

# *Collaborating with ‘blue food’ system stakeholders to achieve optimal nutritional health and wellbeing in less affluent communities*

Article

Published Version

Creative Commons: Attribution 4.0 (CC-BY)

Open Access

Pettinger, C., Hunt, L. and Wagstaff, C. ORCID:  
<https://orcid.org/0000-0001-9400-8641> (2026) Collaborating  
with ‘blue food’ system stakeholders to achieve optimal  
nutritional health and wellbeing in less affluent communities.  
Proceedings of the Nutrition Society. ISSN 1475-2719 doi:  
10.1017/S0029665125102139 Available at  
<https://centaur.reading.ac.uk/127741/>

It is advisable to refer to the publisher’s version if you intend to cite from the work. See [Guidance on citing](#).

To link to this article DOI: <http://dx.doi.org/10.1017/S0029665125102139>

Publisher: Cambridge University Press

All outputs in CentAUR are protected by Intellectual Property Rights law, including copyright law. Copyright and IPR is retained by the creators or other copyright holders. Terms and conditions for use of this material are defined in the [End User Agreement](#).

[www.reading.ac.uk/centaur](http://www.reading.ac.uk/centaur)

## **CentAUR**

Central Archive at the University of Reading

Reading's research outputs online

## Review Article

**Cite this article:** Pettinger C, Hunt L, and Wagstaff C (2026). Collaborating with 'blue food' system stakeholders to achieve optimal nutritional health and wellbeing in less affluent communities. *Proceedings of the Nutrition Society*, page 1 of 10. doi: [10.1017/S0029665125102139](https://doi.org/10.1017/S0029665125102139)

Received: 11 September 2025

Revised: 19 December 2025

Accepted: 19 December 2025

### Keywords:



Blue foods; Blue food system; Stakeholders; Collaboration; Disadvantaged communities

### Corresponding author:

Clare Pettinger;

Email: [clare.pettinger@plymouth.ac.uk](mailto:clare.pettinger@plymouth.ac.uk)

# Collaborating with 'blue food' system stakeholders to achieve optimal nutritional health and wellbeing in less affluent communities

Clare Pettinger<sup>1</sup> , Louise Hunt<sup>1</sup> and Carol Wagstaff<sup>2</sup> 

<sup>1</sup>School of Health Professions, Faculty of Health, University of Plymouth, Plymouth, UK and <sup>2</sup>Department of Food and Nutritional Sciences, University of Reading, Reading, UK

## Abstract

UK food system transformation is urgently needed, but to date, minimal research has investigated 'blue foods' probably because they are ethically nuanced. There exists a paradox whereby materially deprived communities should be eating more fish to meet nutritional requirements, yet there is a global 'red flag' around global overfishing. New collaborative and creative solutions are, therefore, needed to tackle such food system inequities. By working together, all voices can be equally heard when decisions are being made to improve the system. Similarly, innovation and disruption of established supply chains will enable better access to healthy, affordable and tasty food that will support better nutrition, health and wellbeing. This review paper will present a critique of the 'The Plymouth Fish Finger' as a collaborative social innovation case study. Part of the FoodSEqual research project, this exploratory pilot project championed 'co-production' approaches to achieve multiple (potential) impacts. This review will critically explore how this social innovation case study has exemplified the complex interplay between factors driving distortions in access to and availability of fish within the local food system. Through collaborative multi-stakeholder (transdisciplinary) processes, using participatory creative methods, new strategies and recommendations for research, practice, action and policy are informed, all of which offer great potential for progressive and transformative systemic (blue) food system change.

## Introduction

The imperative for food system transformation is well known and concerted UK action is essential to impact inter-related food system issues including health inequalities and diet-related disease<sup>(1)</sup>. Key to this effort is enabling materially deprived (disadvantaged) communities<sup>(2,3)</sup> better access to healthy, affordable, sustainable food<sup>(4)</sup>.

In the context of food systems, to date, minimal research has investigated 'blue foods'<sup>(5)</sup> i.e. foods sourced from oceans and rivers, including fish<sup>(6)</sup>, probably because they are ethically nuanced. There exists a paradox. On the one hand, fish is culturally important<sup>(7)</sup>, providing essential nutrients<sup>(8)</sup> that protect from non-communicable diseases<sup>(9)</sup>. Most UK residents do not eat the recommended amount of fish (two portions/week, one portion of oily fish)<sup>(10)</sup>. A clear health inequality is that vulnerable groups, such as those living in areas of material deprivation, eat low-quality diets, have poor health outcomes, and are most likely not to eat enough fish. On the other hand, eating fish is an environmental 'red flag' because of global overfishing<sup>(11)</sup>. In response to these various complexities, collaborative and innovative solutions are required to catalyse change in the (blue) food system.

This review paper presents a critique of the 'The Plymouth Fish Finger' as a collaborative social innovation case study<sup>(12)</sup> which exemplifies and pioneers food system change. Part of the Food Systems Equality (FoodSEqual) research project<sup>(4)</sup>, this exploratory pilot project championed 'co-production' approaches<sup>(13)</sup> to achieve multiple (potential) impacts including: i) 'disruption' of traditional fish supply chains, by localising processes; ii) improving access to and affordability of fish for local (coastal) communities, particularly those living in areas of material deprivation; iii) education about less common fish species, how to prepare and cook these, and their health and sustainability credentials; iv) enhancing fishing community livelihoods by giving fishers a fair price for their catch; v) informing policy and 'blue food system' discourses, using learned processes to support this impact.

The review paper starts with an outline and definition of the blue food system and blue foods, including their essential nutritional and wellbeing benefits. It will emphasise the needs of materially deprived coastal communities, who are known to suffer the most in terms of diet related health inequities and resulting poor health outcomes. It will then use the fish finger pilot

© The Author(s), 2026. Published by Cambridge University Press on behalf of The Nutrition Society. This is an Open Access article, distributed under the terms of the Creative Commons Attribution licence (<https://creativecommons.org/licenses/by/4.0/>), which permits unrestricted re-use, distribution and reproduction, provided the original article is properly cited.



as exemplar to appraise the need for ‘social innovation’ as a collaborative mechanism to champion blue food system change. This will include judging the range of participatory methods used, which successfully forged relationships between multiple stakeholders including academics, communities, fishing industry stakeholders, schools, school meal providers and policy makers. The review will close with critical reflections on key challenges and learning, offering recommendations for future research, as well as reflective insights for professional practice.

