

Seaweed Sovereignty: Seaweed's Role in the Irish Potato Famine and Modern Day Irish Culture

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Introduction

The Irish Potato Famine, when studied, typically focuses on the food source in its name, potatoes. A seven year disaster of poverty and starvation that led to the deaths and emigration of millions of Irish people is far more complicated than the outbreak of a fungal disease. Political, religious, and ethnocentric factors played a role in the destruction of the native Irish population. Seaweed was one of the few food sources that the starving Irish people had access to and were able to take advantage of in order to survive. This seemingly miraculous marine plant saved the lives of many people during those dark times, but its Irish history goes far beyond the famine. In both historical and modern times, seaweed has played a role in Irish food and industry culture, having a multitude of uses and benefits. The seaweed industry today continues to grow and gain attention, being reminiscent of and honoring ancient Irish culture, and providing jobs in a sustainable, equitable field for Irish people who have centuries of knowledge on the varieties of kelps and algae growing on their coasts.

Nutritional Benefits of Seaweed and its Viability as a Food Source

Several seaweed varieties contain a multitude of nutritional benefits, which may differ based on seaweed type. In both coastal and non-coastal communities, these benefits do not go unnoticed, which is shown in the several cultures such as Japanese, Chinese, and Icelandic, as well as Irish that have eaten seaweed for centuries and continue to do so in modern day (Mahadevan, 2015). Seaweeds are considered both a food and marine medicinal resource. Nutritional value can vary, but many edible varieties have high concentrations of fiber, minerals, fatty acids, and moderate concentrations of lipids and proteins, especially in comparison with common land-grown vegetables (Rakapaske et al., 2011).

Seaweed protein specifically contains all the essential amino acids, and the amino acid index is higher in red seaweed than green or brown seaweeds. The amino acid score in red seaweed proteins such as *Porphyra* spp. and *Undaria* spp. was 91 and 100, which is the same as animal derived-foods. The blue-green alga *Spirulina* is also high in protein, which is about 70%

of the dry matter (Rakapaske et al., 2011). Super Unsaturated fatty acids (Such as omega-3 and omega-6 fatty acids) are essential to human development and maintenance of brain function, but humans cannot synthesize them, they must be taken in through diet. Algae *can* synthesize these fatty acids, and the consumption of algae and foods that can do so by humans is linked to the evolution of complex and large brains (Mouritsen et al., 2024).

In terms of minerals, seaweeds contain a high amount of ash, and mineral content can make up to 36% of its dry mass. Macronutrients can include sodium, calcium, magnesium, and other essential minerals to human vitality and ability to thrive. Dietary fiber, as in non-starch carbohydrates in seaweed can range from 36% to 60% of its dry matter, which is considered to be similar or higher to plant origin sources of soluble fiber (Rakapaske et al., 2011). Dietary fiber supports the health of the gastrointestinal tract, can reduce risk of colorectal cancers, facilitate growth of healthy gut microflora, and suppress bowel inflammation. It is possible to make up to 12-15% of one's daily necessary dietary fiber intake by adding just 8 grams of seaweed into one's diet (Rakapaske et al., 2011). Edible seaweeds can have numerous health benefits, but they are not regularly considered to be calorie dense foods.

Although they cannot always supplement necessary caloric intake, their high concentrations of vitamins, minerals, and fatty acids mean they do provide important nutritional benefits. A food source does not always mean a high calorie component of the diet, but can refer to foods that supplement vitamins and proteins. Seaweed can be especially beneficial in times of food insecurity, as it is a rather straightforward food source to obtain that contributes vital components of a human's diet.

Species of Seaweed Common in Ireland

In order to understand seaweed consumption and usage in Ireland throughout history to today, it is important to understand the fundamental varieties of seaweed that are common to the Irish coasts, and which edible ones are most harvested. Seaweeds are considered to be a microalgae, and within this, classified into three groups: Phaeophyta (brown algae); Rhodophyta (red algae); and Chlorophyta (green algae) (Mahadevan, 2015). Irish coastlines are extremely diverse, with the Atlantic side coast having the most biodiversity. About 7.5% of the world's seaweeds have been reported from Ireland (Monagail Mac et al., 2020). Scientific examinations of Irish seaweed began in the 18th century, and up to today, over 500 species of seaweed have been identified in Irish waters (Morrissey et al., 2011). This is a high number in comparison with

the relative size of Ireland, larger coastlines such as that of France has about 690 identified species, clearly not a ridiculously larger number. One of the reasons for high species diversity is that Ireland is between 51° and 55° North, which means that the range of latitudes contains both the northern limit for some warm-water seaweed species, and the southern limit for cold-water ones (Morrissey et al., 2011). With the exception of a few restricted coastal areas that are within close proximity to large cities, Irish shores are considered to have remained quite pristine. This aids in the establishment and maintenance of large seaweed assemblages in the Irish sea.

