

Type of the Paper (Article)

For the Love of the Sea: Technocratic Environmentalism and the Struggle to Sustain Community-led Aquaculture

Gareth Thomas ¹, Louise Steel ¹ and Luci Attala ^{1,*}

¹ UWTSO 1; gareth.thomas@uwtsd.ac.uk, lsteel@uwtsd.ac.uk; lattala@uwtsd.ac.uk

Abstract: Climate change is transforming marine ecosystems worldwide, disrupting livelihoods and reshaping coastal economies. This paper presents an example of transdisciplinary, humanities-informed sustainability science that examines how different forms of knowledge shape responses to climate change. In Wales, these dynamics are evident in the emergence of regenerative aquaculture as a locally grounded response. This study focuses on Câr-y-Môr, the first community-owned regenerative ocean farm in Wales, where sustainability is practised through collective labour, intergenerational knowledge and situated ecological expertise. Anthropological fieldwork was conducted between May 2024, and June 2025 and comprised participant observation supplemented by semi-structured interviews with farm members, volunteers, directors, regulatory staff and other stakeholders. Fieldnotes and transcripts were triangulated with marine licensing documents, ecological reports, policy frameworks and grant materials, with all data thematically coded. Findings show that while grassroots innovation generates alternative ways of practising sustainability, it is constrained by licensing regimes and funding structures that privilege standardized metrics over lived experience. The case highlights how hyper-local initiatives both depend on and challenge governance systems, offering transferable insights for integrating community expertise into marine planning and licensing.

Keywords: aquaculture; regenerative ocean farming; embodied knowledge; technocratic environmentalism; participant observation, political ecology, transdisciplinarity

1. Introduction

Rapidly changing climatic and environment conditions present a picture of humanity under threat, living on a damaged planet [1, 2]. Coastal communities are particularly under threat from the effects of anthropogenically accelerated climate change including across high latitude northern hemisphere regions; rising sea levels, warming water and changes to marine ecosystems are forcing communities to adapt to a situation that is threatening people's livelihoods and cultures. Regenerative ocean farming, which cultivates seaweed and a variety of shellfish, is increasingly being promoted as an effective response to these pressures, with high yields for minimal human input and acting as effective traps for carbon and nitrogen [3, 4].

Academic Editor: Firstname Last-name

Received: date

Revised: date

Accepted: date

Published: date

Citation: To be added by editorial staff during production.

Copyright: © 2025 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).



Figure 1. Regenerative ocean farming model, at Câr-y-Môr. Source: L. Steel, after Greenwave, <https://canadiangeographic.ca/articles/qa-the-sustainability-of-regenerative-ocean-farming/>

This paper examines some of the socio-economic challenges facing a small-scale community run regenerative ocean farm in southwest Wales (Figure 1). It presents preliminary results of anthropological fieldwork with Câr-y-Môr, a community-owned regenerative seaweed and shellfish farm in southwest Wales. Using participant observation we have collected narratives of people's lived experiences working at the farm, which reveal an interesting eco-social relationship, the ways that people and environment shape each other and how this has informed their business. A key issue that has emerged revolves around how their efforts are constrained by technocratic systems of governance that privilege scientific-based data and enforce standardization, procedural compliance and abstract, desk-based forms of expertise. Our participants frequently observed frustrations with how their knowledge does not get heard because it is not considered relevant by environmental sciences and policy makers. The weighting of quantitative data over qualitative evidence is increasingly being problematized [5] (pp.7-10). Here, we seek to break down the "mutual standoff" [5] (p.53) between data driven sciences and a more experiential, narrative based approach within the humanities. There is increasing awareness of the need to consider the local context and to address local concerns [6]. Drawing upon the voices of our societal partners, we illustrate the merit of listening to and learning from real-world expertise and some of the surprising insights that emerge. Indeed, the qualitative and reflexive knowledges produced within the humanities provides the human context that will enable us to unravel the complexities of people's interactions with the environment [7, 8] and better inform sustainable solutions. This paper seeks to demonstrate the unique worth of qualitative information as opposed to quantitative data, to highlight that there are other non-scientific ways of knowing the world and "to temper the knowledge bequeathed by science with the wisdom of experience and imagination" [5] (p.10).

This paper examines the socio-economic challenges facing a small-scale community-run regenerative ocean farm in southwest Wales. It presents preliminary results of anthropological fieldwork with Câr-y-Môr, a community-owned seaweed and shellfish farm. This paper examines how governance structures shape the possibilities of small-scale regenerative aquaculture. Specifically, we ask: how do licensing regimes, funding frameworks and regulatory norms affect the capacity of community initiatives to contribute to sustainability transitions? While our focus is on Câr-y-Môr, comparable tensions between community-based initiatives and governance systems designed for large-scale operators

have been reported in similar contexts across the Global North, including Scotland and Canada (see discussion below), highlighting that the Welsh case is illustrative of broader dynamics rather than an isolated example. This case is therefore illustrative of wider dynamics rather than representative of all community enterprises. Using participant observation, and interviews, we collected narratives of lived experience that reveal how people and environment shape one another and how this has informed everyday practices of farming and business organization. A key issue that has emerged concerns how community efforts are constrained by technocratic systems of governance that privilege standardized data, procedural compliance and desk-based forms of expertise. Participants frequently expressed frustration that their experience and observations were undervalued or excluded from environmental decision-making. Such tensions have been discussed more widely in debates on the weighting of quantitative over qualitative evidence [5] (pp. 7–10). Rather than presenting scientific and experiential knowledge in opposition, this study explores how they interact in practice and the contributions that situated knowledge can make to sustainability governance. There is increasing awareness of the need to consider local context and address community concerns in environmental policy [6]. Drawing on the voices of our societal partners, we highlight the insights that emerge from lived experience and argue that these provide the human context needed to understand complex interactions between people and environment [7,8]. This paper contributes to ongoing discussions on the value of qualitative information in sustainability research, emphasizing that local and experiential expertise should complement, rather than compete with, scientific data [5] (p. 10).

2. Background

2.1 Challenging Technocratic Environmentalism

Oceans are undergoing rapid and unprecedented transformation. Rising temperatures, acidification, deoxygenation, and biodiversity loss are reshaping marine ecosystems globally, with serious implications for coastal communities [9, 10]. In Wales, and across the UK, these shifts are already palpable. Local fishers describe altered migration routes, declining shellfish populations and increasingly erratic seasonal patterns [11, 12]. As traditional fishing grounds become less viable, these ecological changes are experienced not as distant or abstract projections but as immediate, embodied disruptions to everyday life. While such transformations are commonly framed as evidence of ecological decline, scholars have shown that interpretations of decline are rarely neutral [13]. How change is understood, responded to and governed depends not just on scientific observations but also on political frameworks and institutional logics. Scholars in political ecology and environmental anthropology have long emphasized that interpretations of environmental decline are shaped by broader structures of regulation, law, and governance [13, 14, 15]. These structures determine not only what counts as degradation, but who is held responsible for environmental harms and whose knowledge is considered credible in the face of ecological uncertainty.

Technocratic environmentalism privileges the role of science and technology as the solution to environmental problems, advocating data-driven, efficiency-oriented solutions; this presupposes that scientific experts should lead on decisions about environmental policy [16, 17, 18]. Environmental governance, therefore, is rarely neutral but tends to be weighted towards scientific quantitative data [18], privileging quantifiable outputs, standardized compliance and scalability. Debates over terminology further complicate these dynamics, with scholars noting that labels such as regenerative, restorative and conservation aquaculture are often used inconsistently, shaping governance expectations and policy framings [19] Operating on the assumption that environmental improvement can

(and should) be engineered and managed from above, there is a tendency for institutions to respond to ecological crisis through top-down mechanisms that expand state oversight or introduce market-based controls. These include licensing regimes, environmental assessments and compliance metrics intended to manage risk and enforce accountability [14]. However, these frameworks frequently impose disproportionate burdens on small-scale actors, whose resources, practices and working rhythms may not align with institutional expectations [4, 20]. In practice, this marginalizes the situated knowledge of those with direct, long-term engagement with ecosystems. While such frameworks are designed to reduce risk and manage complexity, they frequently introduce structural barriers for small-scale regenerative initiatives. As a result, conformity with standardized procedures tends to be prioritized over local experimentation, even when the latter could yield more ecologically attuned outcomes. Failure to listen to the expertise, experience and concerns of real-life practitioners risks sidelining those most directly engaged with ecological change and best placed to develop adaptive responses.