### What are ‘blue foods’ – the blue food system

Blue foods are defined as ‘fish, invertebrates, algae and aquatic plants captured or cultured in freshwater and marine ecosystems’<sup>(14)</sup>. They tend to be foods harvested from the ocean, rivers and lakes, including wild and farmed seafood<sup>(15)</sup>. Blue foods contribute importantly to national food systems around the world. For the purposes of this review, the focus is on fish, yet it is important to consider there are many other blue foods, eg algae and aquatic plants, which are emerging as important nutrition topics, but fall outside the scope of this review. They ensure supplies of critical nutrients, provide healthy alternatives to terrestrial meat and therefore reduce dietary environmental footprints, promote just economies and livelihoods under a changing climate<sup>(16)</sup>. This is why the United Nations have prioritised a ‘Blue transformation’ in their recently published roadmap/strategy<sup>(17)</sup>, supported by Eat Lancet<sup>(18)</sup>, both acknowledging that our oceans should form part of solutions to improve global food security. Despite this, to date, most food system discourses have centred on livestock and land-based agriculture<sup>(6)</sup> with blue foods being largely missing from food system transformation research<sup>(5)</sup>.

### The benefits of blue foods (fish)

Blue Foods play a central role in food and nutrition security for billions of people<sup>(6)</sup>. Fish and seafood provide essential nutrients for humans<sup>(8,19)</sup> and are known to have a prominent role in protecting humans against non-communicable diseases<sup>(9,20)</sup>. Commonly promoted to reduce the prevalence of these diseases, they have been cited as major commodities within ‘healthier’ diets such as the Mediterranean diet<sup>(21,22)</sup> and the DASH diet<sup>(23,24)</sup> and have a prominent place within the UK’s Eatwell Guide<sup>(25)</sup>.

Fish contains high-quality protein, and due to its low saturated fat content, is often considered a healthier protein choice than meat<sup>(26)</sup>, although this depends on the fish type and cooking method. Fish (especially oily) is a major source of long-chain polyunsaturated fatty acids, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), known as omega-3 fatty acids<sup>(27)</sup>. These long chain fatty acids (LC n-3 PUFA) play an essential role in health benefits with evidence suggesting that consumption of oily fish has an inverse effect on risk of cardiovascular disease (CVD), attributed to its LC-n-3 PUFA content<sup>(19,28,29)</sup>. Fish is also an important source of essential micronutrients, including vitamins A, B and D, and minerals including calcium, iron, and zinc<sup>(30)</sup>. Fish intake is also known to positively contribute to improved nutrient profiles for Vitamin A<sup>(31)</sup> and vitamin B12 status<sup>(32)</sup>. Fish consumption (especially oily fish) increases concentrations of 25(OH) D in the blood<sup>(33)</sup>.

Current UK guidance recommends 2 portions of fish a week, 1 oily fish<sup>(34)</sup>. Despite the UK showing relatively stable fish-eating trends over the past two decades<sup>(35)</sup>, purchasing data show a slight downward trend of fish intake, with preference for ‘the big five’

species (cod, haddock, salmon, tuna and prawns), according to the Marine Stewardship Council report<sup>(36)</sup>. The consumption of oily fish, however, is well below the dietary recommendations of government guidelines<sup>(19,25)</sup> and shows significant disparities across socio-economic status groups<sup>(10)</sup>.

Fish eating has cultural significance<sup>(7)</sup> which is a known driver influencing its consumption behaviours. For example, socialisation and inter-generational transmission of food choices (from parents to children) can influence fish consumption, family habits and preferences<sup>(37,38)</sup> and this is particularly marked in lower socio-economic communities<sup>(10)</sup> where often children’s dislike of fish is learnt from parent. The latter is likely influenced by education level and lack of confidence in cooking fish<sup>(39,40)</sup>. Education and literacy levels around fish are known to be low in the UK<sup>(41)</sup> which is why educational and promotional strategies are needed to boost fish intake, especially amongst lower socio-economic groups<sup>(10)</sup>.

‘Less affluent’ communities are defined as ‘individuals and families at risk of food and housing insecurity, often culturally diverse, who can experience multiple challenges; financial, mental health, physical health’<sup>(4)</sup> including ‘material deprivation’<sup>(2)</sup>. There remains a paradox whereby such communities *should* be eating more fish to fulfil their nutritional health, yet global fish stocks are massively depleting<sup>(11)</sup>. The United Nations Food and Agriculture Organization monitors over 2,000 fish stocks around the globe. Its 2025 report estimates that 35.5% are fished at unsustainable levels<sup>(42)</sup>. Over-fishing and poor fishing practices have impacted on fishing stocks with an estimated 90% of fisheries now fully exploited, the marine vertebrate population has been halved, and the marine ecosystem has been damaged<sup>(43)</sup>. This is why blue food system reform is so urgently needed.

