Seaweed culture and product development in Quebec

An overview

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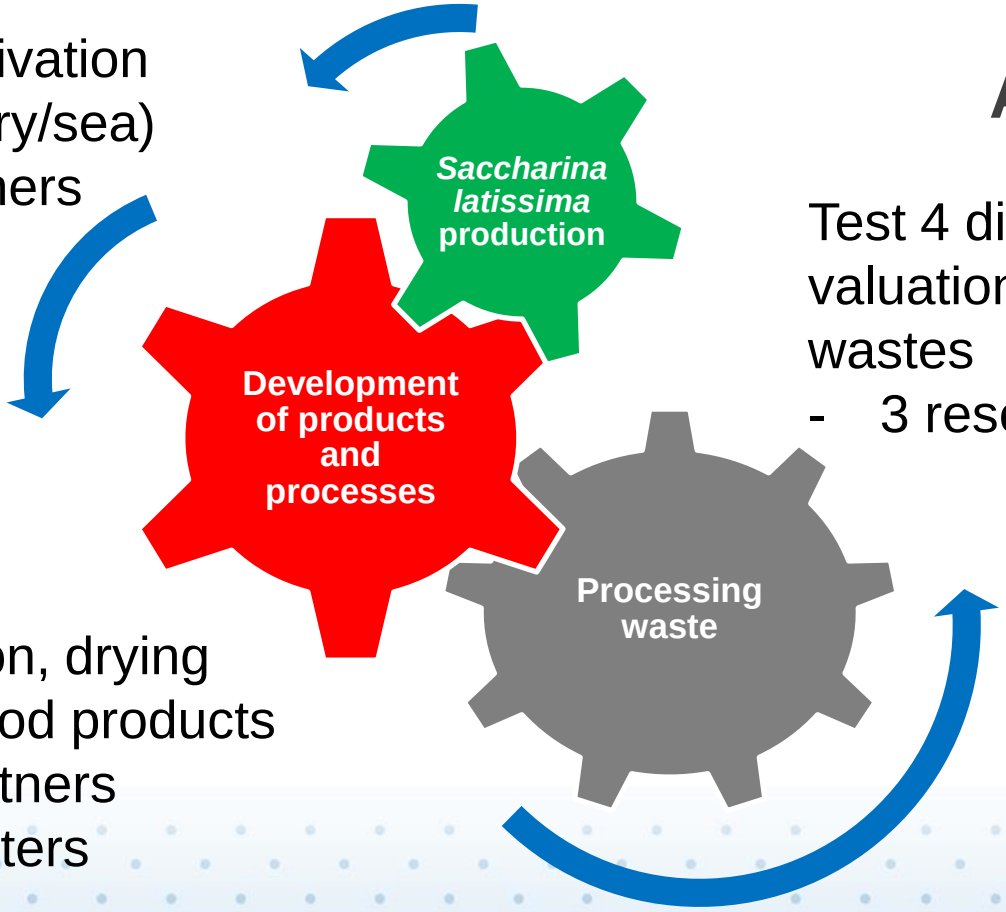
Context

- 2012: NSERC Industrial Research Chair on Marine Macroalgae (Head: Éric Tamigneaux)
  - Seaweed harvesting
  - Seaweed culture
    - 2013: Kelp cultivation techniques transfered to a private hatchery (Fermes marines du Québec)
    - 2014: OPTIMAL NSERC Research program (ICC-RI)
      - Industrial integrated production chain around kelp culture
  - Seaweed processing

OPTIMAL – Research program
3 axis – 5 years

Axis 1

Optimisation of cultivation techniques (hatchery/sea)
- 3 industrial partners



Axis 3

Test 4 different valuation processes for wastes
- 3 research centers

Axis 2

Molecule extraction, drying techniques and food products
- 2 industrial partners
- 3 research centers

