PHYCO HEALTH

Seaweed Science

Pioneering the Seaweed Industry

(is hard work!)

VENUSSHELL SYSTEMS

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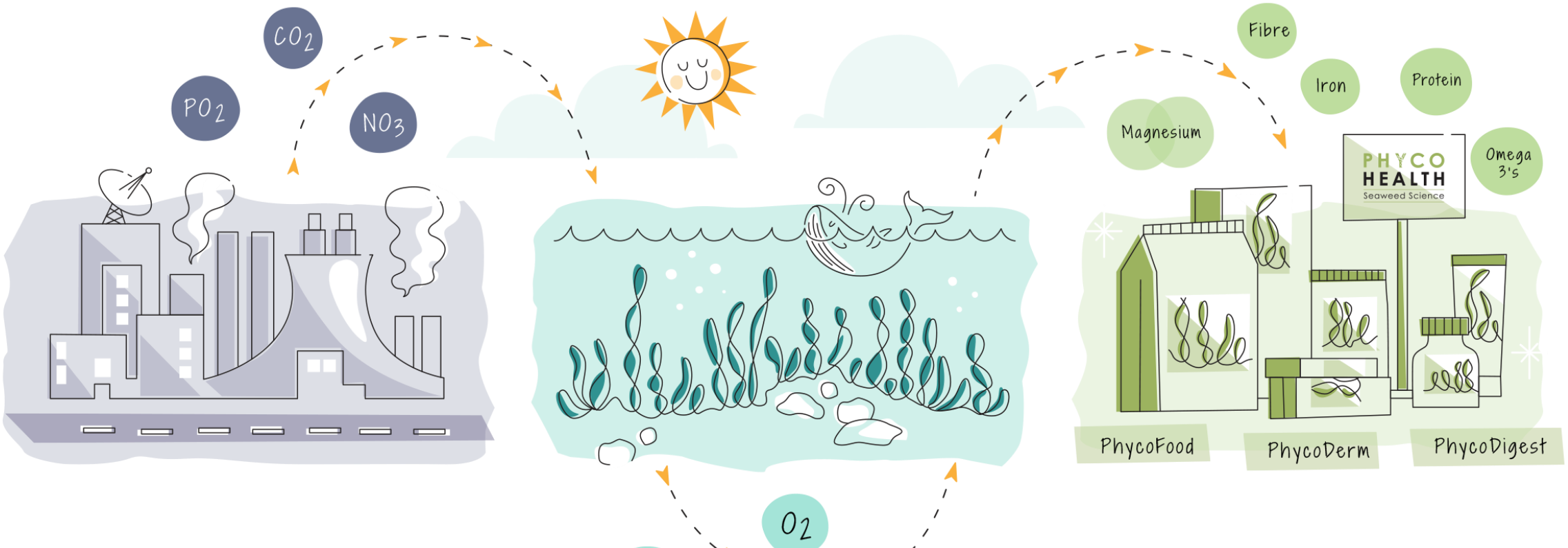
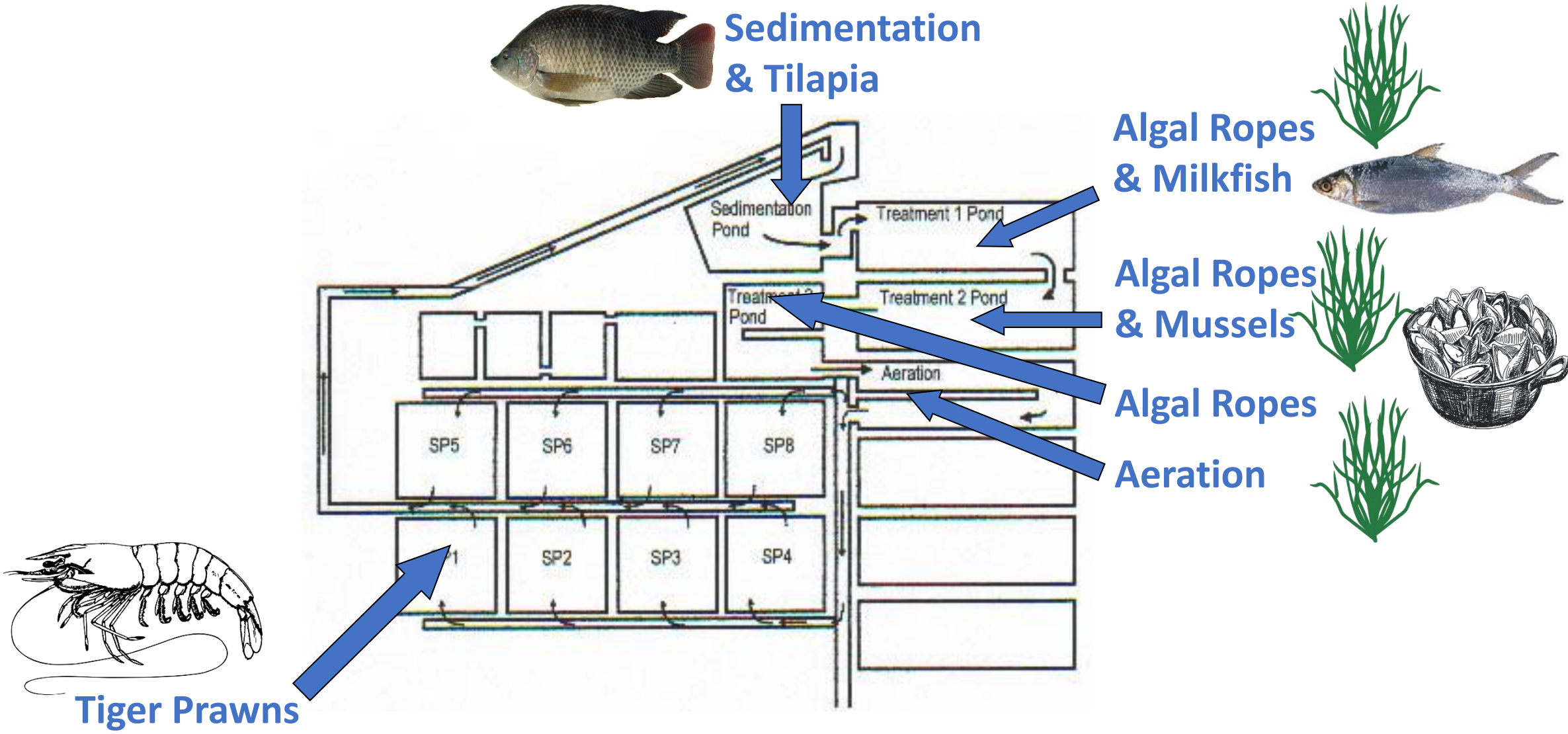
Purpose: waste regeneration, efficient resource use, sustainable food production, human nutrition, renewable resources.



WASTE REGENERATION:
Blue Revolution Disaster of the 1900's

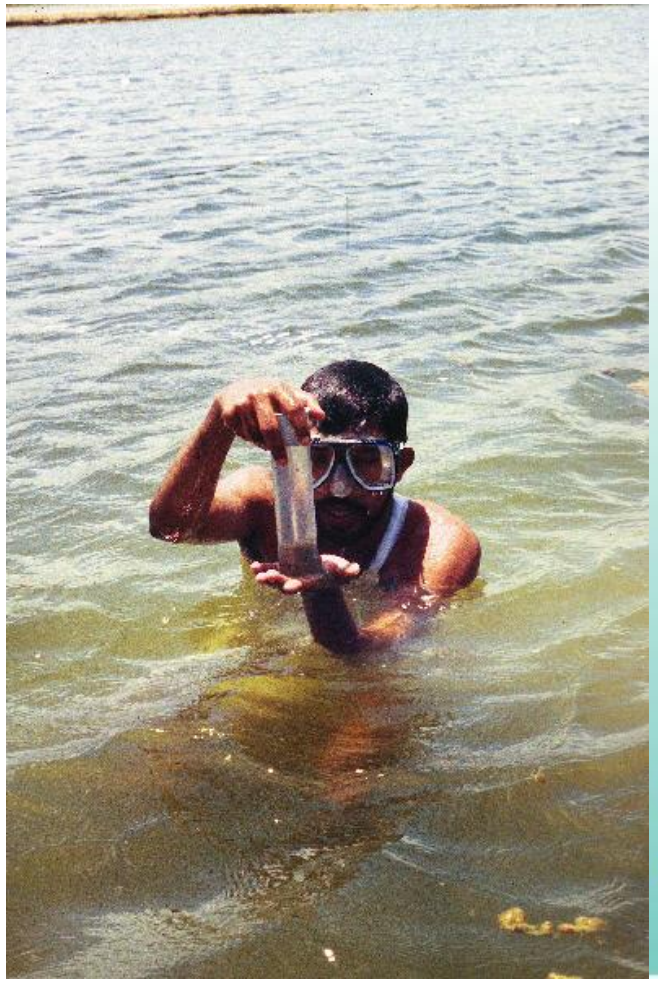
- Destruction of coastal environments
- Carnivorous species deplete wild stocks
- Escapees
- Spreads disease
- Nutrient pollution
- Chemical pollution
- Antibiotic pollution