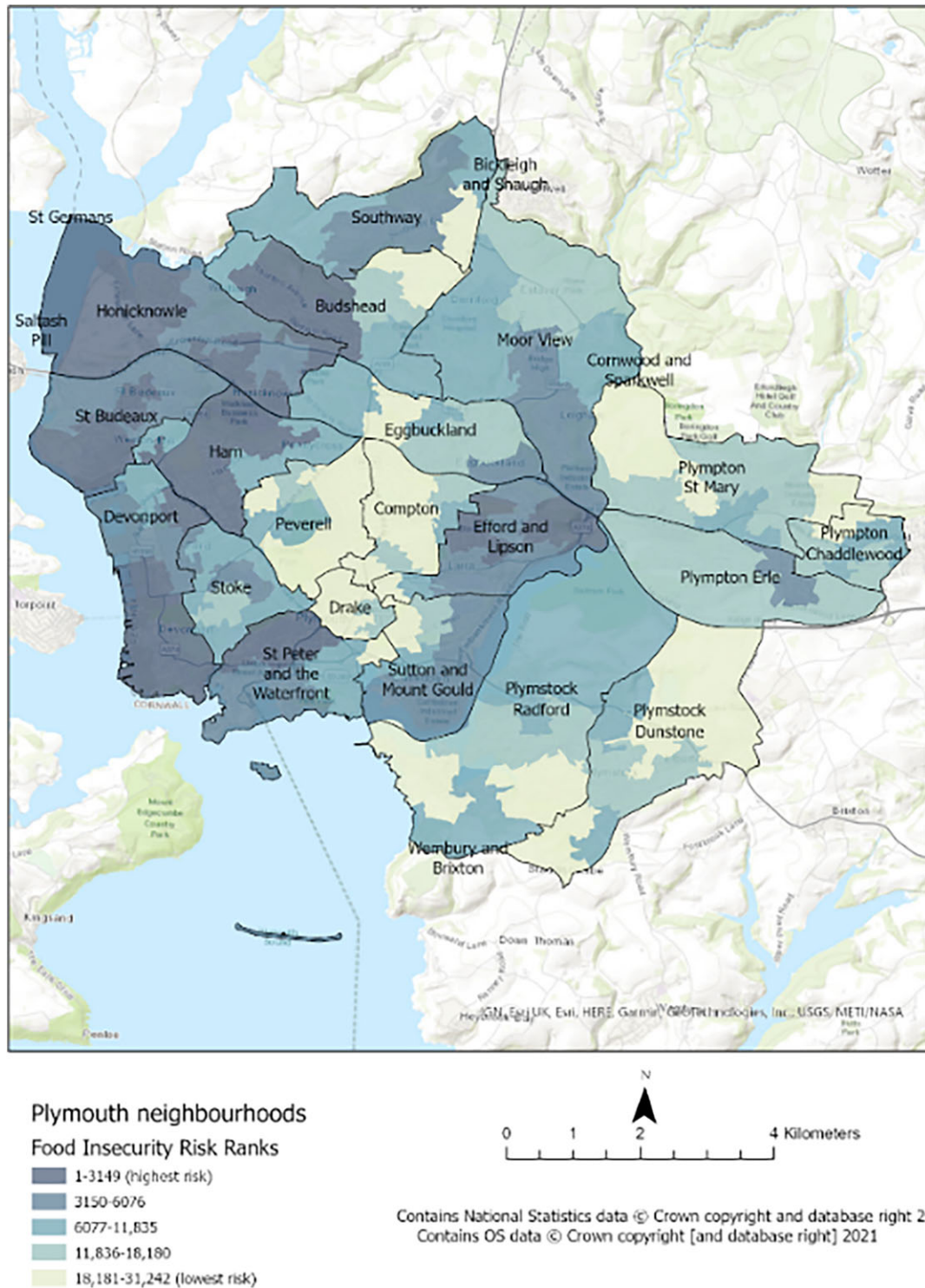
### Nutritional health and fish intake of ‘less affluent’ (coastal) communities in the UK

It is well established that dietary patterns are strongly associated with socio-demographic characteristics<sup>(44)</sup> with lower SES groups less likely to consume diets aligned with public health guidance<sup>(45)</sup>. UK coastal communities are particularly at risk of health inequalities and poorer health outcomes<sup>(46)</sup>. Plymouth, as a southwest coastal community, for example, has persistent, complex and distinct spatial clustering of deprivation<sup>(47)</sup> contributing to extreme social and economic inequalities. Local evidence shows those on the lowest incomes suffer disproportionately from poor nutrition<sup>(48)</sup> due to a range of complex needs with well-established evidence of escalating food insecurity across the city<sup>(49)</sup> associated with poor health outcomes (Figure 1 overleaf).

There are marked socioeconomic inequalities in UK fish consumption<sup>(10)</sup> - lower socio-economic groups have lower fish intake compared to higher income groups<sup>(8,52)</sup>, especially oily fish intake (EPA and DHA sources). Furthermore, coastal fishing communities are particularly at risk of poverty, particularly the small boat fishers<sup>(53)</sup> who have been marginalized from dialogues about sustainable and equitable food system transformation<sup>(54)</sup>. This is influenced by (often corrupt) commercial interests<sup>(55)</sup> market instability (i.e., price volatility<sup>(56)</sup> and unrealistic quota policies, the latter of which signifies that justice and ethics have been sacrificed to power and politics<sup>(57)</sup>.

### The need for collaborative and innovative solutions

There is a call for systemic, multi-level and multi-stakeholder participatory approaches for addressing interrelated issues across



**Figure 1.** Map of Plymouth (UK) illustrating areas of deprivation using food insecurity data. With permission, adapted from<sup>(50)</sup> with updated data coming from<sup>(61)</sup>.

economic, social and environmental dimensions: the so-called ‘food systems approach’<sup>(58)</sup>. Inclusive and collaborative approaches, therefore, should be prioritised and built upon to support transformative mechanisms within blue food system policy and decision-making. The engagement of multi-sectoral stakeholders<sup>(59)</sup> particularly the fishing community, is essential to support inclusive development and protection of human rights within the blue food

sector<sup>(60)</sup>. ‘Social innovation’ involves new strategies, practices, organisational designs and collaborations that address unmet social needs and failures of state and market-led provision. As a multi-stakeholder process and mode of governance, social innovation aims to be more inclusive, participatory and attuned to social wellbeing concerns compared to innovation that is primarily motivated by private profit<sup>(61)</sup>.