Although the species number is vast, Irish industry has heavily relied on seaweed species such as *Ascophyllum nodosum* (Linnaeus), brown seaweed or algae in the family Fucaceae (Monagail Mac et al., 2020). Dominant brown seaweeds grow in horizontal bands on rocky shores, and there are about 147 species that have been reported, with kelps and wracks (seaweed or grasses that are part of the Fucaceae family or wash up and accumulate on the wrack zone of the beach) providing the most biomass and commercially sought after species. Some of these include kelps such as *Alaria esculenta*, *Laminaria hyperborea*, and *Laminaria digitata* (Morrissey et al., 2011). Wrack seaweeds may refer to *Fucus vesiculosus*, *Ascophyllum nodosum*, or *Pelvetia canaliculata*. Red algae can range in color from red, to bright pink, to a dark purplish, but are often bleached by the sunlight. About 247 species of red algae can be found in Ireland, some of the commercially important ones are *Palmaria Palmata*, *Porphyra spp*, and *Asparagopsis armata* (Morrissey et al., 2011). Green algae are more delicate, with thin fronds that are a light green color. Around 8- species of green algae are found in Ireland, the commercially important ones being *Ulva lactuca*, *Enteromorpha intesetinalis*, and *Codium fragile* (Morrissey et al., 2011). A very important kelp in Irish waters is *Laminaria hyperborea*, or “sea rods” that were used for raw material in production of animal feed, cosmetics, medicine, and iodine (which it contained a high concentration of).

In the Rhodophyta, or red algae group, various species were used as a food source or for fertilizer. Coralline red algae, and several other native species of Rhodophyta are referred to collectively as maerl, and the two of the most economically important are *Phymatolithon calcareum* and *Lithothamnion corallioides*. Large amounts of both wash up on Irish shores and have been used as a soil treatment and an additive for animal feed (Monagail Mac et al., 2020). The red algae *Chondrus crispus* produces the thickening agent, carrageen, which was traditionally used in Ireland and is a very common ingredient in several types of foods today

(Mahadevan, 2015). The edible red seaweed *Palmaria palmata* is a reddish-brown color, has soft fronds, and typically grows out into multiple segments is commonly referred to as Dulse in Ireland. The name Dulse comes from the Gaelic word *duileasc*. It is a cool temperature perennial that can regrow from every year, making it an especially valuable food source during the Irish Potato Famine (Maine Coast Sea Vegetables).

Several of these varieties of seaweed can be found elsewhere in the world depending on climate, but it is necessary to understand what varieties of seaweed are familiar to Ireland to gauge the types of seaweed that were consumed during Irish Potato Famine, and continue to be commonly consumed today.

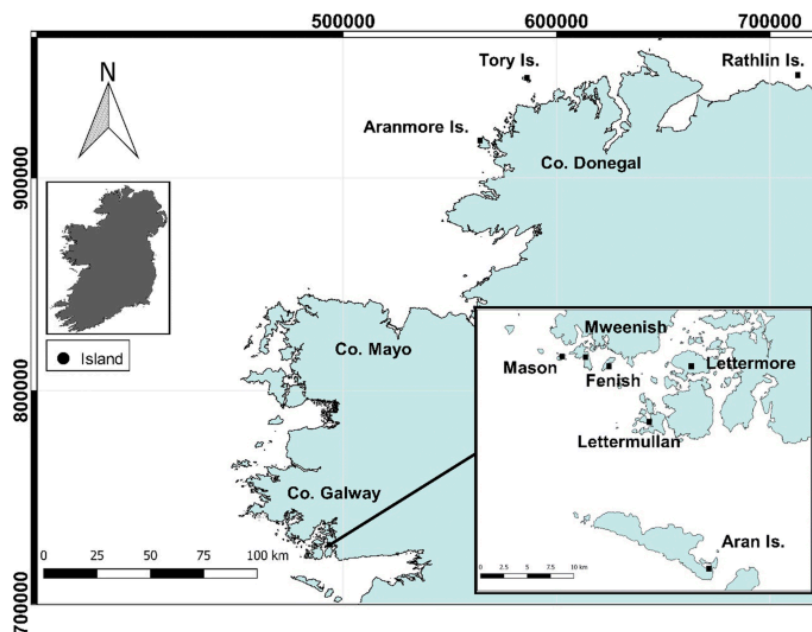


Figure 1. A map of some locations in Ireland where seaweed is harvested (Mac Monagle et al., 2020)

