

## Article

# Gathering and Cooking Seaweeds in Contemporary Ireland: Beyond Plant Foraging and Trendy Gastronomies

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**Abstract:** Seaweed has historically been essential for coastal communities worldwide. Following a period of decline in the last century, Ireland has seen a recent resurgence in the appreciation and use of seaweed. This research explores the evolution in seaweed foraging practices, with a specific focus on gastronomical uses in two Irish regions: the southwest and the west and midwest. It examines the diversity of seaweed and its present and past uses, comparing abandonment, continuation and revitalisation trajectories. Qualitative data were gathered through semi-structured interviews with 27 individuals who forage seaweed for commercial or personal use. We identified 22 seaweed species across the study areas, predominantly from the Fucaceae, Laminariaceae and Ulvaceae families. There was a fair divergence between the seaweed species used in the two study areas (16 seaweed species in the southwest region and 17 seaweed species in the west and midwest region), with 11 species mentioned in both areas. Different trajectories of resurgence were identified. In the west and midwest region, the revitalisation of local ecological and gastronomic knowledge related to seaweeds seems to be deeply entrenched in the territory's historical legacy, showing a sort of continuation with the past and having followed a more commercially oriented path. Conversely, in the southwest region, the revival seems to be fostered by new knowledge holders with a contemporary interest in reconnecting with the marine landscape and promoting educational activities centred around seaweed. This research contributes to discussions on sustainable food systems and food heritage promotion, emphasising seaweed's potential role in Irish coastal communities' foodscapes.

**Keywords:** food heritage; wild food; algae; ethnobotany; sustainable revitalisation



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## 1. Introduction

Seaweed has a long history as a vital component of the subsistence of coastal communities worldwide, being a part of traditional foodscape and serving as an important source of food, medicine and fodder [1,2]. This holds true in different geographical contexts, as documented in the Americas (Abbott [3] and Turner [4] in Canada; Dillehay et al. [5] in South America; Noriega Cardó [6] in Peru; Pérez-Lloréns [7] in the Americas), Asia (Bangmei & Abbott [8] and Tseng [9] in China; Nisizawa et al. [10] in Japan; Dumilag & Javier [11] in the Philippines) and Australia [12], as well as in Europe, with a specific focus on the Mediterranean [13–16] and northern parts of the continent [17,18].

Among those countries which have a long history of the use of seaweed, Ireland harbours a vital reservoir of algal diversity [19–25]. This resource has been an integral part of the traditional livelihood and food culture of local dwellers for generations.

The use of seaweed experienced a notable decline in the last century in Ireland, and its consumption is still somewhat associated with times of famine [24,26]. However, along with other European and non-European countries, Ireland has recently witnessed an incipient process of revitalisation and valorisation of this resource [27,28].

Seaweeds have been pointed out as the “promising food source of the millennium”, given their long history of use coupled with nutritional value, sustainable farming solutions and versatility in culinary applications [29]. This transformation is connected to concurrent phenomena, including the growing interest in the hospitality industry in exploring innovative applications of marine ingredients and the global rise of locavore movements [24].

This revival of seaweed harvesting and related commercial and gastronomic practices has proven a powerful strategy for sustainable development [30–33], coastal community empowerment [34–37] and culinary innovation [38–42]. Reinvigorating the local ecological knowledge and practices regarding seaweed and incorporating them into local food systems could create novel economic opportunities while promoting environmental sustainability and preserving cultural identity.

While the long-term relationship of Irish people with seaweed is well described, less attention has been paid thus far to the dynamics of changes, continuation and revitalisation of seaweed and the related foodscapes in Ireland.

In order to contribute to filling this gap in the literature, this research aimed to document and analyse changes in seaweed foraging practices, with particular reference to the gastronomical uses of wild seaweed in two selected areas of Ireland.

More specifically, this study aimed at the following:

- To document the diversity of seaweed and associated food and non-food uses that are still in use today or at least still present in living memory in two Irish regions;
- To explore the perceived trajectories of evolution of the role of seaweed and associated practices, identifying the main drivers behind any observed changes in two Irish regions;
- To identify similarities and differences in the trajectories of abandonment, continuation and revitalisation of seaweed-based products and practices, through a geographical comparison between the two study areas.

Among Irish regions, the southwest (SW) and the west and midwest (W) regions are ideal for research and stand as the geographical focus of our study.

By presenting specific case studies, this research contributes to the broader dialogue on sustainable food systems and food heritage revitalisation, particularly regarding wild-food-related resources. Specifically, it highlights a promising avenue for fostering the revitalisation of seaweed-related foodscapes in Irish coastal communities, identifying different trajectories underpinning this phenomenon and certain perceived sustainability implications.

## **2. Background: Understanding the Economic, Cultural and Culinary Significance of Seaweed in Ireland**

The exploitation of seaweed has a long history in the culture of Irish coastal communities, giving a distinctive identity to agricultural, cookery, medicinal and small-scale commercial practices in areas where seaweeds were harvested and gathered. However, despite its notable economic and sociocultural significance, seaweed embodied elements of privation, underdevelopment and hardship that characterised life patterns in Irish coastal communities, and consequently, it has a complicated identity and presence.

The potential of seaweed to promote and support small-scale industries in areas of underdevelopment was recognised by the late 19th century. At the end of this century, the use of seaweeds as one of the main forms of income for the people along the west coast was documented, particularly in the form of “black weed” sold and used as fertiliser [43].

Moreover, during the famines of the 18th and 19th centuries, seaweed provided a vital source of income and food security [26,44,45]. As a result, eating seaweed has long been associated with poverty and hunger [46].

The versatility and usefulness of the resource in coastal and island areas is evident in the following account gathered in the 1930s from County Kerry, contributed to the National Folklore Commission Schools' Collection:

The people long ago used to gather a lot of seaweed because they used it for mostly everything. They used it as manure for the land—and long ago, the people used to give it to their horses and cattle to eat. They used it as food for themselves also. In the time of the famine, when the people were very poor and they had not enough of money to buy food for themselves they used eat seaweed. They used first pick the soft part of the seaweeds and boil it in pots. They used put very little water in it. They used leave it boil well and it used get thick like porridge. Then they used take it off the fire and eat it out of enamel plates. It was also very good for [a] cold or cough (NFCSC 0432:341, Co. Kerry).

This account illustrates the complex relationship between coastal communities and this versatile resource. It also depicts practices and attitudes rooted in a traditional society that failed to successfully transfer or survive in more modern socioeconomic systems and cultural settings.

The importance of seaweeds is also reflected in the customary rights, wherein the ancient social relations of Ireland regarded each stand of sea wrack as the inherent right of every territory and the property of every person. However, the people's right to the harvesting of seaweeds was traditional and not legal [47]. Currently, the lack of clarity regarding the management of the rights to seaweed harvesting is considered to be the main obstacle in further developing the seaweed industry in Ireland.

### 2.1. Economic Relevance: The Industry of the Kelp

The primary recorded use of seaweed in Ireland was for kelp ash, with the kelp-burning industry flourishing along the Irish coast [43]. Kelp, at this point, was the name for the product that was derived from the burning of different species of seaweed for sodium or iodine used for different industrial processes. The term kelp is now commonly used for the family *Laminariaceae* of seaweeds, which were favoured for burning, including the species *Laminaria digitata* and *Laminaria hyperborea* [44,48].

The commercial production of kelp lasted into the late 19th century, after which industrial use of seaweed shifted to focus on alginate for food and cosmetics purposes and largely heralded the end of the production of kelp ash [48,49]. Writers such as Tim Robinson [50] and Séamas Mac an Iomaire [51] reported the best seaweeds used for kelp (i.e., those with the highest amount of iodine) and described the burning of kelp for ash in Connemara and the Aran Islands. The changing demand for seaweed biomass in the middle of the 20th century resulted in the evolution of modern harvesting methods and tools [52].

### 2.2. Cultural Relevance: Artistic Depictions of Seaweed

The historical and cultural significance of seaweed in Ireland is deeply rooted in artistic depictions, folk culture, the literature and movies [53].

The folk song *Dúlamán* illustrates the vernacular practice of collecting seaweed as a defence against famine, showcasing its nutritional and socioeconomic significance in times of scarcity. Additionally, the traditional folk song *An Carraigín* underscores the financial value of carrageenan (i.e., polysaccharides that are extracted from edible red seaweed and used in the food industry) in Connemara culture [54].

Literary works shed light on the 20th-century usage and values of seaweed. For instance, Mac an Iomaire stated that the disappearance of *carraigín* (*Chondrus crispus*) would have been "the greatest deprivation for the human race" due to its medicinal benefits [51]. Robinson [50] noted that *carraigín* was a trusted cure for coughs and colds among the Aran people, likening its importance to whiskey. Leon Uris' novel *Trinity* [55] offered a narrative that portrays the diverse uses of seaweed during famine times, from animal fodder to soap production.

### 2.3. Gastronomic Relevance: Seaweed in Past and Present Irish Cuisine

Irish cuisine has a rich tradition of incorporating various seaweeds. Irish coastal people collected shellfish and added seaweeds, vegetables and herbs to make a soup that was left to simmer for several hours and consumed with oat bread [56].