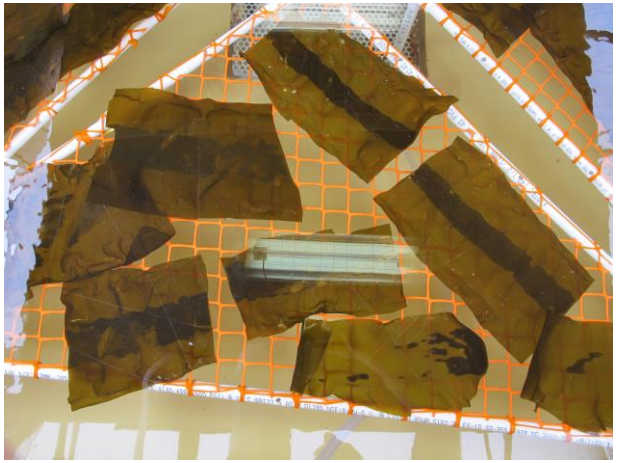
KELP PRODUCTION

Hatchery: Optimisation and scaling up

KELP PRODUCTION - HATCHERY

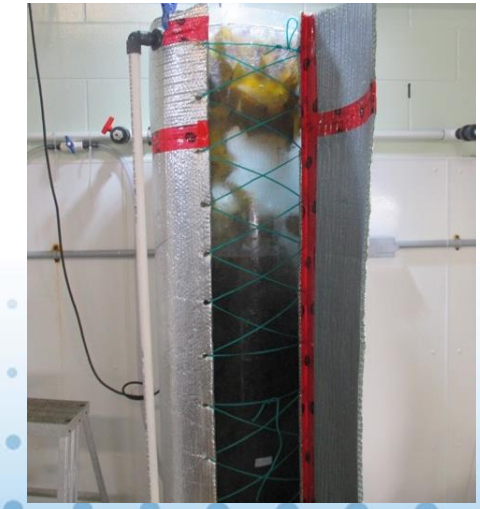
Obtaining spore producing tissue

32-33 days



Alternate conditioning method

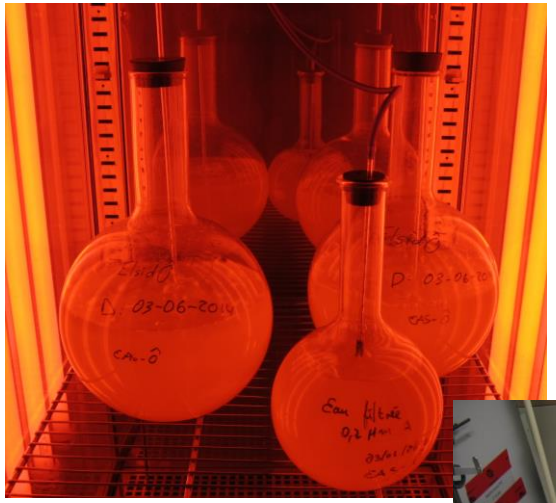
- Reduce floor space required
- Obtain more sorus tissue
- 35 days



