

HIGH-VALUE
NUTRITION

Ko Ngā Kai
Whai Painga

Karengo – A high-value food with potential for commercialization

Tom Wheeler, Cawthron Institute



Challenge Host



Challenge Collaborating Parties



What is karengo?

- Karengo/parengo are a group of seaweeds (macroalgae) traditionally eaten by Māori
- Several species of *Pyropia* and *Porphyra* in the order Bangiales
- Winter seasonal, inter-tidal, temperate latitudes
- Traditional food for many indigenous cultures

Laver (Wales)



Porphyra umbilicalis

Nori (Japan)



Pyropia yezoensis
Pyropia tenera
Pyropia haitensis

Karengo/Parengo (Aotearoa/NZ)



Pyropia virididentata
Pyropia cinnamomea
Clymene coleana + many others

Purpose

- Address knowledge gaps to enable a future karengo industry
- Support iwi in their kaitiakitanga and cultural priorities regarding karengo
- Support development of a sustainable commercial enterprise based on karengo



Outline

- HVN grant “He tipu moana he organga tangata: Revealing the value of karengo as a high-value functional food”

\$600 K, 2 years



- MBIE Catalyst Strategic grant “Realising the value of algae as a source of alternative protein”

\$3 M, 3 years



- Enabling karengo farming

Species identified



Pyropia virididentata



Porphyra "GRB108"



Pyropia cinnamomea



Pyropia plicata



Pyropia rakiura

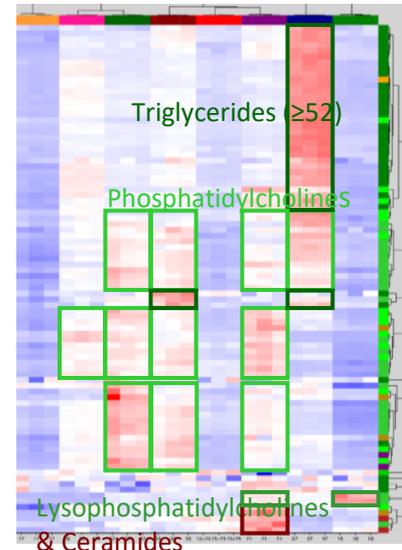


Porphyra "GRB 368"

Compositional analysis

- *Py virididentata*, *Py cinammomea* and *Porphyra* GRB complex all have:
 - High protein (30-35%)
 - High levels of the omega-3 fatty acid, EPA (1-2%)
 - High dietary fibre (50%)
 - Good levels of micronutrients Fe, Ca, I, vitamin B12

- Metabolomics revealed differences:
 - Among species
 - Between locations
 - At different stages of season



MBIE Catalyst Strategic programme

Realising the value of algae as a source of alternative protein

- A collaboration with:
 - Riddet Institute
 - Plant&Food Research
 - University of Auckland
 - Three institutes within A-Star, Singapore
- Karengo-based technical objectives:
 - Develop a scalable process for extracting protein from *Pyropia/Porphya*
 - Determine digestibility and bioavailability
 - Evaluate food-related physico-chemical properties
 - Establish effect of extracts on gut function and energy metabolism in people



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Emerging food ingredient concepts

Fine milled
whole karengo

Dried
aqueous extract

Dried filtered
aqueous extract

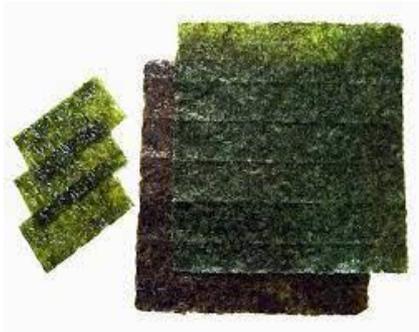


Attributes:

- All components retained
- Increased bioavailability
- Increased bioavailability
- Protein enriched
- High soluble dietary fibre
- High salts and sugars
- Increased bioavailability
- Protein enriched
- High soluble dietary fibre
- Low salts and sugars