*Sloke*, sea lettuce, dulse and carrageen moss were the main seaweeds used for culinary purposes. These were often boiled together with limpets and oatmeal to make a dish called *cruasach* (meaning strength or vigour), and the cooking juice was used as a relish for potatoes. Dried dulse was often simply chewed, and as a snack-type product, it was sold by street-hawkers or at fairs and was taken by emigrants to America. Burnt seaweed ash also played a minor role in food preservation for meats, fish and rolling cheese [57].

Currently, various dishes featuring seaweed, including stews like *schlock* and *crusach*, showcase the diverse culinary applications of seaweeds in Irish cuisine [27]. Some red seaweeds (Rhodophyta), like dulse (*Palmaria palmata*), carrageen (*Chondrus crispus*) and *sleabhac* (*Pyropia* spp.), are still used in a variety of dishes [27,28,56,58–61].

*Palmaria palmata* was traditionally eaten together with butter and fish, boiled in milk with rye flour or incorporated into dishes like the Northern Ireland dulse sandwich or dulse *champ* (a mixture of mashed potatoes, milk, butter and chopped dulse) [28]. It was also enjoyed plain or dried as a snack, added to mashed potatoes, soups or fish stews or served between buttered bread. Despite its gastronomic potential, this species is surprisingly underused in modern cuisine [62].

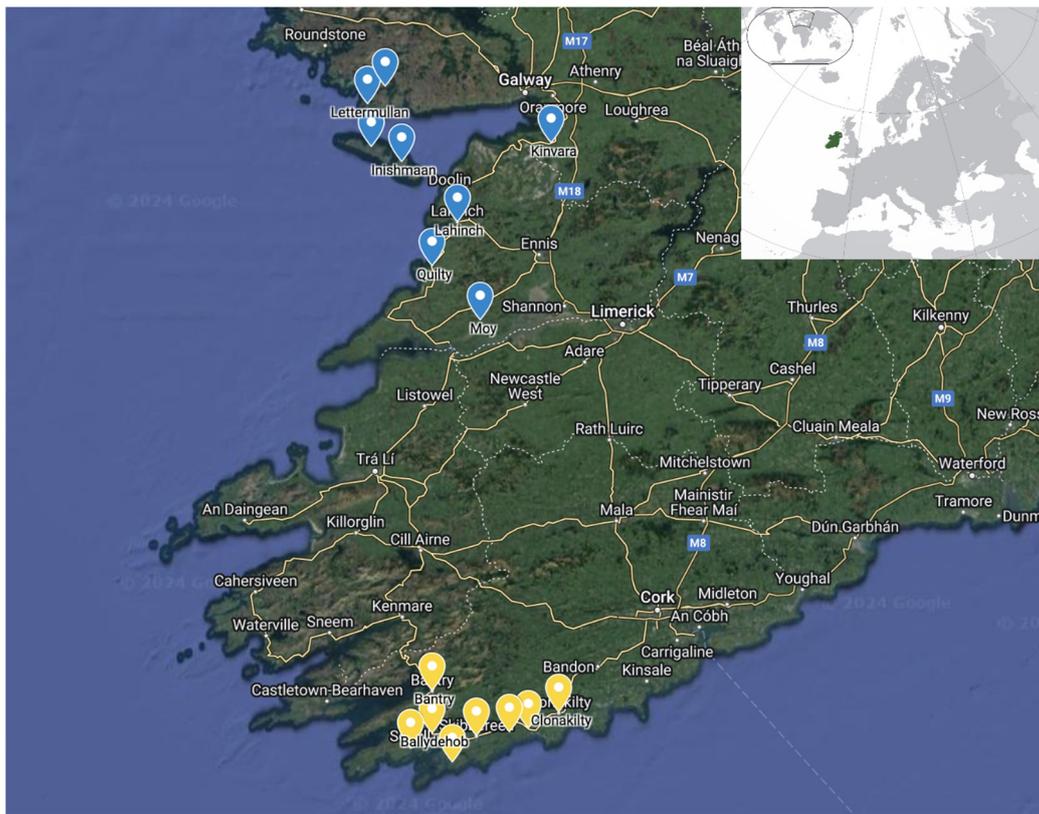
*Chondrus crispus*, known for its gelatinous quality, is used as a milk thickener and in sweet and savoury jelly puddings [27,41].

On Inishmurray Island (NW Irish Coast), *Pyropia* spp. underwent a traditional harvest after the first frost, followed by hours of simmering and seasoning, and it was consumed alone or with potato or bread [28,58].

In recent times, there has been a surge in the publication of both contemporary and historical recipe books, aiming to rekindle interest in the utilisation of seaweed in culinary practices, such as the books of Darina Allen [60], Sally McKenna [59] and Prannie Rhatigan [58]. Notably, these works also emphasise sustainability, recognising the changing landscape of seaweed harvesting practices and offering practical instructions and recipes that blend traditional knowledge of seaweed usage with modern sustainable approaches.

### 3. Materials and Methods

Adopting qualitative comparative case methods [63], this research explored two sets of interviews gathered during fieldwork activities carried out between 2017 and 2022 in two different Irish regions, namely the southwest (coastal West Cork) and west and midwest (County Claire, County Galway and the Aran Islands) regions. Figure 1 shows the key locations of the two field studies.



**Figure 1.** Map showing the study areas within Ireland (file credit: Creative Commons Attribution-Share Alike 3.0 licence).

### 3.1. Study Areas

The southwest (SW) and west and midwest (W) regions were chosen as case studies because they have previously been reported as areas where seaweeds have historically played an important role in the livelihoods, diets and food cultures of local communities. Guiry and Hession [64] identify the western coast, warmed by the fertile currents of the Gulf Stream, as a particular hotspot of seaweed biodiversity in Ireland with between 330 and 570 different species of seaweed. However, very few are used as food [65]. The remoteness of these areas in the past led the population to turn to the sea for sustenance, utilising seaweed for human consumption, crop fertiliser, animal feed and as a product to sell for iodine [23,64].

In the SW region, County Cork (most specifically the West Cork coastal region), has historically been shaped by maritime activities and fishing. The local economy now sees a rise in sustainable seaweed cultivation, contributing to economic diversity, with products like biofertilisers and cosmetics.

W regions such as County Clare have traditionally relied on fishing, with seaweed used for its nutrient-rich properties in agriculture. Today, there is a growing focus on sustainable seaweed harvesting, influencing local cuisine, with chefs incorporating various seaweed species in their menus [61]. Off the coast of County Galway, the inhabitants of the Aran Islands have long relied on agriculture, fishing and kelp making for their livelihoods. They traditionally employed seaweed for food, medicine and in agricultural activities [66,67].

### 3.2. Fieldwork, Data Collection and Analysis of Sociodemographic Data

Ethnographic and ethnobotanical data were collected through semi-structured interviews with 11 people in the SW region and 16 in the W region.

Interviewees were selected via convenience sampling with the constraint that they were practising any kind of foraging/harvesting of seaweeds within the region for commercial or personal purposes. Specifically, the interviewees were asked about the local name(s), harvesting and processing practices and food and non-food uses (e.g., medical, farming, cosmetic) of the species they harvest(ed) and/or consume. Moreover, the interviews investigated the perceived changes in the dietary roles and socioeconomic values of seaweed and seaweed-based products and the main reasons underlying these phenomena.

Co-authors JSN and JEM conducted the interviews in both English and Irish. Before each interview, informed consent was obtained from each informant, as recommended by the International Society of Ethnobiology Code of Ethics [68].

This research was conducted during the off-season for the main harvesting of seaweed. While harvesting was witnessed during fieldwork activities, it was primarily for demonstrational purposes and not to the same extent as it would be conducted during the main harvesting times of spring and autumn.

The subjects interviewed in the SW region were between 30 and 60 years old (Table 1). All the interviewees declared they started their foraging practices in the West Cork area. Two of the subjects declared that they started foraging as children, but the remaining nine claimed to have started after they were eighteen or twenty years old. Only one interviewee earns their sole income through seaweed harvesting, and very few people officially declare themselves as commercial harvesters.

**Table 1.** List of the sociodemographic characteristics of the interviewees.

Interview Number	Region	Location of the Interview	Origin	Age	Occupation
1	W	County Cork	England	50s	Seaweed harvester and cultivator of seaweed
2	W	Inis Meáin, the Aran Islands	Inis Meáin, the Aran Islands	70s	Farmer
3	W	Inis Meáin, the Aran Islands	Inis Meáin, the Aran Islands	60s	Stone wall builder, boat builder and seaweed harvester
4	W	Inis Mór, the Aran Islands	Inis Mór, the Aran Islands	60s	Seaweed harvester with business
5	W	Inis Mór, the Aran Islands	Inis Mór, the Aran Islands	40s	Public relations of seaweed-related business
6	W	Inis Mór, the Aran Islands	New Zealand	40s	Marine biologist and seaweed harvester
7	W	Kinvarra, Galway Bay	Kinvarra, Galway Bay	40s	Dairy farmer and seaweed cutter (third generation of farmers in area)
8	W	Lahinch, County Claire	Unknown	40s	Forager and cook
9	W	Leitir Mealláin, Connemara	Connemara	60s	Irish Gaelic historian and retired marine biologist
10	W	Leitir Mealláin, Connemara	Leitir Mealláin, Connemara	60s	Fisherman and seaweed harvester and cutter
11	W	Leitir Móir, Connemara	Leitir Móir, Connemara	50s	Village shop owner (seven generations of family owning the shop)
12	W	Leitir Móir, Connemara	Leitir Móir, Connemara	80s	Retired seaweed harvester
13	W	Moy, County Claire	Donegal, Northern, Ireland	20s	Pro surfer and organic vegetable farmer

Table 1. Cont.