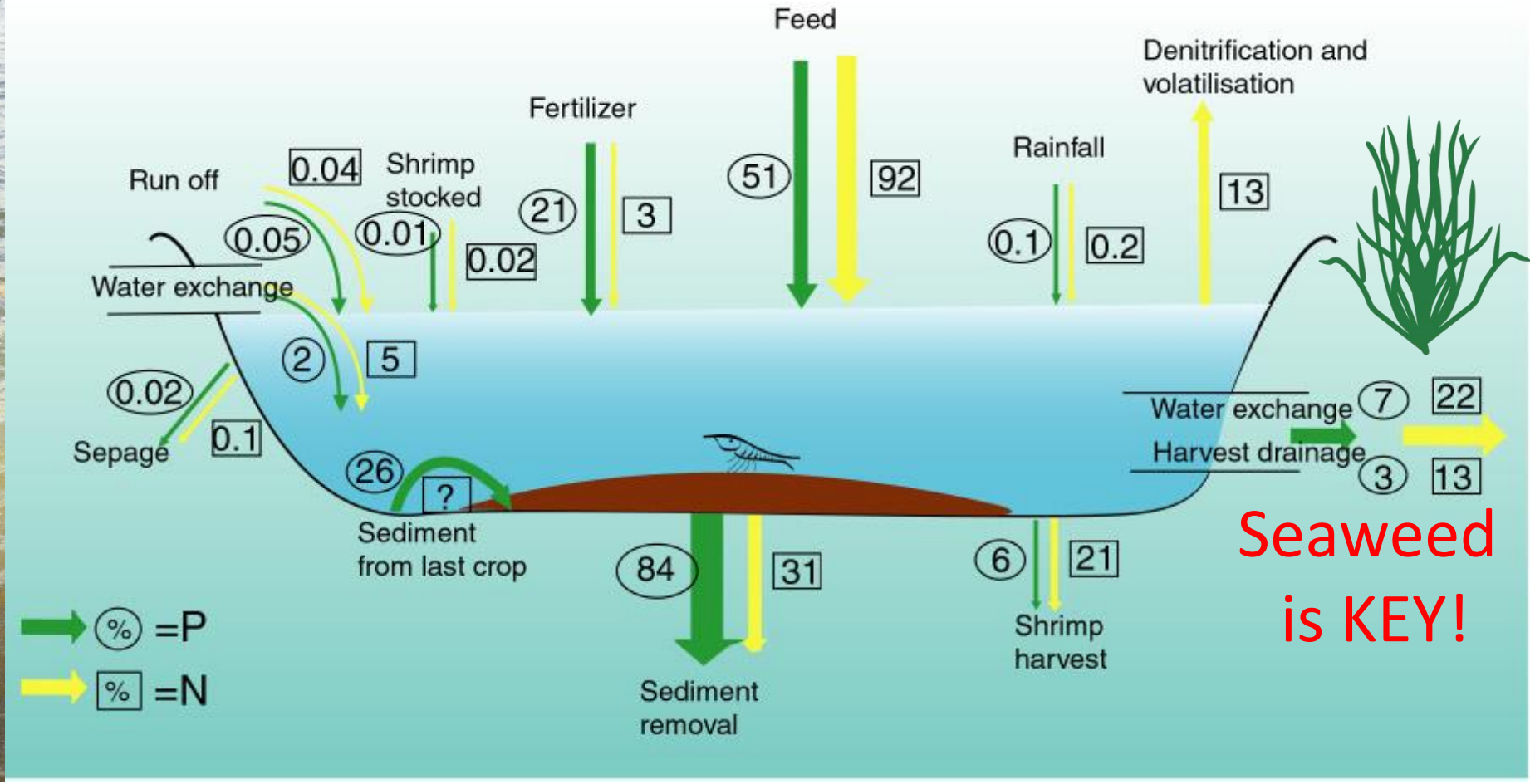
Efficient resource Use: 1998 Indiwary Aqua – Sri Lanka



Where does the nitrogen go????

N_2O = 280 x more potent greenhouse gas than CO_2 AND it causes eutrophication





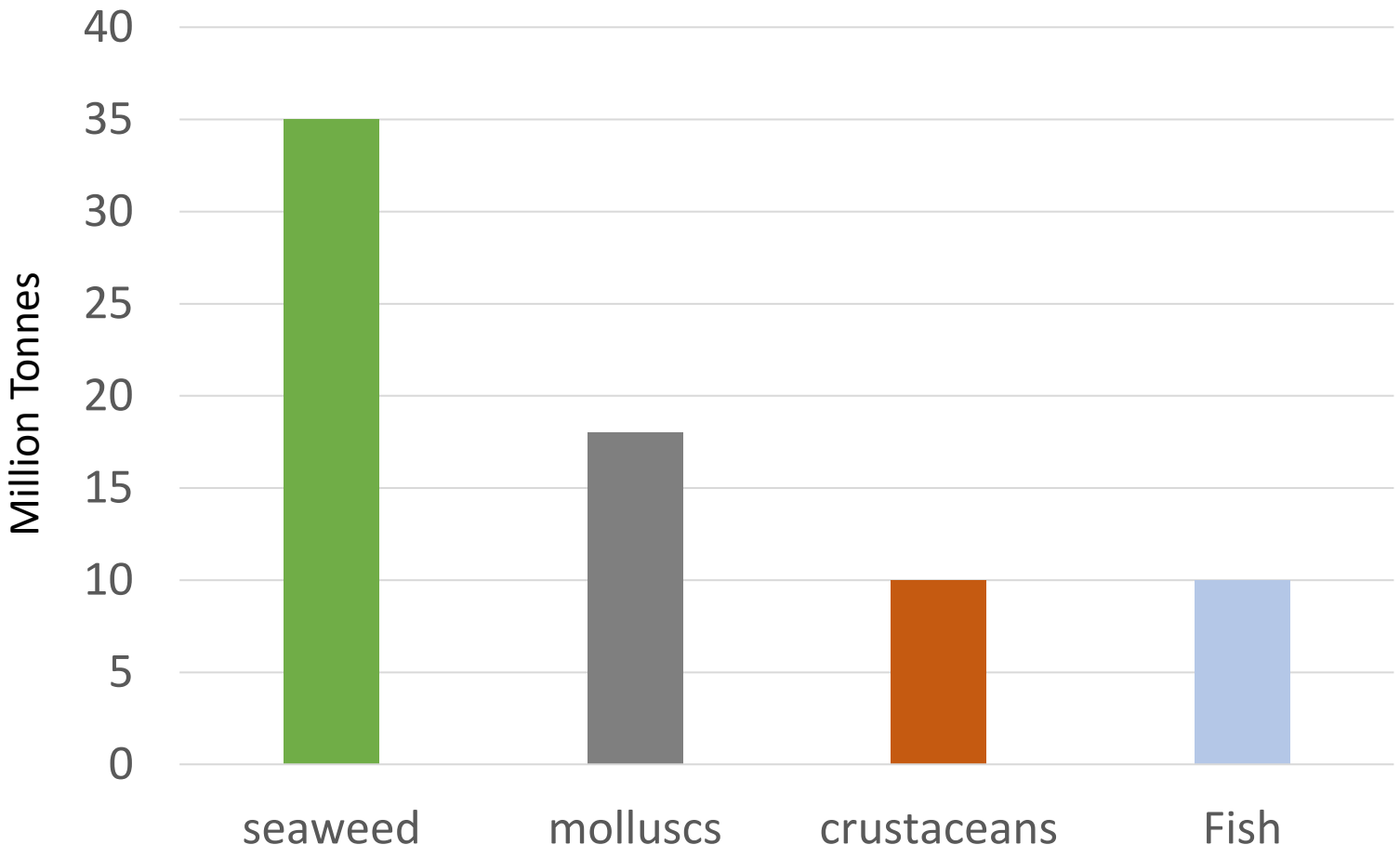
Seaweed is KEY!

If we plant 7% of the oceans with seaweed Pia, we can reverse climate change!
Reality check! Who will pay for it Tim?????...
Go and take a cold bath....

https://www.abc.net.au/catalyst/can-seaweed-save-the-world/11017106
WATCH
Can Seaweed Save the World?
DREAM ON.....