This is especially evident in small-scale, community-led aquaculture. Similar tensions have been documented across the Global North. In Scotland, seaweed aquaculture has raised debates over scale and community benefit [21]. In Nova Scotia, community-based aquaculture projects face governance barriers that restrict their scope [22]. On Canada's Pacific coast, Indigenous and community fisheries highlight the marginalization of situated knowledge within state regulatory frameworks [23]. Historical cases, such as Grand Manan, demonstrate how industrial aquaculture displaced small-scale practices [24]). At the policy level, critiques of the Blue Economy argue that expansion strategies frequently sideline community wellbeing in favour of industrial growth [25]. Across global contexts, traditional and locally embedded fisheries have demonstrated capacities for flexible, place-based adaptation [26]. Their embeddedness in local ecologies [27], responsiveness to ultra local conditions [28] and reliance on collective labour [29] often allow for more nimble and resilient responses than larger, centralized operations [30], as well as having less dramatic environmental impact and greater social benefits than larger fishing enterprises [31, 32, 33, 34]. Yet these approaches still need to operate within institutional systems that define what is fundable, permissible, or legitimate. Adaptive capacity, then, is not only ecological or technical but also institutional. Without recognition and support, even the most effective grassroots responses can be marginalized or rendered unviable [35, 36]. Such constraints often sit uneasily alongside the learning cultures fostered by community-led initiatives in Wales, especially as we know that many small-scale fishers develop knowledge not through desk-based planning, but through iterative experimentation and deeply situated, continuous engagement with the sea [37]. These forms of learning are practical, collaborative and resistant to standardization. They centre responsiveness, care and embodied knowledge as core components of environmental resilience [37]. Despite these insights, little attention has been given to community-owned regenerative aquaculture in the UK. In Wales, governance systems remain primarily designed for large-scale operators, raising questions about how grassroots initiatives navigate and contest these structures.

2.2 Case Context: Câr-y-Môr's Regenerative Model

This paper examines a specific case study and the impact of regulatory metrics, procedural templates and abstracted forms of expertise [38, 39] on a regenerative ocean farm in southwest Wales. The analysis presented here emerges from sustained anthropological fieldwork at Câr-y-Môr (trans: *for the love of the sea*), a community-owned regenerative ocean farm located on the Pembrokeshire coast (Wales, UK) (Figure 2); its three-hectare site lies in Ramsey Sound, off the inshore coast of St Davids. It was established as an intentional alternative to extractive aquaculture in response to environmental and socio-

economic changes [40] and following the collapse of a privately owned aquaculture venture, the new enterprise deliberately restructured to minimize risk through collective ownership and community governance.



Figure 2. Map of Wales showing location of Câr-y-Môr, source: NASA, Public domain, via Wikimedia Commons

The Câr-y-Môr aquaculture farm is guided by principles of biomimicry [41], collective labour and community governance. Its work reimagines aquaculture as a reciprocal, restorative relationship with the sea. Their model draws on principles of biomimetic management and living-systems thinking. Rather than functioning as a linear production unit, the farm operates as a decentralized and adaptive system, embedded in local ecological and social contexts. Governance combines a flat pay structure, in which all employees receive the same living wage, with cooperative, often informal decision-making layered alongside more conventional managerial practices. The farm cultivates kelp, oysters, mussels, scallops and other species in a model designed to support both ecosystem regeneration and community livelihoods. Seaweed species such as sugar kelp (*Saccharina latissima*), sea lettuce (*Ulva lactuca*) and oarweed (*Laminaria digitata*) are grown on horizontal ropes suspended in the water column using a vertical longline system. Native oysters, clams and mussels are also cultivated through suspended systems that enable natural filter feeding [42] (Figure 3).

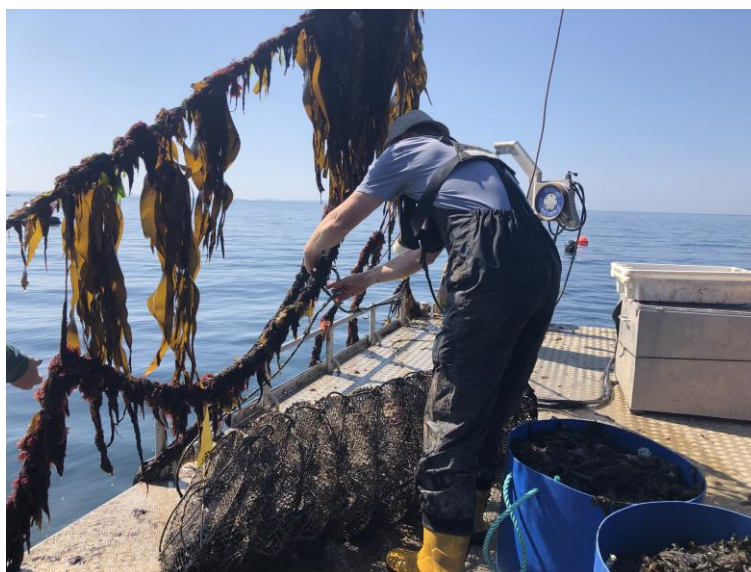


Figure 3. Ropes of seaweed and nets of mussels. Source: Gareth Thomas

In addition to its own aquaculture operations, the farm purchases crab and lobster from local pot fishers, which are processed and packed onsite before being sold to local restaurants and premium markets, including in London. While this trade currently constitutes the main revenue stream, the long-term strategy is to expand seaweed-based production, particularly through the development of bio-stimulant products made from non-edible species. To support this transition, in 2023 Câr-y-Môr embarked on a phase of infrastructural expansion. Supported by £1.1 million in DEFRA funding [43] and a £250,000 loan through the Growth Guarantee Scheme [44], the farm began constructing new seaweed processing units, cold storage facilities and a public-facing hub for training, education and community engagement. These developments aim to expand processing capacity while meeting the compliance and reporting requirements set by public funders. As a direct outcome of this funding, the project is also introducing new operational protocols, including standard operating procedures for processing and compliance, structured training and induction plans for staff and comprehensive risk management systems such as maintenance schedules, safety audits and emergency response protocols.

Nonetheless, as Câr-y-Môr develops, pursuing funding, formalizing operations and navigating complex licensing requirements, it finds itself increasingly entangled in institutional systems structured around different logics and understandings of the world. These systems frequently value disembodied, desk-based expertise over experiential, situated knowledge, making it difficult for grassroots projects to scale without compromising core values. The central question, then, is not just whether Câr y Môr can succeed ecologically or economically, but whether it can do so without compromising the values and knowledge systems that underpin its work. By examining the negotiations and frictions involved in sustaining this regenerative enterprise under bureaucratic pressure, this paper contributes to debates in political ecology [45] and environmental anthropology [46, 47] concerning the institutional and epistemic dimensions of sustainability. It shows how governance structures shape what forms of environmental practice are made possible, visible, or legitimate. Rather than offering Câr-y-Môr as a replicable model, this paper treats it as a live case of sustainability in the making, an evolving process of adaptation, adjustment and situated negotiation.

3. Methods: A Transdisciplinary Approach to Humanities-informed Sustainability Science

Fieldwork at Câr-y- Môr is part of *Coastal TALES*, an international research project, which explores how traditional ecological knowledge and cultural heritage practices inform climate adaptation in northern coastal communities across Wales, Ireland and Alaska [48, 49]. In Wales our focus is on inshore fishing and aquaculture communities in Ceredigion, Carmarthenshire and Pembrokeshire, where long-standing relationships with the sea are shaped by intergenerational knowledge, cultural practice and ecological observation.