Bourdages, D and Garnier, P

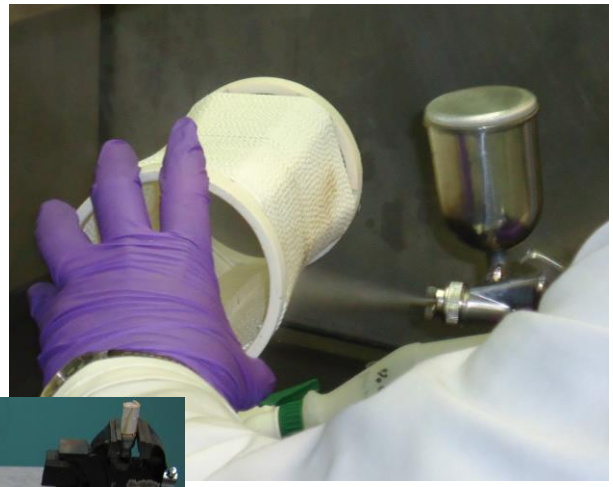
KELP PRODUCTION - HATCHERY

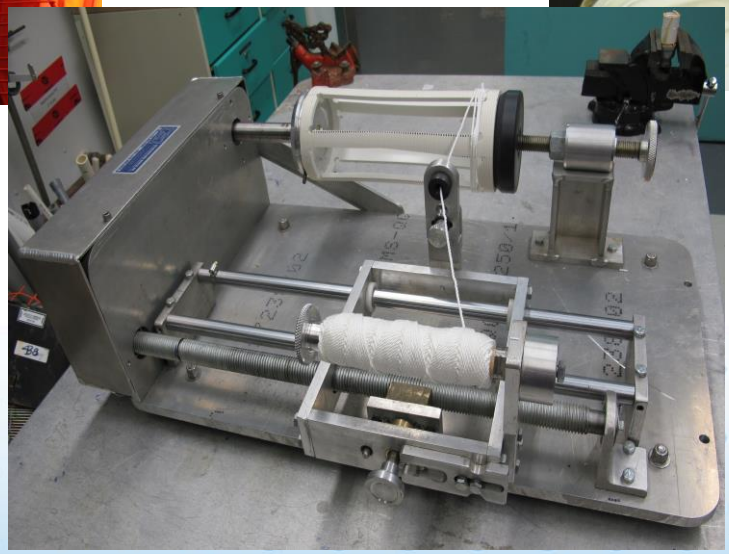
Free-living



58 + 13 days

Seeding





Meanwhile….

Will Nicolas and Murray, H

KELP PRODUCTION - HATCHERY

Pilot scaling up

Research

Private hatchery

KELP PRODUCTION - HATCHERY

Optimisation of hatchery procedures

Seeding density (free-living)

- **Goal**: Optimal amount of gametophytes to seed on spools
- **Densities tested**:
  - 6, 4, 2 and 0,5 g gametophyte/spools

KELP PRODUCTION - HATCHERY

Culture media

Goal: Identify the medium that is the least expensive and gives the best growth

Media tested:

- f/2, nitrate+phosphate, PES and Miracle Gro

Water desinfection

Goal: Identify the technique that is the least labour intensive and prevents contamination

Techniques tested:

- Filtration and UV, pasteurization, salinity, chlorine and acid

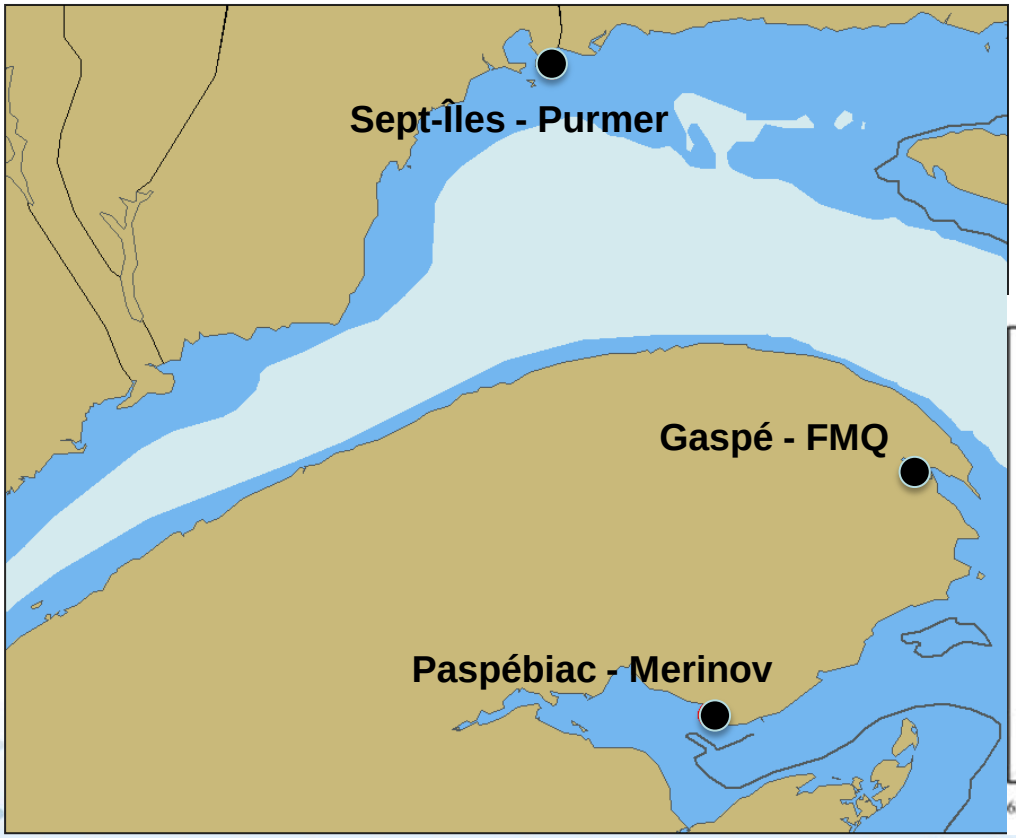
Garnier, P

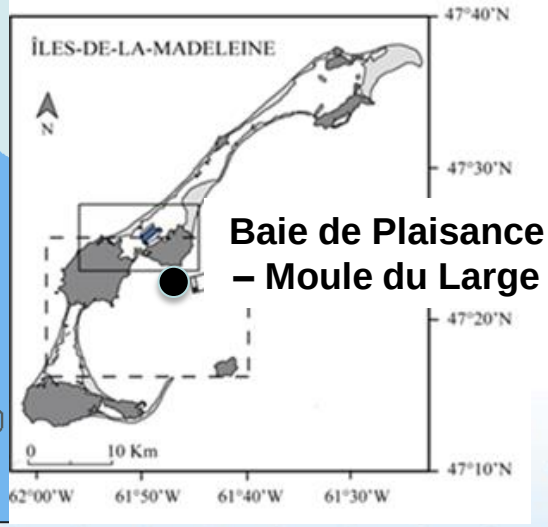
KELP PRODUCTION

Outgrowing at sea

KELP PRODUCTION – AT SEA

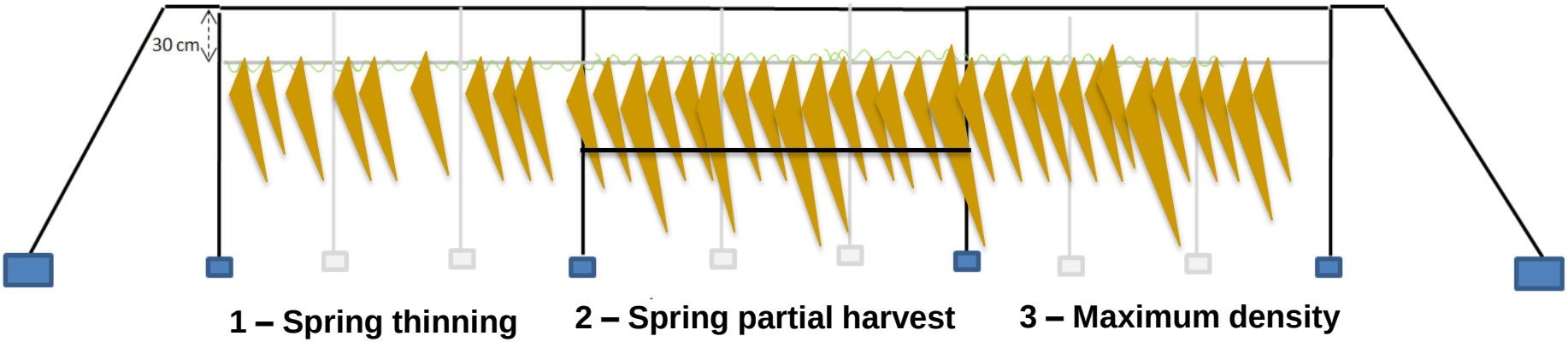
Testing new culture sites





KELP PRODUCTION – AT SEA

Harvesting strategies vs yields

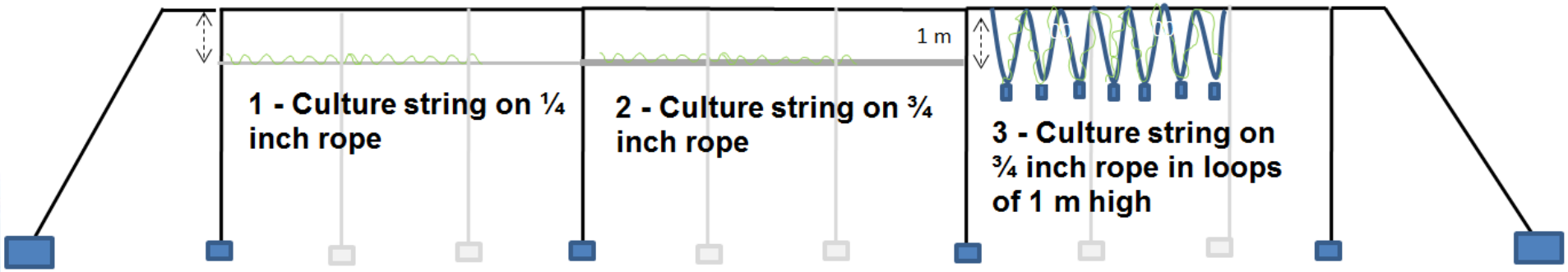


1 – Spring thinning

2 – Spring partial harvest