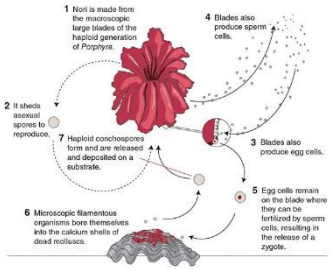
World Marine Aquaculture Production
By ISSCAAP divisions

Seaweed is the biggest aquaculture crop by biomass

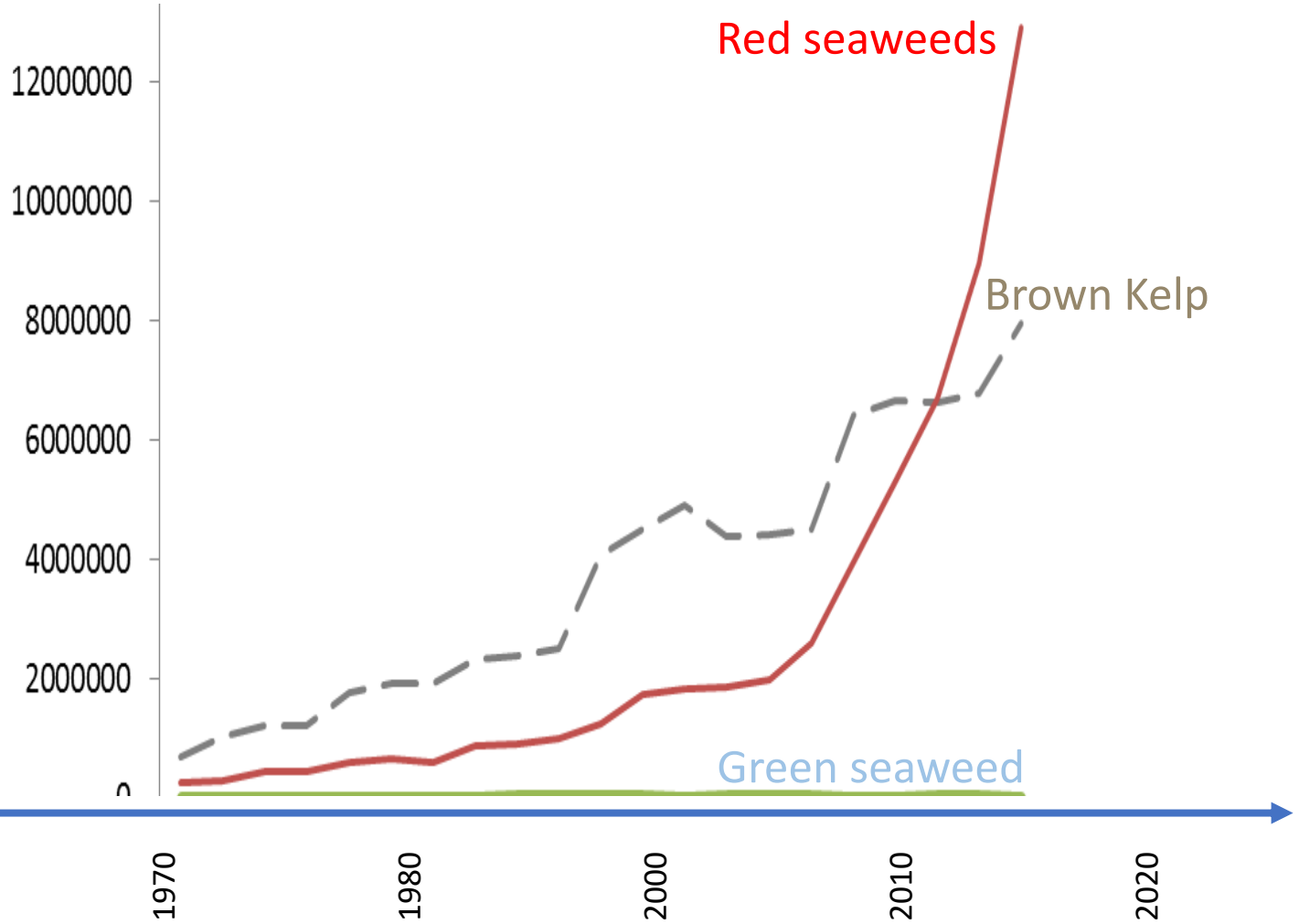


FAO: FISHSTAT 2021

A $15B, 35Mt seafood industry that Australia is not doing much of



Dr Kathleen Drew Baker



Mostly food but also ingredients We are already making so many things from seaweed….

- Food
- Animal feed
- Supplements
- Agriculture and soil management
- E400 range – icecream, toothpaste, printer ink, fire extinguishers, wall paint
- Medical devices

A resurgence of interest has driven product innovation – viable and otherwise

- Water balls
- Clothing
- Footware
- Building materials
- Medical Devices

Tracking a decade old strategy for Australia

2009

Species & Nutritional opportunities

2011

Target markets, Industry strategy & coordination

2011

Global Status & Australian opportunity & position

2011

Australian networking across engaged Industry partners

2013

Culture trials with selected Australian species

2017

Best practise towards standards for Australian seaweed

AgriFutures Australia

FRDC FISHERIES RESEARCH & DEVELOPMENT CORPORATION

RIRDC/AgriFutures research reports since 2009 can be sought at:
http://www.agrifutures.com.au/publications-resources/publications/

2009 – Strategic Industry Development

30 Industry and R&D contributors

- Industry Network – Seaweeds Australia
- Regulatory issues
- Market focus – higher value products

	Market	Value/weight seaweed	Commercial Production
1.	Pharmaceuticals	Very high	Very long term (>10 years)
2.	Nutraceuticals	High	Long term (5+ years)
3.	Organic/sustainable food	Very good	Medium term (<5 years)
4.	Health and beauty products	Good	Medium term (<5 years)
5.	Food	Good	Medium term (<5 years)
6.	Aquaculture/animal feed	Quite g	Medium term (<5 years)
7.	Biofuels	Lower	Medium term (<5 years)
8.	Organic fertilizers	Lower	Medium term (<5 years)
9.	Fertilizers	Low	Medium term (<5 years)

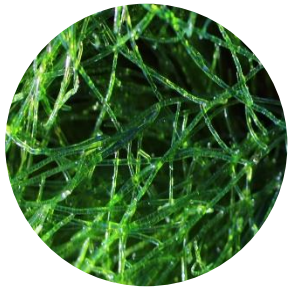
Sweet spot

Polysaccharide diversity in seaweeds offers a broad palette with diverse attributes

	Polysaccharide categories	repeating units
Extracellular matrix	carageenans (galactans) cellulose mannans xylans	glucose, mannose, xylose, galactopyranose, glucuronic acid,
	alginic acid fucoidan	fucose, uronic acids, xylose, glucose, galactose, guluronic acids
	ulvans, cellulose, xyloglucan	rhamnose, glucose, galactose, mannose, xylan, uronic acids (glucuronic & iduronic acids)

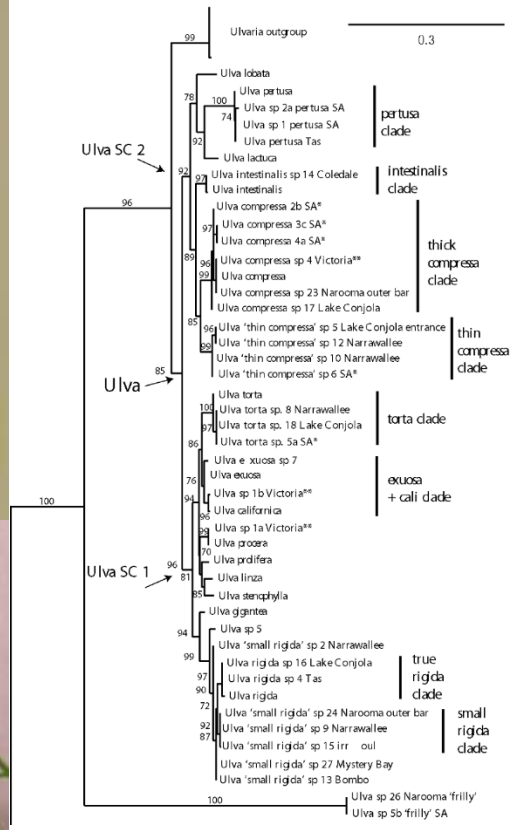
RED SEAWEEDS

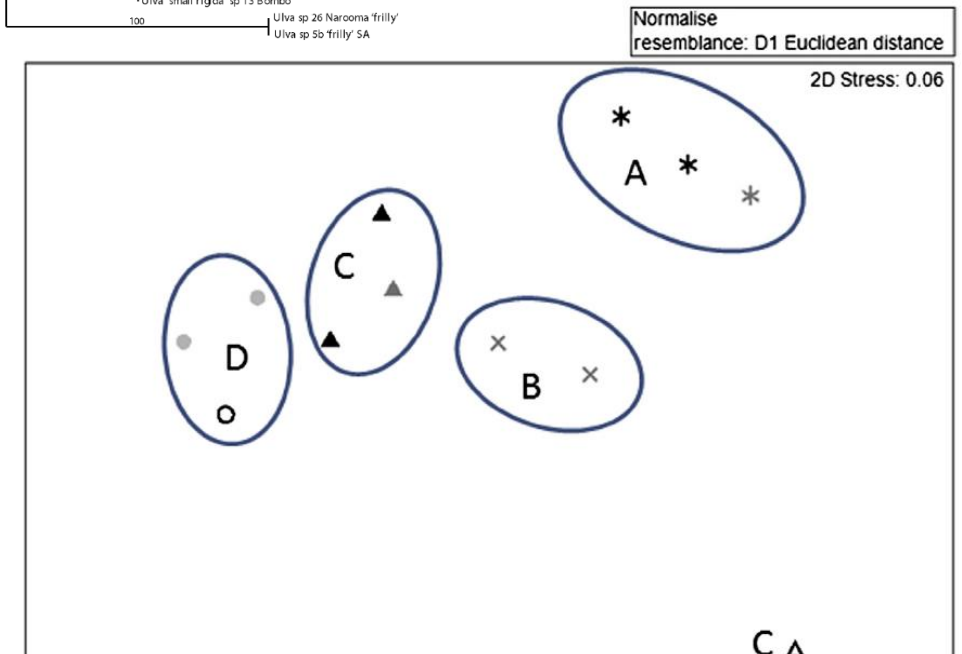
BROWN SEAWEEDS



GREEN SEAWEEDS

Winberg, P. C., J. H. Fitton, et al. (2014). Controlling seaweed biology, physiology and metabolic traits in production for commercially relevant bio-actives in glycobiology. Advances in Botanical Research. N. Bourgougnon, Elsevier. **71:** 221-252.