## An example of good (collaborative) practice – The Plymouth Fish Finger

The Plymouth Fish Finger is an exploratory pilot project<sup>(12)</sup> which is a core output from a large UKRI/BBSRC funded food system transformation research project, running from 2021 - 2026 (Food Systems Equality (FoodSEqual)<sup>(4)</sup>). The pilot made use of local community action research intelligence, leading to a 'social innovation' aiming to improve access, affordability, and increase fish intake for local disadvantaged communities. Using a culturally appropriate and iconic British product 'The Plymouth Fish Finger,' innovation was collaboratively co-designed to be 'healthy' and 'sustainable'. It makes use of low value and underutilised fish species (e.g., pouting, dogfish and whiting which are currently often wasted) caught by local small-scale coastal fishery (SSCF) vessels (under 10m which cause less environmental damage) and then processed with the intention of delivering the product into the local school meals system. The inclusive vision for the product is that it will improve fish intake in disadvantaged communities (children and their families), thus promoting health benefits. Furthermore, giving fishers a fair price for their low value underutilised species means reducing fish waste, limiting environmental damage from overfishing and improving livelihoods in the fishing community<sup>(62,63)</sup>. We have called our fish finger pilot a 'social innovation' because it fulfils the relevant criteria of having a i) social enterprise/business model; ii) education and behaviour change input iii) and systemic/collaborative approaches<sup>(61)</sup>.

FoodSEqual has used a Community Food Researcher (CFR) model<sup>(64)</sup> to catalyse change and innovate healthy and sustainable food systems with disadvantaged communities<sup>(4)</sup>. Plymouth is one of its four UK FoodSEqual study sites. Drawn from within the community, Plymouth CFRs work as an integral part of the FoodSEqual research team to listen to peoples lived experience, what people eat and want to eat, identify food commodities of interest (i.e. fish), and establish community-driven innovation needs (i.e. access and affordability are key, exploring why locally caught fish not available in Plymouth communities).

## The strength of collaborative approaches for (Blue) food system innovation

Multi-stakeholder collaboration is suggested as an essential pillar of the food systems approach and the transition to sustainable food systems<sup>(58)</sup>. Developing meaningful food system transformation action planning requires the active involvement of a broad spectrum of stakeholders, including government, civil society, and private sector actors<sup>(65)</sup>. Authentic stakeholder engagement demands an inclusive, adaptive approach that fosters collaboration and the co-production of knowledge<sup>(66,67)</sup>. Sterner and Trouve<sup>(68)</sup> suggest enabling factors to optimise stakeholder collaboration include maintaining open networks, sharing activities, and flexible agendas. They also stipulate perceived barriers such as lack of resources, assembling heterogeneous stakeholders around common relevant agendas, and difficulties with engaging new actors. Due to their complex multi-sectoral landscape, strategies to engage stakeholders in food systems research are often challenging to embed<sup>(59)</sup>. This is particularly the case with the blue food system, where strategic reform is urgently called for<sup>(69)</sup> with collaborative co-design of blue food policy and practice<sup>(60)</sup> suggested as priorities.

Furthermore, within the higher education academy, advocated by funders and scientists alike, there is a call for improved transdisciplinary research approaches in the transformation of food

systems<sup>(70)</sup> whereby all actor voices should be included, fairly, across the value chain, from production through to consumption. This requires additional consideration of capacity building strategies<sup>(71)</sup> which could lead to enhanced collaboration across different scientific disciplines as well as optimising multi-stakeholder engagement. A more systematic approach, therefore, to build authentic collaborations is important and has great potential to increase the impact of food systems research, activism and practice. The FoodSEqual project, with its transdisciplinary efforts and multi-stakeholder collaboration has advocated this way of working by using a range of tailored (creative participatory) approaches to build trust and relationships with a range of partners (particularly communities, but also diverse food systems stakeholders) to build a strong foundation towards food system transformation<sup>(72)</sup>. The blue food system urgently requires such attention<sup>(5,6)</sup> so that collaborative action can ensue, to achieve strategic priorities<sup>(69)</sup>.

## Participatory approaches to support (and maintain) collaboration

To successfully meet its objectives and optimally engage a diverse range of stakeholders, the 'Fish Finger' pilot project employed a range of creative participatory research methods (alongside more traditional research methods such as interviews and focus groups), focussing on 'co-production' approaches<sup>(13)</sup>. These involved but were not limited to:

The embedding of a community food researcher model<sup>(64)</sup>. The active involvement of community food researchers (CFR) was pivotal to ensuring the community was fully on board and authentically involved in project-related decision making.

Participatory workshops to enhance collaborative developments<sup>(73)</sup> for example community taste testing (also supported by CFR)<sup>(74)</sup> enabled successful community engagement, stakeholder involvement and data collection (see also)<sup>(75)</sup>.

Interactive co-design with secondary school students<sup>(76,77)</sup> promoted as important in food system research to enhance engagement via experiential learning to enhance food literacy skills in young people<sup>(78)</sup> which can build confidence in young people's long-term food practices<sup>(79)</sup>.

Pop-up educational sessions with primary school students ( $n = 92$ ) to learn about the environmental sustainability side of the fish finger and taste test the product<sup>(12)</sup>. These learning opportunities can be a powerful way to engage often marginalised stakeholders such as catering staff and local producers to mobilise school food partnerships which can generate mutual benefits<sup>(80)</sup>. An education pack was produced from these sessions<sup>(81)</sup> and its implementation as a research intervention will be the subject of future research for the project.

Various public engagement activities, known for their importance for knowledge translation<sup>(73)</sup> have been hosted, involving multiple stakeholders, with several visual outputs, including film launch<sup>(63)</sup>, zine<sup>(82)</sup> and song<sup>(83)</sup>. All such visual outputs exemplify the multiple efforts to maintain strong collaborations across the project team and serve to enhance the projects impact and visibility.

