

Rhianna Rees

Seaweed is Sexy

The consumption and utilisation of seaweed throughout
British history and the marketing that surrounds it



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Master's thesis in Global Environmental History

Abstract

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Damp, rotting, smelly, rising from the depths, washed up on shorelines. Seaweed (or Macroalgae) has transitioned over time in its position and uses within the British Isles; as discussed in the thesis it has undergone an evolution from its historical use as a source of food in times of desperation, to the superfood it is lauded as today. Other applications, from medicinal to agricultural, have contributed to a narrative of seaweed's identity over the centuries, to the appeal of seaweed as a food source in the present day. There is an increased interest in seaweed, especially for culinary purposes, in the British Isles. Research by chefs, cookbooks and innovative product ranges also frame the current attitudes in the use of seaweed in common everyday foods. The case study shows the challenges and opportunities in the current revitalised seaweed market, identifying marketing analysis approaches useful for changing the attitudes toward seaweed in the British Isles. Based on interviews with companies marketing seaweed, and a focus on Seagreens®, I draw on advertising theory and consultancy tools (such as SWOT, AGCC, ELM and DAGMAR) to analyse the current seaweed market defining what I call a 'consumer triad' of potential consumers. Findings indicate many possibilities for future USP endorsements depending on the target market, from health-orientated to sustainably farmed. Seaweed interest appears to be more knowledge than consumer driven, so the question instead surrounds the prospect of knowledge sharing in an integrated online manner. Meanwhile, challenges in farming, labelling and conservation within the EU hamper advancements in the field, with the balance shifting to invested interest in Blue Economy models and IMTA systems.

Keywords: Seaweed. Algae. Marketing Theory. History. Environmental. Advertising. Blue Economy.

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Department of Archaeology and Ancient History, Uppsala University, Box 626, 75126 Uppsala, Sweden

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Abbreviations

AGCC - Acculturation to Global Consumer Culture

ASEAN - Association of Southeast Asian Nations

BCE – Before Common Era

BIMP-EAGA – The East ASEAN Growth Area

COP – Conference of Parties

CSR – Corporate Social Responsibility

DAGMAR - Defining Advertising Goals for Measured Advertising Results

ELM – Elaboration Likelihood Model

EU – European Union

GCC - Global Consumer Culture

IMTA – Integrated Multitrophic Aquatic Systems

IPCC – Intergovernmental Panel on Climate Change

LOICZ – Land Oceans Interactions in the Coastal Zone

PDO – Protected Designation of Origin

PfD – Partnerships for Development

SDGs – Sustainable Development Goals

UN – United Nations

UNFCCC – United Nations Framework Convention on Climate Change

USP – Unique Selling Point

WHO – World Health Organisation

WWII – World War II

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Prologue

Right now, we are facing a man-made disaster of global scale. Our greatest threat in thousands of years. Climate Change. If we don't take action the collapse of our civilisations and the extinction of much of the natural world is on the horizon... The world's people have spoken. Their message is clear. Time is running out.¹

The Discovery of an Opportunity

My relationship with seaweed is not as direct as one might expect. I did not grow up living on the British coast, rising early in the morning to collect the beach cast seaweed lining the shores, putting them in baskets for later use, like those in Victorian times. Nor have I even eaten laverbread, despite my Welsh ancestry. I grew up in a vegetarian household where my parents made me banana spirulina smoothies named 'turtle drink' to fulfil the lack of B₁₂ in my diet. During the summers we would camp by the Welsh coast, where you might find the occasional spots of dried seaweed, but the sandhoppers are what I remember most vividly. My dad used to regale us of the times he would visit the beach as a child and pop the air sacks in bladderwrack, inducing the same kind of serenity you might find when popping bubble wrap. The truth I learned later is that all the unwanted seaweed lining the shorelines is removed at the start of the tourist season. The salty putrid smell puts tourists off. That, combined with the fact that there is no practical use for dead seaweed anymore, meant that piles would either find themselves in landfills or would be moved to less popular locations temporarily.

The synergy we once had with nature, to find a use for everything, to pass our ancestral knowledge down the line has been all but depleted. Revolutions in agriculture, industry and exploitation mean we have lost small but important lessons we once knew, like how to properly treat farmland to preserve the soil for as long as possible, or how to balance and coexist with ocean biodiversity without over-exploitation. Aquaculture used to be a very important part of the equilibrium of human ecology. Once we began monocropping the land and factory farming, the attention moved away from the sea and to the land, the economies we had built within the oceans withered and faded. We no longer had to have back-up plans in case of famine and hardship, we no longer needed to store dried seaweed for fertilisers or animal feed for use in the harsh winter and summer months. Since the industrial revolution, overpopulation has changed the world we live in, we have found that so much of our modern lifestyle is unsustainable (O'Brien and Quinault, 1993; O'Brien *et al.*, 2006; Chen and Graedel, 2016). We live in a time of environmental hardship, ecological disasters and depletion (Anderson, 2012; McNeill and Mauldin, 2012; Shelton, 2014; Masson-Delmotte *et al.*, 2018). The quote at the top of the chapter by David Attenborough details exactly this, that we are facing is a countdown towards irreversible changes. People are taking to the streets as part of an 'extinction rebellion', school children are protesting worldwide, the demand for action is ubiquitous and widespread. Time is indeed, running out.

¹ David Attenborough's speech at COP24, Katowice, 2018

The world needs solutions, that much is obvious. Most people these days are hard pressed to go a day or two without seeing or hearing some reference to the plastic crisis, climate change, threats to food safety and the need for sustainable alternatives. Thus, the Sustainable Development Goals (SDGs) were created by the UN General Assembly to help guide governmental decisions concerning aspects of equality, biodiversity, health, education and climate (Rogelj *et al.*, 2016; Masson-Delmotte *et al.*, 2018). These goals *should be* a key consideration in policy making practices since the Paris Agreement was signed in 2015. However, advancements in line with the SDGs are often hampered by counter-productive ideologies or a reliance on unsustainable practices (Pogge and Sengupta, 2015). The words ‘*beautiful clean coal*’ ring in my head². Because of the difficulties in policymaking and the rate of change likened to that of a sea slug, it is very easy to get disheartened and feel powerless. Talks at the UNFCCC COPs (Conference of Parties) are often overshadowed by the wording of phrases or small modifications such as the difference between ‘would’ and ‘should’. With little faith in the political system, some organisations and companies strive to build sustainable prospects for the future. They take it upon themselves to provide solutions for emissions, or alternatives for us, the people, to make our own purchasing decisions.

Prior to my interest with seaweed, I had been fascinated by bamboo. In Asia I used to see construction works surrounded by bamboo structures, a biodegradable alternative to the iron rods and rebar used in the West. Bamboo grows extremely quickly, is very resilient, can be used in a plethora of products from socks to schools, and contains a rich history we could learn from. Much like seaweed. At COP23 I spoke with Fredrik Gröndahl, a researcher from KTH³, who was so inspired by seaweed. “It grows so quickly” Fredrik said, pointing at dried up sheets that hung from a string up above. “It’s sustainable and you can put it in so many things”, he continued, and handed me a cracker which contained seaweed. The taste was not abnormal. The cracker was salty and sweet and perfectly palatable. I expressed my interest in the historical relationships between humans and modern-day solutions which seem so revolutionary but have existed long before our time. “Ah yes” he replied, “algae” (a term he used regularly) “has been used for thousands of years by humans, but we are only just now realising how brilliant it is”.

The more we spoke, and the more I researched, the more infatuated I became with the idea of seaweed and our relationship to it. Seaweed was our solution. Though seaweed has been used for a long time, seaweed is also a revolution. Seaweed *is* sexy.

² Reference to Donald Trump, September 2018 discussing opportunities for coal in the US industry.

³ The Royal Institute of Technology in Stockholm

Introduction

I have seen them riding seaward on the waves, combing the white hair of the waves blown back, when the wind blows the water white and black. We have lingered in the chambers of the sea, by sea-girls wreathed with seaweed red and brown, till human voices wake us, and we drown.⁴

1.1. The Story of Seaweed

The quote above is from ‘The love song of J. Alfred Prufrock’ (Eliot, 2010), a poetic embodiment of the oceanic plants combing the waves from down below. This thesis will be sprinkled with literary references and quotes about seaweed like the one above. Each quote will frame each of the chapters and subchapters to paint the picture of human relationships with seaweed. Seaweed is a surprisingly poetic thing, from the macroalgae, to the nutritional sea sponge. There is a lot to be said about this resilient plant and a lot more to do with it than to cast it away. A lot more.

Many references cite seaweed as a beautiful aspect of nature, but in modern society it is not necessarily considered beautiful, it has no functional use and lies rotting along shorelines (Abowei and Ezekiel, 2013; Smetacek and Zingone, 2013). Entrepreneurs in seaweed are attempting to reinvigorate this long-forgotten plant. Using this as a basis, this thesis is a spiritual segue for ‘the weed that changed the world’⁵, an adaptation of a forgotten weed on the brink of making a comeback⁶. Seaweed is often referred to as ‘the weed’ by fishermen in the British Isles signifying its unwelcome nature as an irritant (Swales, 1982). Ironic, as seaweed is the sustenance of life for the fish they capture. The presence of seaweed in history fluctuates between being a nuisance and a blessing.

The sensual interaction between humans and seaweed does not necessarily evoke pleasant connotations. Salty to the taste, fishy to the smell, slimy to the touch, seaweed is a product with a lesser known history among the masses. Deep dark underwater forests wafting through the waves. The smell of rotting damp washed up on shorelines. Silken fronds stroking legs that attempt to breach the tides they reside in. The challenge of the modern market is to sell this as something altogether different than an old dead sea plant you might see lining the foreshore. More and more, with the cosmopolitan development of the human palate, our understanding of nutritional science, and our desire for healthy alternatives, seaweed is moving away from the traditional discourteous attitudes and being recognised as an edible, tasty, healthy addition to one’s diet (Mouritsen *et al.*, 2013; Mouritsen, Mouritsen and Johansen, 2013; Mouritsen, 2017).

The term itself, ‘sea-weed’ is not a flattering term. ‘weed’ connotes a plant that grows, sometimes uncontrollably, in areas where you don’t want it to grow. More recently researchers

⁴ The Love Song of J. Alfred Prufrock (Eliot, 2010)

⁵ Taking inspiration here from the Mark Kurlansky book: ‘Cod: A Biography of the Fish That Changed the World’ (1997)

⁶ Although, perhaps in light of current global legislative changes, that particular title may soon be given to an entirely different kind of weed altogether

and companies alike have attempted to rebrand seaweed as ‘sea vegetables’ or ‘sea herbs’, this, in an effort to revitalise the algae, to increase the awareness of the versatility of seaweed and to recognise the multiple species and their potential in the modern-day (Evankow, 2017; O’Connor, 2017; Shetterly, 2018). Herbs are adaptable and seaweeds are unique in that they can act as both a seasoning *and* a vegetable or core ingredient of a meal or a salad. Spirulina is a recognisable product, sold as simply ‘spirulina’ - a regular addition to smoothies and shakes. The names of products can be significant too, the microalgae spirulina has much the same appeal as, for example, chia seeds or wheatgrass as a superfood, without the general public understanding that it is, in fact, a single-celled form of algae. The hidden-in-plain-sight approach to seaweed we will cover in greater depth in the coming chapters. Of the macroalgal variety, three groupings exist: *Rhodophyta*, *Chlorophyta* and *Phaeophyta*. Or red, green and brown.

The conceptualisation of this thesis is to build an in-depth understanding of the history of a forgotten, repulsed weed in the western world, and to determine its uses, applications and practices prior to the industrial revolution. Here I will explore the different local histories of seaweed in different administrative regions of the British Isles, as mutually beneficial relationships between humans and the sea. In Wales, where the world famous laverbread is now a Protected Designation of Origin (PDO) product, the seaweed dish is a point of pride for the Welsh population and is still consumed today, but the history surrounding seaweed in the area is associated with famine and desperation. In Ireland, the practice of ‘dulsing’ goes back centuries. Ireland had specific laws surrounding kelp practices, ownership and collection; they also used kelp for bleaching linen and in the Northern Islands, and old kelp kilns used for burning seaweed can still be found. According to the first accounts of the Scottish kelp industry, the practices first came across from Ireland. The Scottish industry flourishing, the country experienced a kelp boom during the 18th and 19th Centuries. But, with the industrial revolution, the industry quickly dwindled and eventually died out. In the Isle of Jersey, where the famous ‘Jersey Potato’ originates, seaweed has long been collected from the shorelines for use as a fertiliser, until 50 years ago. Now, green ocean tides and swathes of dead seaweed disturb communities and tourism spots alike. Seaweed appears in old English cookbooks, and records of its use as a fertiliser are prevalent. The primary purpose here is to look at the main consumers and applications for seaweed from over the past centuries and compare the applications and target market right now. The general public gains knowledge and can change attitudes through marketing when utilised effectively. Are the tides turning in relation to seaweed?

The main case study I will be using for this thesis, Seagreens®⁷, is an organisation that has been working with seaweed since the recent resurgence of seaweed in the British Isles 20 years ago. Their goal is to make seaweed a core part of the British diet, either as a seasoning or as a health product, but they face challenges in perception, marketing and acceptance. By using responses from Seagreens, other organisations and by analysing the market, we can determine potential customers and understand where seaweed might appeal most in the British marketplace. Also covered here are the opportunities that lie within the blue economy and sustainable farming practices, but also the barriers to lawful collection, environmental concerns and difficulties in the labelling aspects of seaweed in the British Isles. Or even the potential rebranding of the name ‘seaweed’.

⁷ From hereon referenced to as just ‘Seagreens’ unless quoted

1.2. A Tale of Three Weeds

‘Kelp’ was a common name for seaweed in historical renditions of the shoreline (Jameson, 1800; Anderson and Anderson, 1834). The term is late middle English used first around the 14th Century (finedictionary.com, 2019). Kelp was the name of the burned ashes of seaweed, but was often used to describe the larger varieties of *Laminaria* seaweed, this oftentimes creating confusion in written accounts (McErlean, 2007, pp. 77). The word ‘algae’ is also often used, but in literature it usually applies to the multi-celled macroalgae form - seaweed, as opposed to the microalgae, a single celled cyanobacteria such as spirulina.

Three is a recognisably common theme in nature. The holy trinity. The troika. The ‘all’ – the beginning, middle and end. It is perhaps easy to view the three types of seaweed in a prophetic ‘goldilocks’ scenario: try one, try another and find the strain that works for you. At present there are approximately 9,800 species of macroalgae (Mouritsen *et al.*, 2013). The Natural History Museum in London stores some 600,000 algae specimens (Mouritsen, 2017) and predictions for the number of species of algae on the planet, known and unknown, reach as high as 1 million (Guiry, 2012). Although records can sometimes be discovered and forgotten. For example, some species of algae which were first reported in the 1850s, were ‘discovered’ once again - almost 100 years later (Den Hartog, 1959). While the most widely reported number is 9,800, realistic estimates predict up to 30,000 (Guiry, 2012; Sahoo and Seckbach, 2015; Makkar *et al.*, 2016). If you break down the different species, of the almost 10,000 known algae at least 145 are used as food globally, only about 652 exist in British Isles coastal waters and of them, somewhere between 40-60 are commercially used⁸ (Ito and Hori, 1989; Lindsey Zemke-White and Ohno, 1999; Kenicer, Bridgewater and Milliken, 2000). The total number of known species of macroalgae in Europe stands around 1550 species at present, Japan, by contrast, has around 2000 species (Mineur *et al.*, 2015; O’Connor, 2017). Thus, the current separation of species into 3 different groups is an incredibly simplified way to group a hugely varied selection of species, but it is the main method of classification currently.

In the dank, dark depths of the sea, in freshwater pools or on the rocks in the shallow waters, the three divisions of seaweed can be found. First, red seaweed (*Rhodophyta*) is the most nutritious, it contains the most micronutrients and it is the most commonly consumed by humans. Usually used for carrageenan and other agar-based products, nori and Irish moss are both types of red seaweed. *Rhodophyta* are not simply red; they can range from a light red to a rich purple or a rusty-brown. Then we find the green (*Chlorophyta*), the wakame, the sea lettuce, the oyster-thieves. Green seaweed is not harvested as much as the other two. It grows the slowest of the three and shares similar characteristics to land dwelling plants: growing in shallow waters, needing high levels of sunlight to photosynthesise (Ito and Hori, 1989). Finally, the brown (*Phaeophyta*) seaweed is likely to be the most recognisable as the washed up, beach-cast seaweed: usually brown, occasionally rusty red, of all different shades, the leaves wide and the stalks thick. Brown seaweed is the underwater version of Jack’s beanstalk - fast growing, vast and towering - it is most commonly used for animal fodder, iodine and food. Nevertheless, brown seaweed is the least nutritious, generally with lowest levels of micronutrients, iron and protein (Mouritsen *et al.*, 2012; Brown *et al.*, 2014).

According to a study exploring the sensory characteristics of 4 different species of seaweed (*Palmaria palmata*, *Saccharina latissima*, *Laminaria digitata* and *Alaria esculenta*), the six most common descriptive words for the flavour, taste and texture are: salty, sea, sweet, grass, neutral and sour (Chapman, Stévant and Larssen, 2015). The different species have subtle differences and characteristics that on first taste might not appear all that different. So, to

⁸ This changes depending which researcher is referenced.

nuance this simplified palate description, let's do a theoretical 'seaweed tasting' for one species: the red seaweed, nori.

We can begin with a dried form of nori as that is the most commonly consumed and likely most recognisable. The texture is crisp, but ever so slightly pliable, the corners can be rotated a touch in either direction. The sheet can be easily broken into two or more pieces or obliterated in a single handful. Smelling it, it has a lightly sulphurous, slightly fishy scent, lightened with floral notes. Visually, the sheet is a dark green, or even black colour. The sheet somewhat melts in the mouth, the crispiness softened by the saliva glands reacting to the salt. The taste is salty, rather sweet and has aromatic 'earl grey' undertones – the micronutrients and high iron content give the seaweed a slightly metallic aftertaste. It is common, especially in Japan and Korea, to flavour nori with chilli, wasabi or other flavours. In doing this, those who aren't fans of the 'seaweed flavour' are still able to consume it. It is also common to have some small pieces, fried and mixed with sugar, salt and sesame seeds on top of salads, soups or rice. But we shall touch on recipes, additives and uses in cooking again later. How does one select the best way to prepare or serve seaweed for the consumers in the British Isles? A review of the product range in Chapter five will outline exactly this.

1.3. Thesis Map

There are four main elements of this thesis that work together to form a bigger picture: the literature history (the backstory), the applied theory, the case study and, finally, the aims and goals. All the elements culminate to structure the four thesis outcomes as listed in the centre of the diagram (Fig. 1). The first is the 'Optimal futures of seaweed ventures in the UK', this highlights the marketing theory (covered in Chapter four) with all other information surrounding seaweed, current and historical. Two, the 'effects of globalisation on the seaweed market' is covered throughout, in the history: industrialisation of the world, the future: the blue economy and in marketing theory: global consumer culture. Three 'the effect of cross-cultural influences' is a reference to cosmopolitanism, a common theme throughout, where seaweed is viewed primarily as an Asian food. But there is a potential for this to change. Finally, 'the current climate / market for seaweed in the UK' encompasses future opportunities, with marketing theory and information from the case study.

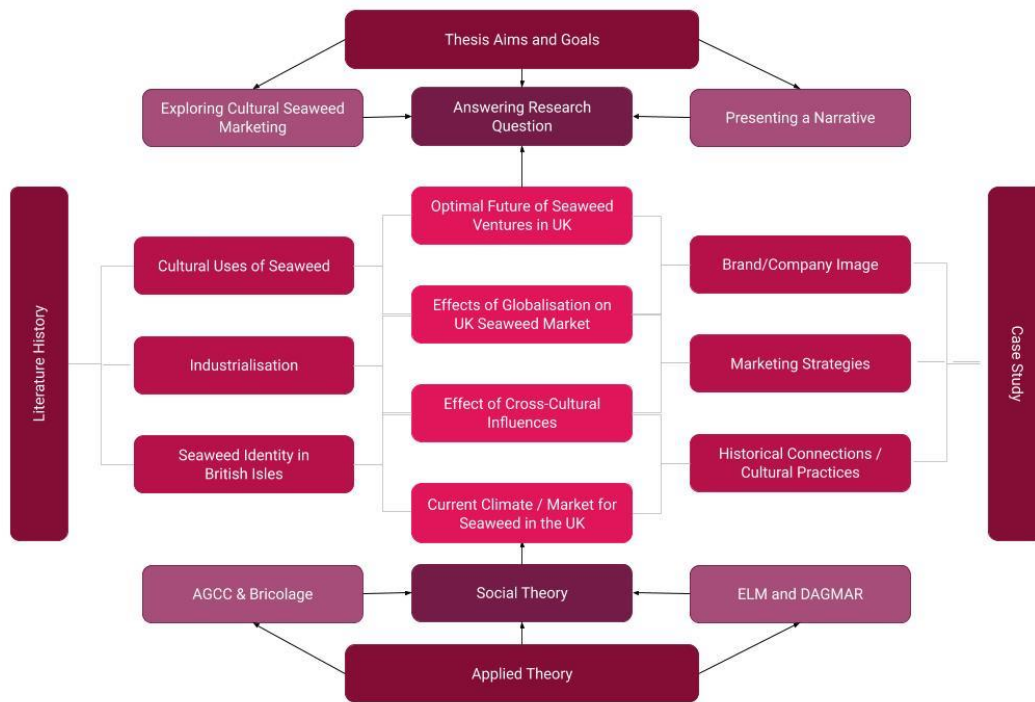


Fig.1. A map of the elements applied and the general structure of the thesis

Within the thesis the structure, the methodology is outlined with an introduction of the case study options and final selection of research questions. Chapters Three and Four explore the history of seaweed in different parts of the British Isles before and during the industrial revolution. This helps to frame the identity of seaweed as an artefact of the British Isles, developing a narrative of where seaweed fit into society. This, with the focus on the case study in Chapter Five, will help to the understand the position of seaweed in society now. Then, in Chapter Six, marketing theory is applied to seaweed in the current marketplace, establishing the effect of cosmopolitanism, global and local markets and unique selling points (USPs). Market theory also helps to transition to the opportunities that lie in the current social and political climate. ‘The blue economy’, ‘alternatives to plastic’, are trendy ideas in the 21st Century, however many barriers lie in the way of seaweed’s potential for development within the EU.

Methodology

God created seaweed... The seaweed made the world.⁹

While seaweed literature is important for depicting and understanding historical relationships, I realised the thesis would need an in-depth case study to discuss the challenges and opportunities facing the seaweed industry today. In this chapter, I rationalise the biggest decisions made in this thesis: which case study to use and which research questions to explore.