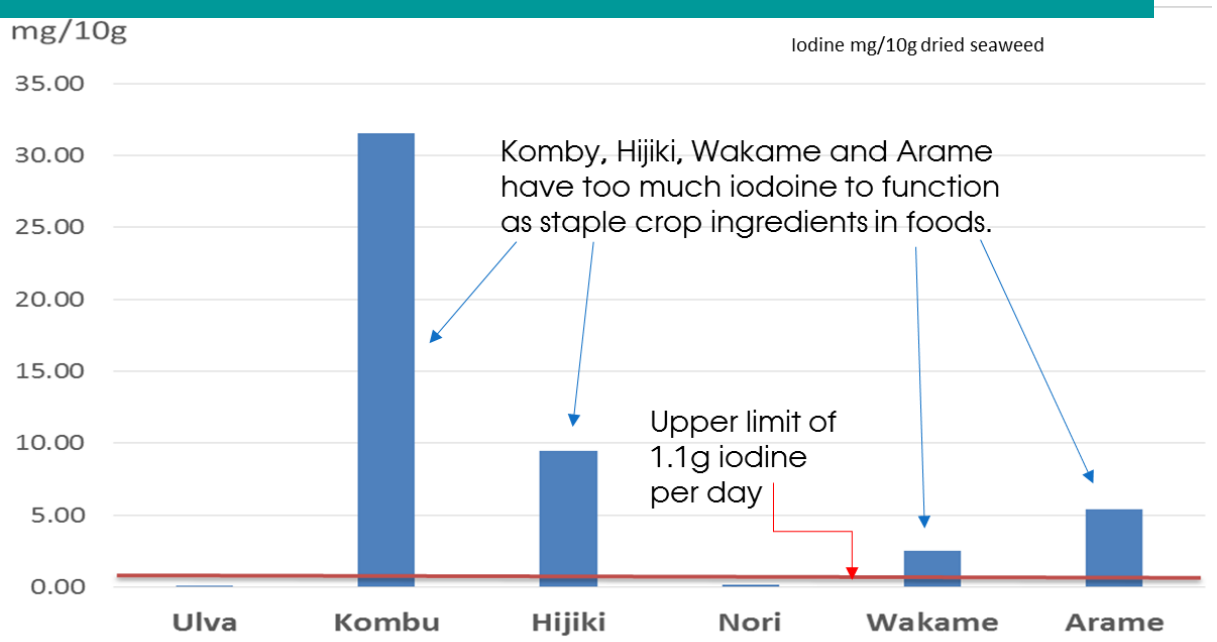




Even closely related species have different Glycocomposition

Kirkendale, L., et al. (2013). "A molecular survey of Ulva (Chlorophyta) in temperate Australia reveals enhanced levels of cosmopolitanism." Journal of Phycology 49(1): 69-81.

Micronutrients - IODINE!!!



Seaweed elements and the importance for and health and safety…..

10g of PhycoGreen in Phettucine

71% of Iodine RDI

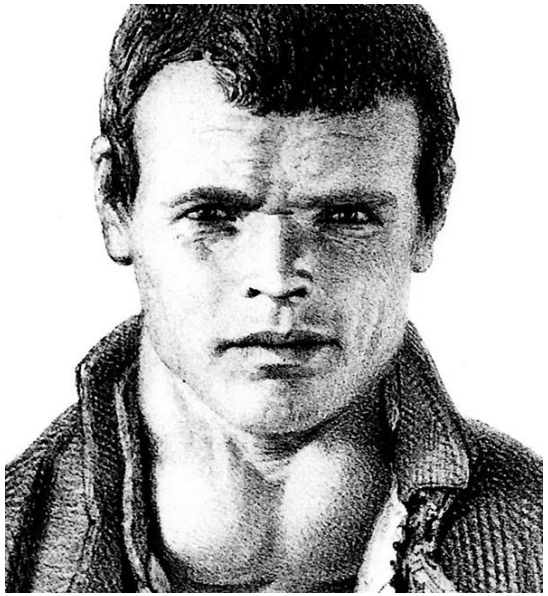
33% of Magnesium RDI

65% of your Boron

42% Manganese RDI

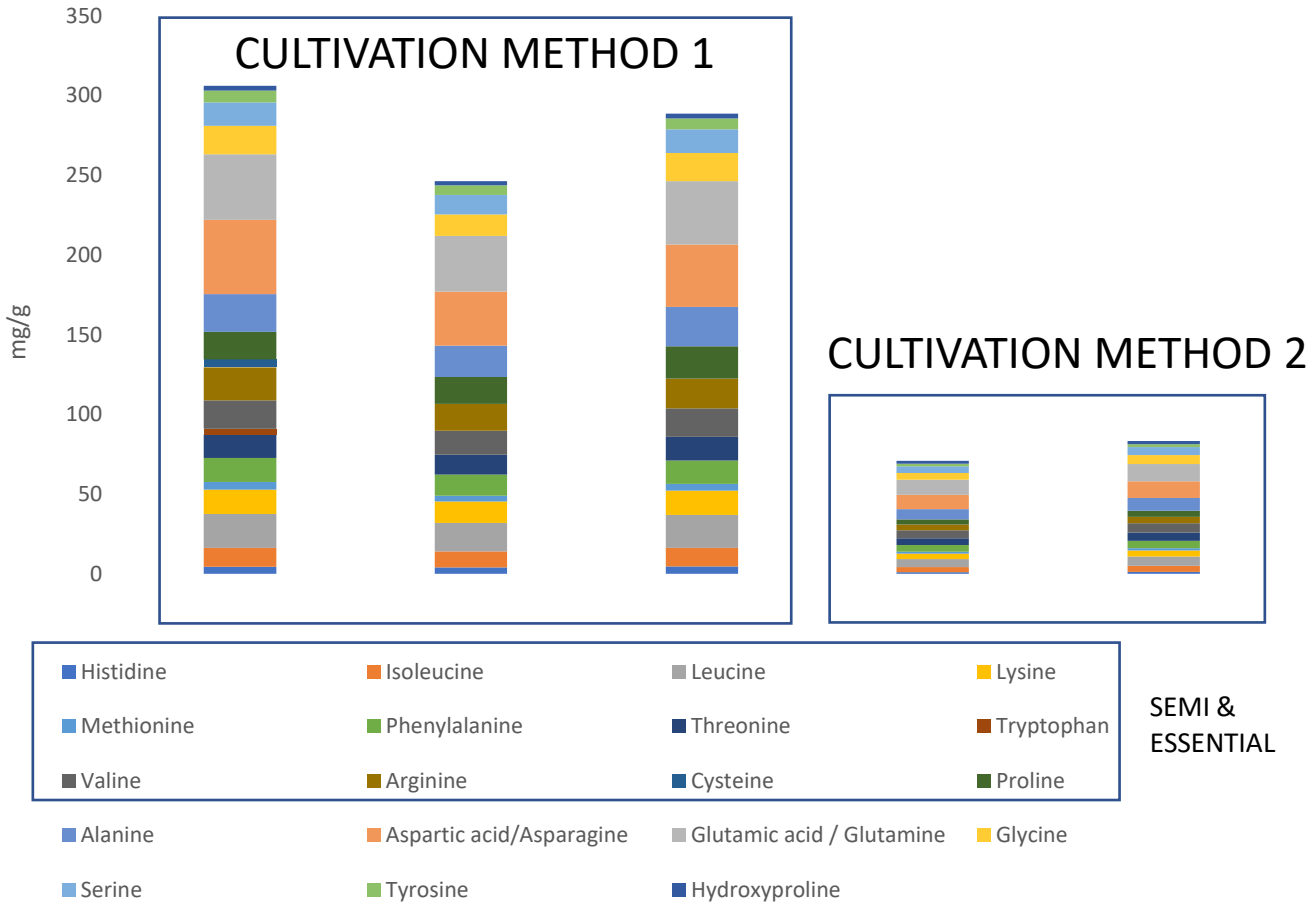
40% of iron RDI

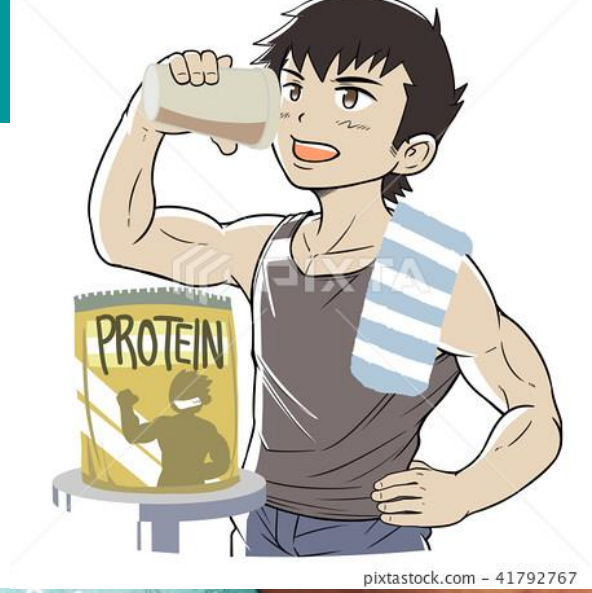
….Select your species wisely



Seaweed protein: PhycoTein™ development

We can grow more protein on a hectare than a cattle farm.
But you have to know how……