Interview Number	Region	Location of the Interview	Origin	Age	Occupation
14	W	Moy, County Claire	Connemara	90s	Unknown
15	W	Quilty, County Claire	Quilty, County Claire;	40s	Seaweed harvester with business (third generation of four generations of seaweed harvesters)
16	W	Quilty, County Claire	County Claire	70s	Retired, but formerly a seaweed harvester and buyer
17	SW	Clonakilty	Dublin	30s	Herbalist
18	SW	Clonakilty	Northern Ireland	50s	Chef/cook
19	SW	Ballydehob	Unknown	30s	Chef/cook
20	SW	Baltimore	England	60s	Retired (harvests seaweed for personal use)
21	SW	Rosscarbery	Cork	60s	Writer
22	SW	Bantry	Unknown	30s	Farmer
23	SW	Glandore	Glandore	60s	Farmer
24	SW	Schull	Unknown	40s	Musician and actor (harvests seaweed for personal use)
25	SW	Skibbereen	Dublin	30s	Chef, activist and harvester
26	SW	Skibbereen	Unknown	50s	Fisherman
27	SW	Ballydehob	Northern Ireland	40s	Chef/cook

Keys: SW (southwest region), W (west and midwest).

In the W region, most of the interviews were in the age group between 30 and 70 years old, although outliers included one under 30 and four on the west coast over 70, including one 98-year-old (Table 1). Roughly one-third of respondents were current professional seaweed harvesters; another third were farmers who harvested seaweed. The remainder were a mix of professionals and retired persons who gathered seaweed for personal use.

The interviews and the field notes were transcribed and anonymised into NVivo version 12.5.0 [69]. Codes, concepts and nodes were generated during the qualitative data analysis. For each of the surveyed areas, field data were organised into tables that outline the following information: scientific name, local name(s), main use categories, specific uses and frequency of citations. This allowed the identification of similarities and differences regarding the diversity of seaweed species, their food and non-food uses and the perceived trajectories of abandonment, continuation and/or evolution of seaweed-based products and associated practices.

The scientific names of seaweed species were identified according to local names and morphological characteristics. For taxonomic nomenclature, we followed the criteria set by the World Register of Marine Species [70].

## 4. Results

### 4.1. Southwest Region

In the SW region, interviewees reported 16 seaweed species belonging to 10 families (Table 2). Noteworthy species most frequently mentioned included *Chondrus crispus*, *Laminaria hyperborea*, *Osmundea pinnatifida*, *Himanthalia elongata*, *Fucus spiralis* and *Palmaria palmata*.

**Table 2.** Mentioned species by class, family, scientific name, common name(s), use categories, description and frequency of citation in the key locations of this study in the southwest region of Ireland.

Phylum/Class	Family	Scientific Name	Common Names	Uses	Notes	Frequency of Citation *
Brown algae	Alariaceae	<i>Alaria esculenta</i> (Linnaeus) Greville, 1830	Atlantic wakame (EN)	Food	Used as a Incorporated into bread dough	+
Brown algae	Fucaceae	<i>Ascophyllum nodosum</i> (Linnaeus) Le Jolis, 1863	Bladderwrack (EN); Feamainn bhoilgíneach (IG)	Cosmetic, Medicinal	Used to stimulate the thyroid and consequently boost metabolism, to treat rheumatism (external application)	++
Brown algae	Fucaceae	<i>Fucus serratus</i> Linnaeus, 1753	Toothed wrack (EN); Míoránach (IG)	Agriculture, Cosmetic	Agriculture: fertiliser Cosmetic: baths and skin masks	++
Brown algae	Fucaceae	<i>Fucus spiralis</i> Linnaeus, 1753	Spiral wrack (EN)	Cosmetic	-	++
Brown algae	Fucaceae	<i>Fucus vesiculosus</i> Linnaeus, 1753	Bladderwrack (EN); Feamainn bhoilgíneach (IG)	Agriculture, Cosmetic, Food, Medicinal	Cosmetic: infusions, baths and tinctures Medicinal: to regulate hormones	++
Brown algae	Fucaceae	<i>Pelvetia canaliculata</i> (Linnaeus) Decaisne & Thuret, 1845	Channelled wrack (EN); Caisíneach, Dúlamán (IG)	Agriculture, Cosmetic	Agriculture: fertiliser feed for livestock (especially pigs) Cosmetic: bath, a skin preparation of blitzed channelled wrack, sea salt and neutral oil for skin ailments	++
Brown algae	Himanthaliaceae	<i>Himanthalia elongata</i> (Linnaeus) S.F.Gray, 1821	Sea spaghetti (EN); Ríseach (IG)	Food	Pickled	++
Brown algae	Laminariaceae	<i>Laminaria hyperborea</i> (Gunnerus) Foslie, 1885	Kelp (EN); Leathach buídhonn, Feamainn gheimhridh (IG)	Agriculture, Cosmetic, Food	Agriculture: fertiliser Food: broths, stews, flavouring enhancer	+++

Table 2. Cont.

Phylum/Class	Family	Scientific Name	Common Names	Uses	Notes	Frequency of Citation *
Brown algae	Laminariaceae	<i>Saccharina latissima</i> (Linnaeus) C.E.Lane, C.Mayes, Druehl & G.W.Saunders, 2006	Sugar kelp (EN); Claíomh (IG)	Agriculture, Cosmetic, Food	Food: broths, stews	++
Brown algae	Sargassaceae	<i>Sargassum muticum</i> (Yendo) Fensholt, 1955	Japanese wireweed (EN); Feamainn ghuaireach, Sheapánach (IG)	Medicinal	Infusions, tinctures	+
Green algae	Ulviceae	<i>Ulva intestinalis</i> Linnaeus, 1753	Gut-weed (EN); Líneáil ghorm (IG)	Food	Baked Butter infusion (seaweed lemon butter, usually mixed with <i>Chondrus crispus</i> and <i>Ulva lactuca</i> )	+
Green algae	Ulviceae	<i>Ulva lactuca</i> Linnaeus, 1753	Sea lettuce (EN)	Food	Baked Butter infusion (seaweed lemon butter, usually mixed with <i>Chondrus crispus</i> and <i>Ulva lactuca</i> )	+
Red algae	Bangiaceae	<i>Porphyra umbilicalis</i> Kützinger, 1843	Nori (EN); Sleabhac (IG)	Food	Used dried Salads (mostly in the past)	+
Red algae	Gigartinaceae	<i>Chondrus crispus</i> Stackhouse, 1797	Carrageen, Irish Moss (EN)	Cosmetic, Food, Medicinal	Cosmetic: lubricants and soap-making, shampoos Food: soup, infused butter Medicinal: infusion (boiled with water or milk and honey) to relieve sore throats, coughs and colds	+++

Table 2. Cont.

Phylum/Class	Family	Scientific Name	Common Names	Uses	Notes	Frequency of Citation *
Red algae	Palmariaceae	<i>Palmaria palmata</i> (Linnaeus) F.Weber & D.Mohr, 1805	Dulse (EN); Dillisk, Duileasc (IG)	Food	Butter/oil infusion (e.g., dulse and wild garlic oil) Garnish Added to salads	++
Red algae	Rhodomelaceae	<i>Osmundea pinnatifida</i> (Hudson) Stackhouse, 1809	Pepper dulse (EN)	Food	Regarded as “truffle of the sea” Used fresh (on white fish cooked with butter), dried or powder as garnish Added to shellfish and pasta dishes	+++

Keys: EN (English), IG (Irish Gaelic); \* (+++ > 50% of interviewees; ++ > 30% of interviewees; + < 20% of interviewees).

The primary usage categories revealed eleven species used for food, nine for cosmetics, five for farming and three for medical purposes.

Interviewees provided insights into both personal and commercial applications. Notably, *Laminaria digitata*, *Alaria esculenta*, *Saccharina latissima* and *Laminaria digitata* were highlighted as the most important commercial species (Figure 2).



Figure 2. Sundried seaweeds collected on Squince Beach, West Cork, SW (Photo: Jeovana Santos Nascimento).

#### 4.1.1. The Contemporary Gastronomy of Seaweed

The seaweed foraged and/or consumed by the interviewees was used in either its fresh or dried form in culinary preparations such as soups, broths and stews, as well as in infusions, as garnish or as seasoning.