2.1. The Case Study Selection

In February 2019 I contacted a few British based seaweed companies via email asking if they would be willing to participate in this study. They included: Arduaine Seaweed (Scotland), Ebbtides (Devon, UK), Seagreens® (British Isles and Nordic region) and The Pembrokeshire Beachfood Company (Wales). With their permission, I emailed a set of questions for them to answer (questions can be found in Appendix i). As Seagreens was the oldest of the three companies, beginning operations in 1998, I felt them to be the best fit for further investigation. I retained information provided by Ebbtides and The Pembrokeshire Beachfood Company, for use in some sections, the answers provided in their questionnaires proved useful in some of the marketing analysis. Seagreens Founder S. B. Ranger and I began regular communication via email discussing the history of Seagreens. Through regular interaction, the motivations, USPs (Unique Selling Points), opportunities and challenges of Seagreens began to unfold. Within their business, Seagreens has faced many challenges, as S. B. Ranger, the company's founder, shared with me (15/3/19):

habits are slow to change, and die hard. The market for seaweed as a dietary ingredient is still embryonic in western food culture... recent years have seen a relatively dramatic surge of interest, especially in the media.

Despite the challenges, Seagreens is focused on pioneering a new and interesting product and range. Accessing the website Seagreens.com, it is inundated with information about seaweed - be it nutritional information, research, poems, recipes, awards or stories about the company history. The organisation seeks to spread news and information, incorporating research and scientific data, the purpose of which to keep consumers up-to-date with reliable sources of information and marketing. S. B. Ranger provided me with a wealth of information including presentations prepared by Seagreens, a series of notes from an interview he participated in 11/2018, an overview of products and information about the business structure. I use most of the information within chapter 5, however quotes and information are sprinkled throughout the marketing chapters to support and define points that apply.

Throughout this thesis there are also many references to online materials. This 'online approach' is, to put it simply, a way to gather information related to any kind of buzz or hype in recent years, identifying news articles, click-bait pieces, search trends and other links.

⁹ From the poem 'the bridge' (Longfellow, 1848) pp. 68 A quote from the famous Irish playwright John B. Keane

2.2. The Development of Research Questions

Asia still champions the market and development of seaweed for human consumption. Seaweed is consumed daily and is very much a prominent and integrated part of East Asia culture and farming, especially within Japan, South Korea and the BIMP-EAGA region (Hurtado *et al.*, 2014).

So why is this? A short while ago the relationship was reversed, the British Isles was a major contender when it came to seaweed for consumption and use. This is also why the British Isles have been chosen as a study region. In fact, the Japanese nori industry and the flourishing of commercial seaweed itself has a British woman to thank. Donned the ‘Mother of the Sea’, Dr Kathleen Drew-Baker did, whilst studying *Porphyra umbilicalis* in Wales, discover the complex lifecycle and fertilisation process of red alga and published a paper in 1949 (Drew, 1949; Harris, Matsuda and Sattelle, 2013; Evankow, 2017). This was a revolutionary discovery; she found that red alga exhibited different physical properties in infancy than in adulthood (Golubic, Perkins and Lukas, 1975). The key connection being between the species *Porphyra* and *Conchocelis*, once thought of as 2 separate species, but actually the same species, merely in different states of metamorphosis (Drew, 1949). This knowledge changed the nori game in Japan forever. Cultivators exploited the discovery and began to effectively mass-produce nori. Prior to this discovery, Japanese nori was subject to environmental conditions and natural fluctuations in atmospheric conditions and, on occasion, there was no nori harvested at all. Before the 1950s, aquaculture farmers in Japan only harvested what they found. They could not plant, they could not monocrop and they could not harvest large amounts. As a result, seaweed was a rare and nationally famed delicacy.

In 600 BC, Sze Teu wrote, “Some algae are a delicacy fit for the most honoured guests, even for the King himself” (Arasaki and Arasaki, 1983). What was once naturally farmed in Japan could now be cultivated *en masse* and sold commercially. The humble Welsh laver was thus the key to the success of the Japanese sushi industry (O’connor, 2009). The Japanese consume seaweed daily, by choice, but in the British Isles, most individuals encounter some form of seaweed every day without even being aware of it - be it toothpaste, milk, custard. This brings me to key question number 1: *What was the history of seaweed in the British Isles?* Which also relates to question number 2: *how does this historical relationship compare to how it is today?*

The exchange of information between Wales and Japan shows how important the globalisation of information proved to be for the world. Where one seaweed model has historically blossomed, another has faded. The industrial revolution moved the West and the East to two opposing sides. In the 21st Century, the divergent relationships are once again moving the far-reaching corners of the world back together again. The world is changing and as information moves freely, so does the perception of change in the world. Cosmopolitanism has since become a widely practiced part of today’s society. This leads me to question 3: *how can marketing theory be applied to the British Isles seaweed industry considering the global perception of seaweed in the past and in the present day?* Combining the idea of a globalised consumer culture, and the specific cultural identity of seaweed based on the information from the case study, I present a market and consumer analysis for the seaweed market in the British Isles.

Seaweed in the British Isles was once regarded as a low-class vegetable, to be used possibly in a soup or a stew. It held little appeal as more than a form of potash. Now seaweed companies are attempting to re-brand seaweed as a superfood. The seaweed industry in the British Isles faces the challenge of reinvigorating a market with exciting new ideas while simultaneously overcoming the current challenges in public perception and legislation. These significant barriers include environmental concerns, effective labelling and sustainable practices.

However, in these problems also lie opportunities, for example: the idea of the ‘blue economy’ and ‘IMTA aquaculture modelling’ as I will explain further in the coming chapters. So, the final question to be explored is: *What major challenges does the British seaweed industry face?* By identifying these challenges, we may also be able to uncover further problems, solutions or opportunities.

Seaweed's Historical Identity

Who knows what virtues we may yet discover in the drapery of the deep? ... Iodine, it would appear, contributes in some way to the health of marine plants, for they all have the power of extracting it from the waters of the deep. Or is this power given them for the good of living creatures, and especially of man, who often derived benefit from it in the use of Sea-weeds, though he knew not of its existence?¹⁰

The quote above by Landsborough (1851) depicts the gratitude at having seaweed in our depths, both for nature and for humanity. For many hundreds of years, algae played a significant role in the way we humans interacted with the environment, in fact, algae can be linked to our very existence, our life, the reason we breath, the atmosphere we need to survive. Algae's unique ability to live and thrive in extreme environments is heavily responsible for the 'conditioning' of our planet from the inhabitable to the habitable (Sahoo and Seckbach, 2015). Even though algae has been around for almost three billion years, the structure and short life of algae in water makes it hard to find fossils to trace (Chapman and Chapman, 1980). Despite this, the earliest known macroalgae fossil, a red algae from the family *Bangiaceae*, dates back 425 million years and is located in Poland (Campbell, 1980). Resilience and slow temporal evolution appear to be algae's greatest assets. Seaweed has a complex nutritional make-up, useful to know for algae entrepreneurs, as the quote from *Seagreens.com* (2019) shows:

From the primordial ocean to the vegetation and animals which remain our food today, the continuous line of our nutritional composition can be traced back beyond the earliest organisms to the very chemistry of life itself, which is also the chemistry of the human body.

Historically, the British Isles had all manner of uses for kelp around the time of economic dependency on the industry. The alkali that came from the burned seaweed (known as *potash, soda-ash or kelp*) proved useful for glass and soap makers and it proved particularly useful for 'salting out soap' a method of forming glycerol (Coley, 2000). In the British Isles a product called 'Barilla'¹¹ was imported from Spain for the soap and glass industry until the late 1700s when embargos and wars hampered imports (Coley, 2000). Another interesting way the British Isles was connected to seaweed was during WWI, when Britain found themselves in dire need of alkalis for their gunpowder after German embargos¹². This meant that potash was a much desired and hard to access product, in its place stood seaweed, harvested and transported from the seaweed farms on the coast of California (Neushul, 1989).

¹⁰ Quote from (Landsborough, 1851, pp.62)

¹¹ the Spanish version of soda ash and a source of sodium carbonate

¹² The *Kali Syndikat* had a monopoly on the global potash industry based from their Strassfurt mines (Cameron, 1912)

3.1. Wales

Near St Davids, especially at Eglwys Abernon, and in many other places along the Pembrokeshire Coast, the peasantry gather in the Spring time a kind of Alga or seaweed, where they made a sort of food called lhavan or llawvan, in English, black butter. The seaweed is washed clean from the sand, and sweated between two tile stones. The weed is then shred small and well-kneaded, as they do dough for bread, and made up into great balls or rolls, which some eat raw, and others fry with oatmeal and butter.¹³

Try to imagine a pot of stewed seaweed, boiling for hours, perhaps five to six hours, until it becomes thick. This dark green sludge is then mixed with a squeeze of lemon juice, a nob of butter and rolled oats. The paste is then fried and served to you – possibly with some meat, eggs or beans. This PDO (Protected Designation of Origin) food is Welsh laverbread. It is as prestigious to the Welsh as Champagne is to the French, or Parmigiano Reggiano is to the Italians. Laverbread is an indication of culture, a local speciality passed down through history, tied irreplaceably to social identity, a distinctive acknowledgement of the ethnic origins of Wales (Chapman and Chapman, 1980; O’connor, 2009). It defines South Wales in a way that no other food can do. However, ‘prestigious’ in this sense does not mean ‘high-class’ or ‘influential’, in fact quite the opposite. Laverbread has connotations with hard times, with failures in agriculture and desperation. The following quote is from Ms. Beeton's cookbook (1907, p.1326) describing the Welsh laver-weed “The laver-weed, a variety of seaweed found principally on the South Wales coast, is collected at low tide, well washed in seawater, and afterwards boiled in slightly salted water”. During the 18th Century, miners would consume laverbread regularly, appreciating its various applications and food combinations. The Welsh history of seaweed is proudly displayed on the website for The Pembrokeshire Beachfood Co. (*Beachfood.com*, 2019):

During the mining era in the eighteenth century, "lawr" became a staple food of the pit workers as part of breakfast. In 1865 George Borrow on his travels wrote of "moor mutton with piping hot laver sauce", a great dish of the time. Swansea became the laverbread mecca ... cockles and laverbread became the icons of Welsh food

While the rest of the British Isles reduced their seaweed use throughout the industrial revolution, in Wales it died once the industrial revolution was over. Because mining communities relied so much on the dish, it died out with the reduction of mining and the availability of processed foods. (*Beachfood.com*, 2019) “the demand of laverbread declined so much so that in the 1970s the BBC Radio 4 Food and Farming program saw it as a food about to be assigned to the history books”. Luckily it was not dismissed to the history books, and the Welsh community held on to their cultural heritage.

While kelp burning still occurred in Wales, it did not occur in the same manner and on the same scale as Ireland or Scotland. Seaweed was, as in the rest of the British Isles, still a perfect fertiliser. In his book on *manures and manuring* Garner (1931, pp.32) details the use and benefits of seaweed as a fertiliser:

It is, however, on such gross-feeding crops as mangolds and the cabbage tribe that seaweed would be expected to show its fullest effects... Alternate layers of “ long “ dung and of seaweed, built up into a manure heap, will rot down quickly into a mass of excellent manure... Fresh seaweed cannot economically

¹³ Quote from Britannia (Camden, 1722, p.765)

be used as a manure at any great distance from the coast, as the expense of carriage of so bulky a product would make the cost prohibitive. For it to be used at all on inland farms it would have to be either dried and ground, or converted into kelp.

Wales contained (and still contains) many stone and pebble beaches. The kelp burning would likely have been affected by these stony shores, as mentioned in Davies *et al.*, (1906, pp.18) an economic account of Wales based on letters and correspondences:

Our kelp in North Wales is good, strong kelp, but pretty full of stones, occasion'd by their burning on stone hearths. It stands here in about twenty-five shillings per ton, delivered on board at the sudry creeks where it is burnt, which are many, and where a large vessel can't come, so there would be an additional charge in bringing it together.

We know then, that seaweed was often used as a fertiliser and one could differentiate between its effect on a variety of crops. Although seaweed also had interesting applications as detailed in *A Handbook for travellers in Northern Wales* (Murray, 1874, pp. 69):

A curious trade is kept up here, that of manufacturing mats, nets, and ropes from the seaweed grass (*Amophila arenaria*), the produce being taken to Caernarvon market.

3.2. Ireland

Buain duilisg

**Seal ag buain duilisg do charraig
seal ag aclaidh
seal ag tabhairt bhídh do bhocsaibh
seal i gcaracair.**

**A while gathering dillisk from the rock
a while fishing
a while giving food to the poor
a while in my cell.¹⁴**

Above is a poem about collecting dulse by St Columbus' Monks from the 12th Century, in Ireland, 'dulsing' (the hand picking of Irish dulse) goes back as far as 1400 years ago (Indergaard and Minsaas, 1991). 'Dulse' (*Palmaria palmata*), reportedly originates from the Irish word 'dils' meaning edible seaweed, it has a long relationship with Ireland, involving manure, kelp burning and fabric bleaching spanning centuries (Naylor, 1976; Pereira, 2011). According to Rhatigan (2009), seaweed was likely a part of the Irish diet as early as five thousand years ago, but, the first written records of seaweed for human consumption only dates from around the 5th Century. Seaweed during this time was used as a condiment with bread, butter and milk (Mouritsen *et al.*, 2013). The Irish code of conduct *Crith Gablach*, from the 6th – 8th Century, suggested that seaweed was an appropriate offering for travellers who crossed one's path and were invited into one's home (Field, 2006; O'Connor, 2017). Approximately 600 years ago, seaweed began to make regular appearances in recipes and was documented as

¹⁴ A poem from 12th Century describing the collection of dulse by St Columbus' Monks (Indergaard and Minsaas, 1991) also quoted on Seagreens website

animal feed, medicine and fertilizer (Wu, 1990). Historical renditions of Ireland and Scotland describe the eating of sea plants such as *P. palmata* (Dulse), in salads, or dried and chewed like tobacco (Turner, 1809).

Algae was used regularly in times of starvation and anxiety as a desperate means to combat malnourishment (Beveridge and Little, 2002). During the long winter of 1847, kelp was used as a dietary replacement for many families along the west coast (Gifford, 1853; Downey and Stuijts, 1960; Lucas, 1960). However, kelp was used for many purposes other than food and was a significant source of economic growth, especially during the 19th century. Manufacturing began in Ireland no earlier than the 17th century and spanned up until the 20th century, it was first produced for the making of soda and then later for iodine (Forsythe, 2006). In 1809, Ireland was exporting upwards of 5400 tons of potash a year (Shetterly, 2018). To make the potash that proved to be such a fruitful source of kelp, locals would gather it and burn it within the kelp kilns:

[...] by making pits, lined and surrounded with stones, in the earth, lighting some fewel therein, and putting on ... some green or fresh weeds or wreck, till the pit is filled with the calcined plants ; then the calcined mass is raked with iron rods ... this is soda or kelp¹⁵

Kelp kilns can still be found on beaches on the outlying islands of Ireland, there is also evidence the locals used drying walls and storehouses to burn or dry their seaweed (Forsythe, 2006). The island communities lacked the agricultural means to depend on farming to survive, so seaweed farming and kelp burning often replaced this practice, either for sustenance or economic wealth (Forsythe, 2006). Although usually the practice became so successful that it replaced and ruined the agriculture within the island communities. Economically speaking, the income from kelp was appealing to the often-impooverished island dwellers. Kelp was also found to make a good alkali used for bleaching linen in Ireland, using kelpchar as a purifying agent (Turrentine and Tanner, 1922; Griffin, 2001). In early accounts of kelp exchanges in Ireland c. 1784, a ton of kelp would be sold and exported to the linen bleachers of Rathlin for £5.5s per ton (Forsythe, 2006). The estimated rate of production at this time was approximately 11/2 tons of kelp in a 3 month season for 1 man (Clow and Clow, 2006; Forsythe, 2006).

Kelp was so lucrative that in Dublin, 1758, an act was passed to “prevent frauds in lappers and others; and to prevent abuses in the manufacture of kelp; and to prevent unlawful combinations in weavers and others” (Fraud Prevention Act, 1758). The seaweed fertilizer was so popular among the Irish for their potato farming that it was often carted long distances from the shorelines (Jenkins, 1917). In the Mayo Hills of Ireland, where poor quality ground was common, a ‘lazy bed’ farming technique was often used (Shetterly, 2018). Far from lazy, the technique involved digging drain-like chasms along the hills. Inside the trenches, seaweed linings would keep the moisture in and around the agricultural yield to benefit it. What we now know is that seaweed also contains high levels of Potassium, Nitrogen and Phosphorous, thus this practice also provided much-needed nutrients to the soils (Abdel-Raouf, 2012; Bjerregaard *et al.*, 2016; Pereira, 2016). The lazy bed farming methods stopped when chemical alternatives became widely available, replacing the naturally occurring Phosphorous and Nitrogen in seaweed with extracts from salt mines.

Carrageenan, however, was not replaced and is one of the only uses of algae that has increased since the industrial revolution. *Irish moss* is also known as *Carrageenan moss*, it was used as far back as 400 A.D. in Ireland, sometimes boiled into soups to thicken the broth (Hurtado, Critchley and Neish, 2017). The extract that later came from Irish moss was named carrageenan

¹⁵ Quote from (Lucas, 1763, pp.8)

after the area of Ireland from which it originated. It was patented around the 1820, but did not become commercially available until the 1930s (Mitchell and Guiry, 1983). Ironically, Ireland is no longer the world's lead supplier of carrageenan as it once was. Before WWII, France and Ireland shared the title of leading global suppliers of Irish moss, however the effects of the war meant that Canada had an opportunity to overtake and become the world's current market leader (Sahoo and Seckbach, 2015).

3.3. Scotland

This useful material does not appear to have been known as a manufacture in Britain, until some time after the beginning of the present century, owing to the backward state of the soap and glass manufacturers... that its first introduction was about the year 1730, into the island of Uist, by a highland gentleman, of the name M'Leod, who brought the art from Ireland, where it had been carried on many years before¹⁶

One of the earliest written accounts of 'kelp-making' and the use of kelp to make glass, comes from Edinburgh c. 1662. Soon after this date, the kelp industry boomed in the region and led to kelp trading opportunities between Scotland and Norway (Clow and Clow, 2006). Seaweed at the time was burned and used for soda-ash in the production of: soap, glass, animal feed and fertiliser (Evans and Critchley, 2014). The quote above by Jameson (1800) hints at the origin of kelp in the Scottish Isles as stemming from Ireland, which also matches with other accounts around that time (Sinclair, 1791; Jameson, 1800). Ireland allegedly outdates Scotland in its practical application of kelp, as most of the basic manufacturing techniques and applications originated from Ireland (Jameson, 1800; Sahoo and Seckbach, 2015; Bjerregaard *et al.*, 2016). The first signs of algae being used *commercially* in Scotland was around 1720, mostly in the Hebrides and outlying islands (Chapman and Chapman, 1980). Before the harvesting and burning of seaweed in Scotland flourished, some apprehension surrounded the practice. In 1694, the Anstruther Council of Fife received an offer of £4 from an Englishman to cut and burn seaweed to make kelp. The offer was contested at the time by a baily, but the concern for inhabitants health and wellbeing was overruled and the offer was accepted (Clow and Clow, 2006). Laws surrounding kelp were put in place in the 18th century, including accounts of disputes that had to be settled in town halls. In a petition from 1761, a dispute between a seaweed-collector and his deceased landlord details the hardship caused by the untimely death:

as it lies along the hard and rocky coast, the petitioner was in use to gather and burn the sea-ware to kelp; and when manufactured, and not fold at home, he intended to export to Ireland or different parts of England... the petitioner was interrupted in the making of his kelp¹⁷

Where there were booms and rushes to turn kelp into money, the agriculture quickly depleted as soil was not well taken care of. The fisheries were not looked after and when business dried up all that remained were starving people, with over-inflated rent thanks to the lucrative industry on the Orkney, Shetland and Hebridean islands (Clow and Clow, 2006). In 1806 Patrick Neill offered his analysis of the situation, predicting what would happen if kelp industry were to be replaced:

¹⁶ The Mineralogy of the Scottish Isles (Jameson, 1800, pp. 242-243)

¹⁷ From a details book of crown rights and proprietors: *Unto the Right Honourable the Lords of Council and Session, the petition of Donald Macneil of Ardmensish* (Macneil, 1761, pp. 2)

Less grain is raised now than thirty years ago. Should a cheap process for extracting the soda from sea-water happen to be discovered, or should the market for kelp, on any other account, unexpectedly fail, the landholders of Orkney will find, when too late, the great imprudence of thus neglecting the cultivation and improvement of their lands. Kelp making also occasions the almost total neglect of the fisheries... between 2000 and 3000 of tons of kelp are manufactured in Orkney.¹⁸

The industrial revolution affected the Scottish Islands kelp industry more than anything else. From the years 1770 – 1810, in the northern reaches of Scotland and highland areas, the price taken for kelp tripled, and it was a valuable and much desired resource (Gray, 1957; Richards, 1973). However, much in the same way that the kelp industry impacted Irish island agriculture, so too did it affect the Scottish Isles. Can one imagine that at one point in time kelp was feared to be the ruin of the Orkney islands? Some written accounts of Scottish seaweed below either predict the impending downfall of an over-used kelp industry or focus on the dependence of kelp manufacture to the community. Rev. Dr John Walker in his *Report on the Hebrides* 1764-1771 stated that: “Besides the making of kelp, there is scarce anything in Sky, that can be called manufacture.” (McKay, 1980, pp.211).

From 1791-1799 John Sinclair kept a series of correspondences which he titled ‘statistical accounts’. Throughout the 22 volumes, he breaks down the economic, socio-economic and agricultural insights from the parishes he oversees within Scotland. In every single volume kelp, or sea-weed, is mentioned at least once, more often multiple times. The communications offer details of common varieties of sea-weeds, their uses, applications, economic and social impacts. One example from volume 7 (1791, pp. 454-455):

It is about 70 years since kelp was first made [on Sanday island]... it was thought formerly that only the tang which grows on the rocks could be made into kelp ; but within 20 years it is found, that sea plants of whatever kind can be made into kelp, and of equal quality, as well as more abundant quality

In the year 1826, a total of 3500 tons of kelp were manufactured. But the economic success was tinged with worry – this was the largest quantity of kelp ever produced on the islands, and it threatened the well-being of the population. The following is a quote from Anderson and Anderson (1834, pp. 636) where a local proprietor discusses his concerns:

[...] alas for the staple of Orkney! ... All the principal proprietors in Orkney have felt the depreciation in the price of kelp severely ... the weeds on the surrounding rocks were much more valuable to them than all the produce of their lands.