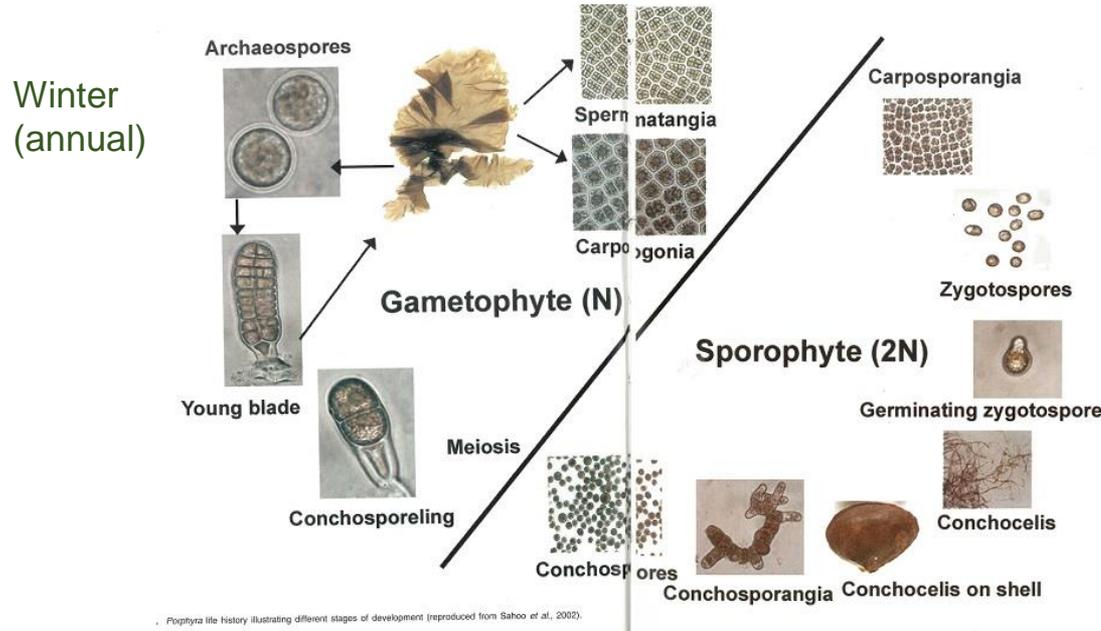
Pyropia/Porphyra farming

- Nori farming has been established in Japan for >300 years
- Today, global production is 1.2 M tonnes, almost all by aquaculture for use in sushi
Ferdouse, FAO report “Global Status of Seaweed Production” 2018
- “*Porphyra* is the most valuable seaweed in the world”
McHugh, FAO report “Guide to the Seaweed Industry” 2003



Porphyra/Pyropia Life cycle

- Life cycle is heteromorphous, with dispersion at two points

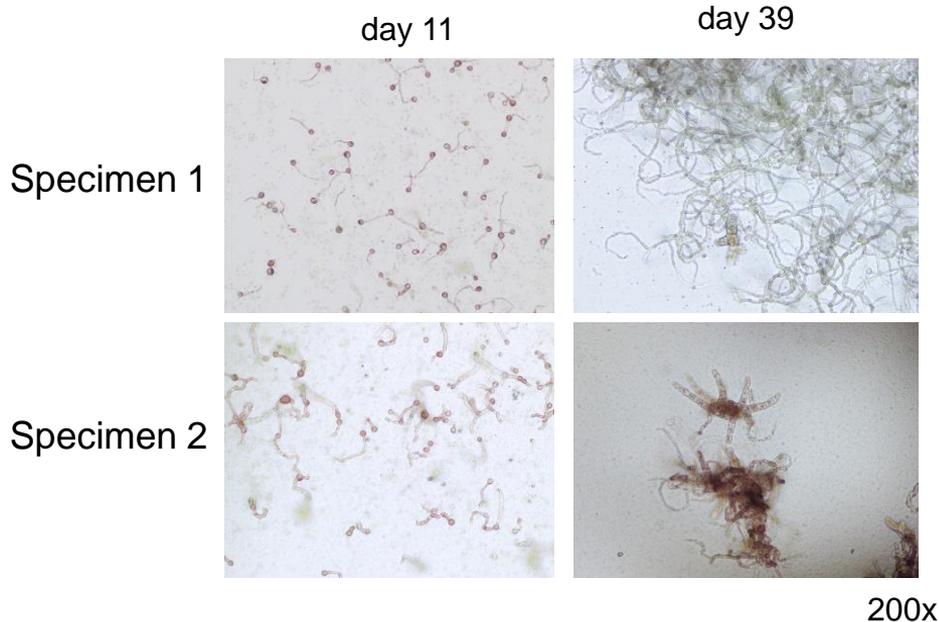


Porphyra life history illustrating different stages of development (reproduced from Sahoo et al., 2002).

Summer
(perennial)

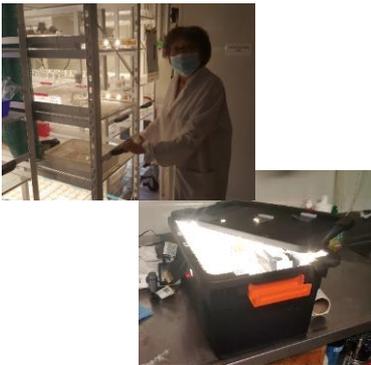
Opportunistic karengo culturing

- We have demonstrated that NZ *Pyropia/Porphyra* can be cultured and differentiated (Rita Lee, Cawthron)



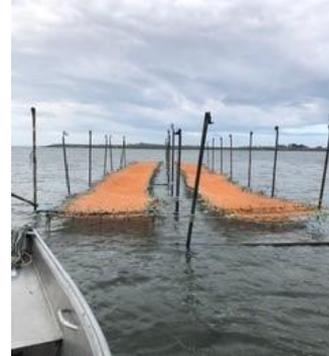
Developing karengo aquaculture

- Establish optimal culturing conditions and control of reproductive cycle
- Evaluate potential for farming NZ species:
 - Quantify conchospore production and biomass accumulation
 - Adapt Asian expertise with nori
 - Evaluate potential farming sites
- Field-test methods and infrastructure



Karengo has been farmed in NZ

- Methods for karengo farming were developed and implemented in Bluff Harbour in the 1990s.
- The effort ceased due to lack of capital
- Karengo farming has been revived in Bluff in winter 2021 and 2022



Can karengo support an industry in NZ?

- Supporting findings:
 - Composition analysis supports nutritional and digestive health benefits
 - Bioactivity suggests possible anti-inflammatory and immune health benefits
 - Metabolomics supports unique attributes
- Challenges:
 - Biomass production - farming
 - Demonstrating health benefits (and creating high value)

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