- CSIRO - Victoria
- PIRSA – South Australia
- UQ - Queensland

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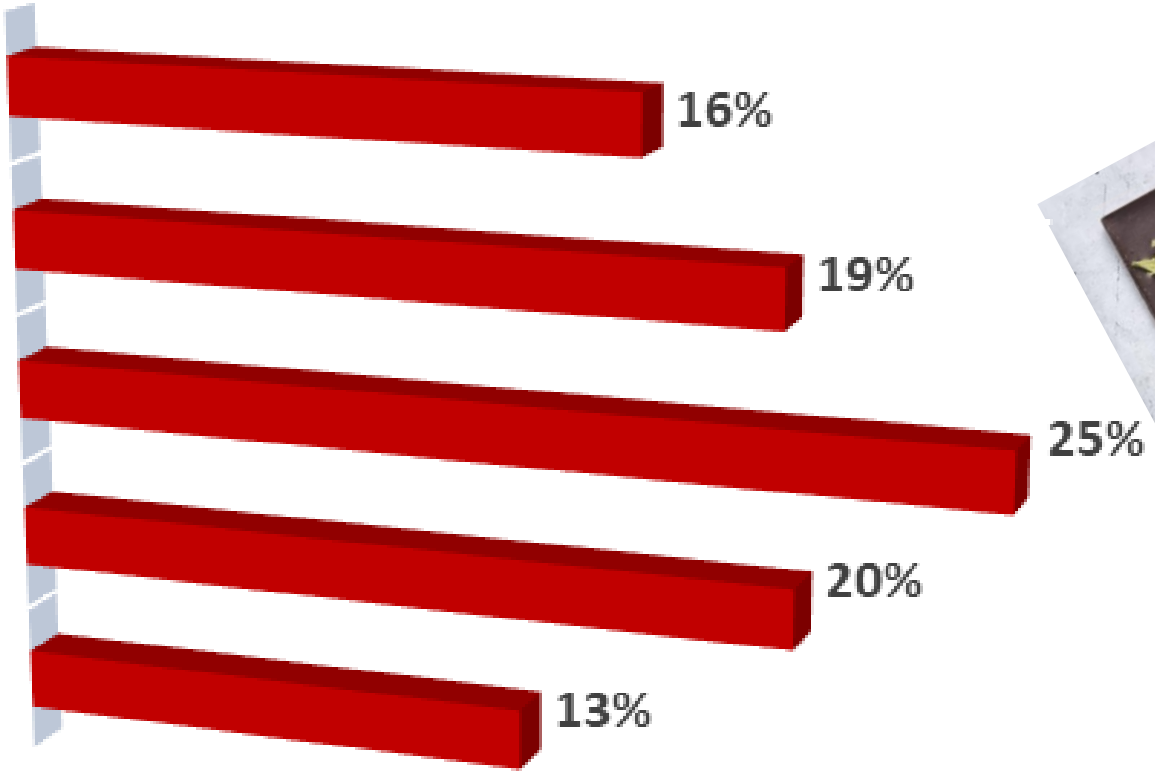
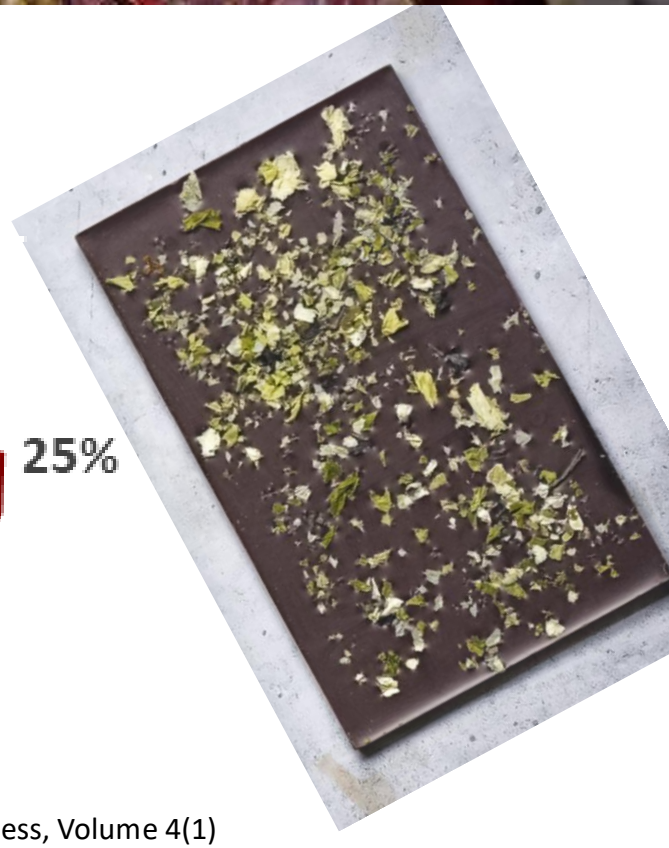
Micronutrients - IRON

Iron deficiency is the second of 6 global health targets of the WHO.

Just 1.4g of green seaweed per day can improve blood iron measures by up to 25%.



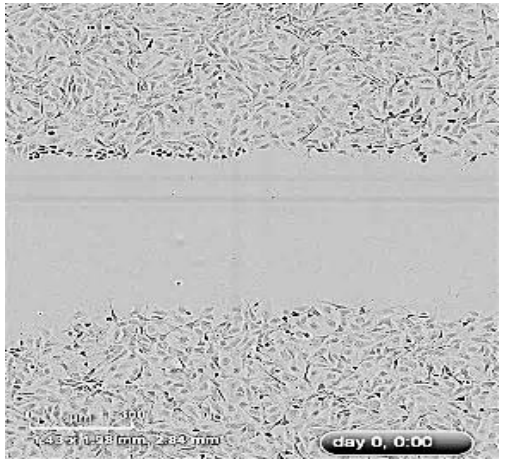


Banu and Mageswari (2015). Nutritional status and effect of seaweed chocolate on anemic adolescent girls. Food Science and Human Wellness, Volume 4(1)