3.1 Transdisciplinary Humanities-Informed Sustainability Science

Our research is grounded in *transdisciplinary humanities-informed sustainability science* (THiSS) [50, 51, 52]. This approach interweaves methodologies from the humanities with a transdisciplinary approach [53] that recognizes the importance of embedding knowledge, expertise and values outside traditional academic fields in the pursuit of common or shared goals. Transdisciplinary research emphasizes that “[w]hen researching good solutions to complex societal problems no knowledge system should claim a priori superiority” [53] (p.16); this enables a variety of knowledge systems to interact in constructive ways in a process of mutual learning [54] and *maintains the distinctiveness of individual voices* whilst promoting more nuanced understandings of complex issues. THiSS draws on interpretative and narrative methods from the humanities, which foreground the historical, social, cultural and ethical context of research [5, 55] and brings them into dialogue with other disciplines such as ecological science, political ecology and policy studies. Moreover, it foregrounds *co-production* with non-academic actors. Integral to THiSS is the understanding that local expertise derived from lived experience is valued *equally* with scientific data and humanities evidence. Braiding intellectual approaches from the humanities and sciences with real-world experiences [56, 8] allows the voice of local experts to be heard and provides reminders of how people and planet are fundamentally interdependent.

Central to our research therefore is the recognition that place-based, relational and experiential forms of knowledge are essential for meaningful climate adaptation. Rather than conceiving sustainability as a purely technical or ecological challenge, our approach treats it as an inherently social, ethical and situated process [51, 57] and recognizes that policymakers who are unable to employ the systemic knowledge provided by the humanities and grounded in local expertise will be less effective in their framing of social and political challenges. Adopting a THiSS approach invites epistemological pluralism into sustainability science, challenging dominant models that prioritize abstraction, standardization and procedural expertise [58, 59, 60]. Through the transdisciplinary lens our research engages not only with environmental challenges but also with the politics of knowledge that shape how adaptation is conceived, legitimized and enacted on the ground.

3.2 Participant Observation

Transdisciplinarity not only expands the notion of expert beyond the academy but equally significantly reconfigures the notion of what knowledge is [5, 53] and how it can usefully be co-produced. This approach resonates with anthropological fieldwork methods, namely the notion of “deep hanging out” articulated by Geertz [61] and the immersion (observation and listening) advocated by participant observation, where the anthropologist is taught by their interlocuter. As such the research methodology we employed was participant observation, which emphasizes the importance of “attentive engagement” [62] (p.354) and understanding lived experience, embedded knowledge and relational dynamics in situated contexts [62, 63]. Instead of relying on structured interviews or focus groups, our research emphasized sustained presence and embodied engagement to create

enduring relationships through participating in the everyday activities of the farm. Rather separating ourselves from our societal partners to study and objectify them, participant observation entails working *with* our participants, paying attention and listening to what they say [5].

We set up our relationship with Câr-y-Môr in 2023 and fieldwork was conducted in short-term visits and extended immersive engagement in 2024–2025. In total, this amounted to approximately 250 hours of participant observation across farming, processing, governance meetings, and community events. The patchwork approach [64, 65, 66], entailing shorter times in the field, “rapid ethnography” and distributing responsibilities between different team members, was adopted out of necessity, recognizing that with our work commitments continuous long-term continuous fieldwork was neither appropriate nor possible. The researcher participated in everyday tasks (Figure 4) including seaweed harvesting, drying and processing, shellfish gathering, training sessions, storytelling events, team meetings and public education workshops. Participant observation facilitated a situated understanding of how sustainability is enacted, shared and negotiated in practice [63, 67]. This approach enabled close documentation of material routines, affective relationships, gendered labour and collective dynamics, as well as the sensory and emotional textures of marine work [63]. These in-person encounters were complemented by online meetings. In addition, 25 semi-structured interviews were conducted with farm members, directors, volunteers, Natural Resources Wales staff, administrators and regulatory officials. Our research also included the collection and analysis of both internal and public-facing documents. Key materials included marine licensing documents, ecological assessments, funding applications and compliance reports, which were triangulated with our anthropological data. These were treated as cultural artefacts that reflect the evolving identity, values, and communicative strategies of the organization [68]. Analysis of these texts provided context for observed practices and added interpretive depth to the ethnographic record.



Figure 4. Embodied participant observation at Câr-y-Môr. Photo: Gareth Thomas.

Fieldnotes, documents and recorded conversations were coded thematically and analyzed using a relational ethnographic approach. Coding combined inductive and deductive strategies, beginning with open coding of fieldnotes and transcripts to identify recurring practices, tensions and themes. These were then refined into analytical categories informed by literature on situated knowledge, political ecology and regenerative governance. NVivo software (or “manual coding” if no software was used) was employed to organize the material. Triangulation between observation, interviews and document

analysis enhanced reliability and regular peer debriefing within the research team provided additional interpretive rigour [64, 65].

Key themes that emerged included technocratic constraint, regenerative labour tensions, embodied ecological knowledge and gendered coastal expertise. These were examined in conversation with theoretical work on situated knowledge, political ecology and regenerative governance [38, 39, 62, 71]. The analysis was further informed by anthropological and feminist literature on moral economies, informal labour and the infrastructural frictions that shape sustainability in practice [72, 73, 74]. Reflexive attention was given throughout to the researcher's role and positionality in shaping the knowledge produced. The researcher often worked alongside participants in seaweed harvesting and processing, which shaped both access and interpretation. This dual role as observer and contributor introduced potential biases, mitigated through regular reflexive journaling and mentorship. Regular mentorship and iterative dialogue supported ethical engagement and interpretive rigour [75; 76]. All participants provided informed oral consent [77]. Anonymization was applied to protect confidentiality, except in cases where participants requested attribution, such as public-facing staff and officials. Data were stored securely in line with GDPR requirements, with access limited to the research team. Ethical approval was granted by the University of Wales Trinity Saint David Faculty Ethics Committee in April 2024, and all research was conducted in accordance with the ASA Ethical Guidelines [77].

4. Narratives of Aquaculture at Câr-y-Môr

The following discussion is based on insights revealed by our interlocutors during participant observation at Câr-y-Môr. Embedding this anthropological methodology within a transdisciplinary approach that emphasizes the importance of *paying attention* to voices and expertise outside academia [5, 52, 53, 54] has allowed interesting and unexpected insights to emerge that challenge society's reliance on the technofix to solve our environmental problems. It demonstrates the effectiveness of this approach for teasing out the real-world challenges faced by small community businesses who are endeavouring to navigate their way to a viable and sustainable future. Here we highlight three key themes: the challenges of technocratic restraints, the importance of situated embodied knowledges and how the community negotiates the gap between their sustainability ideals and the realities of daily labour. Our discussion highlights the voices of the community at Câr-y-Môr, bringing this thread of situated and embodied knowledge to the fore, while recognizing that the necessity of learning from the realities of human experience "does not diminish the relatively important and somewhat privileged role of science" [53] (p.6).

4.1. Regulatory and Licensing Burdens

This section explores how licensing regimes, fragmented authority and risk-averse decision-making constrain community initiatives, creating disproportionate burdens for small-scale regenerative farms. Câr-y-Môr's daily operations are continually shaped by institutional systems [42, 78, 79] that privilege standardization, procedural legibility and narrowly framed outputs. These frameworks often marginalize situated knowledge and ecological adaptability in favour of abstract, quantifiable indicators [38, 39]. As one team member noted, "*We're working with the tides, the seasons, the weather, and they want quarterly outputs in a spreadsheet. It just doesn't translate,*" capturing the gap between technocratic metrics and lived practice.

Among the most persistent challenges is marine licensing [80], described by one staff member as "*eating time like nothing else, we're farming seaweed, not chasing emails, but it feels like half the job is policy work.*" For Câr-y-Môr, these difficulties were compounded by the farm's operation across three sites, two for shellfish and one for seaweed, each subject to

distinct regulatory frameworks. Under the standard licensing route, Natural Resources Wales (NRW) coordinates statutory consultation with other agencies, including the Marine and Coastguard Agency (MCA), Trinity House and conservation bodies, reducing the need for applicants to manage every contact themselves. However, when Câr-y-Môr attempted to pursue a shellfish exemption, responsibility for coordination shifted onto the farm. They had to approach MCA and Trinity House directly, and both declined to confirm exemption status. What had seemed a lighter-touch alternative became instead a source of prolonged uncertainty, leaving the farm caught between overlapping regimes and exposed to retrospective challenge.

