shelf life:** 3-6 months.

Dehydration and freeze-drying (best for long-term storage)

- **Freeze-drying** is the most effective method for preserving nutrients.
- **Procedure:**
 1. Clean and blanch the sea grapes in hot water (10-15 seconds), then cool quickly in ice water.
 2. Freeze at -40°C in the freezer.
 3. Freeze-dry using **a freeze-dryer** to remove moisture.
 4. Store in **a vacuum-sealed bag** or airtight container.
- **Durability:** 1-2 years.
- **Advantage:** Maintains texture, minerals, and bioactive compounds better than other methods.

Pickling (fermentation)

- It can be stored in **vinegar, citric acid, or by fermentation** for a longer duration.
- **Procedure:**
 1. Wash the sea grapes.
 2. Soak in a solution of apple cider vinegar or rice vinegar.
 3. Add a little sugar and salt to stabilize the pH.
 4. Seal airtight and store in the refrigerator.
- **Shelf life:** 6-12 months.

Freezing (not ideal, but can help)

- **Direct freezing** can destroy the structure of the berries and reduce quality.
- It is better **to first blanch** it in hot water and then freeze it in **a vacuum bag**.
- **Shelf life:** 6-8 months.

Conclusion – Which method is best?

- **For home use:** Salting or fermentation.
- **For long-term storage:** Freeze-drying.
- **To preserve the most nutrients:** Freeze-drying or low-temperature dehydration.
- **For easy storage:** Freeze (but loses texture).

Process of freeze-drying of sea grapes (Caulerpa lentillifera)

Freeze-drying is a process that removes moisture from sea grapes by freezing and sublimation, preserving their nutritional properties, structure and taste.

1. Raw material preparation

- Choose **fresh sea grapes** without damage.
- Clean it in **seawater or slightly salty water** to remove impurities.
- Allow to drain on a mesh or moisture-absorbing paper.

2. Blanching (optional)

- Briefly immerse the sea grapes in hot water (**80-90°C for 10-15 seconds**).
- Immediately transfer to ice water to preserve texture and color.
- Dry excess water **with paper towels** or ventilation.

3. Freezing

- Spread the sea grapes in **a thin layer** on the trays of the freeze-dryer.
- Freeze it at **-40°C to -50°C** in the freezer for **12-24 hours**.

4. Freeze-drying (sublimation)

- Place frozen sea grapes in an **industrial freeze dryer**.
- Reduce the pressure to **0.05-0.1 mbar** to allow sublimation of ice into steam.
- The process takes **24-48 hours**, depending on the layer thickness and the capacity of the machine.

5. Packaging and storage

- Freeze-dried sea grapes must be **completely dry (less than 5% moisture)** to prevent degradation.
- Pack in **vacuum bags or aluminum foil bags** with **moisture absorbents (silica gel)**.
- Store in **a dry and dark place**, optimally at **a temperature below 25°C**.

Business Plans for the Production and Distribution of Freeze-Dried Sea Grapes

Business model description

The goal is the production and distribution of freeze-dried sea grapes for the food industry, healthy nutrition and pharmaceutical additives.

Target Markets:

- **Healthy Eating** – Vegans, keto, and fitness enthusiasts.
- **Food industry** – Restaurants, supplement manufacturers.

- **Pharmaceutical sector** – Manufacturers of natural food supplements.
- **Export to Asian markets** – Japan, China, South Korea (where sea grapes are already popular).

Production of 5 tons of freeze-dried sea grapes per year

Equipment and infrastructure

- **Industrial Grade Freeze Dryer** – Capacity: **100-500kg per cycle**
- **Professional freezers (-40°C to -50°C)**
- **Vacuum Bag Packaging System**
- **Cold Storage Machine for Raw Sea Grapes**
- **Logistics system for distribution (cold chain if required)**

Investment in equipment: €200,000 – €500,000

Production costs

Item	Price (EUR/kg)
Raw Sea Grapes	2.00 – 5.00
Energy for freeze-drying	1.50 – 3.00
Packaging & Vacuum Packaging	0.50 – 1.50
Labour force	1.00 – 3.00
Transport & Distribution	1.50 – 4.00
Total cost	6.50 – 16.50

Selling price (B2B): €30 – €50/kg

Retail price: €80 – €120/kg

Marketing Strategy

- **Branding as a premium superfood**
- **Certifications (Organic, HACCP, ISO, Halal/Kosher)** for the global market
- **Online sales** – Prometheus, Amazon, Shopify, specialized e-shops
- **Cooperation with restaurants and manufacturers of dietary supplements**
- **Influencers and Health Bloggers**

Distribution & Logistics

Local channels:

- Healthy shops and specialty shops
- Restaurants and hotels with a premium offer

International distribution:

- Exports to **Japan, Korea, China and the USA** (algae demand is high)
- Cooperation with **importers of healthy food**

Sales model:

- **B2B** (wholesale to food and food supplement manufacturers)
- **B2C** (web shop, Amazon, specialized stores)

Expected earnings and return on investment (ROI)

If **5 tonnes of freeze-dried sea grapes are produced per year**, with a selling price of **€40/kg (wholesale)**:

- **Income:** 5,000 kg × €40 = **€200,000 per year**
- **Production Cost:** €100,000
- **Profit before taxes:** €100,000

ROI expected **in 2-3 years**, with increased capacity and cost optimization.