Such participatory methods have become popular in food systems action research, because they are known to empower and engage a wider range of stakeholders in research processes, cultivating narratives of hope and getting more people involved in decision making<sup>(84)</sup>, many of whom have traditionally been marginalised from solutions (e.g. communities). The transforming the UK (TUKFS) research programme<sup>(85)</sup> has championed this way of working across a range of research activities. In a synthesis study

carried out across a range of projects involved in this research programme<sup>(13)</sup>, authors identified four key shared principles for co-production within food systems research: (1) Relationships: developing and maintaining reciprocity-based partnerships; (2) Knowledge: recognising the contribution of diverse forms of expertise; (3) Power: considering power dynamics and addressing imbalances; and (4) Inclusivity: ensuring research is accessible to all who wish to participate. The fish finger project meets all these principles by fully supporting the involvement of multiple stakeholders. However, crucial understanding to this way of working is the discovery that ‘messiness’ and complexity are inherent challenges associated with applying co-production approaches for improved collaborative practices<sup>(13)</sup>.

The fish finger pilot project has enabled partnership working with local stakeholders to plan and deliver the project, to test the fish finger for acceptability, and to appraise the collaborative and co-production approaches adopted<sup>(12)</sup>. Powerful and constructive stakeholder collaborations (effectively forming a ‘Community of Practice’) built around the project forged relationships between academics, communities, fishing industry stakeholders, schools, and school meal providers. Well considered and evidence informed techniques were used to optimise stakeholder engagement from the start of the project. As well as regular and focussed cross-sector team meetings, training was undertaken by the research team in how to apply systems thinking in a community food context<sup>(86)</sup>. This enabled workshop discussions to be framed around established approaches, for example use of the BATWOVE framework<sup>(87)</sup> supported (blue) food system visioning amongst a range of local/regional fishing stakeholders. A ‘BATWOVE’ exercise<sup>(88)</sup> enables the exploration of complex situations involving transformative change from multiple perspectives. It is mnemonic, with each section analysed as part of the exercise: B = Beneficiaries; A = Actors; T = Transformation; W = Worldview; O = Owner(s); V = Victims; E = Environmental Constraints. Similarly, ‘backcasting’, as a participatory approach known to strengthen cross sectoral collaboration<sup>(89)</sup> was used to connect potential innovation with broader systems-change visions, anticipating complexities and trade-offs. ‘Backcasting’ is a strategic planning exercise whereby participants envision an ideal future scenario and work backwards, figuring out the steps needed to get there<sup>(90)</sup>. Indeed, utilising ‘backcasting’ at an early stage of innovation development enabled the team to avoid pursuing actions that might have been problematic during roll out. By bringing together diverse partners and asking them to look into the future together, varied experiences and expertise were harnessed, revealing proposed challenges not initially obvious to all partners. Taking all voices seriously and acting on these concerns meant the avoidance of time-costly dead ends. Such collaborative efforts were challenging at times, but were worthwhile, as they built trust between stakeholders, offering valuable shared insights, knowledge, and learning that contributed to the development of transition pathways to accelerate blue food systems innovation<sup>(91)</sup>. By taking the time to forge these strong relationships, capacity has been built, and shared visioning realised, both of which can effectively mediate between the interests of system actors, thus informing potential co-creation of the national blue foods strategy that is urgently called for in the UK<sup>(69)</sup>.

## Critical reflections

### Challenges and learning

The concept of a community-led fish finger social innovation has been built, which serves to advocate for collaborative action

towards (blue) food system transformation. Table 1 highlights (and critiques) key challenges and learning from implementation of these collaborative processes, informed by active stakeholder feedback. Signposting is also included for knowledge mobilisation and resources to support research and practice.

### Future aspirations

The fish finger pilot project has generated a lot of interest across (local and national) blue food system stakeholders – a strong ‘Community of Practice’ has emerged around it, which is a positive outcome. But the project is by no means ‘complete’, until successful upscaling is implemented (the current focus of activity). Table 1 (above) goes some way to capture learning and knowledge on collaborations to date, but there is much learning still to happen and capturing this ongoing dynamic learning is pivotal to support project longevity. Similarly, as the project evolves, ongoing management of stakeholder engagement is crucial, to foster a sustainable model that can become a ‘blueprint’ with the option of replication in other (coastal) communities and for co-design/development of other food commodities/products.

There are many potential future research routes that can be recommended based on this collaborative pilot project. These include, but are not limited to: i) co-designing (with multiple stakeholders) interventions that support educational aspects for children and young people, to improve fish literacy and intake, especially in less affluent coastal communities; ii) exploring circular economic models to support the livelihoods and wellbeing of small boat fishers and the fishing community; iii) investigating robust metrics on how to measure ‘social innovation’ effectively<sup>(61)</sup>. Suggestions are emerging on suitable (participatory) methods that can be used to champion the complexities of transformational focussed evaluation<sup>(101)</sup> for food system change, which is a potential area of future research.

All such aspirations need to be carefully and sensitively mobilised for inclusive and optimal learning across diverse audiences and food system players. This requires meticulous attention being paid to robust public engagement strategies<sup>(73)</sup>, that enable knowledge translation, co-producing good practice guides to support replicability of processes. In this way, acting as a ‘blueprint’ for collaborative solutions to increasing fish intake and improving fish supply chains for UK coastal communities. This can pave the way to better understand the causes of health inequalities and their link to the blue food system.

### Personal reflections and (nutritional) professional/practice insights

Collaborative leadership<sup>(95)</sup> and teamwork have been at the forefront of this project. This has meant understanding and an ‘over and above’ attitude and commitment. Our nutrition professional skillset already includes strong communication and compassion/empathy. More demanding perhaps is truly understanding the cross-sector needs and priorities of all players across the food system, but this is essential to build rapport, trust and transparency and break down power barriers<sup>(102)</sup>. Care needs to be taken to fully acknowledge all collaborator input and engagement – whether that means emails of thanks, small gifts and/or other such personal touches, all of which can serve to reinforce human connection<sup>(103)</sup>.