From NRW's perspective, regulation is necessary to protect sensitive ecosystems. Staff emphasized that even small-scale projects can cause significant ecological harm if poorly located, pointing to risks for reef habitats, seagrass beds and entanglement with species such as seahorses. They also suggested that some seaweed farmers resist licensing not only because of bureaucracy, but because they view their activities as inherently beneficial and therefore struggle to accept the need for regulation. For Câr-y-Môr, however, the issue was not the principle of regulation but the practical burden of engagement. When NRW representatives visited the farm, the day was remembered less as a constructive dialogue than as another disruption to overstretched operations. These dynamics show that licensing for regenerative aquaculture is complicated and nuanced: regulatory caution serves vital ecological goals, but the way procedures are structured often places disproportionate burdens on small-scale projects.

These tensions echo broader findings across the UK licensing system, which has been criticized for similar challenges. The *End-to-End Review of Marine Licensing* [81] found that the process is widely regarded as overly complex, duplicative and unpredictable, with delays and inconsistencies that create uncertainty for applicants. It noted that requirements often impose disproportionate burdens on small enterprises, which lack the resources to navigate lengthy consultations, environmental assessments and overlapping agency demands. The review called for greater clarity, proportionality and streamlining of procedures, including better inter-agency coordination and more flexible approaches to low-risk projects.

Further complications arise from fragmented authority, outdated exemptions and risk-averse decision-making. One staff member described the system as "*absurd*," recalling how "*we have to prove we're exempt, and then they still say they might fine us later*." Past controversies over seaweed licensing in Cornwall (England) were said to have made regulators more reluctant to authorize new applications. As another staff member put it, "*Nobody wants to be the one that says yes, so they just keep stalling until you give up*." As Scott [32] argues, bureaucratic systems often default to inaction to avoid accountability, managing complexity through procedural delay rather than responsive engagement. In this way, stasis becomes a form of institutional self-preservation, where the appearance of due process masks underlying paralysis.

To navigate these hurdles, the farm has pursued both a temporary one-year licence extension, used as a stopgap to avoid dismantling infrastructure, and a full licence application for long-term expansion. Managing both tracks simultaneously is labour intensive and diverts limited capacity away from core priorities. From the regulator's perspective, the direct cost of a Band 2 licence for seaweed or shellfish farming is around £2,500, relatively modest compared with other marine activities. Yet NRW staff also acknowledged that small community farms often require far more than the standard allocation of 16 officer hours, in some cases ten times more, creating hidden costs in delays, uncertainty and paperwork.

Responsibility for navigating this complex bureaucratic landscape at Câr-y-Môr has largely fallen to a single staff member, who juggles licensing alongside core duties such

as tank maintenance and species monitoring. *"It's been my life for the last eight months,"* they explained. *"Three or four days a week just chasing agencies, coordinating calls, writing emails, waiting for people to reply."* While some individuals within NRW offer informal support, broader cross-agency communication remains slow and fragmented. *"Even getting one person from each organization in a room at the same time takes a month of emails."* This lack of coordination causes not only operational delays but growing emotional strain. Staff are left to sustain momentum within a system that offers little flexibility or clarity. One staff member attributed a colleague's departure directly to this pressure: *"It actually made Justin quit. He got so disheartened going round in circles and never feeling like he got anywhere."* The weight of reporting, licensing, and compliance obligations takes a cumulative toll—not only stretching material resources, but also eroding morale. *"You learn how to push an inflexible system forward. It's a shit talent. You shouldn't have to have it, but you do,"* another staff member reflected, capturing the quiet exhaustion of trying to innovate within a structure resistant to change. Although a temporary licence extension had been secured at the time, staff acknowledge that it offers only a brief reprieve. As one explained, *"It's not the main one, but it gives us a bit of time to not stress about how to take things out of the water."* While the extension provides some short-term breathing room, it does little to resolve the deeper systemic uncertainties that continue to undermine long-term planning, strain limited capacity, and challenge the organization's ability to remain focused on its core mission.

A key obstacle to obtaining a full licence has been the visual impact assessment. The initial report was rejected with limited feedback and the team now faces the prospect of commissioning a professional consultant to revise their submission, at an estimated cost of £10,000. *"If the parks don't like it, we might have to hire this environmental guy to write a report that ticks all the boxes,"* one staff member remarked, underscoring how opaque standards and escalating costs can turn what appears to be a technical requirement into a gate-keeping mechanism. This situation illustrates a deeper pattern in which regulatory processes, though framed as objective and evidence-based, systematically favour those with the financial and institutional capital to navigate them. This underscores how environmental assessment regimes privilege actors who can afford external consultants, marginalizing community-based ventures reliant on embodied skill and mutual trust. Detailed marine ecology studies have likewise been rejected based on generic criteria like "moderate" or "major" visual impact, with little room for context-specific insight. As one staff member noted, *"They basically came back and said, 'We don't agree with your assessment.' But it's completely subjective."*

These licensing and assessment challenges reveal a deeper epistemic disjuncture. Regulatory frameworks tend to reward abstract, desk-based expertise while penalizing the embodied, iterative knowledge that grounds small-scale sustainability (see discussion below). *"I spend days writing about things I could just show you in five minutes out on the water,"* one staff member explained. As Li [39] and Scott [38] argue, such regimes mistake legibility for legitimacy, privileging metrics over meaning. Project-based funding systems impose parallel constraints; grants demand measurable outputs and time-bound milestones, forcing the team to translate its fluid, relational work into policy-friendly terms. *"We're constantly translating what we do into the language of innovation and impact, even though that's not really how it works here."* These rhetorical accommodations risk obscuring the very knowledge systems that make sustainability viable. Tsing [15] reminds us that improvisation and adaptability, traits that are essential to ecological resilience, are often invisible to bureaucratic assessment.

These frictions are intensified by a fundamental mismatch between institutional timelines and ecological rhythms. Regulatory processes unfold according to administrative calendars, risk cycles and funding deadlines, whereas ecological work, particularly in regenerative aquaculture, operates according to non-linear, seasonal and often

unpredictable patterns. As one team member put it, *“If you cook a load of crab, it only stays. You’ve got to sell it right. It’s going to go off.”* At the time, two refrigeration units were broken, compounding the logistical pressure and highlighting how infrastructure failure quickly cascades into biological and economic risk. This temporal mismatch is more than a scheduling problem, it reflects what Sharma [82] calls temporal governance, where power is exercised not only through control over resources but through control over time. For small, community-owned enterprises, the requirement to synchronize with bureaucratic procedures often means holding regenerative practice hostage to institutional pace. *“We can’t just sit around waiting for permission,”* one staff member noted. *“The sea doesn’t wait for your paperwork to come through.”* Even as the farm is celebrated as a model of regenerative innovation, its daily operations are held together through improvisation and triage, as staff navigate temporal strain with limited resources. In dominant Blue Economy narratives [83], sustainability is increasingly equated with scale, capital intensity and export value, metrics that privilege long-term investment horizons and industrial efficiencies. As another staff member explained, *“We’re not anti-policy, but the infrastructure just isn’t built for us.”* The result is a structural mismatch: a system that recognizes regenerative practice in theory, but undermines it in practice through misaligned timelines, narrow definitions of value and a persistent failure to accommodate small-scale temporalities. The complications of the licensing system’s complex desk-based procedures fail to take account of the realities of practising aquaculture because they are developed by office-based personnel. By emphasizing the experiences and voice of our societal partners at Câr-y-Môr, our research highlights the need for policy makers and governing institutions to find a way not only to streamline their procedures but perhaps more importantly to *co-create* these with the real-world experts.