Dry and reconstituted seaweed seemed to be preferred for taste and nutrition (Figure 2). According to one interviewee in Schull, seaweeds taste better and retain more vitamin D if dried in sunlight (i.e., hung out to dry naturally). However, the drying can be carried out in a dehydrator or even in a low oven with the fan on.

Some seaweed species, such as *Chondrus crispus*, hold a traditional role as both food and medicine in the local diet. As stated by a 60-year-old interviewee in Glandore: “Traditionally, carrageenan was boiled in milk, and honey added to it as a nourishing, mineral-rich drink, used as a winter drink when food was scarce during the colder months”. Even nowadays, different people declare that they use it in syrup and hot drinks (e.g., adding it to a lemon and honey beverage) as an effective remedy for a sore throat.

As far as the taste of seaweed is concerned, two main points should be emphasised. First, two interviewees stressed the strong relationship between seasonality and the perceived taste of the seaweed, as in the case of *Himanthalia elongata*, which has been considered tastier when collected young in spring. Second, clear associations and detailed knowledge emerged regarding the mentioned seaweeds and their traditional and modern culinary uses. For instance, *Ulva intestinalis* keeps its distinctive taste in baking, and “it works very well in the butter and flavoured breads”, as one interviewee in Clonakilty reported. *Osmundea pinnatifida*, which was sometimes credited as the “truffle of the sea”, reinforces mineral and marine flavours of the dishes where it is added, such as with shellfish, potatoes and pasta. Another interviewee in Ballydehob presented this seaweed as follows: “Super fresh pepper dulce on any white fish cooked with butter is my favourite. Its truffle aroma is incredible. Also, butter infused with fresh pepper [dulse]”.

#### 4.1.2. Medical and Cosmetic Uses

A limited number of species employed in traditional medicine were recorded while the emergence of modern applications in cosmetics, mainly in infusions, baths and tinctures, was documented.

*Chondrus crispus* was used in soap-making, shampoos and lubricants. Moreover, the cosmetic benefits of *Fucus serratus* were described by one interviewee in Clonakilty, who reported “a skin preparation of blitzed channelled wrack, sea salt, and neutral oil for skin ailments”, and that “it is also good to use in baths”.

Another method for gaining the seaweeds’ benefits that involves no preparation was described by an interviewee in Skibbereen, who reported “swimming in the sea in September for the iodine released from broken up seaweed”, which is also considered to have medicinal potency, particularly for women’s health.

An interviewee in Clonakilty emphasised the numerous benefits of seaweeds for women’s health, particularly highlighting their positive impact on thyroid health due to their iodine content. However, it is crucial to note that while iodine can be beneficial for thyroid health, it may not be suitable for every individual and excessive iodine intake can lead to complications. For instance, people with hyperthyroidism should avoid consuming seaweed.

#### 4.1.3. Traditional Ecological Knowledge Related to Seaweed Harvesting and Use

In the SW area, seaweed harvesting typically involves selectively cutting monospecific strands of seaweed (e.g., rockweeds and kelps) or gathering storm-cast fronds (resulting in mixed species).

According to an interviewee in Clonakilty: “Four things are important to consider when foraging seaweed: understanding the general distribution—where along the coast does the seaweed grow? What kind of substrate does the seaweed attach to? How strong are the currents, and how exposed is the location? The seasonality of each seaweed must as well be considered”. He followed

this up by saying, “When the sun and moon are aligned, Spring tides happen. Spring, in this context, refers not to the time of year but to the elasticity of the tides. The highest and lowest highs usually occur a day or two after a full moon in spring and autumn”.

Information on specific ecological niches, harvesting techniques and seasons was offered by our respondents for several of the mentioned species, highlighting specific attention to the sustainability of this practice.

In the case of *Ascophyllum nodosum* (Figure 3), which grows in the mid-littoral zone in wave-sheltered rocky shores, interviewees instructed us that when cutting the weed, one should leave 20 cm of the frond attached to the rock to allow regrowth and that it is important to avoid harvesting fertile individuals as much as possible.



**Figure 3.** *Ascophyllum nodosum* (Photo: Jeovana Santos Nascimento).

For *Chondrus crispus*, which is harvested at low tide by plucking or cutting the small plants from the lower intertidal range, recommendations from an interviewee in Clonakilty include harvesting at exposed sites every two years and in sheltered sites with an interval of four years, leaving the mature plants to grow to at least two metres.

Seaweed usage as animal feed or agricultural fertiliser (e.g., seaweed strands washed onto the beaches at high tide and then spread to decay on croplands) was seldom recalled during the interviews, and only a few informants still carry out these practices.

One interviewee from Ballydehob said that her grandparents used to collect strewn pieces of seaweed from the shore and combine them with good soil to create raised beds, locally known as “lazy beds”, to cultivate potatoes and other crops.

Among the mentioned species whose current or past uses were connected to agricultural activities, *Pelvetia canaliculata* was commonly used as food for livestock, especially pigs, and was mentioned as a food source during the Great Hunger. Moreover, several interviewees recalled that local dwellers gathered *Laminaria hyperborea* from the shoreline, especially after a storm, and burned it in stone circles known as kelp kilns, the ruins of which are still visible along the west coast. The ash that remained contained soda and potash, which could be used as a fertiliser and in industrial applications, as mentioned above, such as glazing pottery and making glass and soap. These practices were abundant in times of crisis when seaweed became vital in the absence of an adequate supply of other organic manures.

#### 4.1.4. Evolution and Perceived Changes in Seaweed-Related Foodscape

While our interviewees acknowledged the significance of seaweed in the food culture and livelihoods of past generations, we observed the abandonment of many seaweed-related practices among the two past generations. One interviewee in Rosscarbery pointed out, “For a few generations, they [seaweeds] have not been used or very seldom. I would say in the recent past, it has almost been discouraged as a ‘backwards’ way of gathering food compared to ‘clean’ modern supermarket foods”.

In the SW region, most interviewees claimed that traditional seaweed uses and knowledge are no longer easily accessible, mainly because they were not often passed down through generations. Only two of these subjects started foraging as a child, while the rest reported starting after reaching adulthood. They pursued harvesting practices out of personal interest and curiosity about their local identity and resources, meaning that the collective awareness about the importance of seaweed has begun to present itself again. Over half of the interviewees in the SW region began foraging seaweed at some point well into the 20th century or even early 21st century. They declared not to have had a significant consumption of seaweed growing up, with it mainly eaten in fast food sushi restaurants (especially nori), unknowingly in ice creams as carrageen or in the form of a snack.

One interviewee in Rosscarbery claimed: “Sometimes the older generations remember uses. They used to feed themselves with wild seaweed; nowadays, it is more of an interesting garnish or used to stand out on social media platforms, which weirdly is a good thing”! Indeed, seaweed has begun to be seen as a delicacy, fostering its revival and diffusion in the local food sector. As observed during the fieldwork, small and micro-businesses related to seaweed have grown in the last decade. For instance, different types of dehydrated seaweed can be found in local shops, including healthy food snacks. Moreover, hard cheeses aged with seaweed and other dairy products, such as seaweed butter, have been developed. Seaweeds are also used in a few restaurants as an ingredient in traditional and modern culinary preparations. Moreover, artisanal seaweed soaps and different types of bodycare products have been spreading in Irish shops, and seaweed baths (*Fucus serratus* is used for this purpose) are also becoming common.

Seaweed farming is also expanding in the SW region, focusing on some species that are more suitable for this activity. One respondent who runs a seaweed farm in Bantry said that *Alaria esculenta* adapts very well to being cultivated and gives a good and consistent crop in an otherwise difficult and highly experimental aquaculture. While no interviewees mentioned any particular ways they use this seaweed at home, it is currently sold as a food item for use, similar to its position in Japanese cuisine.

Some interviewees raised issues regarding the sustainable management and harvesting of seaweed. “Although there are vast amounts of seaweeds around our coasts, we should always remember that complex and important ecosystems are intricately entwined around that abundance”, said one of the interviewees when discussing the importance of sustainable harvesting practices in the SW region. Moreover, the long-term sustainability of mechanised seaweed harvesting was discussed in County Cork, where the local community has demanded the suspension of the licence of an Irish company to harvest the kelp forest in Bantry mechanically.

The impact of water pollution was also mentioned more than once during interviews, especially that created by livestock contamination and chemical fertilisers, which can generate food safety issues linked to the harvesting and consumption of wild seaweeds.

#### 4.2. West and Midwest Region

The interviewees of this region reported a total of 17 seaweed species distributed across 11 families (Table 6). Among the most frequently mentioned species were *Chondrus crispus*, *Palmaria palmata*, *Laminaria digitata*, *Laminaria hyperborea*, *Pelvetia canaliculata*, *Fucus vesiculosus*, *Ascophyllum nodosum* and *Porphyra* spp.

**Table 3.** Mentioned species by class, family, scientific name, common name(s), use categories, description and frequency of citation in the key locations of the study in the west and midwest regions of Ireland.