Around 100,000 Scottish people at the start of the 1800s were employed in some relation to kelp (Butler, 1931; Kenicer, Bridgewater and Milliken, 2000). But by 1845, the British kelp soda industry was almost dead (Chapman and Chapman, 1980). Although the locals did hold enough knowledge to know how to cut sustainably. Along the Orkneys, seaweed was cut every third year and dried along the beaches to serve as kelp. Kelp kilns¹⁹ were dug in the sand, sometimes oblong, often in a u-bend, with wooden planks stuck into the ground lining the fire, into the fire kindled peat and seaweed would be added creating massive plumes of smoke of a strong brackish smell (Anderson and Anderson, 1834; Chambers, 2000). The Scottish coastlines were, no doubt, a difficult place to live during this time. Instances of similar problematic kelp burning was not uncommon in history. In Norway kelp burning was linked to

¹⁸ Quote from (Neill, 1806, pp.32)

¹⁹ At the time of first discovery the sites were mistakenly identified as burial sites

the 1804 famine in Nordmøre, mainly because the clouds of smoke were so dense that agriculture suffered as a result (Delaney, Frangoudes and Ii, 2016). Burning for kelp in Scotland was a job for the peasantry in their months off field labour, the seaweed could be harvested from November and burned in March (Anderson and Anderson, 1834). The extent to which kelp burning occurred also led to high levels of arsenic poisoning in the soil from the heavy metals present within seaweed (Riekie *et al.*, 2006). Nevertheless, seaweed was used for food and medicine in Scotland for humans and animals alike. There are renditions of seaweed being chewed on like tobacco, badderlocks being sold as a Highstreet snack and residents in the Isle of Skye using seaweed to treat fevers or help them purge (Turner, 1809; Cameron, 1912). In fact, traditional medicinal applications of seaweed in Scotland are extensive. It was thought to treat rheumatism, arthritis, reduce swelling, function as an adhesive, an antibiotic, an anti-inflammatory, a diuretic and was useful for keeping wounds and the cervix open during surgery (Kenicer, Bridgewater and Milliken, 2000; Turner and Clifton, 2006; Buschmann *et al.*, 2017). Seaweed is now known to contain many elements to support these historic claims. One element of course being the high iodine content found in seaweed. The quote below by Landsborough (1851, pp. 62) depicts a gratefulness for the iodine found in seaweed, but criticises the time it took to discover such a ‘blessing’.

And has its existence and the way of extracting it been discovered so late in the day as 181, to make us grateful for blessings unconsciously received, and to stir us up to more diligent research into God’s works of nature, by the rich remuneration so unexpectedly bestowed?²⁰

We have also more recently found that many seaweeds contain more vitamin C per 100g than oranges (Turner and Clifton, 2006; Sahoo and Seckbach, 2015). On the northern most island of Orkney, the ‘North Ronaldsay Sheep’ is famous for surviving almost solely on the seaweed that line the shorelines of the island. Comparisons between the health of these sheep and other non-adapted sheep showed no notable differences, supporting the use of seaweed as animal fodder (Hansen, Hector and Feldmann, 2003). In fact, it has been reported that seaweed can sometimes improve sheep fertility, although some species of algae can cause digestive problems (Naylor, 1976). When left to decide for themselves, animals are often drawn to different species of seaweed. For example, sheep and goats are often drawn to *P. palamata*, whereas pigs tend to prefer *F. vesiculosus* according to analysis on the island of Gotland (Makkar *et al.*, 2016).

3.4. Seaweed in England

Cornwall and Devon. - Seaweed is diligently collected in the west country in varying quantities. In the market gardening regions of south Cornwall it is usually mixed with calcareous sand as of old and allowed to rot. It is then applied along with guano and superphosphate for early potatoes and cauliflowers.²¹

A survey conducted along the coast after World War II, found that over 2,000,000 tons of seaweed resided in British waters, mostly in Scotland though, where it grew abundantly (Chapman, 1948). In England specifically, the plants tended to group around Cornwall and Devon, in the south of England, where it could be used for many of the same uses as in Ireland and Scotland, although in England it was mostly prized as a manure (Jenkins, 1917). The above

²⁰ Quote from Landsborough (1851, pp. 62)

²¹ Quote from Leaflet 254 from the Board of Agriculture and Fisheries (1919)

is from a report from leaflet 254 of the Board of Agriculture and Fisheries (1919) describing the state of seaweed collection and utilisation along the Coast England of Southern England. There are reports of Britons using the manure from seaweed to fertilise their land. Seaweed proved to be equal, if not superior, to the manure of animals. In Thanet, a region of England near the coast, it was reported that between 10 and 15 tons of seaweed was applied to each hectare of land where fertiliser was needed (Jenkins, 1917). Farmers also used the seaweed as an animal fodder, calling the algae ‘cow-weed’ in reflection of its uses (Mouritsen *et al.*, 2013). Soap makers in England also used seaweed, they adopted the method of utilising the soda extracted from kelp (Clow and Clow, 2006). It proved to be useful and prosperous, for a time.

In England, seaweed use was never depended upon as much as the rest of the British Isles. There were plenty of species that were abundant in England, ones which couldn’t be found anywhere else, it appears that the English were just not as keen to utilise it (Landsborough, 1851). We know that seaweed was exported from Scotland to England, as records show the prices paid at Leith, Newcastle for quantities of seaweed (Neill, 1806). Based on the geography of the country, the extensive coastlines and the availability of seaweed, we can assume it was at least present in the English diet in the years before the industrial revolution. In the literature throughout this thesis we see that many English travellers noted the extensive swathes of seaweed swaying in the oceans.

Mrs. Beeton’s *Guide to Household Management*, originally published in four parts from 1859 to 1861, is lauded as the staple guide for middle-class housewives, from the mid-19th century onwards in England and Great Britain. This ‘guide to hospitality’ is a comprehensive guide on how to behave, present oneself, organise one’s home and cook for dinners and parties. Seaweed is mentioned within the book a couple of times, offering information, nutrition and recipes (Beeton, 1907):

Seaweeds are occasionally employed as food in England. Irish moss or carra geen, is given in the form of soups and jellies to consumptive patients, and is also used commonly as a food in some places. In 100 lbs. of the moss there are only 19 lbs. of water and 9 lbs. of albuminoids, so that it is among the most nourishing vegetable foods we have. Laver, tangle, or red ware, and pulse, are also collected and eaten in pickle, or as a substitute for other boiled vegetables.²²

There is further evidence linking seaweed to Victorian diets, especially along the coastline where such weeds were abundant (Broomfield, 2007).

3.5. Seaweed in the Isle of Jersey

Though regular vraicking is permitted only at stated times, yet, as in tempestuous weather large quantities are torn from the rocks, and drifted on shore, the farmers are at all times on the watch ; so that, even in the midst of winter, whole families, comprising men women and children, of both sexes, are seen raking together the highly prized boon of Neptune, and sometimes breast high in the water; vraicking, like a Catholic holiday, suspending all other secular employments.²³

²² Quote from (Beeton, 1907, p.810)

²³ An extract from ‘An Account of the Isle of Jersey’ pp. 43-44 (Plees, 1817)

The quote above offers some insight into the significance of seaweed collections and the relationship with the coastlines in Jersey, just by looking at the quote, one can see how integrated seaweed farming was for the locals of Jersey just 200 years ago. A part of the British Isles, the Isle of Jersey lies within the English Channel. Originally, I had not intended to cover this island in my analysis, however in Chapter 5.1. ‘The Case for Seaweed’ we will find that of all countries using Google, Jersey had the highest search rates for ‘seaweed’, almost double that of the next searched country. I had to find out why and came to a few possible conclusions for this.

Jersey is a prime spot for seaweed harvesting, although it is still illegal to harvest fresh seaweed, beach cast seaweed is free, and it arrives in abundance. More recently, tractors from the Fish and Agricultural Department of Jersey have begun to roam the shorelines again, collecting dead seaweed from the beaches to spread as fertiliser on local farms. Historically, the gathering of beach cast seaweed in Jersey is well documented (see quote at the top of the section). The use of seaweed as a maintenance tool for agriculture goes back to the 12th Century, and was of such importance that many Jersey laws were created to govern the farming and division of *vraic*²⁴ among the locals, much like in Scotland (Blench, 1966).

In recent years, the high levels of pollution flowing into the ocean combined with a lack of seaweed harvesting for agricultural use have reportedly contributed to an ‘annual scourge of sea lettuce’ (sosjersey.co.uk, 2017). One of the main attractions on Jersey Island is the coastline and the many beaches accessible to tourists. Locals have complained that the green shorelines turn tourists away, attracts flies, omits a terrible smell and is expensive to solve. Current proposed solutions, involving large and expensive machinery, can cost up to £500,000 (itv.com, 2016). The absence left from a seemingly unimportant practice can often lead to negative unwanted effects. One of Jersey’s most prestigious exports is the ‘Jersey Royal Potato’²⁵, a product which has purportedly lost some of its unique taste and appeal, which some chalk up to the absence of seaweed as a natural fertiliser (ExaminerLive.co.uk, 2014). When the horse-and-cart technique died out, some 50 years ago, seaweed collectors stopped coming to the shoreline and, while seaweed is still used by some farmers, it is expensive to collect and not widely distributed anymore (news.bbc.co.uk, 2010). Allegedly, the taste of a potato fertilised and grown in seaweed is almost unmatched, so the unique flavour of the ‘Jersey Royal Potato’ is then in question (Shetterly, 2018).

²⁴ *Vraic* the same as *wrack*, what seaweed was commonly referred to as, during this period in time

²⁵ Another British product with a European Protected Designation of Origin

The Industrial Revolution

There is a history of use for human nutrition in the Nordic region and in the British Isles which began in pre-history, continued in coastal areas as a food tradition until the late industrial revolution, when it became obscured by the introduction of mass produced and manufactured foods and urban cultures²⁶

The quote above is from S.B. Ranger (11/2018), it acknowledges the progression of use of seaweed from pre-history right up until the industrial revolution and then to the obscuration of seaweed in the common household. In this chapter I will ascertain the extent to which the industrial revolution had an effect on seaweed's journey within the British Isles.

4.1. The Introduction of the Industrial Revolution

Let's say we just landed in 1750s Britain. Scottish land-owners have just begun evicting tenants to clear the way for more profitable ventures, such as sheep farming; slavery is in full bloom, the 'Gin Act' has just passed, restricting the sale of gin to licensed locations and the industrial revolution is about to begin. The focus currently is to increase the amount of fossil fuels available to us. So, we want to mine more, mine faster and mine better. The more we mine, the more we have to burn, to explore inventions, to cook our food and utilise. For if we mine, we win. Everyone in the world is mining, but we have an advantage, our coal sits fairly close to the surface of the ground, so for us mining is substantially easier than in other countries. Except, it was not as easy as it appears. There were often dangerous circumstances for miners, worst of which were the floods.

In order to fix this problem, many men came forward to refine an idea. Thomas Savery was the first to invent a steam powered pump to solve the problem in 1698. Then, Thomas Newcomen, with the first commercially successful steam powered piston pump had the ability to remove water from inside a mine (Nuvolari, 2004). This was achieved by burning coal to create steam within a cylinder and using the pressure to suction water up from inside the mine. Turns out, it wasn't very practical or efficient. So, James Watt and John Smeaton entered the picture, Smeaton attempting to improve upon the Newcomen design and Watt who designed a pump that was able to conserve energy by storing used steam for other uses (Nuvolari, 2004). Watt then attached the pump to a wheel, this to also utilise kinetic energy. Soon after, Watt partnered with Matthew Boulton and founded Boulton and Watt, a business manufacturing the steam engine. Later named 'James Watt & Co.', the steam engine was patented in 1775 and manufactured internally from 1795.

²⁶ A quote from S.B. Ranger of *Seagreens*

4.1.2. The Effect on Seaweed

It is calculated that, in the Orkney Islands alone, 20,000 persons now depend on the manufacture of kelp for their subsistence. The introduction of this branch of industry, has likewise prevented the ruinous effects which must otherwise have resulted from the failure of the corn crops, during six or seven years of scarcity, with which the Orkneys were afflicted.²⁷

So, the steam engine is changing the game across Britain, triggering faster mining, better production of fossil fuels and greater opportunities. What then does that have to do with seaweed? All kinds of materials contributed to the success of the industrial revolution, but seaweed especially shot up in value. While the invention of the steam engine meant that the price of coal steadily dropped, in Scotland, the price of kelp rose tenfold between 1750-1810 (O'Brien and Quinault, 1993).

The Orkney islands, in Scotland, had a heavy reliance on kelp manufacture in the first half of the 19th Century as outlined in the earlier sections of local identity. There is a clear picture of the different overlapping timelines of seaweed use throughout history (see Fig.2 on the next page). Potash, Potassium Chloride and KCl were all used to make soap, glass, chemical fertiliser, animal feed and biomass. Germany held a monopoly on the potash industry back before the signing of the Versailles Treaty in 1919 (Aftalion, 1991). The 'kali syndikat' (as they were known) operated until the end of the second world war, using their monopoly to regulate prices and oppose price depression (Cameron, 1913). Eventually, with Chilean salt alternatives for soda, potash and iodine around 1873, the German potash cartel wavered and died, as did the Glaswegian lead on the iodine industry (Miller, 1865; Butler, 1931). The quote below by Miller (1865, pp.282) recounts the impacts of a kelp industry that flourished, but then died out: "Both the people and landlords experienced in the kelp districts the evils which a ruined commerce always leaves behind it".

The large-scale industrialisation of seaweed as something other than a food or burned kelp began around 1945, as a source for pharmaceutical development. The development paved the way for the widescale production of the hydrocolloids: alginate, agar-agar and carrageenan; around the same time Japanese companies invested in alginate extraction in Portugal (Philpott and Bradford, 2006; Armisen and Gaiatas, 2009; Houghton *et al.*, 2015; Valderrama *et al.*, 2015; Delaney, Frangoudes and Ii, 2016). Useful for a wide range of industrial applications, the creation of alginates was the basis for pharmaceutical ingenuity and production in the 20th and 21st Century (McLachlan, 1985; Coley, 2000; Hafting *et al.*, 2015). Thanks to research and development, in 1980, Portugal was the world's leading supplier of alginate, but Europe never supplied sufficient seaweed to meet demand, nowadays Chile leads the market and supplies around 10% of the global supply (Rebours *et al.*, 2014).

²⁷ Quote from Sinclair *Analysis of the Statistical Account* (1831, pp.344).

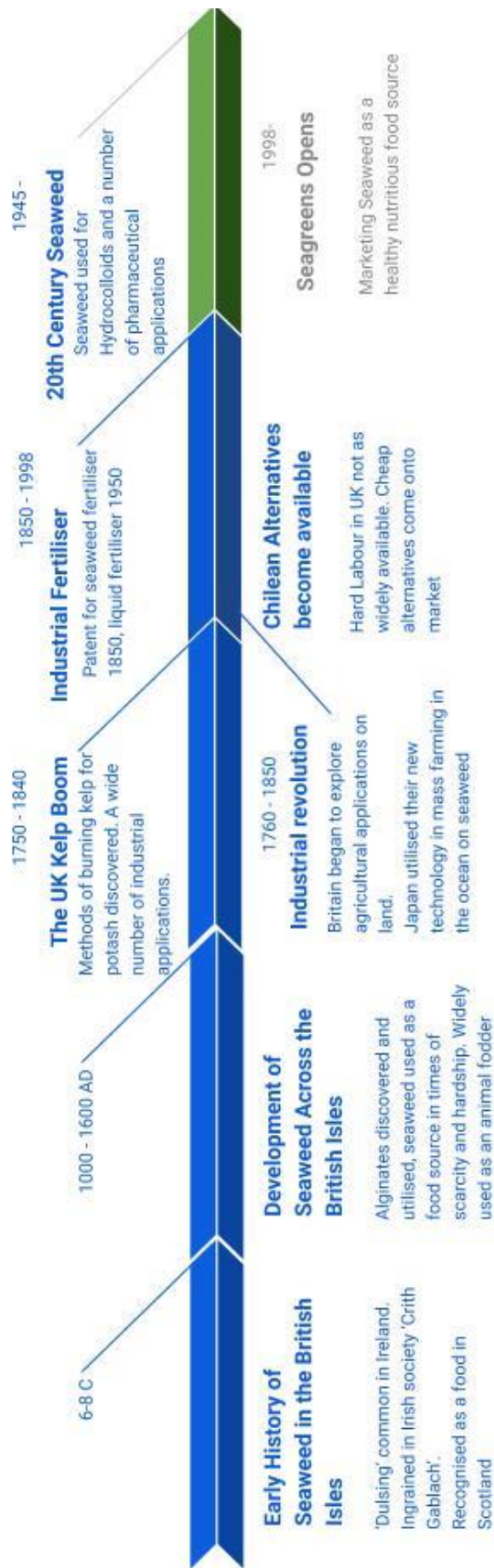


Fig.2. A timeline of the history of seaweed in the British Isles

During the industrial revolution, the availability of chemical nutrients increased dramatically, over five decades Nitrogen consumption increased 20-fold and Phosphorous increased 4-fold (Arzel, 1984). When the increased use of chemical fertilisers began, sewage and agricultural run-off flooded the waters and, in the process, over-nutrication (this is what leads to ‘red-tides’ and other algal phenomena that can wipe out whole areas of biodiversity) (Holdgate, 1995; Cordell, Drangert and White, 2009; Hayashi *et al.*, 2010; Abdel-Raouf, 2012; Makkar *et al.*, 2016). Seaweed acts as a nutritional sea sponge and the levels of absorption have increased dramatically since the industrial revolution. Seaweed is effective in sequestering this run-off and combating the effects of eutrophication which can be devastating (Steneck *et al.*, 2002; Syers, Johnston and Curtin, 2008; Bjerregaard *et al.*, 2016). Now, terms like ‘phosphorous crisis’ find themselves in academic papers (Syers, Johnston and Curtin, 2008; Cordell, Drangert and White, 2009; Abdel-Raouf, Al-Homaidan and Ibraheem, 2012; Linderholm, Mattsson and Tillman, 2012; Markou, Chatzipavlidis and Georgakakis, 2012; Chen and Graedel, 2016; Chowdhury *et al.*, 2017). It is among the great problems of the 21st century.

Overall, the industrial revolution led to better farming practices, importing and exporting like never before, a lessened reliance on locally sourced items if outsourced products were cheaper and a movement away from heavy-duty person-heavy manufacture in developed countries. The workload around seaweed was, and still is, heavy on physical labour. This is especially true for brown seaweeds, which tend to be large, heavy and difficult to handle. The dive and hand-cut method is still the most used technique globally. However, there are suction methods which have since been utilised from Norway to Ireland to Japan (McHugh, 2003). In Japan and other parts of South-Eastern Asia, wakame or mozuku seaweeds, which are smaller lighter and easier to harvest, are often sucked from lines using powered vacuums, with little difficulty (Smetacek and Zingone, 2013; BBC Earth, 2016).

4.2. The Japanese Industrial Seaweed Model

In Japan, these seaweeds are considered highly nutritious and sought-after superfoods. So, how did the Japanese seaweed model come to thrive? The industrial revolution had a large hand in making it so. Japan was the first eastern country to follow Britain into the industrial revolution and benefit from the increased growth rates that came with it. Farming became more efficient, with more effective agricultural tools. While the British Isles looked to the land for their agriculture, Japan used their tools to more efficiently harvest seaweed. It is unclear as to when exactly structured semi-industrial seaweed cultivation started in Japan, but academics predict this is be sometime in the mid-17th century (Miura, 1975; Chapman and Chapman, 1980). Regardless, nori was still harvested by hand until the 50s and early 60s and boats were not used regularly for harvesting until the 1970s (Delaney, Frangouides and Ii, 2016). The combination of an already established cultural acceptance of seaweed, increased knowledge beyond the 1940s (from the ‘mother of seaweed’ mentioned at the beginning) and better machines for harvesting, Japan was primed for success in the harvesting and marketing of seaweed.

Seaweed became more than a food; it became a cultural identity. There is hardly a country in the world that celebrates seaweed in the way that the Japanese do. There is too much history to mention, but the relationship between seaweed and the Japanese is evident. Every year people celebrate *Seaweed Day* on the 20th April and visit a statue of Dr Kathleen Drew-Baker in Uto, Kumamoto, Japan (Lloyd Parry, 2001; Harris, Matsuda and Sattelle, 2013). During the celebration shops hand out tasters, children munch on Nori sheets, photos and other seaweed-related activities take place all over Japan. The tradition is set to mark the year 710, the first year edible seaweed was listed as one of the accepted treasured offerings to provide for the

emperor (Lloyd Parry, 2001). In fact, Tax records from the eighth century indicate that more than 30 kinds of seaweed were listed as tax payments to the Japanese government (Batten, 1993; Teas *et al.*, 2004; O'Connor, 2017).



Fig.3. Nori drying over a fire (1864), Japanese painting; Wikipedia, Public

Before the times of war, of samurais, of kamikaze soldiers, the Japanese were encouraged to foster their culture and fine art. This might be the reason why, in the Japanese language, there are approximately 445 Japanese terms to describe the texture and mouthfeel of food (Hayakawa *et al.*, 2013). By contrast, in the English language, the number of words to describe mouthfeel is only 133 (Nishinari *et al.*, 2008). Cultivating seaweed, cooking methods and a synergy with nature were all common aspects of the Japanese culture. In fact, seaweed used to be the main source of salt in Japan, saturating seaweeds with brine, then burning and evaporating the

residue (a practice named Moshio-yaki), pure salt was formed (shiojigyo.com, 2019). In addition, Researchers have implied that red nori seaweed can be more easily broken down by Japanese consumers due to enzymes in part of their gene coding (Hehemann *et al.*, 2010; Edwards, Holdt and Hynes, 2012). This genetic quality is most likely due to consumption over many generations. In Japan, not only is seaweed present in almost every meal, but it is equally encouraged by the government, nutritional advice recommends the average person to consume it regularly as part of a healthy diet (Yoshiike *et al.*, 2007). The everyday popularity of seaweed in almost every dish was an inspiration for the founder of the Seagreens company S. B. Ranger (5/3/2019):

Visiting Japan for the first time in 2007, Simon was surprised to find a small amount of seaweed in almost every traditional meal - exactly his aim for our western diet. Moreover, this amount corresponded precisely to the level which nutritional therapists in the UK, were by then already reporting they had found to be therapeutic.

This hints to the reasons why British based companies want to follow in the footsteps of Japanese industry. Not only in following the footsteps of a highly successful business model, but also in expanding and learning from opportunities to increase the health of a nation.

The Case Study

I was over a thick bed of kelp. The ends of the long strands of orange-brown seaweed reached up through the murky green water just to my feet, as if I were standing on the tops of sinuous trees in this strange underwater forest. Every now and then, the kelp tops bent in unison like long grass in an open field when a breeze passes.²⁸

Notwithstanding, seaweed has been previously considered unfit for human consumption (Sauvageau, 1920). Equally strange is that, despite its use over centuries as a source of animal fodder, seaweed had no known nutritional benefit for animals, and it was not until the 2000s when the prebiotics it contained were recognised (Evans and Critchley, 2014). It can now be considered a ‘functional food’ a food with optimal nutritional values, a high level of ‘wellness’, this can also be classified as a ‘superfood’ (Mendis and Kim, 2011). The British Isles are showing a renewed interest in seaweeds that were once a traditional part of the culture, nowadays, we find seaweed making its way back into the marketplace. Seaweed cookbooks have already found themselves on the market in many countries around the world, all incorporating recipes using sea vegetables. With the current trend for consumers to embrace organically grown foods and ‘natural’ foods from clean environments, seaweeds should receive an increasing acceptance (Amirtharaj, Ahilan and Oli, 2017).