4.2 Embodied Knowledge and Collective Practice

Here we show how knowledge at Câr-y-Môr is generated through practice, immersion and gendered relational expertise, offering an alternative to the abstract, codified forms of knowledge privileged by institutions. Whereas licensing highlights how external frameworks elevate abstract metrics over lived experience, the daily operations of the farm provide a counterpoint, where knowledge emerges through situated engagement with place and practice. Regenerative aquaculture here is sustained not through codified protocols or formal instruction, but through embodied, relational and often gendered expertise. As scholars of practice theory and feminist epistemology have argued, knowledge is not only what is known but how it is known, emerging through repetition, attention and being attuned to more-than-human rhythms [59, 68, 69]. These are not supplementary ways of knowing, but foundational to how sustainability is understood and enacted on the ground. As one team member put it, *“You can’t learn this in a course. You learn it by doing it, again and again, in the water, with your hands.”*

Câr-y-Môr’s organizational structure, shaped by biomimetic principles [41], reinforces this experiential learning. Hybrid roles are the norm, with staff often switching between seaweed harvesting, shellfish sorting, infrastructure maintenance, education and logistics in the space of a single day. *“There’s no typical shift here,”* one worker said. *“You might be doing ropes in the morning and hosting a school group in the afternoon.”* This cross-functionality builds ecological literacy and fosters a systems-level view of the work. The farm’s internal metaphors, often drawn from marine ecology, frame this flexibility as a form of mutualism, where strength comes from interdependence and adaptive overlap. In these varied situations, learning unfolds through informal and intergenerational mentoring and immersion. New staff are not trained through manuals but through apprenticeship-like observation and hands-on, immersive learning. *“You just pick it up,”* one person explained. *“You watch, you listen and then you start to know.”* This pedagogy is relational

rather than didactic, relying on proximity, repetition and attention. It reflects what Ingold [84] terms an “education of attention,” where skill is cultivated through close sensory engagement with materials and environments (Figure 5).

The nonhuman world is not passive in this process. Seaweed, tides, weather patterns and the behaviour of shellfish are all active participants [85] that shape how and when work is done. Decisions about harvesting or processing are rarely made by fixed protocols. Instead, they are grounded in a constant dialogue with environmental conditions. Staff describe using their senses, touch, sound, smell and even visual cues from the sea, to determine timing and technique. “If it rattles wrong, it’s not clean,” one participant explained while sorting mussels. “You just know from the sound.” Others spoke of how rope tension changes with wave activity or how seaweed texture signals nutrient density and readiness for processing. These are not incidental observations, but central components of what Puig de la Bellacasa [86] describes as a more-than-human pedagogy: a mode of learning where human knowledge emerges through attentive, ongoing relationships with non-human life. In this context, tides teach timing, seaweed signals environmental shifts and shellfish behaviour reflects ecosystem health. The farm’s entire rhythm is structured around these cues, which are not merely observed but felt and interpreted through repeated, intimate contact with the environment. Rather than viewing nature as a passive backdrop or resource to be managed, Câr-y-Môr’s workers treat ecological conditions as dynamic collaborators [85] in the production of knowledge and the pacing of daily work.



Figure 5. Stained hands, resulting from continued embodied engagement with seaweed. Source: Gareth Thomas

Gender and intergenerational learning play a central role in how this expertise is embodied and recognized at Câr-y-Môr. Older members of the organization provide anchoring knowledge, not through formal training but by working alongside newer staff, modelling rhythms, techniques and judgement honed over time. “You learn more in a week watching them than in any training manual,” one younger worker remarked. This is a form of apprenticeship structured by observation and repetition, where embodied knowledge is transferred through shared tasks and subtle cues. “It’s not just how to clean a rope. It’s how to know when not to. That kind of knowing takes seasons,” another added. This situated pedagogy is not gender neutral: women at Câr-y-Môr occupy technical, managerial and logistical roles that cut across traditional gendered boundaries. They repair infrastructure, lead processing, negotiate with buyers and manage farm logistics. “I fix ropes, I gut crabs, I negotiate with chefs. It’s all part of what we do,” one woman explained. Their knowledge is strategic, skilled and formed through sustained engagement with both ecological processes and social relations. As one participant put it, “I’ve worked with fishermen for six years

and never felt I was treated differently. If anything, they respect you more when you know what you're doing."

Rather than treating gender as a demographic marker or women's work as inherently nurturing, Câr-y-Môr reflects what feminist political ecologists have long argued: sustainability is enacted through gendered, material and relational practices that are often rendered invisible in policy and scientific discourse [71, 87, 88]. These practices are not technical efficiencies or by-products, but part of a consciously maintained feedback loop, an expression of situated expertise in which use, meaning and labour are mutually entangled. In this sense, regeneration at Câr-y-Môr is not a technical output, but a layered process of social, ecological and epistemic repair, one in which skill, care, gender and inheritance are mutually entangled. The farm's pedagogies are not structured as formal training programmes, but as ongoing, lived relationships with place, people and the sea.

4.3 Scaling, Labour, and Organisational Frictions

Finally, we examine how scaling introduces new forms of friction, as the cooperative ethos of Câr-y-Môr is tested by increasing managerial demands, uneven labour and external funding pressures. While licensing exposes how external frameworks marginalize local knowledge and embodied expertise provides a grounded counterpoint, scaling reveals how internal practices must continually negotiate the gap between regenerative ideals and the uneven, often invisible burdens of everyday labour. This tension is not unique to Câr-y-Môr, as scholars of political economy and organizational theory have noted, even within care-based or cooperative systems, growth can introduce new forms of friction, informal hierarchy and structural compromise [89, 90, 91]. Adaptability and mutualism, hallmarks of regenerative work, do not eliminate power imbalances but rather reshape how they are distributed, experienced and managed. At Câr-y-Môr, these tensions have become more pronounced as the organization scales to meet infrastructure, funding and regulatory demands. Public and private investment, such as the DEFRA grant and social investment loan, require not only increased capacity but also accountability through formal systems. As one participant put it, *"We had to scale to survive, but once you scale, you can't run on vibes alone."* While technocratic systems prioritize standardization and measurable outputs, regenerative practice at Câr-y-Môr is grounded in adaptation, relational work and embodied care, approaches that support resilience but can generate friction when confronted with the pressures of scaling and institutional change. This is particularly the case when market conditions and funding frameworks compel scale not as a choice, but as a condition of survival.

Câr-y-Môr's vision of regenerative practice was operationalized through a flat pay structure, informal decision-making and decentralized coordination. Yet as the organization has scaled, these ideals have been stretched. The informal and adaptive structure that once enabled flexibility has begun to solidify into new hierarchies. Longer-serving staff have taken on managerial roles and a formal management system is slowly emerging in response to growing operational and compliance demands. While all employees continue to earn the same hourly wage, the distribution of responsibility is increasingly uneven. As one staff member noted, *"The pay is flat, but the workload definitely isn't."* Seasonal fluctuations intensify this imbalance and staff frequently move between roles in seaweed harvesting, community engagement, logistics and visitor events (Figure 6). This role fluidity supports adaptability but also obscures labour expectations and produces uneven workloads. These dynamics reflect what Berlant [73] calls cruel optimism: the desire for meaningful, ethical work that becomes compromised by the conditions through which it must be pursued. At Câr-y-Môr, aspirations toward flat hierarchy and shared responsibility collide with the organizational pressures introduced by the need to meet funder expectations, regulatory requirements and market viability. The original relational governance

model was never designed to accommodate these demands. As a result, the scaling process has intensified reliance on key individuals who take on informal leadership roles without formal recognition or support. Longstanding commitments to care and fairness, while still central to the farm's ethos, can obscure these emerging imbalances. As one staff member put it, *"There's no job description, but if something needs doing, you do it."*



Figure 6. Intergenerational community event at Câr-y-Môr, June 2024. Source: Gareth Thomas

In this context, adaptability often functions less as empowerment and more as endurance. As feminist political ecologists argue, systems grounded in relational labour and care are not inherently equitable; they must be actively sustained through transparency, support and ethical clarity around roles and responsibilities [87]. Without this, even well-intentioned regenerative models risk reproducing the very forms of exhaustion and exclusion they seek to resist. Câr-y-Môr's experience underscores that sustaining a cooperative ethos at scale requires not only values but active structures of care, recognition, and renewal.

5. Conclusions

Câr-y-Môr's story illustrates that regenerative sustainability is not simply an ecological or technical goal, but a relational, institutional and epistemic practice, one forged through daily negotiation with systems not designed to support it. As this paper has shown, the farm's place-based knowledge, gendered expertise and improvisational care practices operate within an infrastructure of governance that privileges legibility, standardization and compliance. These technocratic logics, while framed as neutral, systematically obscure the embodied, iterative and context-specific ways in which sustainability is learned and enacted. The frictions that emerge are not only bureaucratic. They are also temporal, emotional and ethical. Licensing delays, risk-averse decision-making and rigid grant cycles disrupt the ecological rhythms that guide regenerative work. The pressure to translate lived practices into policy language, to scale for survival and to absorb uneven labour expectations exposes the limits of cooperative ideals under institutional strain. Scaling, in this context, demands not only more capacity, but also compromises, of time, energy and values. As feminist and political ecological scholarship reminds us, the ethics of sustainability must be actively maintained, especially where care, adaptability and informal labour risk being stretched to breaking point.