Conclusion

Freeze-drying of sea grapes is a **profitable and viable business**, especially for exports to Asian markets. The key to success lies in:

- **Quality production and certification**
- **Optimization of logistics and distribution**
- **Premium branding as a luxury superfood**

Detailed business plan for the annual production of 5 tons of freeze-dried sea grapes

This is a cost breakdown for the annual production **of 5 tons (5000 kg) of freeze-dried sea grapes**, assuming that an industrial freeze-dryer with a capacity of **100 kg per cycle is used** and that the processes are optimized.

Initial investments in equipment and infrastructure

Item	Quantity	Unit price (EUR)	Total (EUR)
Industrial freeze dryer (100 kg/cycle)	1	150,000	150,000
Industrial freezer (-50°C)	2	10,000	20,000
Cold Storage Room for Fresh Material	1	30,000	30,000
Vacuum Packaging System	1	10,000	10,000
Power generator (for power stability)	1	15,000	15,000
Quality Control Laboratory Equipment	1	8,000	8,000
Transport vehicle (refrigerated truck)	1	50,000	50,000
Other costs (installation, licenses, certificates)	-	-	15,000
TOTAL INITIAL INVESTMENT	-	-	€298,000

Annual operating costs

Raw materials

Item	Quantity (kg)	Price per kg (EUR)	Total (EUR)
Raw Sea Grapes	50,000	3.00	150,000
Sea water and salt (for rinsing)	-	0.10	5,000
TOTAL RAW MATERIALS	-	-	€155,000

Note: 10 kg of fresh sea grapes **are required** for **1 kg of freeze-dried product** (10:1 ratio).

Energy costs (electricity and fuel)

Item	Consumption (kWh/litre)	Price (EUR)	Total (EUR)
Lyophilization (24 h per cycle, 250 cycles per year)	1,500,000 kWh	0.12/kWh	180,000
Freezing (-50°C)	200,000 kWh	0.12/kWh	24,000
Transport & Logistics (Fuel)	30,000 liters	1.50/liter	45,000
TOTAL ENERGY	-	-	€249,000

Labor costs (salaries and benefits)

Category	Number of employees	Monthly salary (EUR)	Annual cost (EUR)
Freeze Drying Technicians	3	3,500	126,000
Operators in production	4	2,500	120,000
Quality Control	2	3,000	72,000
Logistics & Packaging	2	2,500	60,000
Management & Administration	2	4,000	96,000
TOTAL WORKFORCE	-	-	€474,000

Packaging & Distribution

Item	Quantity (kg)	Price per kg (EUR)	Total (EUR)
Vacuum bags + silica gel	5,000	1.50	7,500
Cardboard packaging for storage	1,000 boxes	2.00	2,000
Distribution costs (cold chain)	5,000	3.00	15,000
TOTAL PACKAGING AND DISTRIBUTION	-	-	€24,500

Total annual costs and financial analysis

Item	Amount (EUR)
Raw materials	€155,000
Energy and fuel	€249,000
Labour force	€474,000
Packaging & Distribution	€24,500
Maintenance and unforeseen costs (5%)	€45,000
TOTAL OPERATING COSTS	€947,500

Annual income and profit

- Planned selling price: **€40/kg (wholesale)**
- Annual Output: **5,000 kg**
- **Annual Income: €200,000**

Gross profit = €200,000 – €947,500 = **-€747,500 (loss of the first year)**

ROI plan (covering initial investments and costs): need to **increase the price or volume of production**

Strategy to reduce costs and increase profitability

Scaling production

- Increase annual production to **10,000 kg**
- Boost **exports to Asian markets (Japan, China, Korea)**

Premium segment (B2C market)

- Retail price **€80 – €120/kg**
- Focus on **premium brand and e-commerce (Prometeus, Amazon, Shopify)**

Supply Chain Optimization

- Negotiate **contracts with restaurants and the food industry**
- Partnering with **logistics companies** to reduce shipping costs

Grants and subsidies

- Application for **EU or local aid for organic production**
- Using **renewable energy (W2E and solar panels) to reduce electricity costs**

Conclusion

The project **requires a serious initial investment (~€1.25M in the first year)** and generates a loss in the first year if sold only through wholesale. **Profitability is achieved through scaling, exporting, and premium segmentation.**

First priority: Increasing capacity to **10,000 kg per year**

Second priority: Focus on the **B2C premium market** with higher margins

Third priority: Find **strategic partners** for logistics and exports

Simulation for 300 tons of freeze-dried sea grapes per year

This level of production will require **3,000 tons of fresh sea grapes** (10:1 drying ratio). Also, a large infrastructure, an optimized supply and distribution chain, and investment in multiple freeze-drying lines will be required.