A Brief History of Ireland's Poverty

During the mid-nineteenth century, Ireland was most known in the western world for how impoverished its people were. This was the case even before the Irish Potato Famine. About two fifths of the entire population of about 8.2 million were recorded to have lived in what was called 'fourth class houses', which were one roomed cabins (Ó Murchadha, 2011). This was largely due to the British rule that had begun in the twelfth century, in which the early Irish history of a

thriving, independent civilization began to disintegrate. Ireland had previously avoided conquest by the Romans which allowed their customs to remain (Ó Murchadha, 2011). The year that King Henry II of England took Ireland under British rule marked tremendous change. Irish lands were given away to English nobles and generals, and with this England gained more and more control (Ó Murchadha, 2011). Throughout Henry and then Queen Mary I's rule, there were several Irish chieftains that tried to rise against British rule, but these rebellions were put down by James I in 1603. King James I took the defeated chieftains land, and gave it to thousands of settlers who flooded in from England and Scotland between 1607 and 1641(Ó Murchadha, 2011).

The Irish people fought with James II when he attempted to take back his throne from William of Orange in 1690, but was defeated. Ireland's Protestants (Irish natives were typically Catholic at this point, and Irish Protestants had stemmed from British rule and overtaking of Ireland) introduced the Penal Laws which tried to eliminate as much Catholic practice as possible, in a largely Catholic region (Ó Murchadha, 2011). These Penal Laws also prevented Catholics from purchasing or inheriting land, voting, holding any public office, practicing law, serving in the army, or owning a gun or sword. Catholic churches and schools were closed down. Essentially, the goal was to eliminate every possible independent way of life the Catholics could have (Ó Murchadha, 2011).

The Penal Laws were eventually repealed in totality by 1829, but by this point less than 5 percent of Irish farms were owned by native Catholic Irish people. A small percentage of Anglo-Irish landlords (Protestant landlords who were of English origin) owned the majority of Irish land (O'Neill, 2009). This led to the indentured servitude of most of the Irish population, through smallholder land ownership and leasing, and Irish natives living in squalor on rented land, barely surviving. Poverty and illiteracy were very high for a majority of the population (O'Neill, 2009). This historical context is essential in understanding how the Irish Potato Famine came to be, and why it was so devastating for the country.

The Irish Potato Famine

Referencing the word's of Sinéad O'Connor, it is time to talk about Ireland, specifically to talk about the famine (A reference to her song *Famine*). During the time of land occupancy and ownership by the Anglo-Irish, the only factor sustaining the lives of the Irish was the potato crop. A high yield crop that could sustain several people, that also took up a small portion of land, and could be eaten year round was what kept the poor of the country from starvation. Many

small/land holders, and the impoverished under them grew potatoes exclusively. Right before the famine, about 3 million Irish people were completely dependent on the potato (Ó Murchadha, 2011). Estate holders were typically uninvolved in their farms, as their land was divided up among middle-class Irish farmers, known as middlemen. This land was then divided further to tenants and laborers. Middlemen paid rent, and the land owners profited, middlemen made money by renting land to poor tenant farmers, and some of the laborers were also given a small plot of land (typically $\frac{1}{4}$ of an acre) (Ó Murchadha, 2011).

The most a laborer could do for their own survival was build a small cottage and grow potatoes. Tenant farmers usually had about 20 acres, consisting of animals and some other crops like wheat and other grains. These grains however were almost always exported to England and other parts of Europe, keeping the Irish reliant on potatoes for survival (O'Neill, 2009). Seaweed was actually consumed during this time as well, as it had been for centuries before in Irish cuisine. Dulse was used as a condiment or mixed into potato dishes. In 1845, disaster struck in the form of a fungus, *Phytophthora infestans*, commonly known as Potato Blight. The weather of the growing season constantly shifted between warm and sunny and hard, cold rain. Eventually the weather seemed to settle, and only a few areas seemed to be seeing small amounts of the fungal disease that had been spreading in Southern England (O'Neill, 2009).