And yet, despite these tensions, Câr-y-Môr offers a vital counterpoint to dominant sustainability models. Its practices centre multispecies attentiveness, embodied pedagogy and relational governance. These are not peripheral elements but core to the farm's

ecological and social resilience. What emerges is not a blueprint for replication, but a living case of sustainability-in-the-making, shaped by constraint, conflict and care. The farm shows that regenerative transformation depends not only on ecological restoration, but on institutional reorientation. If community-led sustainability is to thrive, it must be supported by systems that do more than acknowledge alternative knowledge. It is licensing, funding and policy systems that must adapt to accommodate these practices, not the other way around. This requires reimagining how success is defined within regulatory frameworks, grant mechanisms and institutional evaluation, and making room for slower, messier, smaller-scale and more participatory ways of working. Without such changes, the practices most attuned to environmental care will remain the least recognized, supported, or viable.

Our findings are grounded in anthropological research, interviews with farm members, directors, regulators and volunteers and analysis of policy and licensing documents. This methodological depth provides a rich and textured account of how governance structures intersect with everyday practice. While our study is centred on Câr-y-Môr, the analysis is illustrative of wider dynamics seen in small-scale aquaculture in comparable contexts, offering transferable insights for integrating community expertise into marine planning and licensing.

Taken together, these insights demonstrate the methodological contribution of transdisciplinary humanities-informed sustainability science. By combining ethnographic participant observation with relational analysis, and by foregrounding the voices of practitioners, our study contributes to a growing body of work that seeks to reframe sustainability not as a technical problem with technical solutions, but as a lived, situated and negotiated process. In doing so, it highlights that responses to climate change must attend not only to ecological metrics and the institutional systems and epistemic commitments that enable or constrain regenerative practice, but equally should embed local knowledge and expertise.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.youtube.com/watch?v=UjWVuaXkSYc>, Video 1: Coastal TALES;

Author Contributions: For research articles with several authors, a short paragraph specifying their individual contributions must be provided. The following statements should be used “Conceptualization, Luci Attala, Gareth Thomas and Louise Steel; formal analysis, and investigation, Gareth Thomas; data curation, Louise Steel, writing—original draft preparation, Gareth Thomas; writing—review and editing, Louise Steel and Luci Attala; visualization, Gareth Thomas and Louise Steel; project administration, Louise Steel; funding acquisition, Luci Attala and Louise Steel. All authors have read and agreed to the published version of the manuscript.” Please turn to the [CRediT taxonomy](#) for the term explanation. Authorship must be limited to those who have contributed substantially to the work reported.

Funding: This research was funded by Arts and Humanities Research Council, grant number AH/Z000033/1 as part of the Belmont Forum’s Climate and Cultural Heritage joint call.

Institutional Review Board Statement: The study was approved by Ethics Committee of the University of Wales Trinity Saint David (April 2024) Code: EC1272, 24/04/2024

Informed Consent Statement: Informed oral consent was obtained from all subjects involved in the study: https://theasa.org/downloads/ethics/asa_ethicsgl_resources.pdf

Acknowledgments: We would like to acknowledge our societal partners at Câr-y-Môr for welcoming us into their community and freely sharing their time, knowledge and expertise.

Conflicts of Interest: The authors declare no conflicts of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

Abbreviations

The following abbreviations are used in this manuscript:

ASA	Association of Social Anthropologists
DEFRA	Department for the Environment, Food and Rural Affairs
MCA	Marine and Coastguard Agency
NRW	National Resources Wales
THiSS	Transdisciplinary Humanities-Informed Sustainability Science

References

1. Tsing, A.; Swanson, H.; Gan, E.; Bubandt, N. eds. *Arts of Living on a Damaged Planet: Ghosts and Monsters of the Anthropocene*; University of Minnesota Press, Minneapolis, USA, **2017**.
2. Wallace-Wells, D. *The Uninhabitable Earth: A Story of the Future*; Penguin, Random House: London, UK, **2019**;
3. Batini, N. *The Economics of Sustainable Food Smart Policies for Health and the Planet*; Island Press, Washington DC, USA, **2021**.
4. Bennett, M.; March, A.; Failer, P. Blue Farming Potentials: Sustainable Ocean Farming Strategies in the Light of Climate Change Adaptation and Mitigation. *Green and Low-Carbon Economy*. **2023**, 2. DOI: 10.47852/bonviewGLCE3202978
5. Ingold, T. *Anthropology: Why it Matters*; Polity Press, Cambridge, UK, **2018**.
6. Nahuelhual, L.; von Below, J.; Engler, A.; Campos, G.; Bianchi, J. Public Attitudes and Perceptions Towards the Ocean as an Input for Public Policy. *Ocean and Coastal Management*. **2024**, 254, 107175. <https://doi.org/10.1016/j.ocecoaman.2024.107175>.
7. Bercht, A.L. How Qualitative Approaches Matter in Climate and Ocean Change Research: Uncovering Contradictions about Climate Concern. *Global Environmental Change*. **2021**, 70. <https://doi.org/10.1016/j.gloenvcha.2021.102326>
8. Chambon, M.; Wambiji, N.; Fernandez, S.A.; Azarian, C.; Ngunu Wandiga, J.; Vialard, J.; Ziveri, P.; Reyes-Garcia, V. Weaving Scientific and Local Knowledge on Climate Change Impacts in Coastal Kenya, Western Indian Ocean. *Environmental Science and Policy* **2024**, 160, 103846. <https://doi.org/10.1016/j.envsci.2024.103846>.
9. IPCC (2019) *Special Report on the Ocean and Cryosphere in a Changing Climate*. Geneva: IPCC.
10. NASA: The Ocean and Climate Change. Available online: <https://science.nasa.gov/earth/explore/the-ocean-and-climate-change/> (accessed 15 September 2025)
11. Fox, C.J.; Marshall, C.; Stiasny, M.H.; Trifonova, N. Climate Change Impacts on Fish of Relevance to the UK and Ireland. *MCCIP Science Review* **2023**. doi: 10.14465/2023.reu10.fsh
12. Pinnegar, J.K.; Garrett, A.; Wouters, J.; Kelly, R.; Stiasny, M.H.; Marshall, C.T. Climate Change Impacts on Commercial and Recreational Fisheries Relevant to the UK and Ireland. *MCCIP Science Review* **2023**. <https://doi.org/10.14465/2023.reu11.fis>
13. McCay, B.J. *Oyster Wars and the Public Trust: Property, Law and Ecology in New Jersey History*; Tucson, University of Arizona Press, USA, **1998**.
14. Ribot, J.C.; Peluso, N.L. A Theory of Access. *Rural Sociology*. **2003** 68(2), 53–181. DOI: [10.1111/j.1549-0831.2003.tb00133.x](https://doi.org/10.1111/j.1549-0831.2003.tb00133.x)
15. Tsing, A.L. *The Mushroom at the End of the World: On the Possibility of Life in Capitalist Ruins*. Princeton, Princeton University Press, USA, **2015**