5.1. The Case for Seaweed

Talking with Simon Ranger from Seagreens (15/3/2019), a question was put forth to me: “why on earth you came to choose this for your thesis?!!!”. It is, on the outside, not an entirely obvious choice. I hope the previous chapters and quotes like the one above already offered some insights into the motivation behind this study, not to mention my extensive interest in the subject. Based on the sheer amount of research into seaweed, from chemical to biological, economic, social, historical - I am not alone in my interest. The seaweed research wave has been steadily rising in the last 20 years. Seaweed is trending. Fig.4. and Fig.5. show the number of seaweed references over the last 100 years. The graphs show that research containing ‘seaweed’ rose by approximately 142% between 2008 - 2018 and ‘seaweed + food’ by 264%. There is a reason why academic focus has moved toward seaweed. It is an interesting, remarkable product that can be locally sourced, it is a sustainable food with multiple health and digestion benefits as well as chemical and biological applications.

²⁸ Lady with a Spear (Clark, 1953)

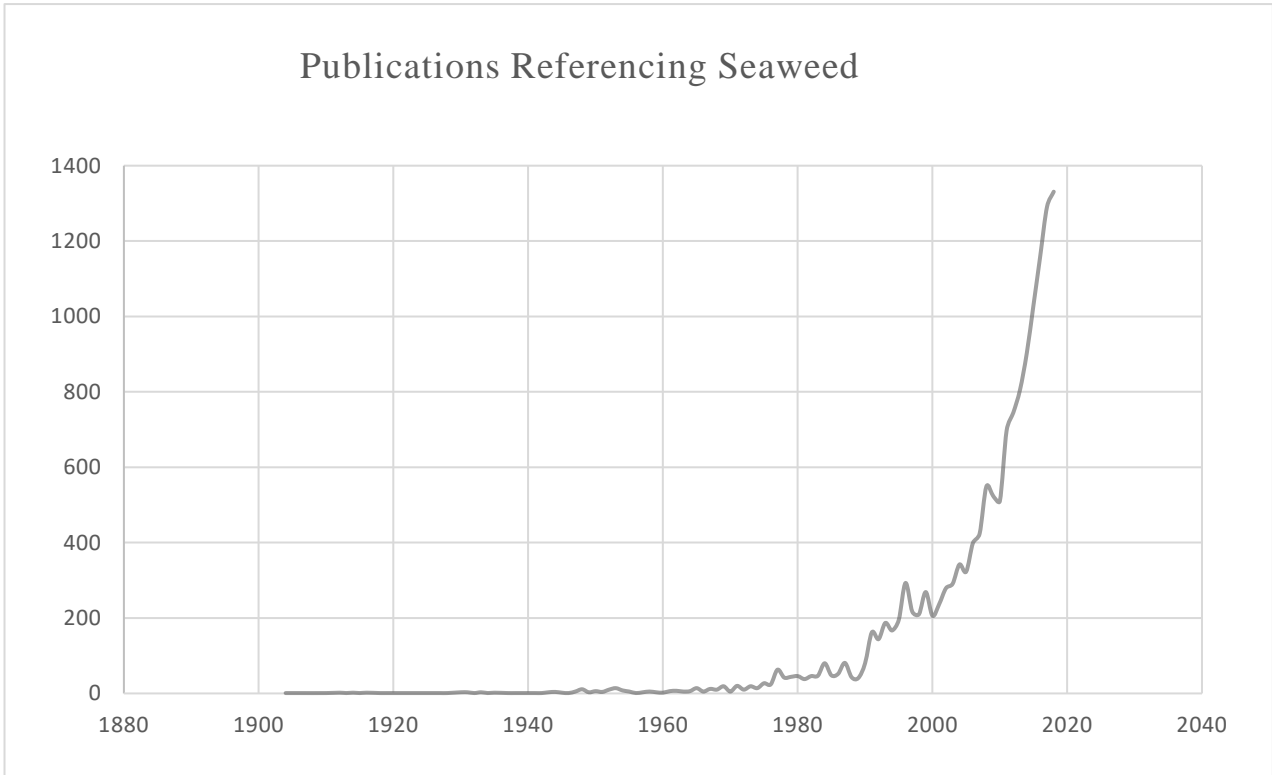


Fig.4. Number of publications referencing seaweed since 1900 featured on the 'Web of Science' (webofknowledge.com).

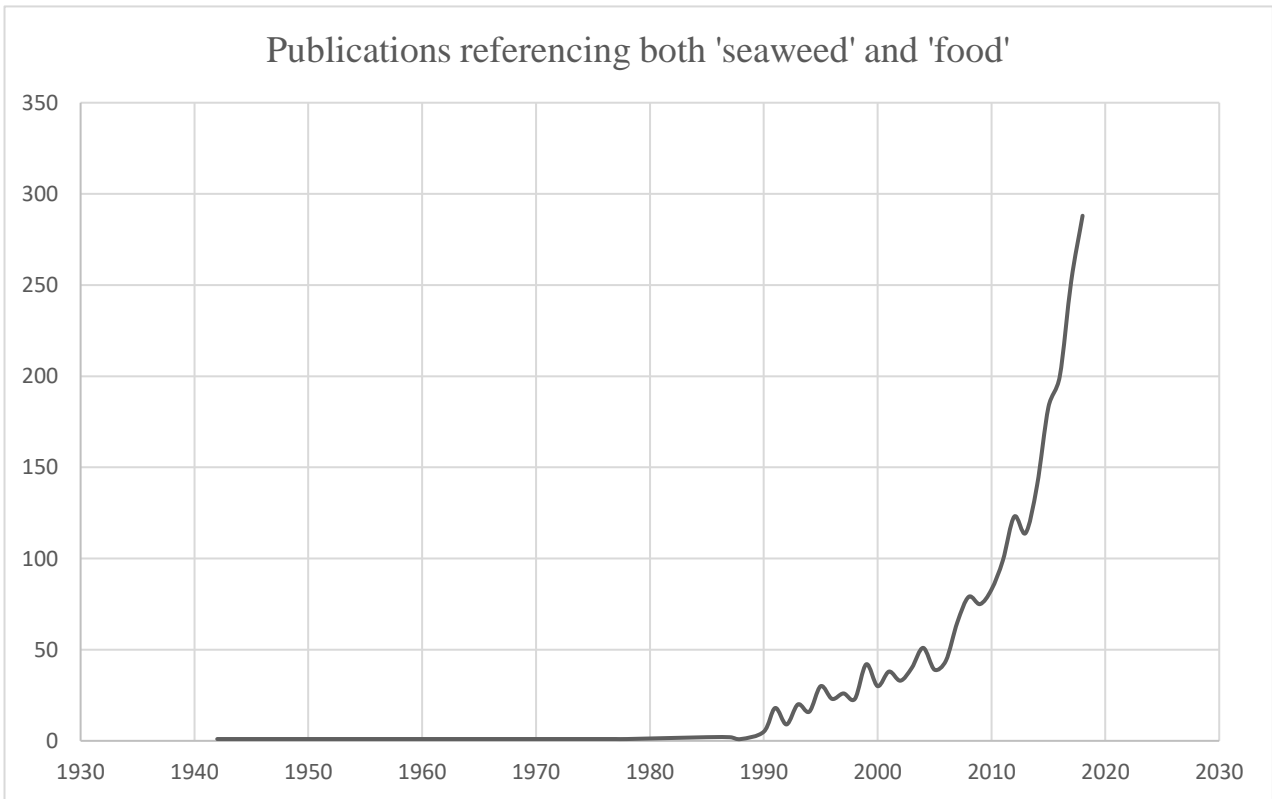


Fig.5. Publications featured on the 'Web of Science' that reference both 'seaweed' and 'food' since 1942 (webofknowledge.com).

Research trends alone do not accurately reflect the interest of the people. The story I have heard repeatedly by individuals in the business is “seaweed for consumption is on the rise”, or “interest in seaweed is increasing”. Luckily this is something I can check. Fig.6., Fig.7. and Fig.8. below display the trendlines in an interest in seaweed over the last 15 years (slightly less time than Seagreens has been operating for). In Google’s global search trends, searches for ‘seaweed’ have risen by approximately 76% from 2004 to 2018. Interestingly, the country with the highest search rate (by a long way) is Jersey, which is a part of the British Isles. As mentioned in the ‘local identities’ chapter.

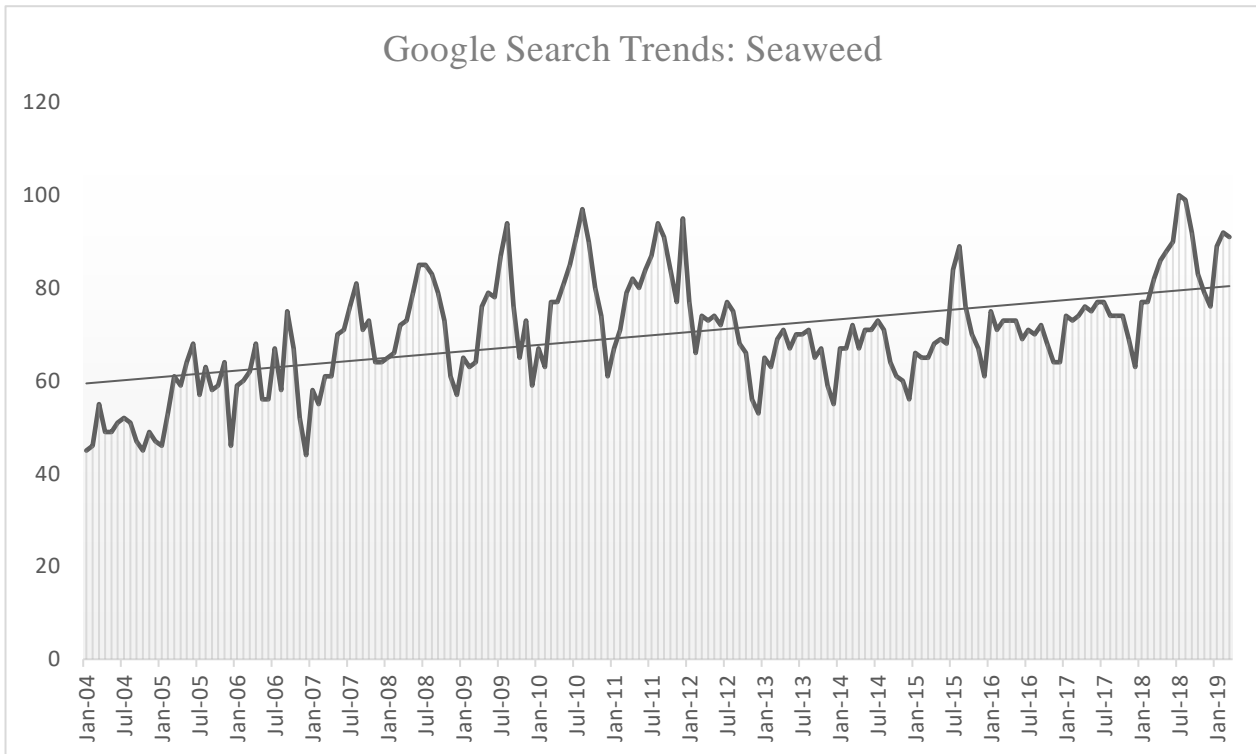


Fig.6. Global Google search trends for ‘seaweed’ from January 2004 until March 2019 (google.com)

Looking purely at trends in searches for ‘seaweed’ under the category ‘food’ globally and in the UK, we find even steeper trendlines. From 2004-2018 average global and UK searches increased by 162% and 240% respectively. So, it appears seaweed fanatics in the business were not wrong about the increased interest. People, and people in the UK especially, are more interested in seaweed as a food.

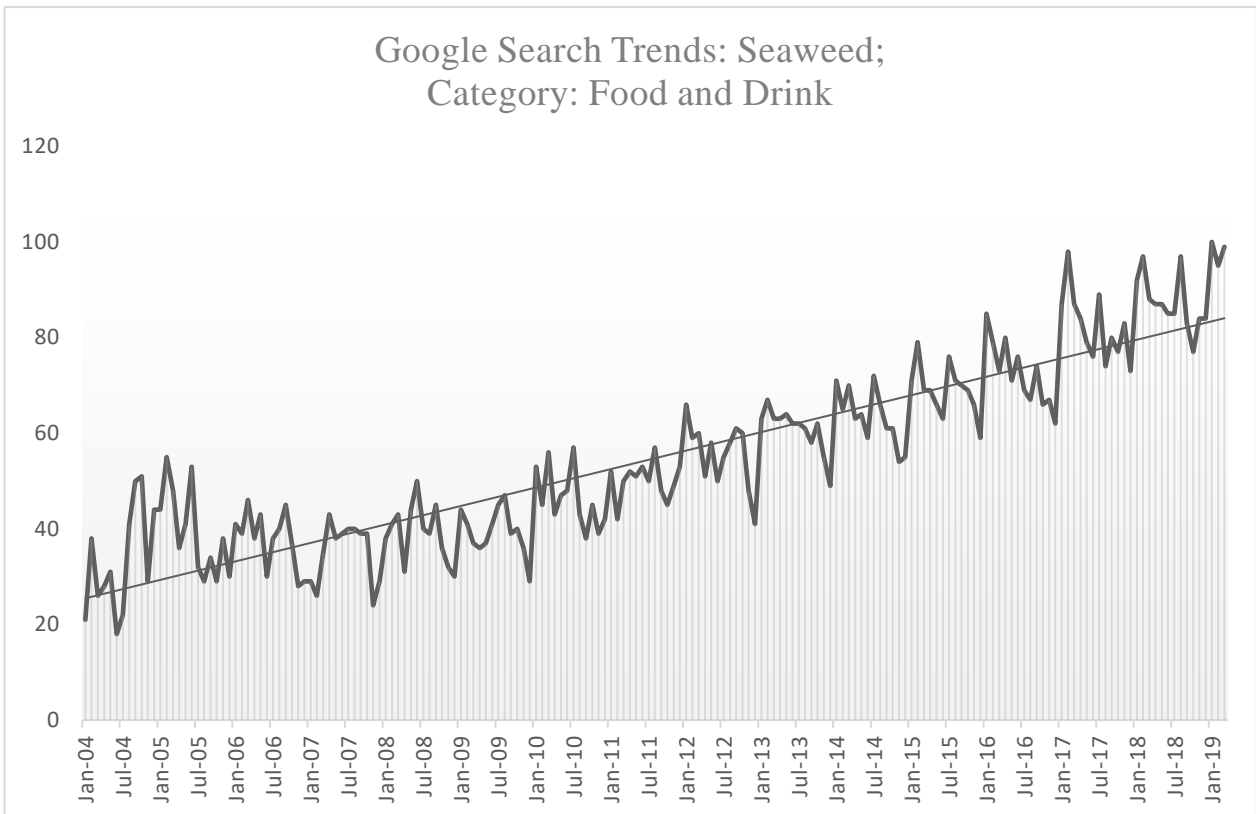


Fig.7. Global Google search trends for 'seaweed' under the category 'food and drink' from January 2004 until March 2019 (google.com)

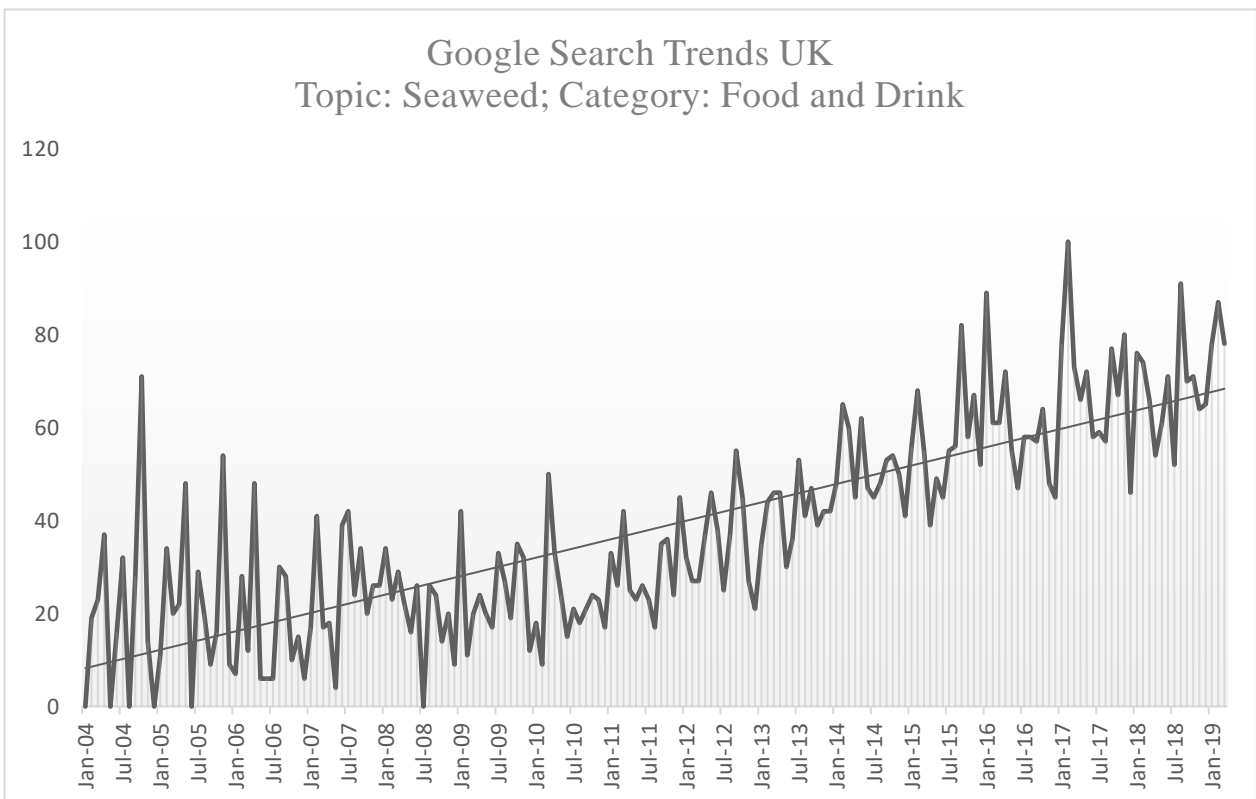


Fig.8. UK Google search trends for 'seaweed' under the category 'food and drink' from January 2004 until March 2019 (google.com)

This thesis so far may present itself as a glorification of seaweed. So, in the notion of fairness, I should point out a few of the currently acknowledged negatives of seaweed. In 2001, Dr Tobacman introduced a debate that those in the phycological society call the ‘carrageenan controversy’, suggesting that carrageenan (a substance present in a huge range of products as a stabiliser made from seaweed or artificially reproduced) could have carcinogens (Bhattacharyya *et al.*, 2014; Bixler, 2017). These findings have been criticized and refuted since their original conception by the toxicology group JECFA, regulatory agencies worldwide and carrageenan companies, with particular reference to the difference between in vivo and in vitro studies (Weiner *et al.*, 2015; Bixler, 2017).

Iodine content in seaweed is very high. Seaweed consumption poses risks of toxicity from high levels of iodine, a build-up of arsenic or other heavy metals which may be present due to pollution in the ocean, or eutrophication (Brown *et al.*, 2014; Bouga and Combet, 2015). The absorption rates vary from species to species²⁹, location to location and in most cases heavy metals such as Cadmium are not generally absorbed by the plants (Possinger and Amador, 2016). It is advised that one should not eat too much of one variety of seaweed. The EU poses heavy restrictions on both labelling and farming. Labelling restrictions are in place to reduce the risks for human consumption but requires overcoming many cumbersome barriers. These barriers will be covered in greater depth in chapter 7.2. Other regulations are in place for the conservation and protection of the EU’s coastlines and, once again, many barriers must be overcome in order to farm on the shorelines. However, many phycological³⁰ researchers argue that seaweed production in fact increases biodiversity, protects against degradation by absorbing wave energy and contributes to deacidification of the ocean (Baldwin, 2000; Dhargalkar and Pereira, 2005; Roberts and Upham, 2012; Abowei and Ezekiel, 2013; Hafting *et al.*, 2015). ‘Side effects’ such as the ones above improve the conditions for the ocean, to mitigate some of the negative impacts of climate change, reduces the risk of harmful algal blooms and creates habitats for many species to flourish.

So, in summary, the British seaweed industry has a unique selling point (USP) as a sustainably sourced local food with health benefits, interesting taste and texture and clear historical and cultural links. It has benefits, it should be an obvious sell as a healthy nutritious food source, yet it still only appears in upmarket circles and not within the broader market. Why is this? Well, this same phenomenon has occurred many times historically. Language, conservatism, availability and social acceptance are all factors in the way a product is viewed.

5.2. The Chef and The Seaweed

The cosmopolitan model is one example of a marketing approach that we will cover in depth later. However, Jamie Oliver, a famous British chef, in 2015 attributed his weight loss to a ‘cosmopolitan’ idea of seaweed, quoting “I thought seaweed was hippy, globetrotting stuff but our ancestors ate seaweed. It’s the most nutritious vegetable in the world” (Dailymail.co.uk, 2018). This kind of historical recognition from prominent and respected individuals in the nutritional field can contribute to the changed attitudes of seaweed. Although, grouping all seaweeds under the term ‘seaweed’ is like calling all varieties of vegetables just ‘vegetable’. The species of seaweed can be as different from one another as a pepper is from a parsnip, but

²⁹ Iodine in Icelandic finger tangle being one of the highest at 8165 µg/g, whereas only 16 µg/g in some Nori species (*Porphyra tenera*) (Possinger and Amador, 2016)

³⁰ The term used for the branch of botany related to seaweeds or algae

as long as they remain under the water, the possibilities remain shrouded. Some researchers *are* attempting to change the game.

Mouritsen (2009; 2012; 2013; 2017) has offered many examples of how to bring umami flavour into Nordic cuisines and also recipes, incorporating seaweed into the diet using ingredients and gastronomy techniques and also using alginates.

In modern household cuisine, dulse could be incorporated into bread, fish and vegetable soups, and fish dishes, or simply eaten toasted as a snack that goes well with a dark beer or an aperitif. It can be fried to a crisp in a little oil or butter and used as an agreeable substitute for fried bacon, e.g., in an omelet. Because it has a somewhat sweet taste, dulse is a good complement for root vegetables and corn. It can also be crushed and sprinkled on salads and vegetables. When toasted, dulse loses some of its red color and turns brownish.³¹

Maderia (2007) and Milne (2016) are two other examples of enthusiastic seaweed cooks and locally sourced foods. Maderia (2007) develops recipes such as ‘nori marinade with lime’, ‘kombu shitake shake’ and ‘sea palm salad dressing’ in her book ‘the new seaweed cookbook’. ‘Seaweed gnocchi’ and ‘seaweed pancake’ recipes appear in Kreischer and Schuttelaar's book ‘Ocean Greens’ (2016). Milne (2016) offers in her book ‘The Seaweed Cookbook’, a selection of recipes from main dishes to desserts, drinks, soups, rubs and sauces, all using seaweed as a flavour enhancer, a seasoner and a way to incorporate all 56 minerals into the regular diet. A study conducted by Chapman, Stévant and Larssen (2015) worked closely with a culinary school and found that seaweeds worked with the flavours of seafood dishes. So, after this expose of foods and flavours, it is time to meet a few organisations in the British Isles who have tapped into this resource and are trying to use a renewed interest in seaweed to develop new and interesting products.