Mid-October harvest revealed withered and slimy potato plants across all of Ireland though, and potatoes that had seemed to be rotting before they even came out of the ground shocked the Irish people (Ó Murchadha, 2011). The few healthy potatoes that were harvested rotted in storage, and Ireland was predicted by January to have no potatoes left at all. The British Government was incredibly slow to aid Ireland's starvation, and the efforts to help were widely flawed (Ó Murchadha, 2011). The harvest of 1846 proved the Potato Blight had persisted, but much of the population had survived (just on a smaller amount of food than they were previously used to) (Ó Murchadha, 2011).

By 1847, deaths drastically increased, and farmers who fled the countryside looking for help in urban areas. This resulted in overcrowded spaces that spread the illnesses that those who weren't dying of starvation were suffering from. Landlords encouraged tenants to go to workhouses for short periods of time, and when they returned, they found that the landlords had burned down their cabins (Ó Murchadha, 2011). Some landlords lied to Poor Law officials, so that their tenants would not receive aid. Many tenants stayed in their cabins out of fear of what

would happen if they left until they starved to death (Ó Murchadha, 2011). The estimated total deaths during the Famine was over 1 million, a quarter of the Irish population. The Potato Blight was perhaps just a fungal disease, but the Irish Potato Famine was far more complicated, being rooted in political, religious, and ethnocentric rules that the English sought to control the native Irish people with (Ó Murchadha, 2011).

Seaweed Consumption and Foraging During the Famine

Although there were other crops grown in Ireland at the time of the Famine, they were limited, and largely exported to England and other countries. This engineered control by the British did not aid in the native Irish struggles during the Potato Blight. There were some resources however, that were accessible from nature that the English did not typically commandeer, such as seaweed. The native Irish people were finding themselves scrounging for other sources of nutrients, and this is where seaweed consumption came into play. The harvesting and consumption of seaweed had been traditional for centuries before the famine in Ireland. However, seaweed was so heavily used as a last resort during the disaster, that it became associated with famine and poverty.

As Irish people were starving, they were eating old cabbage leaves, weeds they found on roadsides, and dulse. On average before the famine, Irish peasants consumed 3-5 kg of potatoes per day, which along with dairy, made up their entire diet. Once the famine hit, seaweed, while not extremely filling, was one of the few sources of vitamins and minerals that the starving Irish were able to get (Mouritsen et al., 2020). Seaweed was mixed into soups with shellfish or with whatever vegetables (often turnips) were available (Mouritsen et al., 2024). It was an improvised adaptation strategy that Irish people used in order to survive. In the west of Ireland, to grow any potatoes, islanders would make holes in rocks and fill them with soil, desperately hoping for a small success. What few potatoes were harvested from this, were then supplemented with seaweed (Mouritsen et al., 2021).

A common question that could be asked is “why didn’t the native Irish just fish?”, which seems reasonable considering that the entirety of Ireland is coastal. It is true that fish did feed some of the population, but between the years 1846-1847, the herring population failed, which was the species that many fishermen depended on (Ó Murchadha, 2011). Some fishermen had also sold and pawned their boats and tackle, desperate for any source of income. By the time the herring population had returned in 1848, they had lost their supplies to fish with. Those who still

had boats by 1848 were often physically weakened, and couldn't make it to sea, or drowned from the inability to row themselves back to shore; sometimes with their boats filled with fish as they sank (Ó Murchadha, 2011). Seaweed and shellfish were easier to collect, and were competed for on the rocks. Other food sources such as rabbits and hares were caught almost to the point of extinction. Some tried to collect bird eggs from nests by hanging from a rope off of the sea cliffs, often falling to their death from physical weakness. (Ó Murchadha, 2011). Although it did become a staple at this time, seaweed led gatherers to their deaths too. As more and more of the starving tried to collect the food source, gatherers were pushed further and further out onto the rocks. These slippery rocks were exposed to deadly crashing waves, which brought many seaweed gatherers to their end (Ó Murchadha, 2011).

The ultimate theme of the Irish Potato Famine (and many other famines in history) was desperation, the willingness to do whatever it took if there was even the tiniest chance of some food. Unfortunately seaweed did not save the entire Irish population, it didn't stop over a million deaths and prevent several million people from emigrating (O'Neill, 2009). It did however save some lives, and it was undoubtedly a resource that the native Irish people were able to take advantage of under the noses of the Anglo-Irish. Despite living through one of history's most disastrous famines, the Irish used seaweed as a way to sustain their food sovereignty and culture.