16. Machin, A.; Smith, G. Ends, Means, Beginnings: Environmental Technocracy, Ecological Deliberation or Embodied Disagreement?. *Ethical perspectives* 2014, 21(1) 47–72. <https://doi.org/10.2143/EP.21.1.3017286>
17. Sustainability Directory: Technocratic Environmentalism. Available online: <https://lifestyle.sustainability-directory.com/area/technocratic-environmentalism/> (Accessed 15 September 2025)
18. Hornidge, A.-K.; Partelow, S.; Knopf, K. Knowing the Ocean: Epistemic Inequalities in Patterns of Science Collaboration. In *Ocean Governance: Knowledge Systems, Policy Foundations and Thematic Analyses*, Partelow, S., Hadjimichael, M., Hornidge, A.-K., Eds.; Springer, Cham, Switzerland, 2023; MARE Publications Volume 5, pp. 25–45. <https://doi.org/10.1007/978-3-031-20740-2>
19. Mizuta, D.D.; Froehlich, H.E.; & Wilson, J.R. The Changing Role and Definitions of Aquaculture for Environmental Purposes. *Reviews in Aquaculture* 2023, 15(1), 130–141. <https://doi.org/10.1111/raq.12763>
20. Jentoft, S.; Chuenpagdee, R. Fisheries and Coastal Governance as a Wicked Problem. *Marine Policy*, 2009, 33(4): 553–560. <https://doi.org/10.1016/j.marpol.2008.12.002>
21. Bjørkan, M.; Eythórsson, E.; Johnsen, J.P.; Lamers, M. Stakeholders' perceptions of seaweed farming in Norway and Scotland: Local values, scale, and sustainability. *Frontiers in Sustainable Food Systems*, 2022, 6, 795024. <https://doi.org/10.3389/fsufs.2022.795024>
22. Bradford, J.; Brett, J.; Milley, C. Exploring Community-Based Marine Aquaculture as a Vehicle for Local Sustainability: Benefits and Challenges. *FACETS*, 2020, 5(1), 103–121. <https://doi.org/10.1139/facets-2019-0010>
23. Pinkerton, E.; Silver, J.J. From Rights to Responsibilities: Indigenous Rights and Co-Management of British Columbia Fisheries. *Marine Policy*, 2017, 80, 1–10. <https://doi.org/10.1016/j.marpol.2016.10.019>
24. Marshall, J.). Global Markets, Local Foods: The Paradoxes of Aquaculture on Grand Manan Island, Canada. In *Rural change and sustainability: Agriculture, the Environment and Communities*, S.J. Essex; A.W. Gilg; R.B. Yarwood; J. Smithers; R. Wilson (Eds.), CABI 2005,. pp. 68–85. <https://doi.org/10.1079/9780851998206.0068>
25. Campbell, LM.; Fairbanks, L.; Murray, G.; Stoll, J.S.; D'Anna, L.; Bingham, J. From Blue Economy to Blue Communities: Reorienting Aquaculture Expansion for Community Wellbeing. *Marine Policy* 2021, 124, 104361. <https://doi.org/10.1016/j.marpol.2020.104361>
26. Salgueiro-Otero, D.; Barnes, M.L.; Ojea, E. Climate Adaptation Pathways and the Role of Social-Ecological Networks in Small-Scale Fisheries. *Scientific Reports* 2022, 12, 15526. <https://doi.org/10.1038/s41598-022-19615-3>
27. Martin, K. Making space for community resource management in fisheries. *Annals of the Association of American Geographers* 2001, 91(1): 122–142. <https://doi.org/10.1111/0004-5608.00236>
28. Berkes, F.; Folke, C. *Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience*; Cambridge, Cambridge University Press, UK, 1998
29. Henrique, K. Cooperatives in Traditional Fisheries Communities: Institutions for Collective Action. Paper presented at the 16th Biennial Conference of the International Association for the Study of the Commons (IASC), Utrecht, Netherlands, 2017. https://www.2017.iasc-commons.org/wp-content/uploads/2017/06/11_Henrique-Kefalas.pdf
30. Olsson, P.; Folke, C.; Berkes, F. Adaptive Comanagement for Building Resilience in Social–Ecological Systems. *Environmental Management* 2004, 34, 75–90. <https://doi.org/10.1007/s00267-003-0101-7>
31. Carvalho, N.; Edwards-Jones, G.; Isidro, E. Defining Scale in Fisheries: Small Versus Large-Scale Fishing Operations in the Azores. *Fisheries Research*, 2011, 109(2–3), 360–369. <https://doi.org/10.1016/j.fishres.2011.03.006>
32. Shester, G.C.; Micheli, F. Conservation Challenges for Small-Scale Fisheries: Bycatch and Habitat Impacts of Traps and Gillnets. *Biological Conservation*, 2011, 144(5), 1673–1681. <https://doi.org/10.1016/j.biocon.2011.02.023>
33. de Melo Alves Damasio, L.; Lopes, P.F.M.; Pennino, M.G.; Carvalho, A.R.; Sumaila, U.R. Size Matters: Fishing Less and Yielding More in Smaller-Scale Fisheries. *ICES Journal of Marine Science*, 2016, 73(6): 1494–1502. <https://doi.org/10.1093/icesjms/fsw016>

34. Lloret, J.; Cowx, I.G.; Cabral, H.; Castro, M.; Font, T.; Gonçalves, J.M.; Gordo, A.; Hoefnagel, E.; Matic-Skoko, S., Mikkelsen, E.; Morales-Nin, B. Small-scale Coastal Fisheries in European Seas Are Not What They Were: Ecological, Social and Economic Changes. *Marine Policy* **2018**, *98*, 176–186. <https://doi.org/10.1016/j.marpol.2016.11.007>
35. Armitage, D.; Marschke, M.; Plummer, R. Adaptive Co-Management and the Paradox of Learning', *Global Environmental Change* **2009**, *19*(1), 86–98. DOI: <http://dx.doi.org/10.1016/j.gloenvcha.2007.07.002>
36. Berkes, F.; Ross, H. Community Resilience: Toward an Integrated Approach. *Society & Natural Resources*, **2013**, *26*(1), 5–20., <https://doi.org/10.1080/08941920.2012.736605>
37. Neis, B; Felt, L. Eds. *Finding Our Sea Legs: Linking Fishery People and Their Knowledge with Science and Management*; St. John's, ISER Books, UK, **2000**
38. Scott, J.C. *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed*; New Haven, Yale University Press, USA, **1998**
39. Li, T.M. *The Will to Improve: Governmentality, Development, and the Practice of Politics*; Durham, NC, Duke University Press, USA, **2007**
40. Câr-y-Môr: Wales First Regenerative Sea Farm. Available online: <https://www.carymor.wales/> (accessed 15 September 2025)
41. Lebdioui, A. Nature-Inspired Innovation Policy: Biomimicry as a Pathway to Leverage Biodiversity for Economic Development. *Ecological Economics* **2022**, *202*, 107585, <https://doi.org/10.1016/j.ecolecon.2022.107585>.
42. ABPmer, AWAA *Aquaculture Activity Assessment: Subtidal Shellfish Aquaculture using Ropes*. NRW Evidence Report No. 725, Natural Resources Wales, Cardiff, **2023**.
43. DEFRA: UKSF Infrastructure Scheme projects: grants awarded in round 2 of the scheme. Available online: <https://www.gov.uk/government/publications/uk-seafood-fund-infrastructure-scheme-projects/uksf-infrastructure-scheme-projects-grants-awarded-in-round-2-of-the-scheme> (accessed 21 September 2025)
44. British Business Bank Growth Guarantee Scheme. Available online: <https://www.british-business-bank.co.uk/case-studies/car-y-mor> (accessed 21 September 2025)
45. Costa-Pierce, B.A. The Social Ecology of Aquaculture in its New Geographies. *World Aquaculture* **2021**, *52*(3), 43–50.
46. Charnley, S.; Durham, W.H. Anthropology and environmental policy: what counts?. *American Anthropologist* **2010**, *112*(3), 397–415. <https://doi.org/10.1111/j.1548-1433.2010.01248.x>
47. Okongwu, A.F.; Mencher, J.P. The Anthropology of Public Policy: Shifting Terrains. *Annual Review of Anthropology* **2000**, *29*(1), 107–124. <https://doi.org/10.1146/annurev.anthro.29.1.107>
48. Coastal TALES: Telling Adaptations, Living Environmental Stories for Coastal Resilience. Available online: <https://bridges.earth/projects/coastal-tales/1> (accessed 29 May, 2025)
49. JPI. Coastal TALES: Telling Adaptations, Living Environmental Stories for Coastal Resilience. Available online: <https://www.heritageresearch-hub.eu/project/coastal-tales/> (accessed 29 May, 2025)
50. Attala, L.; Steel, L.; Oosterbeck, L.; Hartman, S.; Tsimprikidou, D. *BRIDGES: A Humanities-led UNESCO Coalition for Sustainability: Towards a Global Mapping of Integrated CO-Produced Sustainability Science*, **2023**. Available online: <https://bridges.earth/news/post/bridges-coalition-project-mapping-humanities-led-sustainability-science> (accessed 15 September 2025)
51. BRIDGES. Innovating the Way Knowledge is produced. Available online: <https://bridges.earth/about> (accessed 15 September 2025)
52. Seidl, I., Böni, R., Lauber, S. and Herzog, F. Developing, Implementing and Communicating Inter-And Transdisciplinary Research: AlpFUTUR as an Example. *GAIA-Ecological Perspectives for Science and Society*, **2015**, *24*(3), 188–195. DOI: <http://dx.doi.org/10.14512/gaia.24.3.11>