5.3. The Product Range

Long before it became a ‘trend’, we pioneered the production of nutritious seaweed for worldwide human consumption, at 5 remote locations in the British Isles and Nordic region. In 1998 we introduced a small range of flagship consumer products for daily dietary use, and nutritional therapy, now sold by health stores and clinics in America, Australia, Britain, and Slovenia.³²

Even though back in 1998, Seagreens may have been pioneering the seaweed market, there are now many more companies marketing seaweed in the British Isles. In the last 5-10 years a flourish of seaweed-based products, flavours and infusions have been integrated into the current market in the UK and the western world. Examples shown below (Fig.9.) include: Irish moss infused men’s wax, seaweed ‘caviar’, seaweed biscuits, body scrubs and lotions, crackers and rum, all produced by companies based in the British isles.

³¹ Quote from (Mouritsen *et al.*, 2013)

³² Quote from S.B. Ranger of Seagreens (11/2018)



Fig.9. A selection of seaweed products available to western customers. From top left: The Bearded Man Co. Irish Moss Styling Wax, a selection of products available from The Pembrokeshire Beachfood Co., gimMe seaweed thins, Barti DDU Rum – from The Pembrokeshire Beachfood Co., Kurakon kombu seaweed salad ‘on the go’, a selection of seaweed Body Shop products, Tesco Sea Spaghetti Seaweed, Ikea seaweed ‘caviar’.

Based on the historical ties with seaweed, one may expect labelling for seaweed to be reminiscent of the old times, referring to seashore collecting and the old usages of seaweed in the British Isles. However, it is clear the products above are aimed for the mainstream market. Perhaps, one can speculate, to make seaweed appear like a normal daily food product, pharmaceutical addition or snack (See Chapter 6).

Trends can be infectious. In 2014, Da Milhe, a distillery company in Wales created a ‘seaweed gin’ infusing gin with seaweed collected off the Celtic coast (Damhile.co.uk, 2019). Then, in 2015, another distillery in the Shetlands created the Shetland Reel Ocean Scent Gin, made with locally sourced bladderwrack (shetlandreel.com, 2019). The seaweed infused Shetland Reel gin inspired a chef to make accompanying chocolates also infused with the seaweed gin which became a great success, attributing the additional flavour and texture of the chocolate to the presence of the seaweed (Sundaypost.com, 2017). The Isle of Harris created a sugar wrack infused gin, not only that, they went a step further, providing customers with ‘sugar kelp aromatic water’, a small bottle intended to be infused with regular gin, whiskey or seafood to

“bring a wave of Outer Hebridean seas and an extra essence of the island directly to your drink” (harrisdistillery.com).



Fig.10. Left Da Milhe Seaweed gin. Middle Shetland Reel Ocean Scent Gin. Right Isle of Harris Gin Infused with Sugar Kelp.

5.4. The Seagreens Case

Communication between myself and Seagreens began in the beginning of 2019 with an informal email exchange and formal questionnaire. Open conversation continued throughout the project with further questions, additional information, updates from Seagreens and my double-checking of information. Through the information provided I was able to paint a clear picture of their start up, challenges and opportunities. Celebrating their 20th anniversary in 2018, Seagreens has operated throughout the most recent upsurge of seaweed interest in the British Isles, from before the start of the wave of popularity up until now. When, why and how did it start? S. B. Ranger (11/2018) “The idea was to make it easy for anyone to get at least a gram of the most nutritious seaweed into our daily food. Enough to fill significant nutritional gaps in our modern diet, especially the many deficient micronutrients”. When I asked if they have encountered trouble penetrating their target market, S. B. Ranger (15/2/2019) the founder of Seagreens explained:

In 1998 seaweed for human nutrition was NEW! Even the health stores only saw it as cheap kelp tablets and capsules for iodine supplementation, or as imported Japanese farmed seaweeds in packets as an exotic vegetable ... for a small niche market.

Instead of marketing seaweed to the small niche market, Seagreens took on the challenge of broadening the market to encompass a wider audience. S. B. Ranger (11/2018) “In 20 years,

Seagreens has grown from a small start-up in a remote part of Norway in 1998 to the leading pioneer of a new industry for the British Isles and Nordic region”. It was not an easy task, when questioned on how the company developed in terms of size and scope, S. B. Ranger (11/2018) answered “This has not been the result of financial investment - rather the dogged pursuit of a simple, highly focused goal for which not only a market, but a new means of production had to be developed”. What external factors influenced the company’s beginning and development? S. B. Ranger (11/2018)

Public interest in, and demand for, natural and organic food... Public awareness of the loss of minerals in our food and agricultural soils.... Links between ubiquitous health concerns like CVD (cardiovascular disease), obesity and diabetes, and our cultural obsession with manufactured foods.

From this information I was particularly fascinated by Seagreens attention to research alongside product development and their focus on the nutritional aspects of seaweed. When I asked how scientific research into seaweed affected Seagreens marketing strategies or business model S. B. Ranger replied (15/2/2018):

Seagreens has really led the nutrition research using seaweed as a whole food in the form it might be available to the consumer in the health store or supermarket. Prior to 2008 when this programme of research began (in England), virtually all research studies had focused, and still do, on extracts from seaweed, in much the same way as many pharmaceutical drugs are in fact the result of extracting specific nutrients or substances from other natural plants.

I was also directed towards the website; the first interface potential customers will most likely encounter. On the website clear business aims, studies and a research focus draw the audience’s attention to these aspects (*Seagreens.com, 2019*) “In the past decade, a strategic programme of applied research has produced unique data for our customers, on the composition and health benefits of Seagreens®, with many studies published in the scientific journals”. During further research I encountered many forms of ‘hidden’ seaweed usage, in these instances, seaweed was an additive, an e number or an alternative to salt. I also come across occurrences where seaweed was considered an ‘undesirable’ alternative. When I asked S. B. Ranger how he approached the use of seaweed with everyday products as an alternative to salt, he responded (15/3/2019),

**You have arrived at the very heart of why I am doing this project for 20 years!
Replacing salt is where I first began our research programme, as one of the most important and potentially ubiquitous ways to get nutritious seaweed into the daily diet for large numbers of people.**

I was subsequently provided a list of products and information about integrated seaweed (see fig.11.). This shows the need, in the early stages at least, to find ways to integrate seaweed into products without putting people off the idea of consuming it. It is clear in every interaction that, much like a considerate parent, the goal of Seagreens is to feed the public a healthy and nutritious food. Why seaweed? S. B. Ranger (11/2018): “Seaweeds are primordial - they may be *the* original nutritious food. Unlike land grown foods, they are a particularly complete source of all the minerals and in many other ways are uniquely complementary.” We established that salt replacements can be challenging, but there is also a big opportunity there. What other challenges has Seagreens faced and how have you overcome them? S. B. Ranger (11/2018): “Even if Seagreens were to extend its business operations to retailing, it would do so in partnership with and to support its retailers, rather than to compete with them.” In 2008, Seagreens received government funds to explore the potential for seaweed-salt alternatives.

They worked alongside Sheffield Hallam University to conduct their research and were acknowledged as “A Big Idea for the Future” by the UK Research Council in 2012 (Seagreens.com).



Fig.11. products supplied with Seagreens ingredients. Left: Pukka organic supplements with seaweed and right: organic rye bread with seaweed

5.5. SWOT Analysis of Seagreens

Despite strong building blocks, an established brand, a long history within the field, there will always be challenges in the expansion and recognition. A common analytical tool for business is SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis. It is helpful for determining both the internal and external strengths and weaknesses of an organisation to strategically apply yourself when in business competition. The diagram below (fig.12.) displays the SWOT analysis of Seagreens developed from the information and answers given in the Case Study, as well as analysis in the general field of business in the current climate. Although growth has been slow, the market position is their biggest strength. How has it developed? S. B. Ranger (11/2018):

In terms of its products and markets, these have grown from 3 initial consumer products sold to UK health food stores in 1998, to more than 15 on the shelves or in development today, and from 3 to 15 different forms of manufacturing ingredients for a wide range of applications in nutritional therapy, foods and drinks.

They are a highly recognisable name with good connotations, for example in 2012 “Seagreens... rank[ed] "most searched for ingredient" on worldwide Life Science search

engine, Innovadex”. Their ability to position themselves early in the market is one of their greatest benefits. What is your strategy? S. B. Ranger (11/2018):

Retaining a focus which is small enough to be strong in relation to corporate resources and the market opportunity - in Seagreens case establishing a strong position in a very small niche.

There is much to be said about the strengths in the business model and current marketing position. When discussing challenges and weaknesses, S.B. Ranger (11/2018) mentioned the small number of staff at the centre of a growing business “Since Seagreens began, true to its business model, numbers at the centre have been kept as small as possible - currently a management group of 4”. I did not include the management model in the SWOT analysis as it is more fundamental in the way their business functions as opposed to their marketing model.

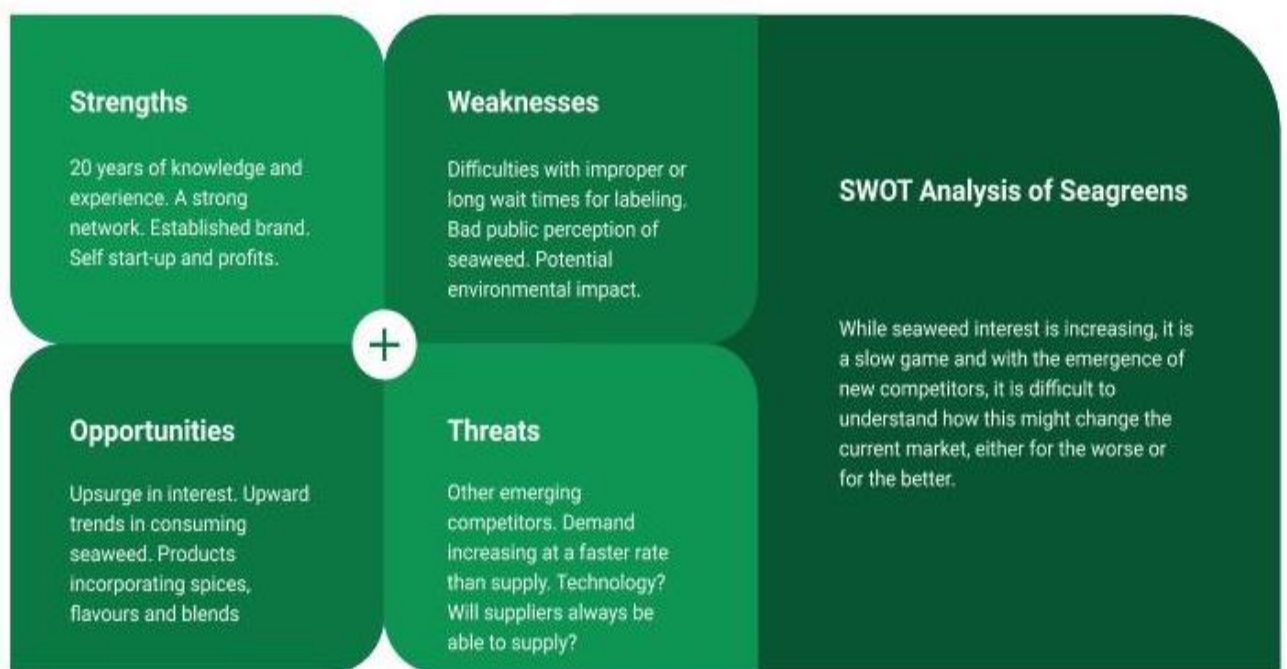


Fig.12. SWOT analysis of Seagreens

Seagreens is a particularly special case, in both the span of time they have operated for and in the way that they operate. So, although the case is being used to generalise the culture, the country and the field, it is important to recognise that it may be an anomaly. Seagreens is also creating a brand image and is marketing themselves in a positive way. Therefore, while they may share certain hurdles and hardships within the company for the research, it is possible they are not upfront about the realities of their difficulties. Regardless, if the business model can be used as an example for other or prospective businesses, it is useful to analyse the ways in which they have successfully penetrated the market.

Market Analysis

**As, sweeping and eddying through them,
Rose the belated tide,
And, streaming into the moonlight,
The seaweed floated wide³³**

As I mentioned before in chapter 2, when I initially sent out the questionnaire in Appendix i, I received answers not only from Seagreens, but also from Ebbtides and The Pembrokeshire Beachfood Company. I chose these organisations because they too had British focused marketing strategies. Seagreens is the organisation I had regular contact with beyond the questionnaire, but the other two organisations offered information on differing marketing campaigns and information. Using this information, this chapter explores the idea of changing perceptions, of organising information in a structured way that works to transform attitudes towards seaweed.

6.1. Current Seaweed Market in the British Isles

British seaweed companies appear rather similar in their marketing of seaweed: the messages conveyed are that seaweed is quality orientated, locally sourced, nutritionally understood, fantastically undervalued. However, all the companies I contacted appear to be tackling the same challenge, convincing the British Isles that seaweed is an ingredient they can all consume and use in their home. In an interview for *Crumbs Magazine* (2017), Tony Coulson, founder of Ebbtides outlined their difficulties in marketing seaweed to the general public:

I'm trying to change perceptions! ... what's really hit me is how positive people have been to what I'm doing here at Ebbtides... people really like the taste of our products – once they've crossed that queasiness barrier... it's not for everybody, but people are often surprised at how delicious it is.³⁴

Here Ebbtides share the same struggle as Seagreens in changing people's attitudes toward, to incorporate seaweed in their regular diet. On their websites, all three seaweed companies have blogs or stories to update visitors. This presentation is somewhat reminiscent of visiting a shoreside store where the owner personally welcomes you, explains their story and tells you why they are doing what they're doing. The reader feels included and invested in their business, offering a wholesome and friendly feel. An example is a quote from the Pembrokeshire Beachfood Company website (beachfood.com):

³³ From the poem 'the bridge' (Longfellow, 1848) pp. 68

³⁴ Café Mor is a range of products selling seaweed in a hot food format straight to end-users.

I see that serving the best food I can source as a privilege. I see cooking with that view everyday as an honour, which money cannot buy... Café Môr³⁵ provides the best food we can possibly offer, sourced from the best producers in the area. Once you have decided to be the best, then decisions on your ingredients are easy... We should stop asking & start understanding, start demanding quality, and enjoying the best food with the best view, because life is too short for anything less.

Pembrokeshire Beachfood Company invoke a very personal feeling and presence with the visitor using that familiar and direct “you”, evoking a sense of care both for the customer and product. Here we see the company’s passion for seaweed, describing it as the ‘best food I can source’.

An online questionnaire was answered by founder Tony Coulson of Ebbtides (7/2/19), and founder Jonathan Williams of the Pembrokeshire Beachfood Co. (12/2/19). Within the questionnaire they both specified their target market as mostly women aged 35+, although this varies depending on the product range. These are considerations for any marketing campaigns, although not exclusively. It seems that the companies begin with seaweed, perhaps sold locally, and work outwards - developing products, ingredients, partnerships. Anything that will reach further afield than their local farmer’s market. This is Seagreens ethos as stated by S. B. Ranger (11/2018):

Using competition that is peripheral or flanking the brand to positive advantage, instead of competing negatively against it, on the basis that markets expand to accommodate good brands.

The companies I spoke with all seemed to want to source food locally for a more sustainable future. However, the biggest market, the Japanese market, remains strong. It is so successful, in fact, that companies in the British Isles have even begun importing seaweed to Japan. Although they are unlikely to admit it, Eastern consumers are still concerned over the safety of seaweed grown in Japan and China. This, because of environmentally damaging events such as the Fukushima disaster and heavy metal pollution. “We understand that Japanese high-end buyers will pay a premium price for quality kelp” stated Kate Burns, Managing Director of Ocean Veg Ireland Ltd, in an interview with Belfast Telegraph (2014), “Our growing conditions are nearly year-round and the kelp is pristine, some of the clients were blown away by the fact that our kelp had grown to two metres in just 13 weeks”. Most kelp forests, indeed, have rates of growth in primary production higher than that of any other marine or terrestrial assemblage (Duggins, Eckman and Sewell, 1990; Mann, 2000).

Dried seaweed sales have been declining in Japan and the demand for fresh sea vegetables is on the rise (Japantoday.com, 2015). Likely because of the increased representation of western food in Japan, or because of the increased nutritional values of fresh vs. dried and a higher awareness of such factors has this move happened. Bren Smith, executive director of GreenWave and owner of Thimble Island Ocean Farm, wants to work with researchers and farmers from Japan, to share knowledge in the west and build a strong platform to utilise the sea’s economic potential, create higher quality products and shape businesses which work to counter climate change (thefishsite.com, 2017). It appears that market strategies prosper when considering a wider market. Milne (2016) writes about how the Scottish seaweed company ‘Mara’ progressed into the spotlight through European markets and trade shows, with strong

branding and an extraordinary range of products, they stocked the shelves of Harrods among others.

The initial barrier is always the first to overcome. Seagreens began when the seaweed wave first began to rise and major opportunities were few and far between. The creator, Simon Ranger and I, had many conversations where he delved into stories of the conception of the company:

During this first decade sales of Seagreens consumer products grew through independent health stores and clinics, mainly in the UK. At the same time, Seagreens seaweed ingredients, found early customers among UK food and drink, and nutrition product manufacturers as a highly nutritious, new functional ingredient.

6.2. The Consumer Triad

During my interactions with Seagreens, other seaweed businesses, news articles and literature, I found a common ‘triad of consumers’: those who are actively searching for seaweed, those who are looking for dietarily beneficial foods and those who do not desire seaweed at all. Using this information, I formed a consumer triad, separately consumers into three major factions representing different consumer opinions and current target markets for seaweed. The finished triad is shown below (fig.13.):

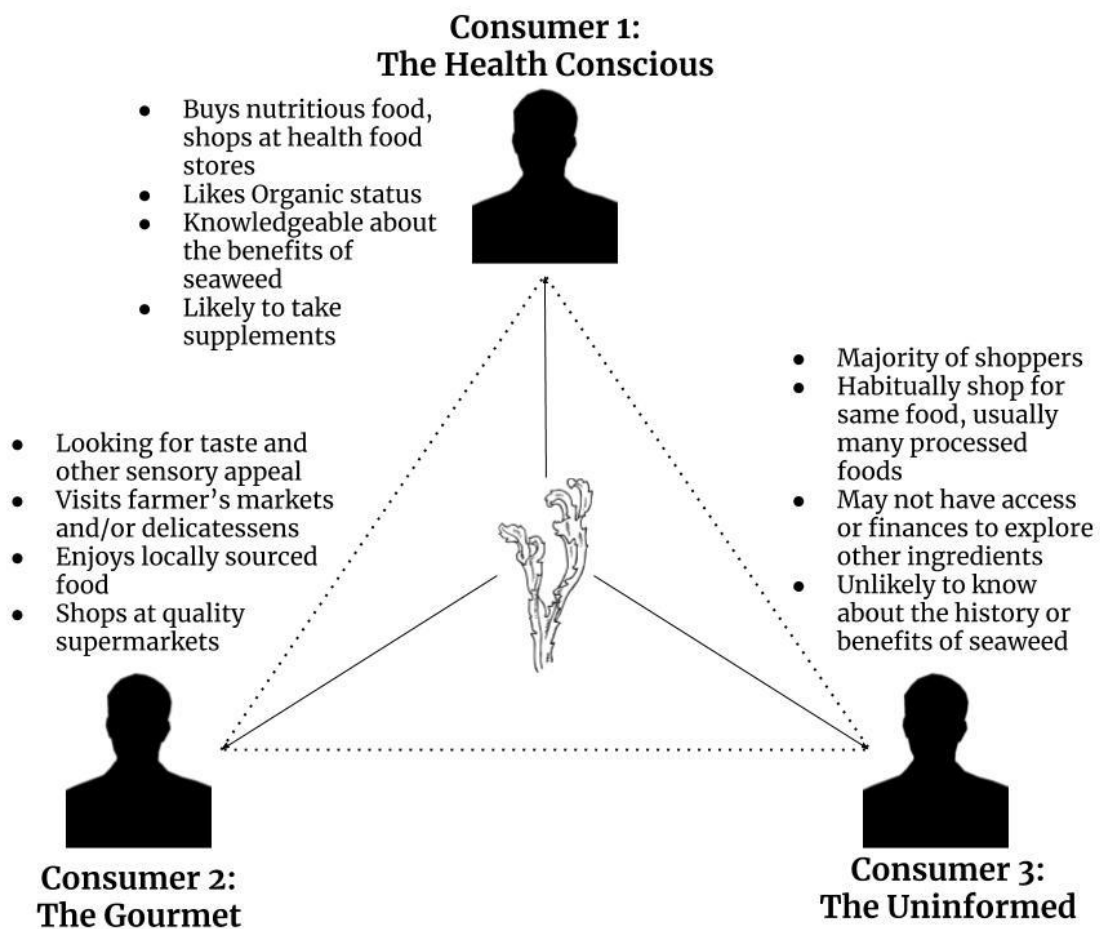


Fig.13. three possible consumers and their likely relationship to seaweed

Each faction represents a different consumer and their shopping habits - this in order to empathise with their thought processes and explore the likelihood of purchasing or interacting with seaweed products and challenges in changing attitudes. Consumer 1 and 2 are equally likely to consume seaweed, but in different forms and for different reasons:

Consumer 1

The 'health conscious' consumer is likely to follow food trends and consume 'superfoods'. They could have dietary restrictions such as veganism or low-calorie diets than require the use of supplements or other dietary replacements. They are aware of vital vitamins, minerals and the nutritional benefits of seaweed, they could also be looking to lose weight (going back to the chef and the seaweed and other studies in seaweed extracts for weight loss), or the consumer might be looking to seaweed as an 'environmentally friendly' food with low environmental impact.

Consumer 2

Enjoys 'gourmet' food. This means they are likely to explore seaweed for its umami flavour, they will likely explore combinations of flavours or ways to marry seaweed with other unique flavour combinations, they also enjoy locally produced foods. The key idea for marketing to a gourmet customer would be for the sensory and unique flavour. They could be producers or consumers, by this I mean chefs or product developers. So, in the 'products' section, when we discussed seaweed gin chocolates, seaweed was the starting point and the flavour infusion was the end goal.