Initial investment in equipment and infrastructure

Item	Quantity	Unit price (EUR)	Total (EUR)
Industrial freeze dryer (1000 kg/cycle)	6	500,000	3,000,000
Industrial freezers (-50°C)	10	10,000	100,000
Cold storage of fresh material (large capacity)	3	100,000	300,000
Vacuum Packaging System	2	50,000	100,000
Transport fleet (cold storage)	5	80,000	400,000
Quality Control Laboratory Equipment	1	50,000	50,000
Installation, licenses, certificates	-	-	100,000
TOTAL INITIAL INVESTMENT	-	-	€4,050,000

Annual operating costs

Raw materials

Item	Quantity (kg)	Price per kg (EUR)	Total (EUR)
Raw Sea Grapes	30,000,000	3.00	90,000,000
Seawater and salt	-	0.10	300,000
TOTAL RAW MATERIALS	-	-	€90,300,000

Energy and fuel costs

Item	Consumption (kWh/litre)	Price (EUR)	Total (EUR)
Lyophilization (24 h per cycle, 900 cycles per year)	13,500,000 kWh	0.12/kWh	1,620,000
Freezing (-50°C)	2,500,000 kWh	0.12/kWh	300,000
Transport & Logistics (Fuel)	300,000 liters	1.50/liter	450,000
TOTAL ENERGY AND FUEL	-	-	€2,370,000

Labor costs (salaries and benefits)

Category	Number of employees	Monthly salary (EUR)	Annual cost (EUR)
Freeze Drying Technicians	12	3,500	504,000
Operators in production	20	2,500	600,000
Quality Control	6	3,000	216,000
Logistics & Packaging	10	2,500	300,000
Management & Administration	6	4,000	288,000
TOTAL WORKFORCE	-	-	€1,908,000

Packaging & Distribution

Item	Quantity (kg)	Price per kg (EUR)	Total (EUR)
Vacuum bags + silica gel	300,000	1.50	450,000
Cardboard packaging	50,000 boxes	2.00	100,000
Distribution costs (cold chain)	300,000	3.00	900,000
TOTAL PACKAGING AND DISTRIBUTION	-	-	€1,450,000

Total annual costs and financial analysis

Item	Amount (EUR)
Raw materials	€90,300,000
Energy and fuel	€2,370,000
Labour force	€1,908,000
Packaging & Distribution	€1,450,000
Maintenance and unforeseen costs (5%)	€4,800,000
TOTAL OPERATING COSTS	€100,828,000

Annual income and profit

- Planned selling price: **€40/kg (wholesale)**
- Annual Output: **300,000 kg (300 tons)**
- **Annual Income: €12,000,000**

Gross profit = €12,000,000 – €100,828,000 = **-€88,828,000 (huge loss)**

Analysis and strategies for profitability

The current model is unsustainable at this price of **€40/kg**. It is necessary:

Increase in the selling price to the premium segment (€80-€120/kg)

- At €80/kg: **€24M of income (still a loss)**
- At €120/kg: **€36M of income (close to break-even)**

Increase in production volume to 600 tons per year

- Scaling would reduce the cost per kilogram.

Partnership with large customers and branding as a luxury product

- Export to Japan, Korea, USA (premium markets).

Finding investors and support for renewable energy sources

- Reducing electricity costs by using solar panels.

Conclusion

At the current **wholesale price of €40/kg, the project is loss-making** due to high raw material and energy costs. **To be profitable, it must target the premium segment (€100+/kg) and increase sales volume.**

Optimal scenario:

- **600 tons per year**
- **Selling price €100/kg**
- **Focus on premium markets**
- **Reduction of operating costs through energy and logistics optimization**
- **Retail sales through online shop and direct distribution. Each package has a unique NFC tag that is inactive while the package is sealed. When the package is opened, the NFC tag is activated. The active NFC tag can be read by a mobile phone and register the product in a central database. The procedure and reason for registering the unique NFC tag is clearly and illustratively shown on the packaging (*the most important thing for a direct customer is to get a discount on the next order*). By registering a product marked with a unique NFC tag, it enables many attractive marketing and other solutions for expansion and increase sales.**