Seaweed in Pre-Famine Irish Culture

Up until recently, it is the unfortunate truth that seaweed consumption in Ireland became synonymous with the famine and known as "poor people's food" (Mouritsen et al., 2021). This could lead to speculation that this association was encouraged by the Anglo-Irish, possibly hoping to destroy what sense of food sovereignty and heritage that the native Irish people had left after the famine. However, Ireland's history with seaweed goes much further back than many, even Irish, people realize.

Before English Common Law, Ireland was governed by its indigenous legal system known as Brehon Law. These laws were administered by the Brehons, who were the successors to Celtic druids (Courts Service of Ireland, n.d.). These laws are considered to be quite progressive for the age, and before English law, there was no court system or police force in Ireland, suggesting that people had a very strong respect for the Brehon law (Court Service of Ireland, n.d.). These Brehon laws from the 5th century mention seaweed, dulse (duileasc) specifically, being used as a condiment with bread and butter (Mouritsen et al., 2024).

Considering that Brehon laws also existed verbally before ever being written down, there is a possibility that seaweed has been used even further back in Ireland, perhaps to the earliest of Irish civilizations. Historical accounts have uncovered laws specifically related to seaweed collection in Ireland dating to the 10th century AD (Buckley et al., 2023). There is further evidence that marine plants have been gathered and eaten in Ireland since at least the middle ages (Morrissey et al., 2001). During the twelfth century, it was said that Irish monks collected seaweed to help feed the poor, so there was some ancient association with seaweed being for those who were starving (Mahadevan, 2015).

Verbally, it has been passed down that Celtic warriors would eat dried dulse for stamina while marching, and that British soldiers later on would replace their chewing tobacco with it to help prevent scurvy while out at sea (Maine Seacoast Vegetables, n.d.). The Auld Lammas Fair has taken place every August since 1606 in Ballycastle, Northern Ireland. This fair has a very long and rich history, including the trading of dulse during it, possibly the longest tradition of dulse trading (Maine Seacoast Vegetables, n.d.). Even today, dulse is sold in bags with yellowman, a toffee-like Northern Irish candy made from golden syrup. This combination has dated back for decades, and dulse alone since the origin of the fair.

Seaweed was also used for other purposes in historical Ireland. Dulse (and other seaweeds) were commonly used as animal fodder (Mahadevan, 2015). Kelp and other brown seaweeds contain large quantities of iodine, and could have antiseptic properties when used in ointments. Seaweeds were dried and burned into ashes from which iodine and potash could be recovered, and then used in glass production (Mouritsen et al., 2021).



Historical and Modern Harvesting Methods of Seaweed in Ireland

With advancing technology, the harvesting methods of seaweed in Ireland have changed, though many modern industries and methods pay homage to their historical predecessors. The collecting of seaweed is known as *agbaint feamainne*.

The traditional method of wild harvesting was to manually cut the seaweed on foot during low tide (Vance et al., 2023). When harvesting seaweed in Connemara, gatherers would cut during low tide using a sickle or small, sharpened knife known as a *corrán* (meaning crescent) or a *scian bheag* (little knife) (Mac Monagle et al., 2020). The collected seaweed was then placed on two crossed ropes that tied the sacks of seaweed into place in a 2-4-t (tonnes) *climín feamainne* (a bundle). After the seaweed was tied up, it was either allowed to float with

the incoming tide or immediately put in tow of a traditional *currach* boat, which would transport it to the nearest harbor to be processed (Mac Monagle et al., 2020). *Curraachs* were small wooden rowboats, it was traditionally a wooden frame with animal skins stretched over it (Vance et al., 2023). Counties such as Clare and south Galway a flat *climín* or a *téad* (rope) was common in harvesting. Seaweed hooks, called *scian mhór*, was essentially a scythe style knife that was mounted on a twelve foot handle to collect seaweed from deep rocks off the coast (Campbell, 2021). In County Kerry, a *corrán cam*, or a seaweed drag (or hook), was used on a long handle to cut seaweed off of underwater rocks (Campbell, 2021). These manual harvesting methods, though effective, are small-scale, with a harvester cutting about 1-4t of seaweed per day (Vance et al., 2023). These harvests were essential to certain industries though, such as the soap industry in England, which relied on seaweed harvested in County Donegal in the 1960s (Campbell, 2021).