Consumer 3

Consumer 3, 'the uninformed', is much less open to the idea of seaweed. This is the majority of the market, but also the hardest to crack in terms of accessibility. The consumer is either unwilling, less willing or simply not exposed to seaweed products. However, it is likely they still use or consume it daily through means they are not aware of. If you eat processed meat, you will likely be consuming seaweed, if you are vegan, you will likely be consuming seaweed in a soy alternative to milk. There are many products in which seaweed is included, but not advertised or listed as 'seaweed', but derivatives of. In these cases, the seaweed ingredient may be instead listed as an e-number. E400-407 are all seaweed e-numbers. Other products use this same 'disguise'. E120, for example, is an E number representing the crushed cochineal bug, used as a red food additive for many desserts and sweets. Occasionally seaweed is used as an alternative for salt in bread/soup/sauce or other salt heavy products, it would be the ideal if seaweed was an accepted and celebrated alternative instead of an e-number. Then, the goal becomes the removal of such a stigma.

Certain products have been designed specifically with certain audiences in mind. Fig.14. shows three products designed for our three different consumers.

Consumer 1: The Health Conscious



- Food supplements
- Iodine tablets
- Ingredients that are easily added to meals to enhance the nutritional value e.g. salt replacements

- Products that enhance umami flavour
- Cosmopolitan foods that explore cultural flavours
- Foods that utilise local sources



Consumer 2: The Gourmet



Products where seaweed is not immediately obvious or an off putting concept



Consumer 3: The Uninformed

Fig.14. product matchings for consumers based on their preferences

Consumer 1

The first is a supplement, meant for consumers who are looking for ways to increase their iodine and calcium consumption. Almost one third of people in the world at present have an iodine deficiency, so this has a lot of potential (Naylor, 1976; Kenicer, Bridgewater and Milliken, 2000; Philpott and Bradford, 2006; Abdel-Raouf, 2012). Seaweed is a natural source of iodine, so consumers have the option of consuming the whole product with the added nutritional benefits of micronutrients. Species to species though, seaweed can have drastically different levels of iodine content, which is another consideration, especially for the first consumer. Seagreens is aware of this opportunity, but also of the challenges that surround the specific iodine quantities. When asked about the challenges encountered in the business, S. B. Ranger replied (11/2018):

Whilst seaweeds are the finest source of natural iodine, and iodine insufficiency is an important global health concern, so little was known of the levels in different species, or the mode of absorption and metabolism in the

body, that again Seagreens found itself having to conduct basic research to deliver the ‘goodness’ of this particular aspect of their rich mineral content.

Consumer 2

The second is a product developed by Seagreens for the supermarket Waitrose, a ‘ruby rich dulse seaweed ingredient’. The recommendations are to add the dried dulse to seafood risottos, spaghetti dishes or soups - this for additional flavour, texture and mouthfeel. The product has a perfect range of qualities to highlight for the ‘cosmopolitan’ gourmet consumer. Seaweed has also been shown to be a natural flavour enhancer, working in cohesion with and highlighting more subtle flavours in food. It is the perfect addition to a curry, pasta or risotto. When asked how the history has affected Seagreens marketing strategy, S. B. Ranger replied (15/2/19)

Seagreens (uniquely) perceived and responded to the need for ordinary people to use seaweed not as a whole vegetable on the plate like bland vegetables, but as ingredients which could be incorporated into almost any everyday food of their choosing. This novel approach determined the kind of products we developed and the kind of processing of the raw seaweeds which we harvest, and indeed what varieties of seaweeds we would focus on. As a result, Seagreens can be used in teas, smoothies, fruit juices, soups, sauces, ready meals, vegetables, condiments, meat and dairy foods, bread and all kinds of baked foods and snacks, and in virtually any form.

Consumer 3

The final product is a seaweed infused oaten biscuit. The seaweed, again provided by Seagreens, adds an extra dimension to the flavour of an oaten biscuit; which, usually by itself, is rather bland. The focus is all about the flavour dimension seaweed adds, not the seaweed product. If integrated enough, our third consumer may venture into this territory, however it is unlikely. Again, the hardest market to crack. Alternatively, seaweed may be added to a liquid product, much in the same way a parent may hide an undesired vegetable in a child’s meal for their benefit. Or, Seagreens offers the 50/50 salt for consumers who are seeking low salt alternatives. When asked how Seagreens appeals to the uninformed customer, S. B. Ranger replied (Seagreens, 15/3/2019):

Replacing salt is where [Seagreens] first began our research programme, as one of the most important and potentially ubiquitous ways to get nutritious seaweed into the daily diet for large numbers of people.

6.3. Global and Local Markets

Companies in the 21st century have the unique position of being able to not only manufacture products in a way they were never able to before, but also to market globally, transport globally and to have global exposure. To give just one example, the British supermarket Waitrose (which Seagreens works in collaboration with) has a product range sold in the Supermarket ‘Park n Shop’ in Hong Kong, half a world away. This means that, more easily than ever, products can transition from local to global markets without much marketing or focus on promotion. However, there is still a significant difference between a ‘global’ and a ‘non-global’ company. The average person is more than likely aware of Coca-Cola, MacDonald’s, Windows, Toyota, Disney. Global companies, in this respect, anchor themselves as recognisable, all present, companies that have scope and reach and are essentially ubiquitous.

How do the global companies improve their opportunities? In essence, by improving their own chances at success in the marketplace, while simultaneously eroding the effectiveness of their competitors (Hout, Porter and Rudden, 1992). The stages of development into the global marketplace appear to start at the local level, then are developed into international brands which then can become global (Hout, Porter and Rudden, 1992). In so far as seaweed is recognised, it has significantly strong cultural ties and historical ties to both Japan and the UK as discussed in previous chapters. Japan has regularly reinforced its position as the global leader in seaweed consumption, however there are not many universally recognisable seaweed companies.

Companies recognise there is a gap in the literature of the effect of Globalised Consumer Culture in globalised societies, especially in non-western contexts, assuming certain global consumer segments exist to aim their international brands at (Cleveland, Laroche and Takahashi, 2015). Based on Fearon's (2003) ratio of cultural diversity, which considers languages as a proxy, Japan ranks 3rd after North and South Korea, whereas the UK ranks 50th of 160 countries. In Japan 98% of the population are of Japanese ethnicity, displaying a high level of cultural homogeneity (*CIA world factbook*, 2018). In the UK 94% of the population are monolingual English speakers, 98% have English as a first language, there are some Gaelic, Welsh and Cornish speakers which we would still count as British, but not in the broad homogenous sense (*BBC*, 2014). This poses significant challenges in the globalised marketing strategies in both the UK and Japan. The cultural diversity in Japan is so slim the likelihood of the acceptance of globalised products is also very slim. In the UK, diversity is higher, offering opportunities for a stronger acceptance of products and cosmopolitanism. In the discussion chapter, we will also look at a parallel case of acceptance of insects in both an American and an Indian diet, in the USA where cultural diversity is more prevalent, and the idea of an insect diet was more widely accepted.

While the Japanese market for seaweed is mostly for human consumption, in the UK other applications of seaweed are more widely accepted, for example, food additives, medicinal, pharmaceutical, cosmetic, other industrial uses (Dhargalkar and Pereira, 2005). There is a recognisable potential for seaweed as a food source in the West, if research, institutions, businesses and entrepreneurs should all marry together with marketing expertise (Dhargalkar and Pereira, 2005). Certain western organisations have attempted to replicate popular seaweed food with their own version of, for example, nori seaweed, not recognising that the different environmental conditions produce completely different versions of the same product (Shetterly, 2018). So, the idea of trying to make a 'local' version of sushi is more difficult than one might imagine. So, the alternative direction would be to embrace the differences of a local species, find the unique flavour, or consistency, or appeal of the local seaweeds and market them. To illustrate a point about the appeal of local seaweed, pepper dulse (*Osmundea pinnatifida*) is considered to be the 'truffle of the sea', a highly sought after rare smoky seaweed found off the coasts of Ireland and Scotland, which currently retails for £12 per 5g dry weight (Biancacci *et al.*, 2017).

Experimentation in product development is key when it comes to seaweed - explorative chefs, recipe developers (as discussed above) and local communities have the means to develop the product potential for seaweed, by utilising their knowledge and historical applications (Matos, 2012). However, availability is fundamental for utilisation, if seaweeds are only available in the areas in which they are harvested, then they never even have the capability to reach all hypothetical consumers. By shifting towards the online market, seaweed has a new stage in which to reach a wider range of customers. However, competing platforms in the online marketplace can be a hindrance to companies in terms of competition. When asked about challenges and the overcoming of such challenges, S.B. Ranger, the founder of Seagreens, acknowledged the difficulties in a larger online presence (11/2018):

Particularly damaging to Seagreens has been the widespread discounting of its consumer products retailed on the internet... the current regulatory environment remains an expensive and hugely time-consuming hindrance and not a help to this new industry.

The internet can be threatening, not only in terms of competition for businesses, but also for individual action on a broader scale. The widespread use of the internet contributes to regularly shifting attitudes and self-identification. While the receiver of information online may think that they are in control of their conscious decisions, they may also be part of a larger system influenced by peripheral information and less direct forms of interaction. The individual action, in fact, may be rendered as a combination of conscious and unconscious social agencies (Cleaver, 2002). In marketing theory, there are many ways to analyse collective opinion and its influence on individual action. Let us begin with the acculturation to global consumer culture (AGCC) which analyses the capability of cross-cultural stimuli sharing and a wider self-identification.

6.4. Acculturation to Global Consumer Culture

The process of Acculturation to Global Consumer Culture (often referred to AGCC) has become a field of study in itself. Cleveland, Laroche and Takahashi (2015) identified an AGCC scale based on 7 dimensions: cosmopolitanism, travelling experiences and attitudes, exposure to English language, global / global mass media, exposure to marketing activities or multinational corporations, openness to global customer culture and self-identification with global customer culture. I will use this same approach. However, I am not using this theory to interpret how well western culture has influenced the east (or vice versa) as they did, rather the aim is exploring these definitions to discern whether the staples of other cultures³⁶ may be well received in the British Isles. For this the dimensions have been adapted slightly to focus on seaweed and, more specifically, of the marketing of seaweed. Then, we will shift the attention to a relatively new idea of a 'local' seaweed market and look at the various ways we can call attention to the marketability of local seaweed as a staple food, as opposed to an *Eastern* food.

Cosmopolitanism: This dimension refers to the 'experience' of another culture without total integration, the idea of 'window shopping' a culture or lifestyle in a recognisable setting. Sushi falls into this category, it is a lauded and well-recognised staple of Japanese culture, something you are likely to find in cosmopolitan areas around London and Manchester. However, it is increasingly common in the UK through supermarkets and chain restaurants. Sainsburys and Waitrose have in recent years adopted sushi bars into their business model. Marks & Spencer and Boots, on the other hand, focusing on ready to go products.

Global / Foreign Mass Media Exposure: If cosmopolitanism is the experience *without* integration, then mass-media exposure is the TV show about it (possibly less removed than that, but still surprisingly effective at changing attitudes). If individuals see people they admire doing something like eating seaweed, we are more likely to consider it. Snapchat and Instagram are some of the most effective techniques for the exposure of products to younger audiences. The popularisation and overnight fame of Greta Thunberg globally is, in part, attributed to this. Instagram has 1 billion users worldwide (as of June 2018, *statista.com*) exposure to a global audience being the key appeal for most businesses. Some cultures have integrated these tools better than others, with the UK falling around no.8 globally with 24 million users (*statistica.com*).

³⁶ If we consider here seaweed as an 'Eastern' product rather than a local product, because of current perceptions

Exposure to English Language: In this respect, we are looking at the language used in its symbolic sense, which words are most effective in portraying what they mean to and which are not? English is globally symbolic, in logo and in presence. One key problem with the term ‘seaweed’ is that *it doesn’t sound very nice*, it has bad connotations and is more commonly associated with poor swimming water or the sea monsters. How can language adapt to offset this negative imagery and why does the west still hold true this idea, while the east does not?

Openness to Global Consumer Culture: The current online interaction has created a universal platform for ideas, cultures and experiences. There is a new method of symbolism. Individuals can discern for themselves what to appropriate for their own personal statement. Essentially, people are picking and choosing from a wider range of ideas to market themselves. We are all part of a system where individuals want to be unique but, in doing so, are ultimately inserting themselves as part of the collective.

Self-identification with GCC: Thinking patterns are influenced by the concept of social identity. The prerequisite for self-identification is no longer your position in the tribe that you are a part of, but an independently formed ‘character’ based on exposure to varied belief systems and cultural experience. In the modern-day we tend to use social media as the platform to construct our own social identity, it is the platform in which we share political views, religious beliefs, our social life, health care routines, meals, pets etc.

6.5. DAGMAR, ELM and Advertising Theory

Trying not to delve too deep into marketing theory, we shall explore two further advertising theories that I think are applicable to and may help understand the model presented above, these are DAGMAR and ELM. DAGMAR (Defining Advertising Goals for Measured Advertising Results) is the theory that the consumer must be taken through a 4-stage process from *unawareness* to *awareness* in their product purchasing decisions (Colley, 1961; Dutka and Colley, 1995)³⁷. The ELM (Elaboration Likelihood Model) is a similar theory exploring the power of persuasion, but explores the power of *elaborative* vs *peripheral* cues, or the likelihood of an individual paying attention to and processing ‘the message’ in and of itself, or paying attention to the context in which ‘the message’ is presented (Petty and Cacioppo, 1986). These are not perfect models, as many academics agree. Cognitive models or theories that incorporate any form of ‘hierarchical nature’³⁸ or psychological predictive analysis tend to focus solely on the behaviour change of consumers habits and not long-term effects of an organisation. This is because other factors may influence a purchaser and the organisation, including: purchase satisfaction, online reviews or other referrals, repeat patronage behaviour and other post-purchase effects (Egan, 2008). With this seaweed analysis, however, I am looking at how to change consumer’s habits and established opinions at the point of purchase, to convince consumers to try the product and alter perceptions surrounding seaweed. The two diagrams below (fig.15. and fig.16.) show possible routes to take to spread the message ‘Seaweed is a product worth purchasing’.

³⁷ It is also a more concise take on the famous AIDA (Attention, Interest, Desire, Action) technique

³⁸ Indirect reference here to Maslow (1943) and other hierarchical models



Fig.15. the DAGMAR model for seaweed marketing

Beginning with the Dagmar model (Fig 15), the consumer is initially unaware of the health benefits or positive impact of seaweed. This method can be used for consumer three if we assume they know nothing, or at consumers one and two if we intend on simply increasing their awareness. Through some mode of delivery (be it social media, TV advertising etc.) they receive the first *communication* from the supplier, then their ability to *comprehend* the message comes into play: *is the tagline or information relevant or informative enough?* Fourth step is conviction, is the health-centric information enough for them to desire the product? If everything comes together i.e., they have been introduced, informed and convinced by the information, they transition from *unawareness* to *awareness* and buy the product.

Looking at the ELM model (Fig 16) if we use the message: *seaweed is a product worth purchasing*, we can use Seagreens ‘motivation’ which is health focused. Outlining this, is an excerpt taken from their website (*Seagreens.org*): *Seaweed, still absorbing all the nutrients from our mutual beginnings, contains a little of everything still needed by our bodies - a unique capacity to fill the many nutrient gaps in the very different foods we now eat, including land vegetables.* Now, depending on the method of delivery (be it social media, TV advertising etc.) and the type of consumer, they may or may not respond to the health-centric message. search for healthy items in their day-to-day life. Individuals in the consumer 3 category need to be exposed to engaging peripheral cues to result in a ‘weak but positive attitude change’.

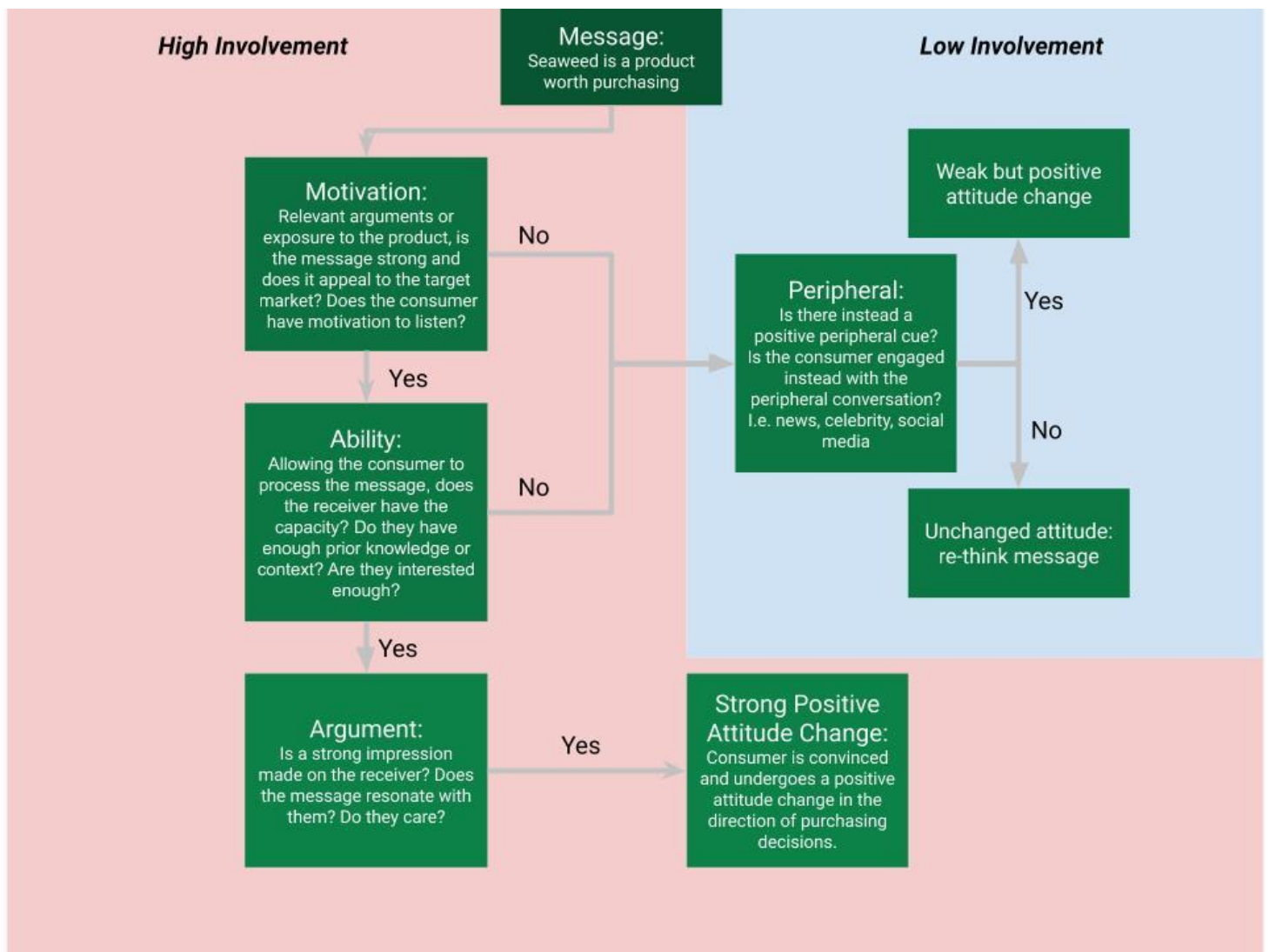


Fig.16. the ELM model for seaweed marketing

The important first step not outlined in either of the diagrams, is the establishment of the target market, decided by the consumer section. These diagrams can also function as problem solvers if the marketing techniques are not working.

6.6. British Based Seaweed Marketing

Looking at the aspects of seaweed that the Seagreens company has focused on (the utilisation of seaweed as an additive, a health food and a supplement) there is a clearly defined market incentive to hone in on the health benefits of seaweed. Mentioned earlier, the self-described target market for seaweed is mostly women of ages between 30 and 70³⁹. The key point being that women concerned about bone health, health during pregnancy, menopause, inflammatory, autoimmune systems or cardiovascular disease are likely to look to foods that are naturally high in vitamins, Omega-3 fatty acids and low in saturated fats (Mendis and Kim, 2011). Enter seaweed.



Fig.17. Eyn's 'Laver Snack' in Korea

Items containing laver, such as the one above, have an appeal beyond Wales. Even though the item is based on a familiar product (nori) it is still packaged and marketed as a foreign item (laver) sold in a manner that would be appealing to locals. This method of marketing can also be reversed. Think of a familiar dish in the British Isles, like a quiche - but using laver instead of spinach or broccoli. This adds an extra umami flavour, is locally sourced, offers many micronutrients and has historical and social ties to the British identity. However, the marketing strategy for an item such as seaweed is difficult for many reasons. It is not an item that many consumers have a lot of experience and exposure to. Considering the consumer triad above and the 'message' we are attempting to convey let us explore a few of the 'key attractive qualities of seaweed' with which the message could come from to effectively market the product:

Local: The item is sourced locally with local impacts, local benefits and local significance. Consumers who want to know where their food comes from are able to find the source the

³⁹ Seagreens described their target market as the whole family by association.

food, they are also supporting local business, something which has gained more attention in the last decade or two. It encourages local connections and lost ties in the concept of community. In the UK (as of 2015) seaweed or seaweed-containing products are available primarily online and only 30% are available in the UK's top supermarkets, 63% did have British origin (Bouga and Combet, 2015). This supports the idea of 'locally sourced superfoods'.

Historical: Any of the historical links outlined in the *Identity* section (see above). The whole of the British Isles has strong historical ties with seaweed, it is an interesting theme to explore when considering the 'unwilling' consumer who may become intrigued or informed in this area. Consumers 1 and 2 will likely either be already informed or intrigued by the concepts surrounding historical ties. These include: the use of seaweed as a source of nutrition for hundreds of years, the environmental applications of seaweed (I often add a little spirulina in the water I give to my plants for some added nutrients), the rise of the use of seaweed in almost every stabilised product (and why we don't know that it is seaweed) and the once great reliance on seaweed for the British economy.

Cultural Significance: this is in the same realm as the historical context, but in this respect the relationship is aimed at traditional foods, medicines, practices among local communities. Laverbread being one, the use of seaweed as a medicine to purge, for the treatment on the swelling of cuts, to increase iodine consumption, for assistance during childbirth and surgery, for treating arthritis, all things we knew many decades ago but have since forgotten. Maybe we would pay more attention if we knew what our ancestors accomplished with seaweeds.

Research-oriented: or even had any awareness of what we could still accomplish. Seagreens researchers alongside research on production, are also offering an insight into the health trends of the modern British consumer. Not only have these areas not been researched before, the consumer habits also guide further development into different products and opportunities. Seagreens website (*Seagreens.com*) repeats this time and again on their website, here's just one example of how they feel:

This virtuous cycle needs the knowledgeable support of our customers and those in medical practice, the media, the environmental movement, in the food industry and among the regulatory authorities: people sufficiently interested to learn more about what we are doing - and still aim to achieve.

Transcontinental / Cosmopolitan: Linking this idea to the 'eastern appeal' of seaweed covered in the last section. A cosmopolitan approach is a way to introduce new foods to people who have not previously been exposed, without it feeling like new territory. The examples could range from the consumption of sushi as a starting point, an eastern use of seaweed which is familiar, to fried seaweed crisps, still eastern, but more familiar as an alternative to junk food. Then, the argument would be that the transition to the widely accepted application and use of seaweed in the western diet would be easier. So, applications such as a seaweed flavoured biscuit or the use of laver in a quiche or a pie, seaweed as an alternative to salt or a seasoning in and of itself. The transition would be a slow one, involving exposure, willingness to try and acceptance at different stages.