Phylum/Class	Family	Scientific Name	Common Names	Uses	Notes	Frequency of Citation *
Brown algae	Alariaceae	<i>Undaria pinnatifida</i> (Harvey) Suringar, 1873	Atlantic wakame (EN)	Food	Dried and rehydrated Eaten raw or cooked	++
Brown algae	Fucaceae	<i>Ascophyllum nodosum</i> (Linnaeus) Le Jolis, 1863	Yellow weed, Egg wrack, Knotted wrack, Bladderwrack (EN); Feamainn Bhúi (IG)	Agriculture	Fertiliser, mulch, animal feed, cash crop, alginate	+++
Brown algae	Fucaceae	<i>Fucus serratus</i> Linnaeus, 1753	Serrated wrack (EN)	Medicinal	Used in baths for absorption of the nutrients and soothing effect	++
Brown algae	Fucaceae	<i>Fucus vesiculosus</i> Linnaeus, 1753	Bladderwrack (EN)	Agriculture	Fertiliser	+++
				Food	Flavouring in food	
				Medicinal	Gel in bubbles used for antiinflammatory purposes on skin	
Brown algae	Fucaceae	<i>Pelvetia canaliculata</i> (Linnaeus) Decaisne & Thuret, 1845	Channel wrack (EN); Caisíneach (IG)	Agriculture	Food for livestock, particularly pigs Eaten as famine food	++
				Food	Similar uses as those of <i>Sargassum fusiforme</i> in Japan	
Brown algae	Himanthaliaceae	<i>Himanthalia elongata</i> (Linnaeus) S.F.Gray, 1821	Sea spaghetti (EN); Ríseach (IG)	Food	Dried and rehydrated Eaten raw as salad or cooked	++
Brown algae	Laminariaceae	<i>Laminaria digitata</i> (Hudson) J.V.Lamouroux, 1813	Kelp, Kombu, Oarweed, Long kelp, Laminaria (EN); Copóg (IG)	Agriculture	As fertiliser, mulch and crop cover	+++
				Food	Flavouring (not traditional) Main type of kelp used now, often referred to as kombu and used as such	
				Medicinal	Old treatment for varicose veins, by being wrapped around the leg	

Table 4. Cont.

Phylum/Class	Family	Scientific Name	Common Names	Uses	Notes	Frequency of Citation *
Brown algae	Laminariaceae	<i>Laminaria hyperborea</i> (Gunnerus) Foslie, 1885	Kelp, Kombu, Laminaria, Mayweed (EN); Scothach (IG)	Food	Flavouring  Often used interchangeably with <i>Laminaria digitata</i> but less preferred	+++
Brown algae	Laminariaceae	<i>Saccharina latissima</i> (Linnaeus) C.E.Lane, C.Mayes, Druehl & G.W.Saunders, 2006	Sugar kelp (EN); Claíomh (IG)	Food	Cooked  As a dried snack  Not traditionally used as food	+++
Red algae	Bangiaceae	<i>Porphyra</i> spp. C.Agardh, 1824	Nori, laver (EN); Sleabhacán (IG)	Food	Stewed fresh with salt and water or pork fat  Accompanied with potatoes, bacon and butter  Reported in the past to have been cooked all day with turf (peat) on the beach while harvesters were harvesting  Dried and milled into a seasoning (a modern invention for commercial purposes)  Dried and then reconstituted during the boiling process	+++
Red algae	Gigartinaceae	<i>Chondrus crispus</i> Stackhouse, 1797	Irish moss, Carrageen (EN); Carraigín (IG)	Agriculture  Food	Feed, with milk for nutrients, especially for calves  With milk as a set pudding  In stews as a thickener	+++

Table 5. Cont.

Phylum/Class	Family	Scientific Name	Common Names	Uses	Notes	Frequency of Citation *
					Antiviral and antibacterial properties	
					As a drink, it is soaked, boiled (water/milk), strained (or not) and flavoured with combinations of lemon, honey, whiskey, garlic, cocoa and brown sugar	
				Medicinal	Boiled in milk and drunk with similar flavourings as above	
					Boiled in water and then left to go cold after straining. The resulting liquid will cool into a gel, which can then be dissolved spoon by spoon into hot water or kept	
				Agriculture	Animal feed	
					Eaten raw, dried as a snack or cooked	
					Bar snack with stout beer	
Red algae	Palmariaceae	<i>Palmaria palmata</i> (Linnaeus) F.Weber & D.Mohr, 1805	Dulse, Dillisk, (EN); Duileasc, Séagrass, Creathnach (IG)	Food	Boiled with potatoes	+++
					Simmered together with milk or fried with butter	
				Medicinal	Traditionally a cure for worms because of iodine content	
Red algae	Rhodomelaceae	<i>Osmundea pinnatifida</i> (Hudson) Stackhouse, 1809	Pepper dulse (EN)	Food	Eaten fresh as flavouring or snack	
					Not sold or traditionally used	
Green algae	Cladophoraceae	<i>Cladophora</i> spp. Kützinger, 1843	Slobán (IG)	Agriculture	Fertiliser	+
				Food	-	
Green algae	Ulvaceae	<i>Ulva intestinalis</i> Linnaeus, 1753	Gutweed (EN)	Medicinal	Referred to as sea spirulina	+

Table 6. Cont.

Phylum/Class	Family	Scientific Name	Common Names	Uses	Notes	Frequency of Citation *
Green algae	Ulveae	<i>Ulva</i> spp. Linnaeus, 1753	Sea lettuce (EN)	Food	-	++
Porifera	Codiaceae	<i>Iotrochota birotulata</i> (Higgin, 1877)	Green sponge fingers (EN)	Food	Identified as edible but not used by any respondent	+

Keys: EN (English), IG (Irish Gaelic); \* (+ > 50% of interviewees; ++ > 30% of interviewees; +++ < 20% of interviewees).

We also recorded seaweed species that, according to the interviewees, were not traditionally prevalent or utilised in the past, including *Alaria esculenta*, some species of the genus *Laminaria*, *Saccharina latissima*, *Ulva* spp. and *Osmundea pinnatifida*.

In terms of usage, fourteen species were identified for culinary purposes, nine species were associated with farming practices and seven species were linked to folk medical uses.

Overall, five species were identified as multipurpose species (i.e., used for food, medicinal and farming purposes) and six species with dual functionality, serving both food and medicinal uses, notably *Chondrus crispus* and *Palmaria palmata*.

#### 4.2.1. The Contemporary Gastronomy of Seaweed

Among the recorded gastronomic applications of seaweeds, the main uses encompass raw consumption, cooking, flavouring, stewing and thickening. In this context, most newly introduced/adopted seaweed species are used raw, either fresh, dry or rehydrated, and often in salads or as snacks.

*Palmaria palmata* stands out as the most frequently mentioned species among local respondents. It is hailed as “the cream of the crop” according to two interviewees in County Claire. Its preparation involves diverse methods, from the common practice of eating it as a dried snack to pan-frying, baking or incorporating it into dough. Traditional recipes include boiling with potatoes, simmering with milk and frying with butter. Innovative uses extend to eating it as a bar snack with stout beer. An interviewee from Quilty described *Palmaria palmata* as something that “enhances flavour and even our perception of texture. It makes things seem more meaty”.

*Porphyra* spp. plays a distinct role in local gastronomy, especially in slow-cooking preparations such as stews (Figure 4). A long cooking process, lasting a minimum of five hours with water and salt, results in a dish served with butter, boiled potatoes and pork. Variations include cooking with pork fat or turf (peat) on the beach during harvesting, though this practice was most common in the past. Preservation methods involve freezing or drying for reconstitution during boiling.

Regarding *Chondrus crispus*, one of the mentioned preparations involves soaking, hydrating and boiling to make a tea, often flavoured with lemon, honey, garlic, sugar, whiskey or cocoa. Milk-based preparations include boiling milk with various flavourings or using it in set milk puddings. However, this latter use was less commonly recorded. According to two interviewees in Kinvarra and Quilty, milk simmered with a bit of carrageen was traditionally prepared for babies in the past.



**Figure 4.** *Porphyra* spp. cooked in seawater with potatoes in Quilty, County Claire (photo: Jack Edwin Martin).

#### 4.2.2. Medical and Cosmetic Uses

The limited vernacular medical applications of seaweed recorded during the interviews primarily centre around its anti-inflammatory, antiviral and antibacterial properties, along with its potential use in addressing varicose veins, acting as a vermifuge and providing soothing effects.

Only *Fucus serratus* was exclusively mentioned among the six identified species for medical purposes, particularly in therapeutic baths for nutrient absorption. The remaining species also found applications in both culinary and agricultural contexts.

*Palmaria palmata* was consumed either on its own or simmered in milk, creating a healthful tonic. The respondents in Leitir Mealláin mentioned *Laminaria digitata* as a traditional treatment for varicose veins, where it is applied by wrapping around the affected leg. *Fucus vesiculosus* was reported during some interviews to be employed to stimulate the thyroid gland, thereby boosting metabolism and controlling hypertension. It is also utilised in treating rheumatism, particularly when formulated into external applications for inflammations.