Modern day seaweed cultivation is a mixture of wild harvesting, and current technology. Of the five hundred or so seaweed species in Irish waters, about twenty of them are relevant in modern day commercial cultivation (Steelesrock Strategy Consulting, 2023). The previously explained traditional methods are still common in modern harvesting, with some seaweed cutters being able to bring in up to 7 t per tide cycle (Mac Monagle et al., 2020). Beds that have been cut are then left fallow for between 3 and 7 years to allow regeneration, and this varies based on harvesters local knowledge and experience. By about 2016, the boat and rake method of harvesting seaweeds (algae specifically) was introduced in Ireland, in which gatherers stand on a boat with a long rake trailing in the water that collects the seaweed (Mac Monagle et al., 2020). These rakes are specially designed to cause as little change to the habitats as possible. However due to the slopes of shoreline and geomorphology of several parts of the Irish coast, traditional harvesting methods are still the only viable methods (Mac Monagle et al., 2020). Modern harvesting methods have been formed around sustainability. This stemmed from increased exploitation of certain Irish seaweeds (such as *A. nododsum*) in the 1960s that made it clear that some of these harvests were going to be large-scale. These methods can include leaving the base of the seaweed plants attached to the shore to speed up the regeneration process, and leaving pockets of completely undisturbed plants to minimize the displacement of fish and other animals (Morrissey et al., 2001). Practices such as these are common among the harvesting of several Irish seaweed varieties.

	
<p>A <i>scian mhór</i> (Sythe style knife) (Campbell, 2021)</p>	<p>A <i>corrán cam</i> (Seaweed hook/drag) (Campbell, 2021)</p>

Mechanical harvesting involves a machine cutting the seaweed, and although they are efficient, there is a lot of concern around their impact on ecosystems. Many mechanical machines can kill up to 30% of the seaweed plants as they are being harvested, thus eliminating the Irish sustainability model of preserving the stumps of the seaweed plants they harvest from (Mac Monagle et al., 2020). The National Parks and Wildlife Service (NPWS) at the Department of Culture, Heritage, and the Gaeltacht in Ireland are responsible for the protection and conservation of Ireland's seaweeds, and have expressed their issues with licensing mechanical harvesting (Mac Monagle et al., 2020). Mechanical harvesting is legal in Ireland, but a license can only be provided by the Irish government. Currently, the only company that holds a license is BioAtlas, and the areas in which seaweed is allowed to be mechanically harvested is restricted to specific spots.

Commercial seaweed farms are still in their infancy, as the Irish seaweed industry is only recently gaining global popularity. The first commercial seaweed farm was established in 1996, and today there are 25 licensed farms in Ireland (Steelesrock Strategy Consulting, 2023). Wild harvesting still remains the most popular method, as these commercial farms require more infrastructure and investment than what is currently available. However agencies such as Bord Iascaigh Mhara are working to promote sustainable seaweed aquaculture (Steelesrock Strategy Consulting, 2023). There is also something to be said for the deep rooted tradition of wild seaweed harvesting in Ireland, and seaweed farming could potentially change or diminish this culture.

Modern Day Seaweed Resource in Ireland

Today, the seaweed industry in Ireland is growing in popularity, from both a culinary standpoint and other uses. *Chondrus crispus*, or Carrageenan (also called Irish moss) is the most important and well known Irish seaweed (Morrissey et al., 2001). Hydrocolloid carrageenan is a polysaccharide that can be used in the place of agars and other substances as a thickening agent. The culinary use of these polysaccharides is vast, in the thickening and preservation of milk, in canned goods, bakery fillings, salad dressings, pet foods, ice creams, and so many more. They can also be used in the production of alcohols such as wine and beer (Morrissey et al., 2001). Carrageenans are also found in soaps, body lotions, toothpastes and other common household goods. Traditionally, they were used in soap making, for leather curing, and the manufacturing of paper and linen. Medicinally, carrageenans can be used as a stabilizer in medical creams and drugs, and was previously used in the 1830s as a treatment for bronchitis and other respiratory ailments (Morrissey et al., 2001). Sea moss gel has gained recent popularity as a “health food” item online, and it is made of carrageenan.