Sustainable: A large factor to consider in the is the increased interest in sustainable practices. There has recently been an increase of high-profile activism globally, with statements in speeches, movies, TV shows, news stories, all raising awareness of the catastrophic effect of humans on the climate (Global Web Index, 2019). The shows *Blue Planet II*, *Before the Flood* and *An Inconvenient Truth* are all examples of this, as well as A-list celebrities like Leonardo DiCaprio (who is a UN ambassador for climate), Arnold Schwarzenegger and Mark Ruffalo

all advocating for increased action in combatting the effects of climate change. The ‘Attenborough effect’ coined by Global Web Index in their study of consumer behaviour in sustainable packaging (2019) found that the speech made by David Attenborough in Katowice in 2018 increased the amount of plastic recycling in the UK by 55%. The blue economy, covered in the next chapter, is also a widely recognised concept, gaining traction in political and social circles alike. Sustainability is a selling point, precisely because it works with the current consumer trends in the British Isles. When I asked Jonathan Williams of Pembrokeshire Beachfood Company if scientific research into seaweed affected the marketing strategies or business model, he replied (13/2/19):

we have always focused on flavour, history, sustainability on our seaweed. It does have numerous health benefits which we have only touched on in our marketing, however other companies focus on [scientific research] in much greater detail.

Health-Oriented: Focusing on the health orientated aspect of seaweed can be a very strong selling point, as stated above. The ‘health orientated’ consumer is looking to extend their life expectancy or quality of their life, especially as leading causes of death in high-income countries such as the UK are largely attributed to lifestyle (Kraft and Goodell, 1993; WHO, 2018). Japan currently has the longest life expectancy, seaweed and other ‘clean’ foods are commonly attributed to the reasons why this is (Arasaki, S. Arasaki, 1983; Philpott and Bradford, 2006).

Countries which consume ultra-processed food and, at the same time, consume low levels of fibre, can be victims of high levels of obesity and even death (Juil and Hemmingsson, 2015; Monteiro *et al.*, 2018). Fibre in seaweed has been proven to help weight-loss in obese patients and studies on rats have shown that seaweed can help reduce the effects of diabetes (Brownlee *et al.*, 2012; Houghton *et al.*, 2015; Lange *et al.*, 2015; Akbarzadeh *et al.*, 2018). Adding seaweed extracts to fast food can also make the food healthier, by adding extra fibre to an otherwise fibre lacking food, which can make consumers feel fuller for longer and therefore consume less (Dhargalkar and Pereira, 2005; ScienceDaily.com, 2005). In general, seaweed has a strong case for marketing as a clean-eating, multi-faceted ‘superfood’, full of nutritional benefits. Spirulina, has also been shown to reduce cholesterol in humans and is fed to chickens to improve yellow pigment in eggs (Sánchez *et al.*, 2003). The micronutrients in seaweed can also improve brain health. B12 is plentiful in most seaweeds, however it is not easy to obtain outside of a meat diet, which is why so many vegetarians and vegans are lacking (Watanabe *et al.*, 2014; Woo, Kwok and Celermajer, 2014). Researchers have found a link between major depression and low levels of folates and b12 in the blood, as well as other neuropsychic disturbances (Fava *et al.*, 1997; Coppen and Bolander-Gouaille, 2005; Bottiglieri, 2009). Seaweed has also been proven to be an effective treatment against acne (Ruxton and Jenkins, 2013; Lee *et al.*, 2014).

Within the UK specifically, there is a relatively low level of awareness of the iodine levels needed during pregnancy and a low availability of iodine-rich items, such as enriched salt, compared to the rest of the world⁴⁰ (Bath, Button and Rayman, 2014; Bouga and Combet, 2015; Combet *et al.*, 2015). With a protein content of up to 47% , B-complex vitamins, vitamin C and some of the largest quantities of calcium (up to 30%) in vegetables, seaweed can be a very attractive health food (Pereira, 2016). While labelling is supposed to market healthy alternatives and at the same time, giving the consumer freedom of choice, there is evidence that consumers regularly do not utilise labelling in their decision making. The more complex

⁴⁰ Apparently 70% of the world has access to iodine enriched salt according to the WHO, but the UK does not fall into this category

the information on a label, the less likely a customer is to use the information (Grunert and Wills, 2007).

Flavour

Famous and popular, the ever mysterious fifth flavour *umami* is associated with seaweed. As mentioned before, many seaweed cookbooks are using this flavour instead of masking it. The idea behind umami is that when combined with other flavours it can enhance them, much in the same way that salt can (Mouritsen *et al.*, 2012; Chapman, Stévant and Larssen, 2015). So, the product can be marketed as a core ingredient or a replacement. This usually involves using the product in a recipe or as a healthy alternative for a different product. Some overlaps in western culture already exist. The popular Japanese cracker mix has flakes of seaweed in it – it is not marketed for the seaweed, but they exist and are widely consumed. Famous and popular, the ever mysterious fifth flavour *umami* is associated with seaweed. As mentioned before, many seaweed cookbooks are using this flavour instead of masking it. The idea behind umami is that it can enhance other flavours it is combined with, much in the same way that salt can (Mouritsen *et al.*, 2012; Chapman, Stévant and Larssen, 2015). So, the product can be marketed as a core ingredient or a replacement. This usually involves using the product in a recipe or as a healthy alternative for a different product. Some overlaps in western culture already exist. The popular Japanese cracker mix has flakes of seaweed in it – it is not marketed for the seaweed, but they exist and are widely consumed.

Whichever focal point is used in a marketing strategy, any new developments in market and production is nonetheless hampered by barriers. Seaweed specifically faces many challenges as it operates in a relatively unknown area of food and health safety. In the next chapter we will look to the farming and harvesting of seaweed, barriers in conservation and potential confusion about what is best for the environment are also fraught with challenges and red tape.

The Blue Economy

**So when storms of wild emotion
Strike the ocean
Of the poet's soul, erelong
From each cave and rocky fastness,
In its vastness,
Floats some fragment of a song:

From the far-off isles enchanted,
Heaven has planted
With the golden fruit of Truth;
From the flashing surf, whose vision
Gleams Elysian
In the tropic clime of Youth;⁴¹**

Travellers and discoverers viewed the sea with admiration, the ocean was a beautiful entity, willing to give and willing to take... a temperamental Spirit or a vengeful God as reflected in the quote above. The excerpt taken from the poem 'Seaweed' by Longfellow (1850) describes seaweed as a resilient fruit from the heavens given to earth as a gift. There have been many water-based Gods in mythology, anywhere where water could be found - from the God of flooding, to fertility, to rivers, to spas, to springs, to the sea (Fontenrose, 1980). In the epic of Gilgamesh, Utnapishtim directs Gilgamesh to dive to the bottom of the sea to collect a 'plant of life', which could be referring to seaweed, although the plant is described as having thorns which no known seaweed at present does (Fontenrose, 1980; O'Connor, 2017). There are, however, accounts of a seaweed named 'prickly tang', the serrated seaweed, of which Gilgamesh may be referring (Neill, 1806; Chambers, 2000).

Our view of the sea at present is clinical and scientific. We are working to create circular economies and mitigate climate disasters (Chen and Graedel, 2016; Chowdhury *et al.*, 2017). This leads us to the blue economy, an exploration into oceanographic opportunities (European Commission, 2013; Moffitt and Cajas-Cano, 2014). The idea is marketed to governments as a positive evolution in business; the development of an otherwise underdeveloped economy and the utilisation of a spectrum of strategies to save the world's oceans and water (Costa-Pierce, 2002; Pauli, 2010; Winder and Le Heron, 2017; Carvalho, Guillen and Calvo Santos, 2018). So much can be said about the 'blue economy', 'blue growth', the 'blue revolution', but I will keep it simple: it is an investment-driven, biological-ecological interaction aimed at redesigning the governmentality of marine resources (Choi, 2017).

⁴¹ From the poem 'Seaweed' by Henry Wadsworth Longfellow (1850)

7.1. Seaweed for the Environment

Moving forwards, we need growth without degradation, use without exploitation, development that is sustainable. The EU holds these ideals to the utmost degree. With so much coastline, 50% of the EU population currently resides within 10km of shorelines (European Commission, 2013). Not only are the shorelines at risk of destruction, sea-level rise and erosion, but also of a loss of cultural heritage (Howard and Pinder, 2003; Perez-Alvaro, 2016). Across the whole of the EU the ‘Not-In-My-Backyard’ principle applies with any kind of disrupting offshore farming (Delaney, Frangouides and Ii, 2016). Although, kelp forests, when planted along coastlines, can act as a cushion, absorbing wave energy and reducing the effects of erosion, this can be useful for preservation (Baldwin, 2000; Dhargalkar and Pereira, 2005; Roberts and Upham, 2012; Hafting *et al.*, 2015). The rising global temperatures, increasing population and threats to land agriculture are also of growing concern, especially with respect to food shortages (Fleurence *et al.*, 2012). In fact, a kelp forest an area the size of the Netherlands would produce enough protein to feed the entire European Union (Perez-Alvaro, 2016; Carvalho, Guillen and Calvo Santos, 2018). Despite this, seaweed farming has declined heavily in Europe since the early 1990s but has slowly been increasing since 2007 (see fig.18. and fig.19. below). Although data is available from 1950, the dataset begins at 1987 because that is when the first records of European seaweed harvesting began.

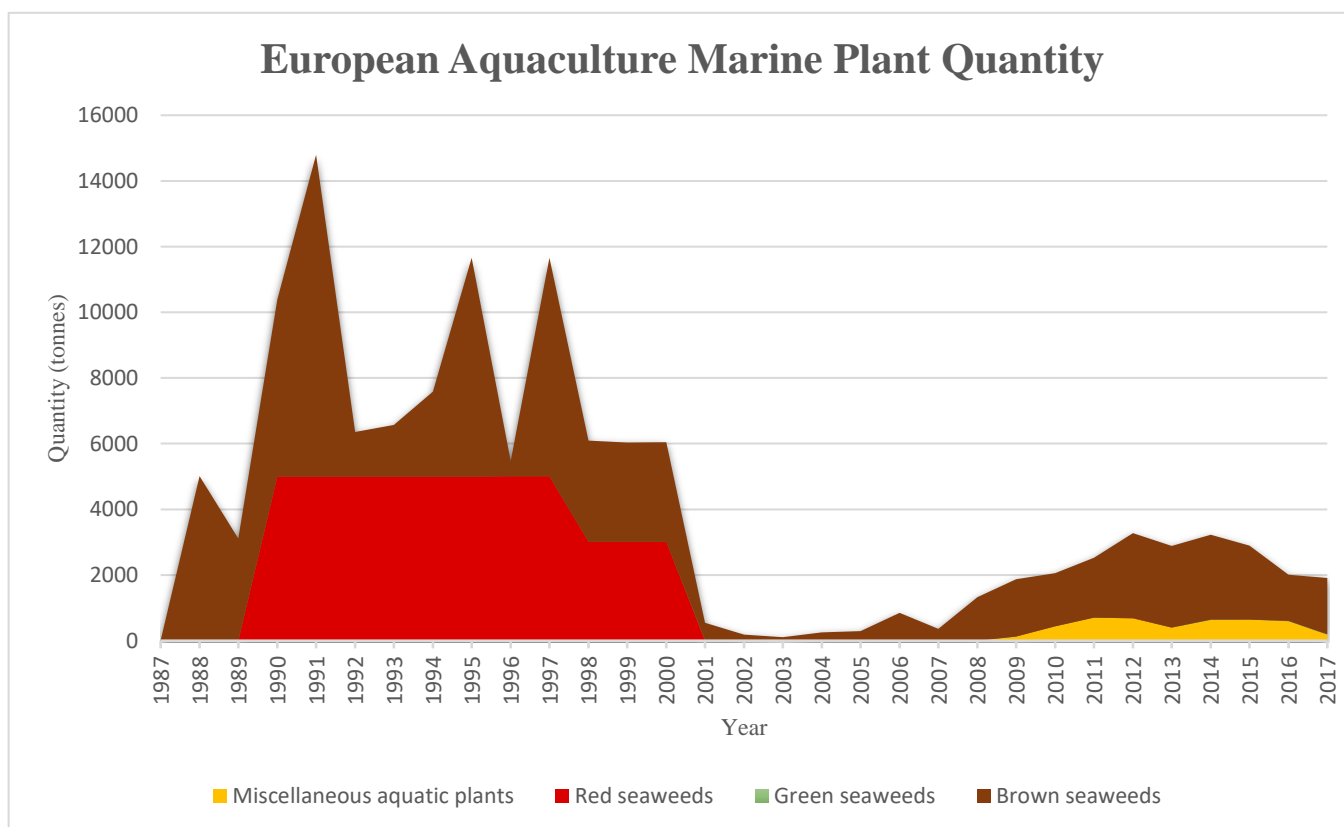


Fig.18. Seaweed Aquaculture Trends, Quantity in Tonnes. Dataset taken from FAO.org

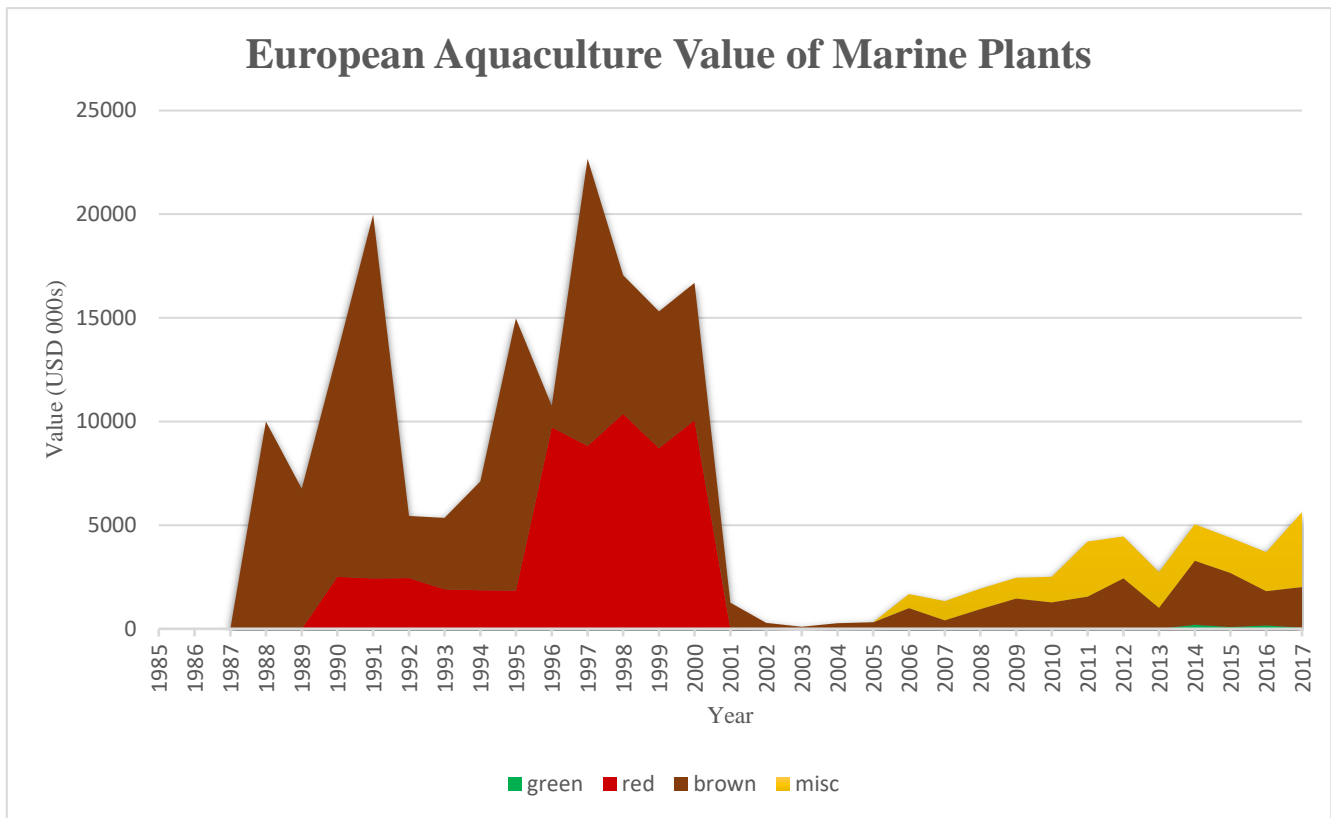


Fig.19. Seaweed Aquaculture Trends, Value in USDs (000s). Dataset taken from FAO.org

Generally, seaweed farming is considered among the academic community to be an environmentally non-destructive practice (Abowei and Ezekiel, 2013). It does not take much to see that our interactions with the ocean have historically been destructive to the environment. Just look at the depletion and near extinction of a small range of species: fur seals, dugongs, whales⁴², lobsters, cod, tuna, to name a few (Shetterly, 2018). The problem is that open-access resources such as these are not well maintained, and we quickly lose the careful equilibrium between sustainable and non-sustainable (Holdgate, 1995). Seaweed forests create large habitats for biodiversity to flourish, but the unsustainable hunting of animals like the sea otter can affect deforestation. Off southern coast of Australia and South Africa an abundance of sea urchins graze on swathes of seaweed without sea otters to prey on them (Thorne-Miller, 1999). In fact, large scale deforestation of kelp forests are all too often caused by sea urchins (Steneck *et al.*, 2002). This is damaging for many reasons, kelp forests are home to any number of fish, mammals, invertebrates and other species of algae⁴³, and the deforestation of these areas threaten the extensive biodiversity (Graham, 2004). Kelp forests are highly productive and some of the most diverse ecosystems in the world, dominating most coastal habitats (Dayton, 1985; Steneck *et al.*, 2002; Erlandson *et al.*, 2007). This highlights the need to support such ecosystems, to plant and harvest sustainably, to protect against unsustainable deforestation by both humans and animals. In countries where the human population is high and protein availability is low, the greatest source of protein is from fish and other marine animals, especially in many small Island states. Seaweed offers an plant-based high-protein alternative

⁴² This can also be divided into the many species or location, the Hebridean stocks of whale, for example, were depleted between 1900 – 1914 (Holdgate, 1995)

⁴³ Not just the most common *Laminaria* brown species of kelp that make up the majority of these forests

to over-farmed or threatened species of fish (FAO, 2000; Mendis and Kim, 2011; Pereira, 2011).

When we discuss the blue economy and environmental improvements, we must also understand ‘blue carbon’ is different from ‘regular’ carbon. Seaweed forests have the potential to create underwater carbon-sinks, effectively sequestering some carbon dioxide and thereby, mitigating some effects of global climate change, including the warming of the oceans (Abowei and Ezekiel, 2013; Ahmed *et al.*, 2017). However, mangroves, seagrass and salt marshes are all known to be the most effective in sequestering levels of carbon (up to four times more than rainforests) and protect shorelines from erosion (McLeod *et al.*, 2011; Abowei and Ezekiel, 2013; Ahmed *et al.*, 2017; World Economic Forum, 2019). They have the added benefit of sequestering both blue and regular carbon, but are at risk of drowning from rising sea levels (McLeod *et al.*, 2011).

7.2. Barriers for Seaweed in the British Isles

It is true that, in the British Isles, locals or families hold the right to collect seaweed for personal consumption (Hibberd, 1872; Blench, 1966; Baldwin, 2000; Field, 2006). They can head out when the tide is down, at 4 am, wicker basket in hand, wellingtons and overalls, prepared for a morning of seaweed harvesting. They have every right to do so. Seaweed collecting was always very popular among coastal-dwelling housewives of the British Isles. The following quote is from Margaret Gatty's *British Seaweeds* (1872, pp. viii) “If anything would excuse a woman for imitating the costume of a man, it would be what she suffers as a sea-weed collector from those necessary draperies”. The quote also appears in Hunt's (2005) ‘Free, Bold, Joyous’ which is a celebration of women’s written accounts of seaweed in the Victorian era. Seaweed gathering appeared to be a common practice for women residing by the coast during this time. The Victorian era experienced a ‘cult of the seashore’, where locals and in-landers alike began to flock to the coast for their weekends, holidays or to live (Edwards, 1986).

In much of Northern Europe, the crown owns the majority of the coastline – the same rules apply now as they did in the 1800s, collecting for personal consumption is fine, but commercial farming along the foreshore requires licences which take a long time to process (Roberts and Upham, 2012; Delaney, Frangouides and Ii, 2016; Wood *et al.*, 2017). In the UK, farmers would need a lease for the seabed and a marine licence in order to cultivate seaweed (Wood *et al.*, 2017). This makes it incredibly difficult and off-putting to conduct large scale cultivation. Regardless, the European Union has recently begun to turn its attention to the ocean for economic opportunities, developing partnerships with organisations that develop large-scale seaweed farming, such as AlgaeDemo, an organisation based in the Netherlands and Belgium (ec.europa.eu, 2019). The historical aspects of seaweed cultivation and future development in fields such as this go hand in hand. Where we know much about the history, the application of previous lessons is where we fall short. Work into the development of large-scale seaweed farms, no matter where in the world they are constructed and for what purpose, should have the proper input from specialists in different fields: aquaculturists, fishers (who have strong oceanographic skills) and phycologists (Bennett *et al.*, 2018; Thurstan *et al.*, 2018). Norway is an example of a European country attempting to change the seaweed game in Europe for good. The Norwegian Seaweed Technology Centre and Seaweed Energy Solutions aim to research, build knowledge platforms and harvest across the whole of Europe (Delaney, Frangouides and Ii, 2016; Ferdouse *et al.*, 2018).

Shared oceans, previously viewed as open-access resources, not separated by clear land borders must be carefully managed. However, because the EU is such a large body, it is divided in

terms of management of oceans. There are many European ‘Blue Growth’ development projects being supported. In 2019, 104 different companies in 22 countries were appointed €15.1 million for new maritime projects (ec.europa.eu, 2019). While many of these projects are ocean funded, many European countries avoid working seaweed cultivation because coastlines are well-protected. In the interview with S.B. Ranger at Seagreens, he shared his frustration with EU procedures and laws with me (15/2/2019): “Overbearing regulation, and in particular the inaccessibility, frequency of change, immutability and sheer volume of EU Regulation, has been the source of immense cost, delay, frustration and uncertainty.” Researchers into seaweed farming, especially in IMTA models or ‘3D farming’, believe concerns are unsubstantiated, and instead improve environmental performance (FAO, 2000; Beveridge and Little, 2002; Pauli, 2010).