Wound Healing PhycoDermTM

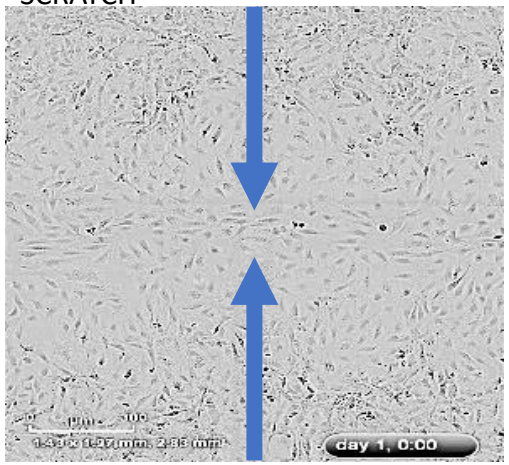
More than just a moist media

Artificial scratch in fibroblast cell culture

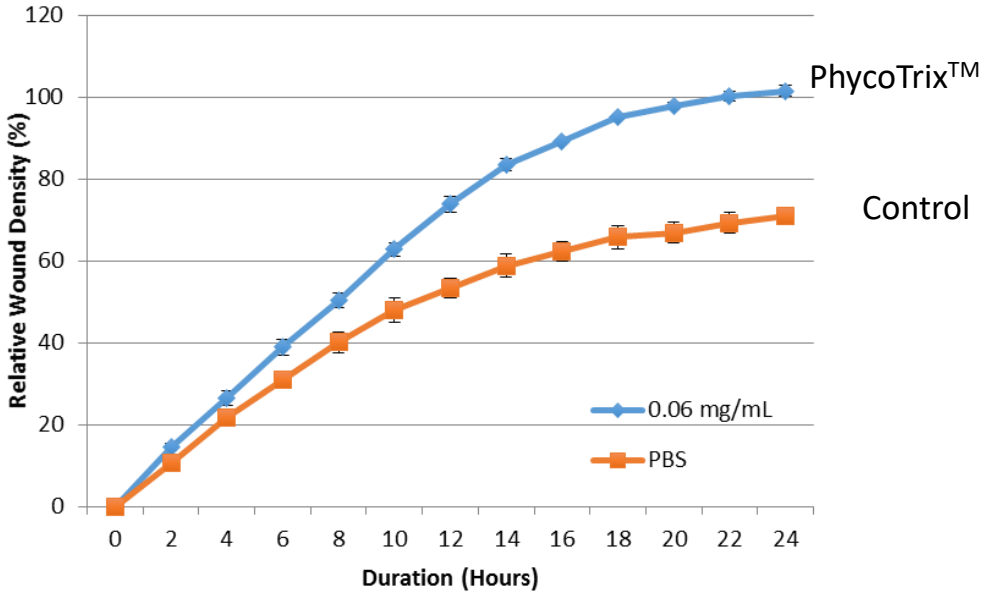


0 hours

QUANTIFY EXTENT & TIME TO RECOVERY OF CELLS ACROSS SCRATCH



24 hours



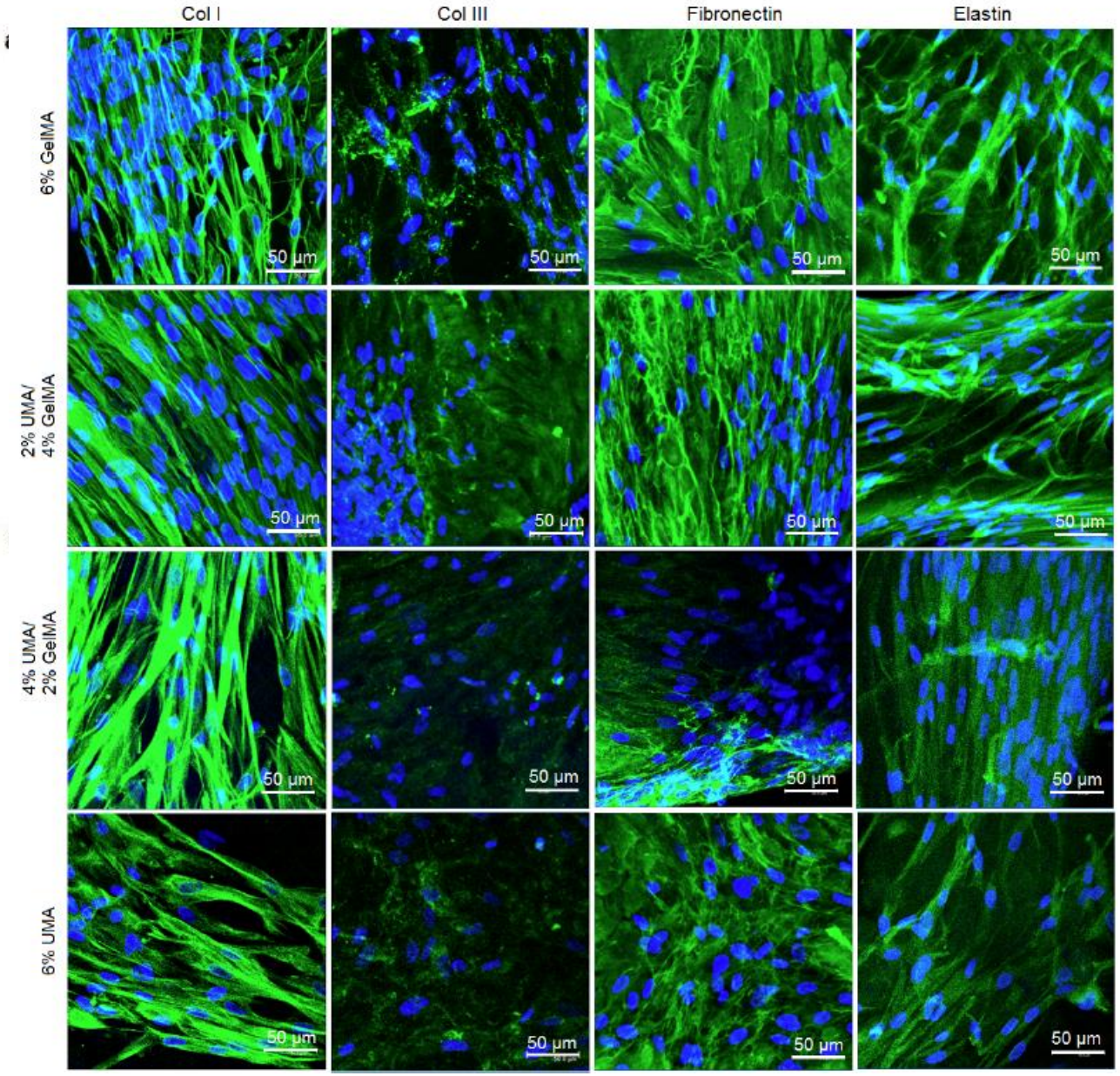
Fetchet, Skropeta, Ranson, McCauley and Winberg (2015 Honours research)

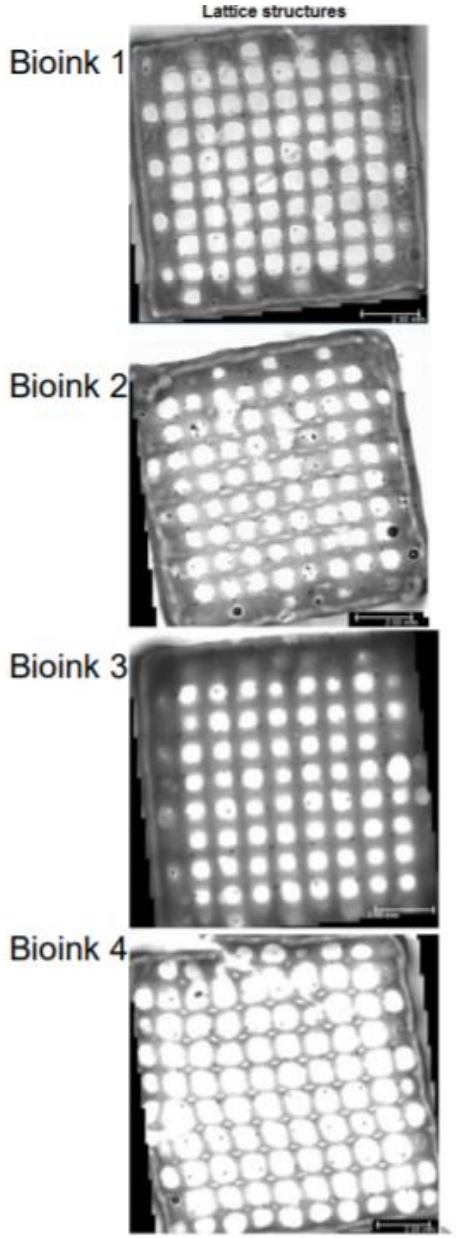
PhycoTrix™ BioInks development

Chen, X., et al. (2019). "Development of rhamnose-rich hydrogels based on sulfated xylorhamno-uronic acid for wound healing application." Biomaterials Science.

Kang, L., et al. (2018). "Fabrication and In Vitro Characterization of Electrochemically Compacted Collagen/Sulfated Xylorhamnoglycuronan Matrix for Wound Healing Applications." Polymers 10(4): 415.

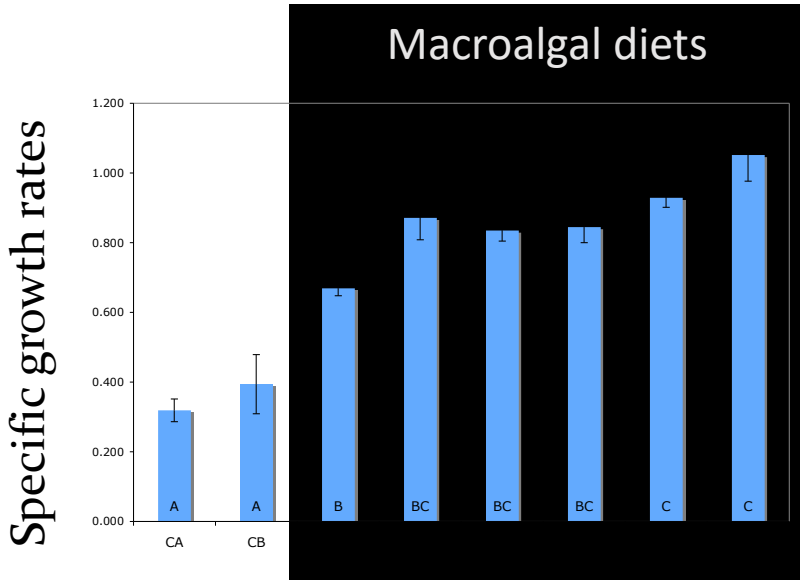
Molino, P. J., et al. (2018). "PEDOT doped with algal, mammalian and synthetic dopants: polymer properties, protein and cell interactions, and influence of electrical stimulation on neuronal cell differentiation." Biomaterials Science **6**(5): 1250-1261.