#### 4.2.3. Traditional Ecological Knowledge Related to Seaweed Harvesting and Use

Interviewees in the Aran Islands categorised different harvesting practices, which differ according to the seaweed species and its intended use, corresponding to distinct terminologies. In particular, we documented four terms employed for this purpose: cutting, harvesting, gathering and picking.

The term “cutting” is used for species of *Fucaceae*, which are harvested by hand and cut using a knife at low tide, several centimetres above the holdfast. In Connemara, they were referred to as weeds and are utilised as fertiliser or sold commercially.

“Harvesting”, used somewhat interchangeably with “gathering” and “picking”, is a term used for collecting seaweed for home use or sale, either for food or medicinal purposes. “Gathering” and “picking” denote the practice of collecting driftweed washed up on beaches by storms. This mixture of different species (mainly wracks and kelps) is mainly used for fertiliser. Particularly noteworthy is the collection of storm weeds following intense weather events, especially during or after winter (winter weed).

More detailed information was recorded for a few seaweed species, such as *Palmaria palmata* and *Porphyra* spp. The former is harvested at low tides and collected separately from other seaweeds. Our interviewees described a specific small type of this species, known as *creathnach*, that usually grows on juvenile mussels latched onto rocks at the low tide mark and is harvested from August to early December. Moreover, one interviewee in Quilty described a traditional practice of “cleaning the *dillisk*” (another folk name generally referring to *Palmaria palmata*), involving spending one low tide picking all the bad growth and obscuring cover so that by the next tide, the regrowth will be healthier.

Concerning *Porphyra* spp., two interviewees in Quilty distinguished two types: “wild” and “domesticated”, which are harvested differently. The wild type is pulled from the rocks on the beach, while the domesticated one is found on granite rocks further out at low tide. This latter grows from the rocks and can be picked rather than pulled off the rocks. This enables it to be managed similarly to the process described for cleaning the *dillisk*.

Interviewees demonstrated considerable knowledge regarding the use of seaweeds in agricultural pursuits, employing them as fertiliser, animal feed and mulch (Figure 5). While most of these applications have been abandoned, these practices are still recalled and used by a few individuals. An interviewee in County Clare, who grew up on the coast of Connemara, recounted stories of dragging driftweed to decay in potato beds to serve as fertiliser for growing her family’s vegetables, as there were no alternative fertilisation sources.



**Figure 5.** Potato bed fertilised with seaweed in Kinvarra, Galway Bay (photo: Jack Edwin Martin).

*Chondrus crispus* was used to provide essential nutrients for baby calves. After extracting the fat for butter, it was simmered in the skimmed milk returned from local creameries.

One interviewee in Quilty mentioned that this species was fed to bulls or cows before going to market, as it had a bloating effect that increased their size for a better price at sale.

On the other hand, *Ascophyllum nodosum* was dried and milled into animal feed or sold for alginate production. Farmers in the study area also claimed to spread this seaweed on fields as partial cover and for nutrient absorption into the soil during winter.

*Fucus vesiculosus* was occasionally employed by farmers as a manure alternative. In addition, one interviewee in Kinvarra mentioned using it in cattle feed because the animals seemed to enjoy it, believing it would provide nutrients and salt to their diet.

#### 4.2.4. Evolution and Perceived Changes in Seaweed-Related Foodscape

When exploring the patterns of evolution and changes in seaweed-related traditional ecological and gastronomical knowledge, several trends emerged.

First, seaweed-based traditional activities have lost their centrality in the local foodscape, particularly in their applications in farming activities. Seaweed cutting is now a supplementary act to farming or other professions. In the collective memory remains the kelp industry and the extensive gathering of seaweed, and a large number of harvesters recalled lining the beaches during childhood experiences or in the narratives of their ancestors.

Second, we observed increased formal commercialisation of seaweed products, particularly on the west coast, where some harvesters have expanded their businesses, selling seaweed to shops across Ireland and exporting it abroad. Seaweed is transforming from a subsistence crop to one experiencing heightened commercial demand in the food and agricultural sector. This shift is evidenced by various seaweed companies run by multiple generations of harvesters. In addition to selling whole seaweed, companies have diversified their offerings by creating value-added products via repurposing unsuitable harvests into seasonings and cosmetic products. These processes are exemplified by *Porphyra* spp., considered by most interviewees as a type commonly consumed in the past but now less popular. One respondent markets it milled into dried flakes and labelled as nori.

The entry of local companies into more formalised markets has influenced traditional practices related to seaweed processing, such as those associated with *Palmaria palmata*. Interviewees engaged in commercial seaweed sales are forced by food safety regulations to dry seaweed indoors to prevent contamination. A small shop in Connemara, run by a family for seven generations, continues to sell hand-sealed plastic bags of seaweed. Seaweeds are dried traditionally, either outdoors on rocks (*creathnach*) or in the field (*carraigín*). However, modern food safety regulations and processing times hinder these products' market presence.

Concurrently, the present seaweed industry, focused primarily on seaweed for alginate and animal feed, heavily relies on the species *Ascophyllum nodosum*. In this context, new harvesting technologies have been introduced. These changes include using rakes from boats to collect this species and adopting mechanical kelp harvesting [71].

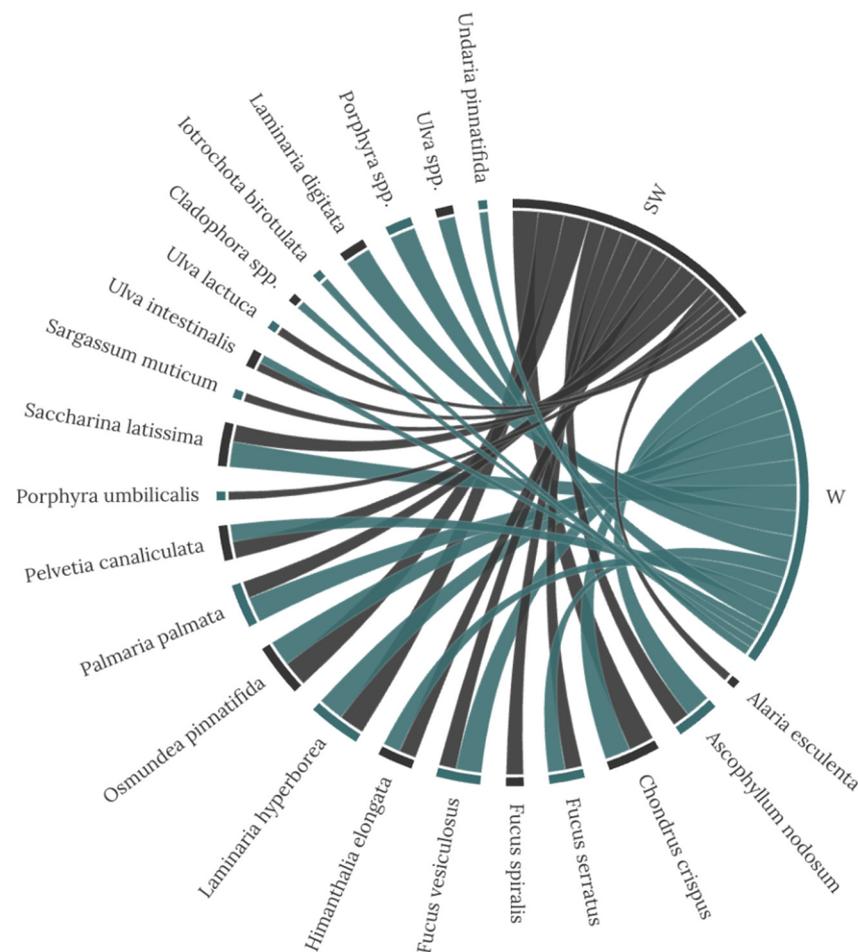
According to one farmer in Kinvarra, the growing commercial importance of seaweed has attracted new economic players who have entered the Irish seaweed market by acquiring traditional family-owned businesses. For example, there is the case of a company in Connemara, which was initially set up by the state to purchase and process cut *Ascophyllum nodosum* from Galway Bay and Clew Bay for export to Scotland (see also [49]). In 2017, this company was acquired by a Canadian multinational company. The sale of the company has raised concerns among seaweed cutters regarding the future of hand-cutting. Traditionally, the right to harvest seaweed rested with the landowner whose property touched the seashore, a regulation seldom enforced today.

During field research, it was observed that these developments have also affected the availability of specific seaweed species due to changes in local ecology and climatic conditions. Interviewees from the Aran Islands, Connemara and County Clare noted a decrease in the supply of *Palmaria palmata* and a significant reduction in the availability of this seaweed on the Atlantic-facing side of the island in recent years.

#### 4.3. Comparison of Species Diversity and Uses between the Study Areas

During our two field studies, we recorded 22 seaweed species used or mentioned by interviewees, with the majority of them belonging to the Fucaceae (5), Laminariaceae (3) and Ulvaceae (3) families. Among the most frequently mentioned species across both study areas were *Chondrus crispus*, *Laminaria hyperborea*, *Osmundea pinnatifida*, *Ascophyllum nodosum*, *Fucus vesiculosus*, *Laminaria saccharina* and *Palmaria palmata*.