While British interest in seaweed is growing, European stocks of wild seaweed are insufficient for the current growing demand (Delaney, Frangoudes and Ii, 2016). One reason for the increased interest is in the levels of iodine. I touched on the importance of proper labelling earlier in the chapters when discussing the iodine content. It is important to be clear when labelling, but the current methods of seaweed farming in the EU can make it difficult to have concrete nutritional data (Bouga and Combet, 2015). Again, S. B. Ranger (11/2018) touched on the difficulties encountered in labelling:

This above all, has been a primary obstacle to investment and in particular the development of production infrastructure in the British Isles. The list of important matters thus delayed is long, including production standards, environmental protection, product labelling, including the organic and novel foods regulations.

7.3. Plastic not so Fantastic

Recently, there have been several developments into seaweed-based product substitutions, such as: alternatives to plastic, biodegradable single-use products and other alternatives to plastic lined products (such as fast food wrappers and cookie trays). Evoware, Ooho and Margarita Talep are a few examples of companies that are using seaweed as a base for their biodegradable products (skippingrockslab.com, 2019; algaeindustrymagazine.com, 2019; evoware.id, 2019). See fig.20. below for examples of the types of products they produce. I found a quote on the evoware.id webpage outlining how and why seaweed can replace common disposable plastic:

Seaweed-based packagings are good for small-format food sachets and wraps, e.g. instant noodle seasoning, cereal, single serving coffee powder and the complements, rice wrap, burger wrap, etc. It's good to replace your conventional packaging to enjoy your delicious food in a convenient and healthy way, and a best way to save our only earth. It can also be used to package the non-food based contents such as toothpicks, soap bars and sanitary pads.

The negative global opinion about environmentally damaging practices has created a movement. Indonesia, for example, aims to reduce its disposable plastic waste by 70% by 2025 (jakartaglobe.id, 2017). Their \$1bn investment in curbing plastic waste has opened opportunities for innovative solutions, including Evoware, a company co-founded by a 25-year-old developer. Ooho, an organisation based in the UK aiming to reduce plastic cups, has collaborated recently with fast food delivery service ‘JustEat’ to find alternatives to single-use plastic sauce sachets. Waves have been made in recent years surrounding the use of sodium

alginates for bioprinting, which could replace the need for organ donors (Song *et al.*, 2011). The hype around these innovations also adds to their popularity on social media and news agencies. Their appeal to the youth is what will likely get them the most exposure online.



*Fig.20. Left: an 'edible water' bubble, intended to replace single use water bottles, source: Ooho Instagram.
Right: biodegradable single use packaging by Evoware, source: evoware.id.*

There are many seaweed products which are not new but are still being used regularly, such as: liquid fertilisers, pharmaceutical bases and other agar or alginates. For these products, the fact that they are made from seaweed is hidden. But clearly this is now changing. Societal shifts in product acceptance are not new. In fact, the class system and use of language have changed the perceptions of products over centuries.

Discussions

Like the sea-tangle, swaying in the wave

Hither and thither, my wife would cling to me,

As she lay by my side⁴⁴

Kelp, or sea-weed, is used with advantage where it can be obtained.⁴⁵

The rate of change is increasing when it comes to aspects of food, health and nutrition. Whether it is caused by food and dietary fads, easier transportation of products, cheaper airfare and an increase of cosmopolitan restaurants or interest in new products, changes in our ‘food culture’ can happen overnight. There was no such thing as a can in England before 1818, paving the way for products like baked beans. Quiches came over from France and blossomed in popularity in England following WWII, sun-dried tomatoes became a staple food in the USA in the 1980s. Changes in acceptance or dejection of a product can seemingly happen overnight. Ten years from now, the types of foods we consume could look completely different from how they look now.

8.1. Language and Class

The language used for plants and foods have often changed over time to become appealing in various marketing strategies. In Swedish, for example, ‘ruccola’ used to be widely referred to as ‘senapskål’ (mustard kale) but has since been rebranded to match the Italian name. This action increased sales, making the salad more appealing to consumers as an exotic and interesting plant (Göransson and Ärlemalm, 2010). Other unfortunate names for a product, historically, include arsewisp, bumfodder and bumf, which were all words used to describe toilet paper around the 17th Century (Dictionary.com; B.E., 1699). Unfortunate names are often a side-effect when translations are involved. I think back to my first visit to Hong Kong in 2014, when all the recycling bins had the words ‘litter cum recycling’ adorned above them. Since 2014 the signs have been changed to litter / recycling, clearly recognising an issue with the original translation. Similar issues with food names around the world include: the Australian ‘Golden Gaytime’ ice-cream, the Chinese toothpaste ‘Darkie’⁴⁶ and the Swedish candy ‘plopp’, to name a few.

Unfortunate or unappealing names can be changed, embraced or altered, as the marketing strategy sees fit. Or, to improve range and recognition, can be divided into subsets with empowered names. Apple, for example, have around 7,500 different species, approximately 100 of which are sold commercially. These species have been separated into instantly recognisable marketable products: Granny Smith, Braeburn, Pink Lady. There is a potential to rebrand products *and* focus on the different genus of seaweed in a developing market, which could allow for better marketing opportunities in a competing marketplace. Although, we

⁴⁴ Quote is featured in a poem by Nippon Gakujutsu Sinkokai 1965, found in Ruud (2006, p. 363)

⁴⁵ Quote from Crozier (1891, p.26) it is actually in reference to its use as a manure, but I thought it seemed fitting here

⁴⁶ later rebranded ‘Darlie’, portraying a smiling black man on the tube

should delve into the fact that macroalgae has already been rebranded once, it was, at one point, named a 'float-wort' in the British Isles, an unfortunate name evoking worse imagery than 'seaweed' (etymology.com).

There is also a relationship between social status and food. Historically, there are many foods that were once considered a food for the poor which are back in vogue so to speak, becoming synonymous with the rich. Rags to riches food items include oysters, lobsters, caviar, monkfish, quinoa, polenta and escargot. Note that a lot of these products come from the sea, in the same way that seaweed does. In this case, the class appeal has something to do with the availability of a product. Oysters, for example, were once so readily available that commoners could walk the shorelines at low tide picking up a bucketful of oysters for little to no cost in times of need. As mentioned in Darwin's *Pickwick Papers* "poverty and oysters always seem to go together" (Darwin, 2004, pp. 425). During the Victorian era, oysters were consumed in abundance, harvested and transported to markets all over the country; the natural stocks quickly depleted (independent.co.uk, 2018). Oysters are also particularly susceptible to pollution. Increasing levels of contamination in the water meant that oyster numbers close to the coastlines dwindled and the cost of fishing for them increased substantially (Gowanloch, 1935). For a time, they were considered an aristocratic food for the upper-class, now, while somewhat keeping this title, they are also considered a sustainable food source, easily replenished and available in a variety of different ways (Hughes-Games, 1977).

Lobsters are today among the most expensive and revered foods in society. Nevertheless, during the colonial-era, lobsters were fit only for the incarcerated, dejected and poor; fed regularly to prisoners, the meals were considered a cruel and unusual punishment (Wallace, 2005). On occasion lobster was also applied to the earth as a fertiliser in times of agricultural need, much in the same way seaweed was (Tye, 2011). One must be careful making these comparisons though, as seaweed is still available in abundance along the seashore. It is not then in the lack of availability that seaweed is making a comeback as a higher-class food though, but instead it is in the way it is marketed which is of the utmost importance. Quinoa is an example of a food which has changed status because of new nutritional information, understanding and global availability. In Japan, where seaweed is better understood as a high nutrition product, nori seaweed prices vary tremendously depending on the way they are prepared and packaged. To give an example, in 2018, a store in Japan's Capital sold a canister of nori seaweed for US\$117 as a 'premium food product' (soranews24.com, 2018).

8.2. Seaweeds and Insects

Much like the consumption of seaweed, entomophagy (the practice of eating insects) is something that, in the west, is often only performed by indigenous or upmarket people. Nowadays one can find insect cookbooks or purchase chocolate covered ants, bees in honey and fried grasshoppers, products available and generally aimed at the upper-class (Ramos-Elorduy, Menzel and Esteban, 1998). Noma, the Copenhagen-based and widely lauded 'best restaurant in the world' made waves by including live ants in some of its dishes; especially selected for their flavour and texture (or for the headlines), the ant dishes have also been served in Claridge's – one of London's most luxurious 5-star hotels (Independent.co.uk, 2012; Telegraph.co.uk, 2015).

The flavour of insects can vary greatly - while nopal worms reportedly taste like fried potato, wasps have a taste more like pine nuts – the preparation and application of the insects can also vary: consumed live, fried, mixed into salads, used as pizza toppings or even drink garnishes (Ramos-Elorduy, Menzel and Esteban, 1998, pp.14). The versatility and exploration of insects

in high quality cuisines has given entomophagy a new light in the current culinary world. The increased availability of insects from around the world because of globalisation is also a factor. While on the streets of Mexico or Thailand insects are a regular street food, in the USA or Europe these are rare sources of food. Societies in the west have not used insects for a long time because of the (similar) connotations with times of hardship. For example, meal worms have a high fat content, so high that in some Amazonian tribes they are cut lengthways and baked over a fire where the fat drips and is collected for the frying of other foods (Ramos-Elorduy, Menzel and Esteban, 1998). The calorific necessity of the consumption of insects has depleted, now the bourgeoisie have a new use for it as a high protein, sustainably sourced food and an iron-rich, high-protein alternative to factory farmed meat.

By 2050 an estimated 10 billion people will inhabit planet earth (Sahoo and Seckbach, 2015). The increased number of inhabitants mean that food production will need to approximately double in order to keep up with the demand. The foreshadowing of climate change and the damage of monocropping generally indicate that resources other than agriculture and pastoral land need to be utilised. Hence why the concept of IMTA farming is becoming so attractive to investors, the ocean becomes a vast and plentiful resource (Hafting *et al.*, 2012; Abowei and Ezekiel, 2013; Makkar *et al.*, 2016). The insights into the growing presence of seaweed in the western diet might also be an insight into other food trends. There are over 2000 species of edible insect throughout the world, the consumption of which is growing in popularity. A common edible commodity in South East Asia, insects are not necessarily widely accepted in the western diet, yet. However, much like seaweed, insects have a certain ‘cosmopolitan’ feel of exoticism.

A study conducted by La Trobe University made links between the appeal of sushi and that of insects (Ruby and Rozin, 2019). The findings indicated that 80% of American participants would be open to the idea of eating whole insects in meals and 65% agreed that insect farming would create less pollution and greenhouse gases than livestock rearing (sciencedaily.com, 2019). Over-population, food waste and compelling marketing strategies mean that “today’s food system exhibits a ‘lock-in’: over-production distorts what bodies need, while human aspirations and market power distort land use, and marketing distorts desire” (Lang, 2010, pp. 89). The consumer culture has distorted the balance of the world’s resources, especially in the production and distribution of food. So, how do potentially threatened companies feel about the rise of more sustainable ‘green’ foods? What area of production are seaweed and insects attempting to replace?

8.3. What is Seaweed Replacing?

While insects may be replacing meat or other sources of protein, it is more difficult to define the items in which seaweed is or will replace⁴⁷. When food was scarce hundreds of years ago, the locals looked to the sea for alternatives for themselves or their livestock. Logically speaking then, something must have replaced seaweed as a desperation food. Completely different methods of human consumption 100 years ago compare to now. Now, it is a health care product, before it was a resource in times of agricultural scarcity. So, the gap it created is not relevant, because it wouldn’t be competing in the same way at all. The price of seaweed in society has gone up dramatically, because of the ‘locally, organic and sustainably’ sourced nature of seaweed cultivation, all labels that demand a higher price. This is also true of the malnourished aspect of society. Since the industrial revolution and the introduction of

⁴⁷ Assuming the upward trend in seaweed will continue and the invested interest in seaweed is not unsubstantiated.

governmental benefits, societies are not starving in the same way they were before. we are certainly not in lack of agriculture, the availability of food is not governed by the weather in the same way it was 200 years ago – now malnourishment becomes an aspect of affordability, if the farming of avocados is stunted, avocados increase in price, sometimes 6-fold. So, considering the current climate, let's say, 'ramen noodles' or rice are a current staple food in times of economic desperation, they are simple foods that provide enough nutrition to survive, but do not offer enough nutritional benefits for a well-balanced diet. In fact, nutritionally speaking, it is a much worse 'desperation' food than seaweed.

So, now 'desperation' foods are something altogether different. The capitalisation of food markets have simultaneously been our success and our downfall, we have an abundance of affordable foods that are no good for us, we have tinned soups filled with sugar and salt, the £1 hamburger, the crime of fast-food. While the use of seaweed died out, these industries had the opportunity to thrive in the gap seaweed left behind. The highly processed 'tech-foods' are what replaced locally resourced, higher nutrient containing foods, like seaweed (Matos, 2012). However, the reintroduction of seaweed is not being branded as a food to have in times of desperation. Farming for seaweed now costs much more, there are more barriers to both harvesting and end-product distribution. The fact that the industry began again from scratch 50 years on from its last real use as a food source means we need to invest heavily in the industry, re-learn how best to use harvest and overcome barriers in harvesting and labelling costs alike. Like many other 'health foods' seaweed has become a product for a more affluent customer.

Below is a diagram (fig.21) of potential products seaweed might replace and the strengths and weaknesses of each replacement. Certain products, like infused rum, biscuits, crackers and gin, have not been included because they only really offer an extra flavour dimension, something for the palate. In this respect, seaweed is not replacing a product, only competing with other unique flavour combinations.

Item		The seaweed replacement	Strengths and Weaknesses
1	Wheatgrass	Spirulina	<ul style="list-style-type: none"> • Spirulina has a strong 'earthy' taste • Colour is very dark blue-green, can be unappealing
2	Salt	Dried Flakes of Seaweed as additives	<ul style="list-style-type: none"> • Does have a different taste to salt • Make require some getting used to • Unfamiliar territory for many people
3	Iodine enriched products	Seaweed capsules Dried Flakes of Seaweed as additives Seaweed Iodine Extract	<ul style="list-style-type: none"> • The Industry already existed but died out • Revitalising an old industry has many challenges • People are unaware of the lack of iodine in their diet
4	Crisps / Chips	Flavoured Nori Sheets	<ul style="list-style-type: none"> • Already very popular in Asia • Many Asian products are already imported to the UK, difficult to compete • Not very similar in flavour or texture
5	Spaghetti	Seaweed 'spaghetti'	<ul style="list-style-type: none"> • Not very similar to spaghetti • A 'healthy alternative' • More expensive than seaweed
6	Junk Food	Alginate-enriched Junk Food (additive)	<ul style="list-style-type: none"> • Claims made about combating diabetes, obesity and other weight-related health problems • The junk-food consumer not main customer for most seaweed industries • May make the products more expensive

Fig.21. Replacement product examples with strengths and weaknesses as replacements

Conclusions

There is one marine production which, from its importance, is worthy of a particular history. It is the kelp... This plant grows on every rock from low-water mark to a great depth, both on the outer coast and within the channels.⁴⁸

9.1. Reviewing the Timeline

Going back to the questions at the beginning regarding the history of seaweed in the British Isles, there is indeed a history of seaweed. This was proven time and time again throughout the third chapter. Seaweed was used as a fertiliser, as a soil conditioner, for glass making, soap making, cloth bleaching, for animal feed and finally, food for humans. It was a sign of Irish hospitality, it was the basis for a soup with seafood, it is the famous laverbread of Wales. But, the history of seaweed was lost once the industrial revolution took over Britain. Food from the sea was viewed as an abundant and worthless food only fit for consumption in times of hardship. The attention turned to land agriculture and the importing of exotic foods. Where farming was once victim to draughts and environmental conditions, it could now be manipulated and mono-cropped, other goods such as bread and pasta replaced the staple foods of economic hardship. The once proliferate seaweed died with the lack of use and so did its history. This diverse set of weeds that were used openly for hundreds, even thousands of years, was reduced to a pharmaceutical, an alginate, an additive and a e-number.

In the isle of Jersey, the human-seaweed relationship was lost, which led to it harming business, tourism and even their potatoes. The coast of Ireland, where seaweed was so ingrained in the culture that it was included as a gift in the Irish code of conduct, is now barely touched. The Scottish isles, where thousands of people relied on the business of seaweed harvesting, to provide jobs, money and opportunity, an industry now lost. England, with the least documented seaweed history, indeed had a strong relationship hundreds of years ago – but the knowledge and the methods of utilisation of which have been forgotten. Wales, where laver bread, recently awarded protected status food, was better known 100 years ago compared to now. But the times are changing, Wales is a prime example of the phoenix rising from the ashes (or potashes), by applying for a PDO for seaweed, bringing attention to algae as a food source in the 21st Century.

But the fear of rapidly increasing interest in a ‘superfood’ is that it risks being a fad. While social media is good for spreading information rapidly and changing opinions, it also means that attention surrounding products and fads can burn out just as quickly. The three companies discussed in the thesis: Ebbtides, Seagreens® and The Pembrokeshire Beachfood Company, are all attempting to create the interest, but without the burn out. They are not trying to create a brand or a food that will last for now, but rather change the attitude surrounding seaweed in the British Isles entirely – “*to get a gram of our most nutritious native seaweeds into the population daily diet.*” – as quoted by Seagreens in chapter two. The best model to follow appears to be the Japanese model, as was mentioned in chapter four, where S. B. Ranger (Seagreens.com, 2019) “*was surprised to find a small amount of seaweed in almost every*

⁴⁸ Quote from ‘the voyage of the Beagle’ (Darwin, 2001, pp.1151)

traditional meal - exactly his aim for our western diet". The significant difficulty found in basing the British model from the Japanese one is that, in Japan, seaweed has always been revered as a delicacy, a food fit for emperors and the height of society. Now that seaweed is widely available, Japan simply monopolised on its popularity. Whereas, in the British Isles, seaweed has historically been a food in times of hardship, so viewing it as a high-class or a regular food source is the challenge.

Discussing such challenges with Seagreens is what led me to my market analysis – how to change perceptions and attitudes. Using SWOT analysis, I was able to analyse further where the opportunities and challenges lie in the marketing of seaweed currently. Problems discovered lay in labelling, restrictions in distributing or in harvesting, widescale EU conservation efforts and fears or inconsistencies around minerals and heavy metals such as iodine. What I also realised was that there are many ways to market seaweed depending on who the target market is. Which consumers are targeted should be considered carefully based on their prior acceptance of seaweed, which is why the consumer triad was created, separating three theoretical consumers based on their current attitudes. Then, the possible USPs were identified based on their relevance to seaweed. This can change based on the marketing strategy and product range, Seagreens, for example, focuses on a health USP, seaweed is iron-rich, high in protein, good for skin, good for nails, effective in weight-loss or diabetes. According to Seagreens seaweed can be an additive, a supplement, a regular alternative to salt or its own seasoning. Whereas Pembrokeshire Beachfood Co. focuses on a local and sustainable USP, they focus on serving seaweed in its natural form, to a public who might enjoy it as a 'vegetable' in a seafood dish. The marketing theories AGCC, ELM and DAGMAR I found to be useful for analysing the different USPs and their effect on changing minds and attitudes, also useful for any further analysis in the field.

9.2. Seaweed is Sexy

I hope the general takeaway from this is that seaweed truly is, sexy. That seaweed has the potential to be attractive to consumers, desirable to the public, fascinating to researchers and full of potential. The UK can learn from its history, in terms of how to better their environments or methods. Sometimes things were done a certain way because they *worked* for all actors in an ecosystem, in cohesion. When we make giant leaps like revolutionising in industry, we speed up production, profit, leaving little time to think about the inevitable consequences of our actions. These are the years that unravel the roots of cultural singularity. In doing so, political and social divides between generations swing Hegel's pendulum in defiance of the natural consequences of sociocultural outcomes, which would otherwise rise from interconnected, interdependent glocal spaces. In this instance there is a careful balance between moving too slowly and too quickly to integrate/assimilate/interact. To do so in either direction, would be met with resistance.

The British Isles are obviously not the only example of an area of the world with strong historical and cultural ties to seaweed. Alaska, France, Iceland, Florida, New Zealand, Rome, Portugal, Norway, Denmark, Indonesia, South Korea all have interesting seaweed tales to tell. From seaweed roofs for houses, to seaweed for weapons in the First World War, seaweed has a remarkable history. But, here, in 2019, the story of seaweed is becoming increasing glocalised. Locally harvested, building on old practices but globally marketed and sold. Now the story is becoming one of health and wellbeing, of co-existence with habitats and agriculture, of improving the world around humans by viewing aquaculture as a 3D interaction instead of a dominance.

The good thing is the ‘uniformed’ fraction of the population is decreasing as people become more informed, are more considerate about what they put in their bodies and care more about the environment. It is at a time like this, when acai berries and wheatgrass are what people want, when a transparent balance of nutrients from reliable sources are important, when ‘superfoods’ are trending, it is here that seaweed has an opportunity. At a time like this, when seaweed not only has a spot as a smoothie additive, but when it can act as a replacement for spaghetti, or instant noodles, or crisps. It can be served in its raw form, or its dried form - in a soup or a seasoning - instead of salt, instead of plastic - in butter, in cheese, in biscuits, in tea - or pesto, or meat. Really, its applications seems endless and I am excited to see what the seaweed market will come up with next.

9.3. Further Research Suggestions

Although I came up with the consumer triad, I was not able to conduct market research on these three theoretical consumers. This kind of information could offer further insight into different consumer thoughts on seaweed and test out the strength of the ELM and the DAGMAR models to see which techniques (if any) worked in changing attitudes.

It would be useful to delve into approaches within the marketing of seaweed while considering ‘green marketing myopia’. That would be application and potentially negative impacts of using a solely sustainable ‘green’ USP.

Much in the same way Chapman, Stévant and Larssen (2015) tested the flavour profiles of different species of seaweed, it would be interesting to research the flavour profiles of British seaweed with the British consumer. This would offer insight into preferences or the subtle differences between the different flavour profiles, useful for marketing campaigns. Similarly, one could further develop new and interesting seaweed dishes and recipes that would appeal to the British consumer.

Because of the increasing popularity in IMTA and 3D farming systems, I would have liked to interview local fisheries about their take on the blue economy. Fisherman have tremendous oceanographic knowledge that could be useful for researchers. Equally, the effectiveness of IMTA systems could be tested using a combination of different species of plant and animal. Finding the ideal combinations could offer new and interesting insights into the field.

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Appendix i



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Thank you for agreeing to participate. The aims of these questions are to determine how history, culture and scientific research in relation to seaweed can affect business models and marketing strategies (if at all). Please elaborate as much as possible for each question and ask the researcher if you need any clarifications. If there are any questions you do not feel comfortable answering, just leave the answer blank. Your answers will be recorded and used in a case study for a master's thesis at Uppsala University. If you wish to withdraw your answers, you can do so at any time by contacting Rhianna Rees at rhiannacat@hotmail.com.

Questions:

1. In which year did your business start-up?
2. How would you describe your seaweed business model?
3. Who is your target market/average customer?
4. In your location do you currently/have you had strong cultural ties to seaweed?
5. Has your knowledge of the history of seaweed in your area affected your marketing strategy at all?
6. Has scientific research into seaweed affected your marketing strategies or business model?
7. How has your business model and marketing strategy been affected by higher value seaweed products (if at all)?
8. Have you had any difficulties penetrating your target market?