Palmaria palmata, also known as dulse or dillisk, is the other most popular seaweed that is harvested in Ireland. It is harvested year round, and its vitamin content is known to be very high. Dulse is often eaten dried in whole plant pieces or in flake form (Morrissey et al., 2001). It can be mixed into breads and soups, used as a condiment, eaten alone, or with potatoes (which takes the form of a popular Irish dish called colcannon). Dulse is also used in several cosmetic products, and in fruit wine production (Mac Monagle et al., 2020). As previously mentioned, dulse is eaten with honeycomb candy, called yellowman in Northern Ireland. Medicinally, it was used in the 1800s in Ireland as a treatment for parasitic worms, as it contains some the anthelmintic (worm killing) compound kainic acid (Maine Seacoast Vegetables, n.d.). Popularity for dulse has become worldwide, with companies such as Maine Seacoast Vegetables growing it in Maine and shipping throughout the U.S. and Canada

Ireland is one of the main seaweed producers in Europe, and is estimated to produce about 30,000 tonnes per year, the majority of which is wild harvested (Vance et al., 2023). This harvesting and production contributes to the supplemental income of coastal Irish families, while preserving cultural heritage practices. Seaweed aquaculture, both wild and farming, help to create high-skilled jobs in rural coastal communities in Ireland. Many of these coastal communities have preserved wild seaweed harvesting for centuries, and understand the

traditional methods of collection (Vance et al., 2023). The Irish seaweed industry is predicted to provide employment opportunities for up to 40% of the Irish population who live within 5 km of the coast as harvesting efforts continue to grow (Mac Monagle et al., 2020).

The global commercial market value for seaweed in 2020 was about \$16.7 billion in U.S. dollars, and has been estimated to increase to \$30.2 billion by 2025, which is a compound growth rate of 12.6% in just five years (Steelesrock Strategy Consulting, 2023). This is thought to be due to an increased demand for seaweed in culinary, cosmetic, industrial, and agricultural sectors. The overall demand for seaweed is still primarily for food purposes, including the hydrocolloids used in starches such as guar and xanthan gums. It is expected that this demand for seaweed will continue to be primarily in its uses as an alternative food source (Steelesrock Strategy Consulting, 2023). Efforts from organizations such as the National Marine Research & Innovation Strategy 2017–2021 is to encourage the growth and contribution of seaweed as part of Ireland’s food production, as this is the country’s largest indigenous industry sector (Mac Monagale et al., 2020).

The consumption of seaweed in Ireland has seen a comeback in the past few decades, as it was previously not as popular, likely due to its association with the Irish Potato Famine. Recently, seaweed has undergone a sort of culinary “renaissance” in Ireland, and across Europe, being appreciated for its health benefits as well as its flavor potential (Mac Monagle et al., 2020). Prannie Rhatigan M.D., has helped in this rebirth, with her writings on the harvesting and cooking of sea vegetables, and the health benefits they can provide (Mouritsen et al., 2024). She was praised as “Ireland’s leading seaweed expert” by *Food and Wine* in 2012. Irish Michelin starred chefs such as JP McMahon have incorporated seaweed into many of their renowned dishes. McMahon even argues that seaweed should be given the title of Ireland’s national vegetable (Hanlon, 2023). Why has seaweed become so popular? There are a multitude of reasons. With culinary experts becoming increasingly interested in alternative food sources, seaweed raises its hand as a sustainably cultivated, environmentally friendly option that can lend itself to a variety of dishes and uses.

Environmental Benefits of Seaweed Cultivation

Although seaweed cannot “save” the planet or stop climate change, it can certainly contribute. Globally, seaweeds and microalgae (such as phytoplankton) are responsible for producing most of the atmosphere’s oxygen and the fixing of carbon dioxide (Mouritsen et al.,

2021). The increased cultivation of seaweed could not only be used for commercial purposes, but also as a potential way to sequester carbon while simultaneously increasing nutrients and biodiversity in coastal waters (when put in the deep ocean) (Vance et al., 2023). Seaweed could also help to mitigate greenhouse gas emissions in two additional ways. The first is an increased rate of consumption in place of meat, and the second is to actually increase the use of seaweed in cattle feed, as it can lower the emission of methane from cattle ruminant digestion (Mouritsen et al., 2021).

Seaweed harvesting, at least while using manual methods, also has a relatively low environmental impact. Mechanical methods decrease social benefits (jobs that involve labor) and increase negative environmental impact (Vance et al., 2023). Thus, the manual seaweed harvesting that dominates Ireland's industry contributions should continue to be encouraged for social and environmental reasons. The cultivation of wild and farmed seaweed has become prominent within the EC and Joint Research Centre reports on the Blue Economy, as it has become its own sub sector in the blue bioeconomy in Ireland (Steelesrock Strategy Consulting, 2023). However, it is estimated that increasing water temperatures will have a negative impact on essential Irish seaweeds such as *A. nodosum*, altering the growth, quality, and health of the plants (Mac Monagle et al., 2020). In order for seaweeds to continue to aid in positive environmental change, action must be taken to combat climate change from several points, without primarily relying on seaweed to fix the issues.