Five species were exclusively mentioned by respondents in the SW area: *Alaria esculenta*, *Fucus spiralis*, *Sargassum muticum*, *Porphyra umbilicalis* and *Ulva lactuca* (Figure 6). Conversely, another six species were solely reported by interviewees in field locations within the W region: *Undaria pinnatifida*, *Porphyra* spp., *Cladophora* spp., *Istrochota birotulata*, *Laminaria digitata* and *Ulva* spp.



**Figure 6.** Chord diagram showing the overlaps and differences in the species mentioned by the respondents in the two study areas. Key: SW (southwest), W (west and midwest).

In total, we documented seventeen species used as food, ten for farming, eight for medical applications and eight as cosmetics (Table 7).

In both case studies, food uses were prominent compared to the uses of seaweed in agricultural and medical domains. In this regard, our interviewees reported traditional uses of seaweed (as thickener, seasoning as well as ingredients in soups, stews and puddings), especially those of *Palmaria palmata*, *Chondrus crispus* and *Pyropia* spp.

**Table 7.** Comparison of the uses of the seaweed species recorded in the two study areas.

Family	Scientific Name	Food	Agriculture	Medicinal	Cosmetic
Alariaceae	<i>Alaria esculenta</i> (Linnaeus) Greville, 1830	SW	-	-	-
Alariaceae	<i>Undaria pinnatifida</i> (Harvey) Suringar, 1873	W	-	-	-
Bangiaceae	<i>Porphyra</i> spp. C.Agardh, 1824	W	-	-	-
Bangiaceae	<i>Porphyra umbilicalis</i> Kützing, 1843	SW	-	-	-
Cladophoraceae	<i>Cladophora</i> spp. Kützing, 1843	-	W	-	-
Codiaceae	<i>Istrochota birotulata</i> (Higgin, 1877)	W	-	-	-
Fucaceae	<i>Ascophyllum nodosum</i> (Linnaeus) Le Jolis, 1863	-	W	SW	SW
Fucaceae	<i>Fucus serratus</i> Linnaeus, 1753	-	SW	W	SW
Fucaceae	<i>Fucus spiralis</i> Linnaeus, 1753	-	-	-	SW
Fucaceae	<i>Fucus vesiculosus</i> Linnaeus, 1753	SW   W	SW   W	SW   W	SW
Fucaceae	<i>Pelvetia canaliculata</i> (Linnaeus) Decaisne & Thuret, 1845	W	SW   W	-	SW
Gigartinales	<i>Chondrus crispus</i> Stackhouse, 1797	SW   W	W	SW	SW
Himantothaliaceae	<i>Himantothalia elongata</i> (Linnaeus) S.F.Gray, 1821	SW   W	-	-	-
Laminariaceae	<i>Laminaria digitata</i> (Hudson) J.V.Lamouroux, 1813	W	W	W	-
Laminariaceae	<i>Laminaria hyperborea</i> (Gunnerus) Foslie, 1885	SW   W	SW   W	W	SW
Laminariaceae	<i>Saccharina latissima</i> (Linnaeus) C.E.Lane, C.Mayes, Druehl & G.W.Saunders, 2006	SW   W	SW	-	SW
Palmariaceae	<i>Palmaria palmata</i> (Linnaeus) F.Weber & D.Mohr, 1805	SW   W	W	W	-
Rhodomelaceae	<i>Osmundea pinnatifida</i> (Hudson) Stackhouse, 1809	SW   W	-	-	-
Sargassaceae	<i>Sargassum muticum</i> (Yendo) Fensholt, 1955	-	-	SW	-
Ulvaceae	<i>Ulva intestinalis</i> Linnaeus, 1753	SW   W	W	-	-
Ulvaceae	<i>Ulva lactuca</i> Linnaeus, 1753	SW	-	-	-
Ulvaceae	<i>Ulva</i> spp. Linnaeus, 1753	W	-	-	-

Keys: SW (southwest), W (west and midwest).

## 5. Discussion

Our field studies revealed two main findings, namely, a fair divergence between the seaweed species used in the two Irish study areas and a revitalisation of local ecological and gastronomic knowledge related to seaweed with slightly different trajectories in the two case studies.

In both study areas, we documented the popularity of eight species for gastronomic use: *Chondrus crispus*, *Fucus vesiculosus*, *Laminaria digitata* and *hyperborea*, *Osmundea pinnatifida*, *Palmaria palmata*, *Porphyra* spp. and *Saccharina latissima*. We found that *Palmaria palmata*, *Chondrus crispus* and *Pyropia* spp. were documented in other historical and contemporary works on Irish seaweed cuisine and gastronomy (see [27,28,56,57,59,60]). The food significance of *Palmaria palmata* lies not only in its versatility but also in its perceived nutritional richness (high in vitamins, minerals and protein), which has been confirmed by different studies [32,72]. This seaweed has been traditionally linked to the Irish diet and cuisine, and it is still among the principal seaweeds consumed in contemporary Ireland [62].

The gastronomic use of seaweeds slightly diverges in the two study areas, with novel uses (i.e., not traditionally present in the past according to the interviewees) prevalent in areas located in the SW region. According to our respondents, species such as *Alaria esculenta*, *Laminaria* spp., *Saccharina latissima*, *Ulva* spp. and *Osmundea pinnatifida* were not traditionally prevalent or utilised in the past. The emerging uses of these species may be attributed to evolving market demands and growing commercial interest in recent decades, especially within the food industry and gastronomic sector [41].

The detailed local ecological knowledge (LEK) related to seaweed harvesting showed a more robust continuation of this practice over time in the SW region, where, according to our respondents, seaweed-related practices and uses were stigmatised and abandoned

for several decades. These dynamics have possibly led to seaweed's LEK and, specifically, TGK (traditional gastronomic knowledge) erosion. Our field study in the W region showed that this situation could possibly be linked to the profile of the interviewees, who were directly involved in harvesting activities but showed limited first-hand experiences in the culinary uses of seaweed. The scarce attachment to traditional seaweed gastronomy in the SW region could be related to the stigmatisation of seaweed among older generations due to its association with poverty and especially the times of famine in Ireland [24,26], similar to in other countries such as Iceland and Peru [26,43].

Among non-food uses of seaweeds, *Ascophyllum nodosum* was often mentioned in both areas and is at present the main seaweed harvested in Ireland for commercial processing (e.g., plant biostimulants, animal feed and organic fertiliser, [73]) and may open new opportunities of development for Irish coastal communities.

In W locations, a richer knowledge and memory of the uses of seaweed in agricultural activities, especially as fertiliser and animal fodder, was recalled during the interviews. This circumstance could be linked to a strong legacy of agricultural activities in the recent past, as is the case for the Aran Islands, where agriculture and the kelp industry permeated the livelihoods of local dwellers until the first half of the XXth century [66,67].

Traditional and modern cosmetic uses were mentioned, especially by interviewees in the SW area. This trend could be explained by considering the specific backgrounds of our interviewees, including newcomers or local people who have recently revived specific elements of the seaweed-related foodscape, contextualising them within current trends that promote seaweed as novel and healthy food ingredients [31,40]. Additionally, overarching trends in the food tourism industry, where experiential activities linked to nature (e.g., foraging wild plants and fungi) [74] have also emerged in the last decade, may have contributed to this phenomenon.

### 5.1. Trajectories of the Revitalisation of Seaweed: Dynamics behind the Divergent Trajectories

Seaweed-related foodscapes and associated systems have undergone significant evolution in recent decades, driven by the growing global demand for seaweeds, especially in the food industry and gastronomic sector [39,52,75]. This trend seemed to have shaped and prompted the revitalisation of seaweeds in our two study areas, with slightly different trajectories.

In the W region, interviewees (mainly seaweed harvesters and their families of a generation or more in the trade or who have learnt directly from someone of a previous generation of knowledge) saw their practices as continuing traditional knowledge. In contrast, in the SW region, most interviewees claimed that traditional seaweed-related knowledge is no longer easily accessible, and they do not have a strong familiar legacy with this practice. They engaged in harvesting practices driven by personal interest and a curiosity about their local identity and resources. This resurgence in collective awareness about the importance of seaweed has led to the emergence of a modern seaweed foraging tradition. Similar trends have been noted in the research conducted by Łuczaj et al. [76] among contemporary British foragers, as well as in other studies exploring the revival of wild food foraging, where recreational and leisure pursuits play a significant role in this process [77]. This divergence in the loss/continuation of traditional knowledge related to seaweed and associated practices translates into different dynamics of revitalisation of these resources.

In the W locations, the revitalisation of the seaweed and seaweed-related foodscape is deeply entrenched in the region's historical legacy, showing a continuation of the past. From being a traditional livelihood activity, seaweed harvesting has transitioned into a blend of leisure pursuits and commercially driven enterprise. This evolution has led to the professionalisation and industrialisation of the seaweed-based economy, revitalising certain elements of the traditional seaweed foodscape. However, alongside this resurgence, external economic actors have entered the scene, potentially marginalising local stakeholders from the benefits of promoting seaweed and its associated heritage. This mirrors

trends observed in other contexts where the promotion of traditional and heritage foods sometimes excludes local actors from the benefits stemming from the promotion of these elements [78,79].