This fish finger pilot ‘social innovation’ project journey has taught some interesting lessons from the perspective of a nutrition professional. Understanding that nutrition is a very small part of this very large systems puzzle. This does not diminish its

**Table 1.** Fish Finger project collaboration – challenges and learning

Time and funding	This way of working (co-production for collaboration) is resource intensive (both time and funding) so this needs to be considered at the outset and sufficient resource dedicated to ensuring creative social innovation methods <sup>(61)</sup> are authentically and robustly implemented (see illustrated checklist 92) to optimise collaboration.
Language and communication	Stakeholders can define things in different ways so it is important to ensure everyone is on the same page to optimise understanding towards a shared project vision – this can take a lot of effort and relies on clear aims/objectives from outset (See <sup>(58)</sup> ) as well as optimal communication of information. This can necessitate translation of complex scientific terminology to more inclusive/accessible modes of outputs (the latter is where creative visual outputs and public engagement activities <sup>(73)</sup> can be helpful).
Diverse priorities	Stakeholders also often have diverse priorities and agendas making collaboration challenging. Key conditions for success include clear definitions of the roles of all stakeholders and of the sharing of resources, responsibilities, risks and benefits <sup>(58)</sup> .
Ownership and governance	It is important to consider who <i>owns</i> the project and how <i>ownership</i> is established between diverse stakeholders? Governance roles in multi-stakeholder environments are crucial and specific practices that enact clear roles are important, e.g. building relationships and fostering collaboration as well as ensuring transparency of accountability <sup>(93)</sup> .
Leadership	Bold leadership is an essential component for success of such a complex multi-stakeholder project. This is where a collaborative style of leadership is vital, to engage team inclusively and optimise collaborator engagement. Support for the sustainability agenda needs to be ubiquitous and collaborative rather than coming from one actor or sector <sup>(94)</sup> . This style of leadership can be challenging for those who are used to more hierarchical leadership models but is essential to broker the complexities of the sustainable food system agenda <sup>(95)</sup> .
Complexity and ‘messiness’	There is a need to embrace complexity and ‘messiness’, both inherent within this type of research <sup>(13)</sup> . An example here relating to the fish finger project is the ‘paradox’ whereby less affluent communities need to eat more fish, yet global overfishing is a major issue. Each stage of our project has presented new ethical dilemmas to navigate. A further example relates to ‘sustainability’ as a concept – what does this mean for our product? (see language section above). If we create a demand for ‘by-catch’, does this negate our sustainability credentials? This requires scientific rigour, deep reflection, reflexivity and ongoing transparent dialogue between all stakeholders involved.
Systems thinking	The call for a ‘food systems approach’ <sup>(58)</sup> requires a different way of thinking. Systems thinking <sup>(96)</sup> is established as a mechanism to shift away from linear and reductionist approaches <sup>(97)</sup> , towards addressing complex issues and embracing complexity science <sup>(98)</sup> . The system around our fish finger innovation has recently been critically mapped to enable identification of possible interventions for change <sup>(99)</sup> . Interestingly, this way of thinking is proposed for nutrition professionals in their everyday practice, but its implementation (within educational curricula) requires fostering a cultural shift within the profession and overcoming resistance to change <sup>(100)</sup> .
Power, politics and commercial interests	Beyond the scope of this review paper, but questions need to be posed around how to broach power dynamics, politically driven challenges (i.e. not fit for purpose fishing policies/quotas) and (often corrupt) commercial interests <sup>(55)</sup> . The need for development of a UK blue food strategy to rejuvenate re-localised blue food systems has recently been critiqued <sup>(69)</sup> . This is a welcome development that requires urgent action across system players.

importance of course but putting it in context especially where collaborators with different priorities are concerned, is a very useful message. This reinforces the need to embrace the ‘messiness’ and complexity<sup>(13)</sup> associated with food systems research and action, which requires a mindset shift. Similarly, integration of systems thinking into nutrition curricula, to recognize interconnections, diverse perspectives and consider the big picture<sup>(104)</sup> is needed. Particular skills are required to navigate political and commercial interests<sup>(55)</sup>.

Finding ways to navigate the identified ‘messiness’ and complexities<sup>(13)</sup> of food systems research/action requires passion, patience, confidence and dedication. Nutrition professionals already possess a range of essential transferable skills, values and competencies. To amplify these, however, risks need to be taken, to step out of comfort zones and embrace new opportunities, evidence, perspectives and (creative) ways of working, all of which require personal, professional and creative courage<sup>(105)</sup>.

We need to view our ever growing pressing social, political and cultural issues through a more ‘critical creative’ lens, embracing the uncomfortable challenges this presents<sup>(102,105)</sup>. Self-compassion, as a core part of curious creativity, can galvanise action and inspire others, thus leaving an important legacy<sup>(106)</sup>. Demonstrating holistic values can enable us to embrace a more adaptable, agile and flexible mind-set, and lead by example, focussing on collaboration, with people as assets, to build stakeholder capacity, citizenship and community connection.

## Conclusions

The Plymouth fish finger collaborative ‘social innovation’ has shown great promise as an approach to benefit society: It has forged relationships between food system stakeholders (academics, community members, fishing industry stakeholders, school students, schools and school meal providers); It has successfully built the concept of a community-led fish finger product, advocating for improved nutritional wellbeing and collaborative action towards (blue) food system transformation; it has built a strong ‘Community of Practice’ to ensure its ongoing impact and longevity.

Through deliberative actions to collaborate with blue food system stakeholders, the project has demonstrated strong potential to optimise nutritional health and wellbeing in less affluent communities, thorough its ongoing inclusive vision to:

- 1) improve fish intake (& education/skills) in ‘less affluent’ communities (children and their families), thus promoting nutritional health benefits and tackling health inequalities
- 2) give fishers a fair price for low value, under-utilised ‘by-catch’, thereby reducing fish waste, limiting environmental damage from overfishing and improving livelihoods in the fishing community
- 3) contribute to a resilient local food economy (promoting, in particular, a circular economic approach to support future blue food system resilience)<sup>(107)</sup>. This is a win-win for coastal



communities<sup>(46,47)</sup> which are in urgent need of dedicated intervention and regeneration<sup>(108)</sup>.

