



Summary on the second RSE Saltire *Scientific Knowledge Across Jurisdictions* cross-disciplinary workshop, 6 May 2022

Theme: *Scottish coastal communities and marine biodiversity: knowledge, extraction and use of marine resources past, present and future*

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The aim of this workshop was to review the past, present and future of the interactions between coastal communities and marine biodiversity in rich and intertwined cross-disciplinary discussions. Key themes were the past, traditional and future cutting-edge uses of marine resources by local communities and the close and multifaceted interconnections among marine resources, the sea and the community. Some talks remarked how on several historical occasions large commercial organisations and external regulations (such as tax and tariffs) have had an impact on this complex interactions between coastal communities and marine resources. By studying the past (via archival resources and museum collections), and through renewed scientific engagement with kelp and seaweed (including community engagement), the workshop brought together an extraordinary wealth of expertise across different fields to show the ongoing legacy and importance of these local resources and local knowledge for local coastal communities and their local economy (from biofuels to bio-tech products). This all suggests, in Scotland and elsewhere, a new focus on reprioritising and reclaiming the relationship between communities and marine resources and the need for a reinvigorated engagement among local communities, industry, and relevant legislation about the fair and environmentally responsible use of marine resources.

Session 1. The past. How did local Scottish coastal communities contribute to knowledge, extraction and use of marine resources?

Elliot Holmes introduced the fascinating archive collections at the *School of Scottish Studies Archives and Library at the University of Edinburgh*. This includes recordings, autographs, manuscripts and videos, recording the history of marine life and practices of coastal communities and past cultures in Scotland, particularly

regarding the work of women and ways of life. The Library serves as a place to enable memories to be passed on to new generations so they can understand the treasures of the Scottish history and culture. Finally, the Library actively collects and receives databases, provides remote and in-person streamer services on sound collections, and welcomes enquiries on the access of materials for local and community use. Holmes drew attention to the MacLagan Manuscripts collection, run by Robert Craig with a team of collectors. The collection includes around 9200 pages of written accounts concerning folklore, customs and beliefs of the local coastal communities in the West Highlands and other parts. Kelp harvesting features as an historically important economic resource for local crofters.

Next speaker was *Craig Kennedy from the School of Energy, Geoscience, Infrastructure and Society, Heriot Watt University, Edinburgh*. Kennedy shared the journey of kelp harvesting and its historical link to glassmaking manufacturing, with the rise and fall of the glass industry in Scotland between 18th and 19th century. The Romans discovered the use of alkali flux (obtained from ashes of seaweed) to reduce the melting temperature on glassmaking. This technique was imported from the Mediterranean and played an important role in Scottish glassmaking. The kelp business in Scotland (and North England too) bloomed and peaked producing five thousand tons of kelp per year in the 17th century. However, the business collapsed in the 1830s due to a high taxation—only 500 tons of kelp was produced in Orkney in 1833. The kelp industry and its export community faded drastically. Glass windows made using kelp can be dated scientifically and provide a well-preserved record of the history of the kelp use in glassmaking manufacture.

Our third speaker was *Fiona Mackenzie from the Isle of Canna Archive, run by the National Trust of Scotland*. The talk started with a wonderful song in Gaelic —“ A’Bhean ladach” — a traditional song among the local coastal communities of Scotland where the theme of the seaweed is intertwined with the life and fate of local working women and the culture of the seastrand. The talk illustrated the rich collection at the Canna Museum, with records and photos and videos collected by Margaret Fay Shaw and John Campbell, and the key role of seaweed at the centre of lives and local traditions. The Isle of Canna off the West Coast of Scotland has a long tradition in kelp harvesting and fishing, and there is also a close relationship between Gaelic culture and marine environment. Unfortunately, extreme poverty, due to kelp industry decline, pushed most of population away from the island; plastic pollution in more recent decades further exacerbated the situation.

Reflecting on the presentations, workshop participants noted the importance of the history of kelp industry; remarked on a long journey of the cultivation and harvest of kelp; identified and discussed the interaction between the natural climate and the community; and noted the vital role that kelp has played in the local economy, the heritage and cultures of the island community.