3 – Maximum density

Culture gears vs yields

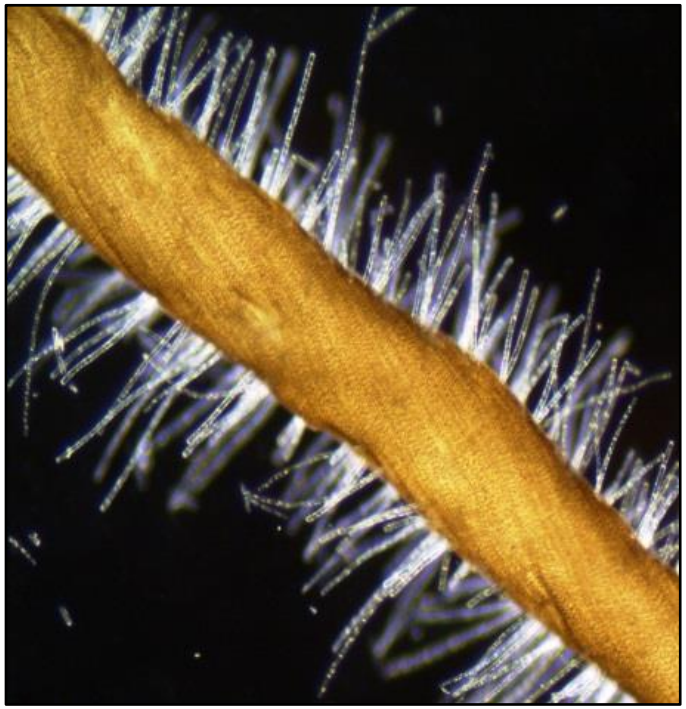


1 - Culture string on ¼ inch rope

2 - Culture string on ¾ inch rope

3 - Culture string on ¾ inch rope in loops of 1 m high

DIVERSIFICATION



Trials with *Chorda filum*

- Summer sp., fast growth
- Mean growth (in tank):
  - 1.40 ± 0.19 cm/day

Trials with *Sacchoriza dermatodea*
to come (arctic, fast growing kelp)

Solomon, L. and Tamigneaux, T.