Future (blue) food system research and practice can be shaped through more creative engagement practices, such as the participatory approaches critiqued in this article to optimise collaboration, because they harness energy, vision and skills development, thus enabling active agency and capability to be enhanced within system stakeholders and the communities they serve. This permits integration of more progressive solutions to persistent blue food system issues, informs the need for strategic reform and gives people a stronger voice to support the re-imagining of their own, more inclusive, co-operative and democratised system.

**Acknowledgements.** The authors would like to acknowledge the many partners and stakeholders who have tirelessly engaged in this project, supporting collaborative activities, sharing knowledge and expertise as well as assisting with its delivery. Thanks go to Caroline Bennett (Sole of Discretion CIC); Ed Baker (Plymouth Fishing & Seafood Association CIC); Brad Pearce (CATERed Ltd), our community food researchers (Laura and Star); school children and teachers; Food Plymouth CIC.

**Author contributions.** CP created the concept for the presentation and drafted the review paper. LH as research fellow assisted with research design and ongoing engagement with multi-stakeholder collaboration. CW acquired funding, made substantial contributions to the conception of the FoodSEqual research project.

**Financial support.** This research is part of FoodSEqual, a large consortium project funded by the UKRI Strategic Priorities Fund 2021–2026 Transforming the UK Food System programme (BB/V004905/1). The funding body had no role in the study design, analysis or data interpretation.

**Competing interests.** The authors declare no competing interests.

## References

- National Food Strategy (2020) <https://www.nationalfoodstrategy.org/approach-2020/>.
- Department of Work and Pensions, Summary: Review of the UK Material Deprivation Measures (2024) <https://www.gov.uk/government/publications/review-of-the-uk-material-deprivation-measures/summary-review-of-the-uk-material-deprivation-measures> (accessed 11 September 2025).
- The Health Foundation, Trends in Material Deprivation (2024) <https://www.health.org.uk/evidence-hub/money-and-resources/poverty/trends-in-material-deprivation#:~:text=Material%20deprivation%20is%20defined%20as,sufficiently%20heated%20home%2C%20and%20being> (accessed 11 September 2025).
- FoodSEqual (2021) Food systems equality: co-production of healthy, sustainable food systems for disadvantaged communities UKRI funded research programme (<https://research.reading.ac.uk/food-system-equality/>).
- Nicolini G, Bladon A, Clarke J, *et al.* (2024) What about seafood? Report international institute for environment and development (IIED). <https://smarthinking.org.uk/report/what-about-seafood/> (accessed 11 September 2025).
- Tigheelaar M, Leape J, Micheli F, *et al.* (2022a) The vital roles of blue foods in the global food system. *Glob Food Secur* **33**, 100637.
- Martino S, Azzopardi E, Fox C, *et al.* (2023) The importance of local fisheries as a cultural attribute: insight from a discrete choice experiment of seafood consumers. *Marit Stud* **22**(2), 22. doi: [10.1007/s40152-023-00308-2](https://doi.org/10.1007/s40152-023-00308-2).
- Ruxton CHS (2011) The benefits of fish consumption. *ition Bulletin* **36**(1), 6–19. doi: [10.1111/j.1467-3010.2010.01869.x](https://doi.org/10.1111/j.1467-3010.2010.01869.x).
- Jamioł-Milc D, Biernawska J, Liput M, *et al.* (2021) Seafood intake as a method of non-communicable diseases (NCD) prevention in adults. *Nutrients* **13**(5), 1422.
- Gale S, Aboluwa R, Hunt L & Pettinger C (2025) What is known about the fish intake of people living in disadvantaged communities in the UK? A scoping review. *Nutrition Bulletin* **50**(4), 577–603. doi: [10.1111/nbu.70030](https://doi.org/10.1111/nbu.70030).
- Food and Agriculture Organization, International Fund for Agricultural Development, UNICEF, World Food Programme, and World Health Organization (FAO, IFAD, UNICEF, WFP, and WHO) (2020) The state of food security and nutrition in the world 2020: transforming food systems for affordable healthy diets. FAO, IFAD, UNICEF, WFP and WHO, Rome, Italy.
- Hunt L, Pettinger C, Tsikritzi R and Wagstaff C (2025) Collaborative co-design for local blue food system transformation: the practicalities and challenges of the UK's (FoodSEqual) 'Plymouth Fish Finger' pilot study. *Environmental Research: Food Systems* (Blue food special issue). accepted manuscript available at: <https://iopscience.iop.org/article/10.1088/2976-601X/ae1f1c> (accessed 4 December 2025).
- Shaw N, Hardman CA, Boyle NB, *et al.* (2024) What does 'co-production' look like for food system transformation? Mapping the evidence across transforming UK food systems (TUKFS) projects. *Nutr Bull* **49**(3), 345–359. doi: [10.1111/nbu.12690](https://doi.org/10.1111/nbu.12690).
- Bennett A, Basurto X, Virdin J, *et al.* (2021) Recognize fish as food in policy discourse and development funding. *Ambio* **50**, 981–989. doi: [10.1007/s13280-020-01451-4](https://doi.org/10.1007/s13280-020-01451-4).
- Marine Stewardship Council (MSC) (2025) <https://www.msc.org/en-us/what-we-are-doing/blue-foods-seafood-feeding-growing-global-population>.
- Crona BI, Wassénius E, Jonell M, *et al.* (2023) Four ways blue foods can help achieve food system ambitions across nations. *Nature* **616**, 104–112. doi: [10.1038/s41586-023-05737-x](https://doi.org/10.1038/s41586-023-05737-x).
- FAO (2022) Blue transformation roadmap 2022–2030: a vision for FAO's work on aquatic food systems. <https://openknowledge.fao.org/server/api/core/bitstreams/2f12c8a2-fc0a-4569-bb97-6b5dbf5b6fbc/content>.
- Rockstrom J, *et al.* (2025) The EAT-lancet commission on healthy, sustainable and just food systems. *Lancet* **406**(10512), 1625–1700.
- Scientific Advisory Committee on Nutrition (SACN) (2004) Advice on fish consumption. UK government. Available from: <https://www.gov.uk/government/publications/sacn-advice-on-fish-consumption>.
- Verbeke W, Sioen I, Pieniak Z, *et al.* (2005) Consumer perception versus scientific evidence about health benefits and safety risks from fish consumption. *Public Health Nutr* **8**(4), 422–429. doi: [10.1079/PHN2004697](https://doi.org/10.1079/PHN2004697).
- Willett WC, Sacks F, Trichopoulou A, *et al.* (1995) Mediterranean diet pyramid: a cultural model for healthy eating. *Am J Clin Nutr* **61**(6), 1402S–1406S. doi: [10.1093/ajcn/61.6.1402S](https://doi.org/10.1093/ajcn/61.6.1402S).
- Romagnolo DF & Selmin OI (2017) Mediterranean diet and prevention of chronic diseases. *Nutr Today* **52**(5), 208. doi: [10.1097/NT.0000000000000228](https://doi.org/10.1097/NT.0000000000000228).
- Umamoto S, Onaka U, Kawano R, *et al.* (2022) Effects of a Japanese cuisine-based antihypertensive diet and fish oil on blood pressure and its variability in participants with untreated normal high blood pressure or stage I hypertension: a feasibility randomized controlled study. *J Atheroscler Thromb* **29**(2), 152–173. doi: [10.5551/jat.57802](https://doi.org/10.5551/jat.57802).
- Soltani S, Shirani F, Chitsazi MJ, *et al.* (2016) The effect of dietary approaches to stop hypertension (DASH) diet on weight and body composition in adults: a systematic review and meta-analysis of randomized controlled clinical trials. *Obes reviews* **17**(5), 442–454. doi: [10.1111/obr.12391](https://doi.org/10.1111/obr.12391).
- Public Health England (2016) The eat well guide. Available from: <https://www.gov.uk/government/publications/the-eatwell-guide>.
- de Boer J, Schöslér H & Aiking H (2020) Fish as an alternative protein – A consumer-oriented perspective on its role in a transition towards more healthy and sustainable diets. *Appetite*, **152**, 104721..
- Harris W (2007) Omega-3 fatty acids and cardiovascular disease: a case for omega-3 index as a new risk factor. *Pharmacol Res* **55**(3), 217–223. doi: [10.1016/j.phrs.2007.01.013](https://doi.org/10.1016/j.phrs.2007.01.013).
- Rimm EB, Appel LJ, Chiuve SE, *et al.* (2018) Seafood long-chain n-3 polyunsaturated fatty acids and cardiovascular disease: a science advisory from the American Heart Association. *Circ* **138**(1), e35–e47. doi: [10.1161/CIR.0000000000000574](https://doi.org/10.1161/CIR.0000000000000574).