Session 2. The present. From seaweed stories to conservation projects

In our second session, *Julia Parks*, an artist filmmaker, shared how films, short movies and photographs can tell important stories about the sea and seaweed. Her works include exploring geographical areas in West Cumbria and illustrating how kelp industry shaped the landscape. Parks has created documentaries on seaweed harvest and its link to Gaelic culture, and investigated the history of foreshores and algae industry in Scotland. Seaweed offers a bio-diversified habitat which one can use films and movies to record, so as to explore and understand any emerged tensions among resources, the environment, and people.

The next speaker, *Lesley McEvoy* from the *University of the Highlands and Islands*, Shetland's Seaweed and Coastal Communities project, explored the establishment of seaweed farms in Shetland. McEvoy explained how the suitability of potential sites were determined by investigating environmental factors and human perceptions; and that seaweed species each require differing levels of exposure and local communities have varying levels of tolerance for these interventions. The opinions of Shetland residents were noted to be generally positive, with their main concerns relating to potential local habitat disruption or interference with shipping lanes. There were benefits of seaweed farms, as natural seaweed grows prolifically on mussel lines. It was noted that one market opportunity, aviation biofuel, would involve large increases in drying and freight expenses.

Reflecting on the presentations, workshop participants discussed seaweed lifecycle and the need for more funding opportunities, which typically arrive only when there are potential commercial applications like biofuels. It was also noted how increased oil prices are currently making seaweed research more fundable. Biofouling was highlighted as having a significant impact on seaweed yield; changing weather patterns and increased water temperatures may mean biofouling windows are less predictable and certain seaweeds become non-viable in Scottish waters.

Session 3. The future. Coastal communities and marine biotechnologies in Scotland and beyond

The next speakers were *Michele Stanley* from *Scottish Association for Marine Science* (SAMS) and *Charlie Bavington* from the company *Oceanium*. They both gave detailed overviews of the processes and considerations required for successful seaweed cultivation, generally and in the context of particular purposes. The presentations highlighted the impact of seaweed species, site selection and harvesting time choices on seaweed content compositions, limiting biofouling, possible uses and monetary value. Aquaculture monitoring allows informed decision-making, regarding site selection and harvesting time, but experience and local community knowledge are essential here.

Michele Stanley emphasised the importance of engagement and conflict resolution with local communities during site selection. Whilst seaweed farms in Scotland currently have low visual impact, increased scale and mechanisation would be required if seaweed products are to replace established products from less sustainable resources. The potential environmental impacts of seaweed farms will vary depending on the site selected and its carrying capacity —large-scale kelp harvesting may release greenhouse gases and iodine into the atmosphere. Seaweed farms have also positive environmental impacts. They can increase local biodiversity and seaweeds may absorb and remove heavy metals from aquatic environments. SAMS repurposes their seaweed farms to grow oysters during the summer. Integrative multipurpose aquaculture sites may compensate for potential negative impacts from farming one species. Blue carbon bonds were discussed, noting that there is a need for more science to underpin these, and that this is relevant to the debate regarding cultivated vs natural kelp beds.

Charlie Bavington introduced the diverse range of compounds available from seaweed and their possible applications, from fake leather to dietary fibre, which can be developed from seaweed gathered in from all over the world. Seaweed is the ultimate biomass source; it does not require land, fertiliser, pesticide or fresh water and instead provides seabed protection, employment, and food security. However, one can never replace all oil-derived plastics with alternatives coming from seaweed unless society also reduces its overall plastic consumption. The importance of maximising output from each seaweed harvest was emphasised; clean and green processes are used to extract and repurpose all constituent components of the seaweed. Public life-cycle analyses of these processes determine their overall environmental impact and allows critiquing of standards.

The final speaker for this workshop was philosopher of science *Michael Weisberg* from *University of Pennsylvania*, Co-Director of the Galápagos Education and Research Alliance. Weisberg discussed ongoing initiatives and projects in the Galápagos to engage local communities in sustainable interaction with their environment and rich biodiversity. These involved enabling the local community to better explore and engage with the local aquatic park and the importance of conserving the Galápagos national park. The key message was the importance of ensuring local community involvement, which is essential to the success of conservation projects in the Galápagos as in any other geographical part of the world.

Reflecting on the presentations, workshop participants discussed the importance of active engagement with local coastal communities in Scotland, and how more jobs can be created for these communities. This importance of facilitating career changes and diversification for the green economy was also highlighted. For example, the expertise fishermen possess about local waters is directly applicable to seaweed farming and to assessing impact. Working with local communities about seaweed farms and better understanding how they will affect their area is pivotal to understanding different forms of benefit sharing and impact assessment.