Conversely, in the SW region, traditional seaweed practices had been largely abandoned, only to be recently rediscovered and revitalised through modern lenses of sustainability, healthiness, wellness and connection with the natural landscape, which have been identified elsewhere as key drivers fostering the revival of wild foods and wild-food-based products [40,80,81]. The revival here is driven by a contemporary interest in reconnecting with the marine landscape and promoting educational activities centred around seaweed. New knowledge holders are pivotal in spearheading these initiatives, fostering a renewed appreciation for seaweed's role in the local ecosystem. As observed by Łuczaj and Pieroni [82], this knowledge is rarely exclusively related to local heritage; instead, it results from hybridisation between local and external knowledge, usually acquired by individuals from media sources (e.g., books, websites, etc.).

During our field study, we observed that this region is witnessing a surge in initiatives and gatherings aimed at disseminating seaweed-related knowledge, from workshops on harvesting to communal preparation sessions on the beaches. In this context, Irish seaweed is attracting new generations to the landscape who may appear as small-scale entrepreneurs in elaborating and preparing foods and cosmetics with seaweed in their compositions or "new/modern" knowledge holders, creating courses and workshops. This revival does not entail only the food uses of seaweed but also the redefinition of the cultural significance of seaweed for the local population, emphasising its ecological importance and fostering community engagement in its revitalisation. This bottom-up approach seems to revitalise seaweeds through an actualisation process, which has also been identified as one of the dynamics underpinning the heritagisation processes in food and gastronomy [83]. Through this process, new meanings are attributed to seaweed that redefine its past significance, often linked to scarcity and famine, and attribute it new values associated with ideas of wellness, leisure and sustainability [84], as also observed for other wild foods and associated practices [85–87]. As observed in previous studies, this could reposition seaweed and other wild food resources as an asset in the local tourism industry [88–90].

### *5.2. Promoting Seaweed: Sustainability Issues and Implications*

As the popularity of seaweed increases, the sustainability of this resource, as well as those of other wild food resources [91], is being questioned, bringing to the fore issues related to the ownership of the resource, its over-exploitation and the commercial adoption of damaging harvesting techniques [33,71,92–94]. For instance, Mourtisen et al. [28] highlighted that the growing interest in Irish seaweeds is accompanied by challenges related to harvesting rights.

There is a fear that individuals may unexpectedly lose access to beaches due to the sale of harvesting rights. Such worries are shared with other sociopolitical contexts such as eastern Canada [95] or France [96].

While the resurgence of seaweed gastronomy in Western Ireland is a cause for celebration, challenges such as sustainable harvesting practices and environmental conservation must be addressed. In addition to seaweed harvesting, other anthropogenic activities threaten seaweed resources, like invasive species, climate change [24], coastal eutrophication and pollution; the latter was often mentioned by our interviewees. Ultimately, a regulation and a formal national policy are urgently needed to protect seaweed resources, to make sure their use is maintained sustainably and, at the same time, to ensure that the harvesting seaweed tradition is protected and preserved. Collaborative efforts between local communities, researchers and policymakers are essential to ensure the long-term viability of seaweed as a culinary and economic asset [33].

As highlighted by Guiry [65], the sustainability of seaweed harvesting has become a pressing issue with the growing interest of multinational companies and government efforts to expand the industry as a major export crop. In terms of our findings, the majority

of the species quoted by the study participants are commonly available seaweeds along the Irish shore (see [21,23,24,73]). Moreover, hand-harvesting is still the main method used, and thus we may presume that the resources are currently reasonably well managed. This finding could confirm a more likely sustainable nature of LEK related to seaweed foraging, as normally happens with the majority of traditionally gathered wild food plants in Eurasia, as a recent cross-regional analysis underlined [97], although sustainable foraging is a much larger conceptual framework [98]. In this regard, one of the crucial issues when addressing the sustainability of wild resource gathering is often the small-scale dimension of the collection. When the pressure is applied of an external market requiring specific plant items, sustainable gathering could be disrupted, as sometimes happens with wild medicinal plants collected for foreign markets in remote areas of the Balkans [99].

In the case of the W study locations, official seaweed harvesters have been leveraging traditional knowledge passed down through several generations of the family. Harvesting seaweed, once a subsistence activity, has transformed into a luxury food pursuit. However, the industrialisation and mechanisation of seaweed-related activities, which have been pointed out by several interviewees as growing trends, could trigger an erosion of traditional harvesting practices, also impacting the ecology of the area. Such a shift (i.e., the replacement of manual harvesting with mechanical techniques by boat), which in Ireland is permitted only for subtidal seaweed (e.g., *Laminaria digitata*, *Laminaria hyperborea*, *Ascophyllum nodosum*), may also produce a more remarkable impact on the marine ecosystem, as the mechanical methods are more destructive and less selective [100,101]. Garineaud [102] noted a similar trend in a study of kelp harvesting off the coast of Brittany, where the abandonment of hand-harvesting and the adoption of mechanical methods resulted in a loss of LEK and a negative impact on the ecosystem.

Considering the dynamics at stake and the perceptions shared by local people, some issues should be considered to guarantee a sustainable revitalisation process of seaweed and the associated foodscape. Among the strategies that could support this path are the following:

- Co-creating a formal (regional and) national policy to ensure the sustainability of seaweed harvesting and farming and enhance communication to prevent over-exploitation;
- Promoting responsible gathering techniques and implementing ad hoc regulations about licences for harvesting;
- Developing and supporting seaweed aquaculture initiatives;
- Developing value-added seaweed products that cater to both local and international markets, such as creating innovative seaweed-based food products as well as non-food items like cosmetics and biodegradable packaging;
- Encouraging culinary innovation by working with local chefs and food entrepreneurs to incorporate seaweed into traditional and contemporary recipes, also via cooking workshops, food festivals and educational events, which can help raise awareness and appreciation for seaweed as a culinary ingredient;
- Fostering seaweed-related hospitality initiatives, such as developing food tours, culinary experiences and themed events that showcase the seaweed heritage and knowledge;
- Promoting community engagement and active participation in the revitalisation efforts by involving local stakeholders, such as fishermen, farmers, artisans, restaurants and small food-related businesses;
- Implementing education and awareness initiatives to inform multiple stakeholders including both locals and visitors about the nutritional benefits, environmental importance and cultural significance of seaweed;
- Advocating for supportive policies and incentives from the local and national governance to facilitate the growth of small-scale seaweed foraging and transformation.

In devising strategies, some other issues merit consideration. Firstly, it is essential to address potential health risks associated with seaweed consumption. While seaweed offers numerous nutritional benefits, excessive intake can lead to adverse effects on human health. For instance, certain species of seaweed may contain high levels of compounds

like iodine, surpassing recommended daily limits and potentially causing thyroid-related complications [103]. Moreover, the conditions under which seaweed is harvested play a pivotal role. Seaweeds can absorb beneficial vitamins and minerals from sediments and seawater, but they can also take up organic and inorganic chemical contaminants. If localised sources of pollution are present, seaweed can absorb contaminants and may pose potential health risks to consumers [104]. Therefore, comprehensive measures should be implemented to ensure the safety and sustainability of seaweed harvesting practices, safeguarding both human health and marine ecosystems [105].

## 6. Conclusions

Our study investigated the traditional ecological and gastronomic knowledge of seaweed in two areas in West Ireland. We recorded 22 seaweed species used or mentioned by respondents. Our findings revealed a fair divergence between the seaweed species used in the two Irish studies areas (16 seaweed species in the southwest region and 17 seaweed species in the west and midwest region), with 11 species mentioned in both the study areas. In both case studies, food uses were prominent compared to the uses of seaweed in agricultural and medical domains, although some variability in specific uses was observed. Moreover, different trajectories underpinning revitalising traditional ecological and gastronomic knowledge related to seaweeds were identified. While in the west and midwest locations, this process showed a sort of continuation with the past and followed a more commercially oriented path, in the southwest region, traditional seaweed practices had been largely abandoned. The revival seems to have fostered new knowledge holders showing a contemporary interest in promoting seaweed as healthy and sustainable food, reconnecting with nature and fostering educational activities centred around seaweed and associated landscapes.

Future research should broaden the geographical scope of our study to encompass additional Irish strongholds of seaweed tradition, including other locations in the Connemara area and other regions along the west and north coasts, as well as expanding the sample of interviewees involved in the research. Furthermore, in-depth ethnographic investigations into specific initiatives aimed at revitalising seaweed, including local food movements, experiential activities and workshops, could shed light on the specific motivations and practices fostering the promotion of seaweed and associated foodscapes. Additionally, sustainability implications stemming from the revival of seaweed-based practices deserve closer attention, emphasising the need for nuanced analyses of the underlying dynamics prompting this resurgence.

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