KELP PROCESSING

Molecule extraction and food R&D

MOLECULE EXTRACTION

Laboratory scale work (Summer 2015)

- D-mannitol extractions of samples taken at the various sites throughout the summer from May to July

Other tests

- Fucoxanthine, β-carotenes and violaxanthine
- Phlorotannin

Scaling up (Winter-Summer 2016)

- Identify the best sequence to extract the various molecules of interest

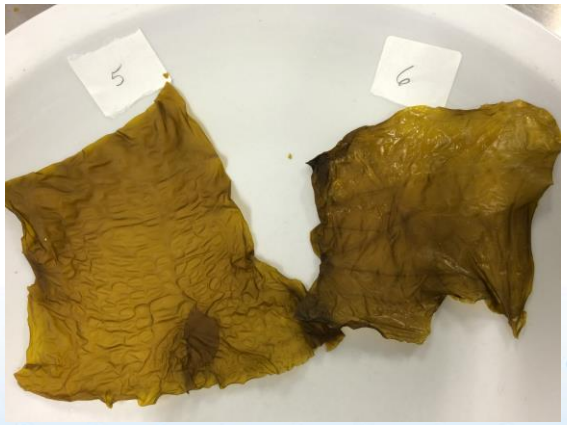
FOOD PRODUCTS R&D

FRESH SEAWEED IN TRAYSEALING IN MODIFIED ATMOSPHERE (MAP)

- **Raw, blanched or salted seaweed**

SMOKED SEAWEED

- **Flavor, color and preservation**
- **Maple-sesame or other seasonning**



Berger, K. and Michaud, H

FOOD PRODUCTS R&D

DRYING

Conventional air drying

-Low TºC (40-50ºC)

-Simple

-Higher cost at the industrial level ;

• Loss of certain vitamins ;

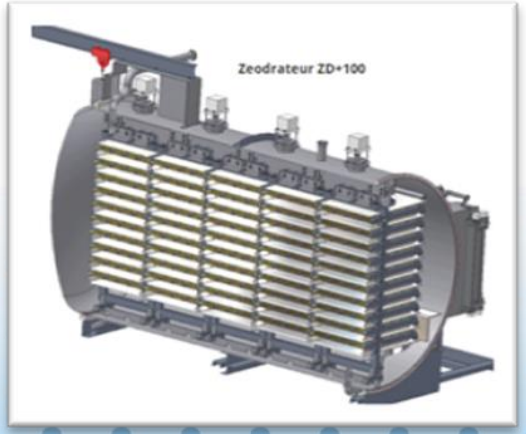
• Alteration of food taste

Contained Zeodration

-Vaccum drying improved by the absorption of water by zeolites;

-Very soft drying operation;

-The product keeps gustatory, olfactory, visual and nutritional quality.



Instant controlled pressure drop (D.I.C.)

-Short treatment (30 to 60 s)

-Ends with a drastic and rapid pressure drop that generates the water extraction, drying and texturing of the product (swell - drying)

- Increasing the availability of bioactive molecules

Berger, K. and Michaud, H

FOOD PRODUCTS R&D

COLD-PASTEURIZED SEAWEED PRODUCTS- High Pressure Process (HPP)

- Products, already sealed in its final package, are introduced into a vessel and subjected to a high level of isostatic pressure (300–600MPa/43,500-87,000psi) transmitted by water.
- High Pressure Processing respects the sensorial and nutritional properties of food, because of the absence of heat treatment, and maintains its original freshness throughout the shelf-life.

Berger, K. and Michaud, H

FOOD PRODUCTS R&D

SEAWEED PRODUCTS BY TECHNOLOGY OF EXTRUSION COOKING

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FOOD PRODUCTS R&D

SENSORY ANALYSIS

- Evaluate the general acceptability and quality attributes of the seaweed products : general appearance, colour, odour, flavour, texture
- Expert sensory evaluation : **MERINOV**
- Consumer panel : **CINTECH**

Berger, K. and Michaud, H

CONCLUSION

Where we are at…

- Kelp culture
  - Transferring to industry and scaling up (hatchery/at sea)
  - Reducing production costs
  - Demonstrating feasibility and adapting culture methods to various climatic and industrial contexts
- Kelp processing
  - Identifying the products and processes to obtain maximum value from kelp biomass
  - Building a network of specialists to develop an integrated production chain

MERCI DE VOTRE ATTENTION !