µm) and lattice structures under

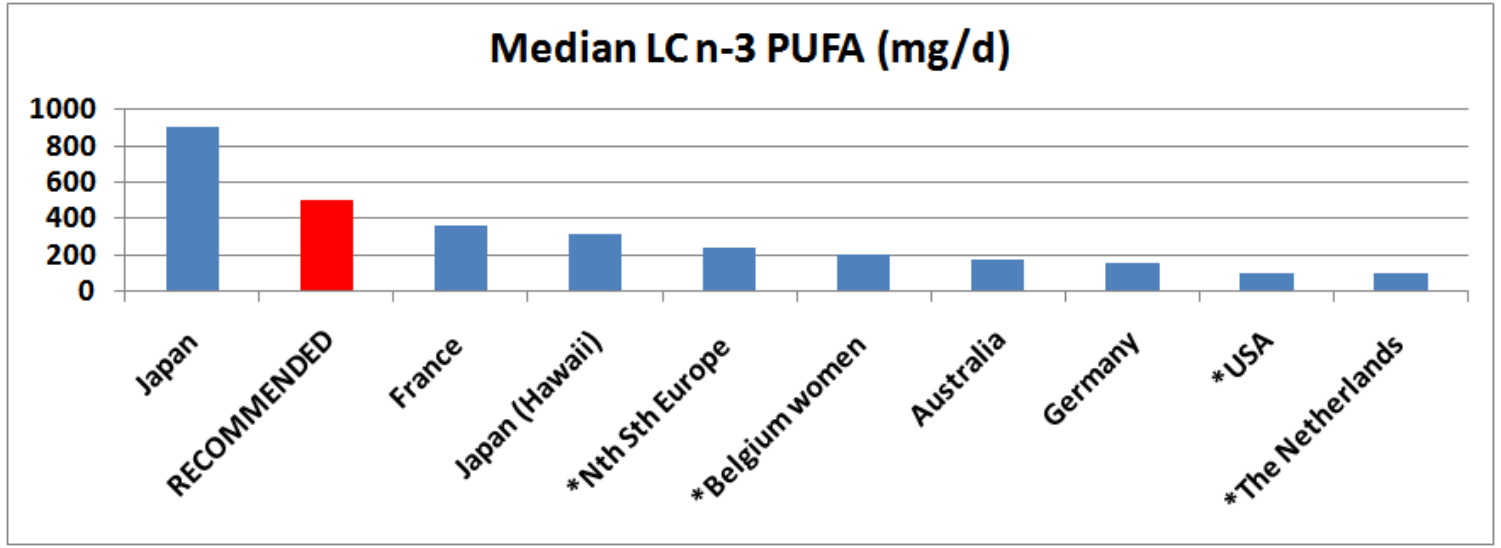
COMPLEX NUTRIENTS - Benefits in diets of abalone



Mulvaney, W. J., et al. (2015). "Recovery of seafood Omega-3 profiles of cultivated abalone by dietary seaweed supplementation." Journal of Applied Phycology

Mulvaney, W., et al. (2013). "Feeding rhodophycean and chlorophycean macroalgae improves growth and condition of a hybrid species of abalone (*Haliotis rubra* Leach x *Haliotis laevigata* Leach)." Journal of Applied Phycology **25**: 815-824.

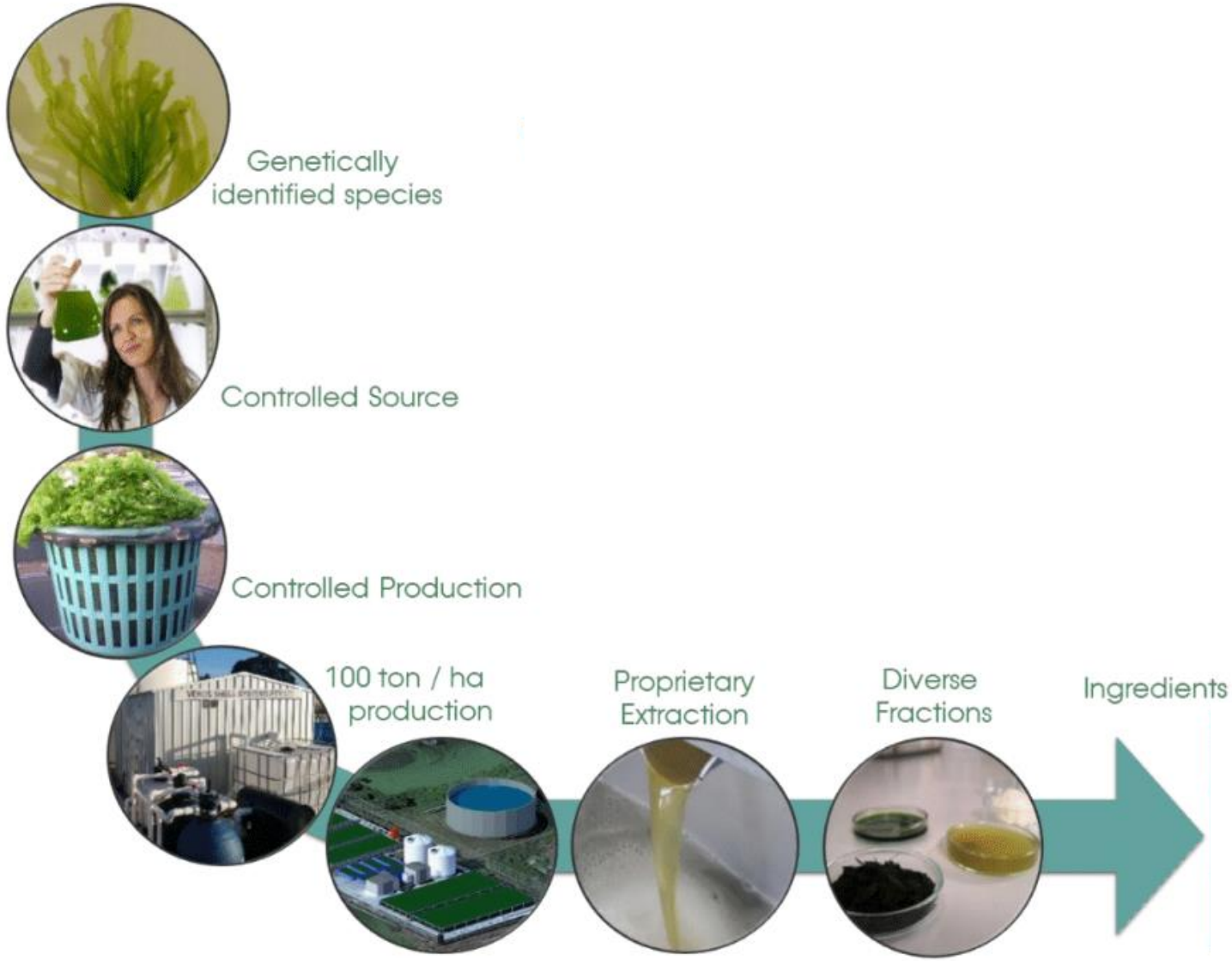
PEAK OMEGA-3 OIL - a challenge to World Peace



Meyer, B. J., et al. (2015). "Baseline omega-3 index correlates with aggressive and attention deficit disorder behaviours in adult prisoners." PLoS ONE **10**(3)

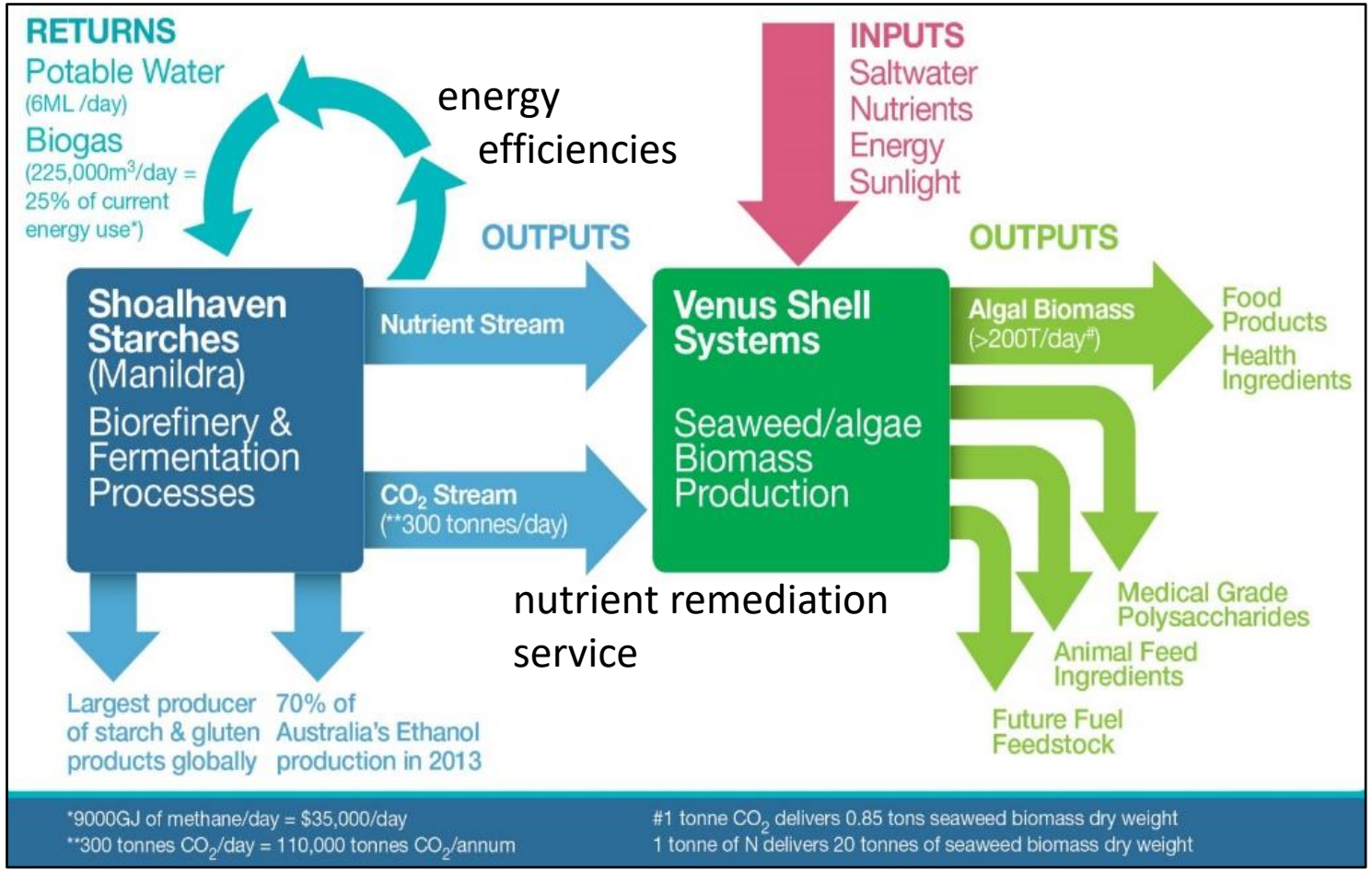
MAKING SEAWEED

PRODUCTION TO PRODUCTS



VSS industrial ecology process

Our current site system in Australia converts clean waste streams from Australia's largest wheat refinery:



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Industrial ecology

Miraculous Power of the Humble Seaweed

We had to build a factory and then another factory

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Woman is SCALPED and suffers massive blood loss in a horror workplace injury

- Woman scalped and suffered massive blood loss in a horrific workplace accident
- The 48-year-old was working on a Manildra Group mill around south east NSW
- Her hair caught in the drive shaft of a machine and was ripped from her skull
- Emergency services airlifted her to a Sydney hospital in a serious condition

By AIDAN WONDRACZ FOR DAILY MAIL AUSTRALIA
PUBLISHED: 12:14 AEST, 8 February 2019 | **UPDATED:** 12:17 AEST, 8 February 2019

Sites ABC

Conversations

with Richard Fidler, Sarah Kanowski

The seaweed scientist who survived being scalped

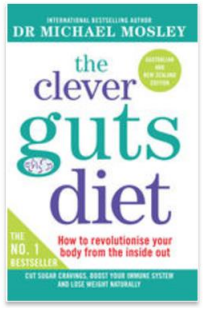
on **Conversations**
with **Richard Fidler**

After decades as a marine ecologist, Pia Winberg began her o
accident

48mins 1sec
Wed 3 Jul 2019, 11:00am

Be careful what you wish for… you sometimes need skin in the game

You have to get it out there.....



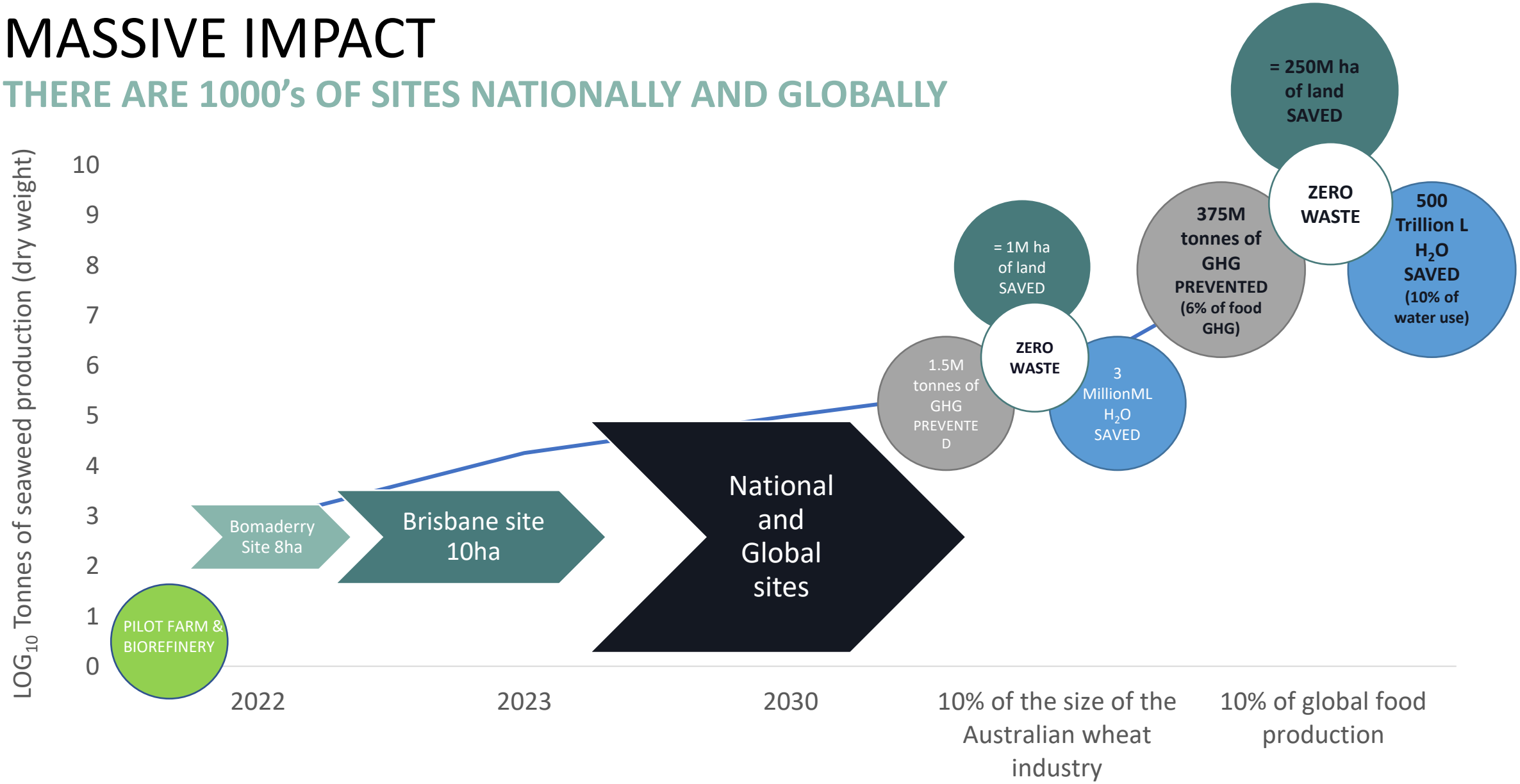
New Product Development

Partner with your local Sydney Rock Oyster Farmer

(and beer, and mussels, and wheat, and lupins, and hemp…..)

MASSIVE IMPACT

THERE ARE 1000's OF SITES NATIONALLY AND GLOBALLY



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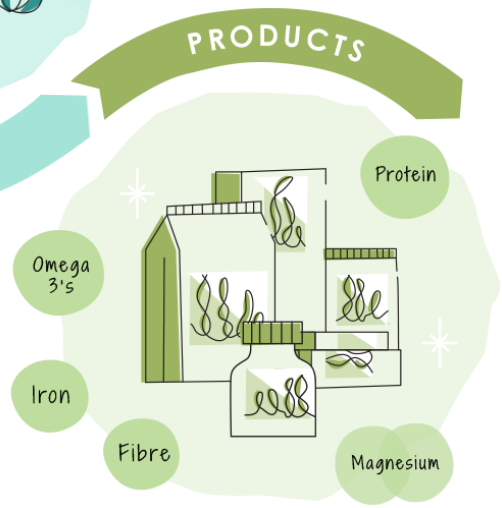
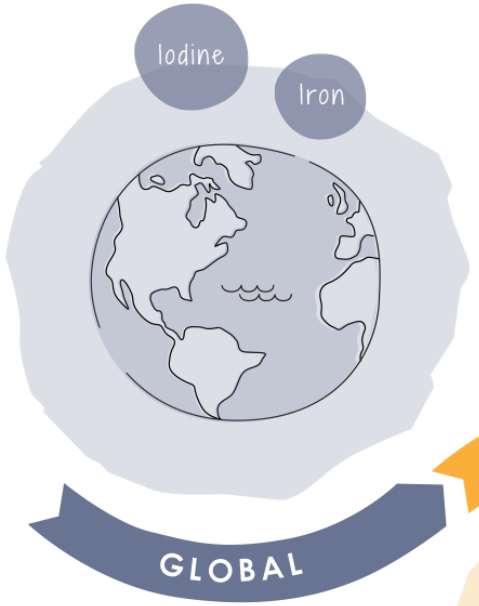
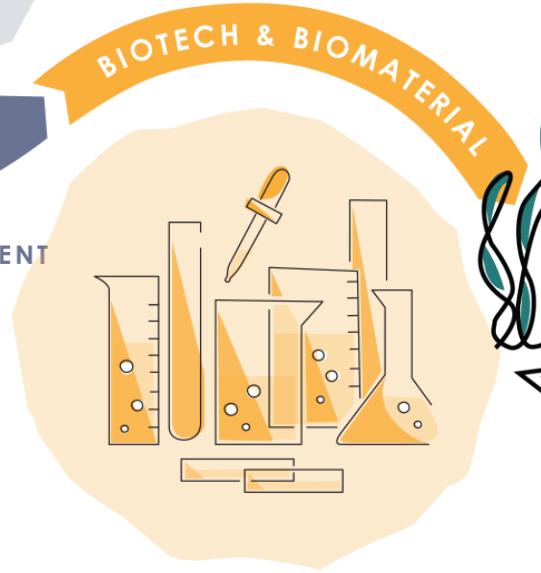
Seaweed Biomass: NSW First and partner to Oysters





SUSTAINABLE DEVELOPMENT
& NUTRITION GOALS



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