53. Kaiser, M.; Gluckman, P. *Transforming Transdisciplinarity: Looking at the Future of Transdisciplinary Research*. International Science Council, **2023**. <https://council.science/publications/transforming-transdisciplinarity>
54. Seidl, R.; Brand, F.S.; Stauffacher, M. Science with Society in the Anthropocene. **2013**, *AMBIO* **42**, 5–12
<https://doi.org/10.1007/s13280-012-0363-5>
55. Holm, P.; Jarrick, A.; Scott, D. *Humanities World Report*; Palgrave Macmillan, London, **2015**.
https://doi.org/10.1057/9781137500281_2
56. Kimmerer, R.W. *Braiding Sweetgrass: Indigenous Wisdom, Scientific Knowledge and the Teachings of Plants*; Penguin, London, UK, **2013**.
57. ICOMOS, *The Future of our Pasts: Engaging Cultural Heritage in Climate Action*. International Council on Monuments and Sites, **2019**. https://climateheritage.org/wp-content/uploads/2021/01/ICOMOS_climate-change.pdf
58. Stirling, A. *Emancipating Transformations: From Controlling 'The Transition' to Culturing Plural Radical Progress*. STEPS Working Paper 64. STEPS Centre, Brighton, UK, **2015**
59. Latour, B. *Down to Earth: Politics in the New Climatic Regime*; Polity, Cambridge, UK, **2018**.
60. Castree, N.; Adams, W.M.; Barry, J.; Brockington, D.; Büscher, B.; Corbera, E.; Demeritt, D.; Duffy, R.; Felt, U.; Neves, K.; Wynne, B. Changing the Intellectual Climate. *Nature Climate Change*, **2014**, *4*(9), 763–768.
61. Geertz, C. Deep Hanging Out. *The New York Review of Books* **1998**, *45*(16), 69–72.
62. Ingold, T. *The Perception of the Environment: Essays on Livelihood, Dwelling and Skill*; Routledge, London, UK, **2000**.
63. Pink, S. *Doing Sensory Ethnography*, 2nd edn.; Sage, London, UK, **2015**.
64. Günel, G.; Varma, S.; Watanabe, C. A Manifesto for Patchwork Ethnography. Member Voices, *Fieldsights*, June 9, **2020**. Available online: <https://culanth.org/fieldsights/a-manifesto-for-patchwork-ethnography> (accessed 16 September 2025)
65. Günel, G.; Watanabe, C. Patchwork Ethnography. *American Ethnologist* **2023**, *5*(1), 131–139.
<https://doi.org/10.1111/amet.13243>
66. Günel, G.; Watanabe, C.; Jungnickel, K.; Coleman, R. (2023) Everything is Patchwork! A Conversation about Methodological Experimentation with Patchwork Ethnography. *Australian Feminist Studies* **2024**, *38*, 115–116, 211–229, DOI: 10.1080/08164649.2024.2372622
67. Emerson, R.M.; Fretz, R.I.; Shaw, L.L. *Writing Ethnographic Fieldnotes*. 2nd edn; University of Chicago Press, Chicago, USA, **2011**.
68. Prior, L. *Using Documents in Social Research*; Sage, London, **2003**.
69. Desmond, M. Relational Ethnography. *Theory and Society*, **2014**, *43*(5), 547–579. DOI 10.1007/s11186-014-9232-5
70. Burawoy, M. The Extended Case Method. *Sociological Theory*, **1998**, *16*(1), 4–33. <https://doi.org/10.1111/0735-2751.00040>
71. Haraway, D. Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective. *Feminist Studies*, **1988**, *14*(3), 575–599.
72. Palomera, J.; Vetta, T. Moral Economy: Rethinking a Radical Concept. *Anthropological Theory*, **2016**, *16*(4), pp. 413–432.
73. Berlant, L. *Cruel Optimism*; Duke University Press, Durham, NC, USA, **2011**.
74. Anand, N.; Gupta, A.; Appel, H. *The Promise of Infrastructure*; Duke University Press, Durham, NC, USA, **2018**.
75. England, K.V.L. Getting personal: Reflexivity, Positionality, and Feminist Research; *The Professional Geographer*, **1994**, *46*(1), 80–89. <http://dx.doi.org/10.1111/j.0033-0124.1994.00080.x>

76. Pillow, W. Confession, Catharsis, or Cure? Rethinking the Uses of Reflexivity in Qualitative Research; *International Journal of Qualitative Studies in Education*, **2003**, *16*(2), 175–196. <https://doi.org/10.1080/0951839032000060635>
77. *ASA Ethical Guidelines for Good Research Practice*. Association of Social Anthropologists of the UK and Commonwealth, **2011**. Available online: <https://www.theasa.org/ethics/guidelines.shtml> (accessed 15 September 2025)
78. Aquaculture Regulatory Toolbox for Wales. Available online: <https://businesswales.gov.wales/marineandfisheries/funding-and-business-development/aquaculture-regulatory-toolbox-wales> (accessed 20 September 2025)
79. ABP Mer. AWAA Aquaculture Activity Assessment: Subtidal Seaweed Aquaculture using Ropes Report No: 723. Available online: <https://cdn.cyfoethnaturiol.cymru/3jqlziaa/awaa-aquaculture-activity-assessment-subtidal-seaweed-aquaculture-using-ropes-final.pdf> (accessed 20 September 2025)
80. NRW. Marine Licensing. Available online: <https://naturalresources.wales/permits-and-permissions/marine-licensing/?lang=en> (accessed 20 September 2025).
81. *End-to-End Review of The Marine Licensing Process: Summary Report*. Welsh Government / ICF (2022). Available online : <https://www.gov.wales/sites/default/files/publications/2023-01/end-to-end-review-marine-licensing-process-summary-report.pdf> (Accessed 28 October 2023)
82. Sharma, S. *In the Meantime: Temporality and Cultural Politics*. Duke University Press, Durham, NC, USA, **2014**.
83. United Nations Blue Economy Definitions. Available online: https://www.un.org/regularprocess/sites/www.un.org.regularprocess/files/rok_part_2.pdf (accessed 19 September 2025)
84. Ingold, T. . From the Transmission of Representation to the Education of Attention. In *The Debated Mind: Evolutionary Psychology Versus Ethnography*; H. Whitehouse (Ed.), Berg: London, UK, **2001**; pp. 113–153.
85. Attala, L.; Steel, L. Introduction: Talking of (and with) (the Materiality of) Plants. In *Plants Matter: Exploring the Becomings of Plants and People*; L. Attala; L.Steel (Eds.), University of Wales Press, Cardiff, UK **2023**, pp. 1–36.
86. Puig de la Bellacasa, M. *Matters of Care: Speculative Ethics in More than Human Worlds*; University of Minnesota Press, Minneapolis , USA, **2017**.
87. Nightingale, A.J. Bounding Difference: Intersectionality and the Material Production of Gender, Caste, Class and Environment in Nepal; *Geoforum* **2011**, *42*(2), 153–162. <https://doi.org/10.1016/j.geoforum.2010.03.004>.
88. Mol, A. *The Body Multiple: Ontology in Medical Practice*; Duke University Press, Durham, NC, USA, **2002**.
89. Bear, L.; Mathur, N. Remaking the Public Good: A New Anthropology of Bureaucracy; *Cambridge Journal of Anthropology* **2015**, *33*(1), 18–34. DOI: doi:10.3167/ca.2015.330103
90. Ferguson, J. *The Anti-Politics Machine: Development, Depoliticization, and Bureaucratic Power in Lesotho*; University of Minnesota Press, Minneapolis, USA, **1994**.
91. Gibson-Graham, J.K. *A Postcapitalist Politics*; University of Minnesota Press, Minneapolis, USA, **2006**.

Disclaimer/Publisher’s Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.