Asian and Pacific Cultures that Cultivate and Eat Seaweed

Ireland is certainly not the only country that cultivates and benefits from the uses of seaweed. There are several other areas in the world that not only contribute even more to the global production of seaweed, but have cultural ties to it that are just as old, or even older than those in Ireland. About 13 million tons of seaweed is harvested across 40 countries every year (Mahadevan et al., 2015).

Seaweed has been widely consumed traditionally in Asian and Pacific cultures such as China, Japan, across the Pacific, and the Republic of Korea (Young et al., 2022). In Asia, seaweed is eaten in soups, salads, pickled in certain dishes, in condiments, and in sushi (which was one of the ways seaweed became initially popular in the modern Western world in areas such as the United States) (Young et al., 2022). Japan, China, and the Republic of Korea are the largest consumers of seaweed (Mahadevan et al., 2015). It has been found that seaweeds were

consumed in China in 2700 BCE. Over 74 species of seaweed have been consumed as food or medicine in China, predominantly wakame, nori, and konbu (Mouritsen et al., 2023). Cantonese seaweed soups, vegetable dishes, and fillings in dumplings are just a few common ways of eating seaweed in China.

Remains of seaweed dating back to the Jōmon Era (10,500 - 300 BCE) have been found in Japan. Seaweeds were prepared and eaten in clay pots, which is presumed to be quite similar to the modern day dish *nabemono* which is the most eaten type of hot pot dish in modern day Japan (Mouritsen et al., 2023). Konbu is used as one of the main components in *dashi*, a very popular Japanese soup stock. Nori, in seaweed sheets and paper, is used in globally popularized Japanese dishes such as *onigiri* and sushi. It has been said that in Japan, seaweed in sushi is the equivalent to the American sandwich, in reference that you can find it at almost every train station, market, and family home (Mouritsen et al., 2023).

Korea's folklore and culture is rich with seaweeds such as wakame nori. An example of the use of seaweed is the use of wakame as an ingredient in the soup *miyukkuk*, which is traditionally very significant and eaten for the celebration of childbirth and birthdays (Mouritsen et al., 2023). Polynesian islands such as Hawaii have eaten seaweed going back 3 millenia. There, they are considered to be a food suited for the gods (Mouritsen et al., 2023). In Hawaii, seaweeds were grown in special marine gardens, containing species such as *Asapargopsis taxiformis*, *Grateloupia filicina*, and several others. Seaweeds were, and are mashed and chopped with chilis and eaten as a relish called *poi* (Mouritsen et al., 2023).

Whether it be Ireland, Asia, or the Pacific Islands, it seems that the consumption of seaweed and the known benefits of doing so transcends distance and time period. Although used and cultivated in different ways, seaweed has become a staple part of so many cultures. It can lend itself to a variety of dishes, but also used in non-culinary purposes such as medicine and animal feed. Despite the glaring diversities of these cultures, seaweed species have historically and continue to influence the diets and traditions of its worldwide cultivators.

Conclusion

The relationship between seaweed and Irish culture, both historical and modern, is complex. Its role in the Irish Potato Famine led to wrongful assumptions that seaweed was only meant for poor Irish people. This isn't unique to seaweed though, with stereotypes regarding native Irish people, especially concerning class and religion running deep in English and

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Anglo-Irish culture. Yet seaweed has prevailed, continuing to be an important resource for the Irish people. Through times of poverty and times of prosper, seaweed has remained a quintessential piece of Irish heritage. Going forward, there is hope that the Irish seaweed industry will further prosper, and not only add to the country's blue economy, but withhold cultural practices as well. Seaweed can be a sign of abundance and sovereignty, and modern day culinary and environmental experts are trying to give Irish seaweed this narrative. Even in historical times, the Irish knew of seaweed's value. The burning of kelp to withdraw iodine in glass production supplemented bits of Irish income. A phrase that came from this in Carnlough, when someone arrived at church in a new outfit was "The kelp is shining on you". Seaweed held the power to represent fortune and security. Just as it provided security during the Irish Potato Famine, when that comfortable feeling was essentially nonexistent.

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