29. Khan SU, Lone AN, Khan MS, *et al.* (2021) Effect of omega-3 fatty acids on cardiovascular outcomes: a systematic review and meta-analysis. *EClinicalMedicine (Lancet)* **38**, 100997. doi: [10.1016/j.eclim.2021.100997](https://doi.org/10.1016/j.eclim.2021.100997).
30. Tacon AG, Lemos D and Metian M (2020) Fish for health: improved nutritional quality of cultured fish for human consumption. *Rev Fish Sci Aquacult* **28**(4), 449–458. doi: [10.1016/j.cnu.2020.11.019](https://doi.org/10.1016/j.cnu.2020.11.019).
31. Roos N, Wahab MA, Chamnan C, *et al.* (2007) The role of fish in food-based strategies to combat vitamin A and mineral deficiencies in developing countries. *Journal of Nutrition* **137**(4), 1106–9. doi: [10.1093/jn/137.4.1106](https://doi.org/10.1093/jn/137.4.1106).
32. Scheers N, Lindqvist H, Langkilde AM, *et al.* (2014) Vitamin B12 as a potential compliance marker for fish intake. *European Journal of Nutrition* **53**(6):1327–33. doi: [10.1007/s00394-013-0632-5](https://doi.org/10.1007/s00394-013-0632-5).
33. Lehmann U, Gjessing HR, Hirche F, *et al.* (2015) Efficacy of fish intake on vitamin D status: a meta-analysis of randomized controlled trials. *Am J Clin Nutr* **102**(4), 837–847. doi: [10.3945/ajcn.114.105395](https://doi.org/10.3945/ajcn.114.105395).
34. NHS (no date) Fish and Shellfish <https://www.nhs.uk/live-well/eat-well/food-types/fish-and-shellfish-nutrition/> (accessed 8 September 2025).
35. Public Health England (2020) NDNS: results from years 9–11 (combined) – statistical summary <https://www.gov.uk/government/statistics/ndns-results-from-years-9-to-11-2016-to-2017-and-2018-to-2019/ndns-results-from-years-9-to-11-combined-statistical-summary#:~:text=Mean%20consumption%20of%20oil%20fish,less%20than%2020g%20per%20week> (accessed 8 September 2025).
36. Marine Stewardship Council (2025) What sustainable seafood species can you eat in the UK? Available from: <https://www.msc.org/uk/what-you-can-do/sustainable-fish-to-eat-in-the-uk> (accessed 8 September 25).
37. Hardcastle SJ & Blake N (2015) Influences underlying family food choices in mothers from an economically disadvantaged community. *Eating Behaviors* **20**, 1–8. doi: [10.1016/j.eatbeh.2015.11.001](https://doi.org/10.1016/j.eatbeh.2015.11.001).
38. O'Neill M, Rebane D & Lester C (2004) Barriers to healthier eating in a disadvantaged community. *Health Educ J* **63**(3), 220–228. doi: [10.1177/001789690406300303](https://doi.org/10.1177/001789690406300303).
39. Adam SJ, Goffe L, Adamson AJ, *et al.* (2015) Prevalence and socio-demographic correlates of cooking skills in UK adults: cross-sectional analysis of data from the UK national diet and nutrition survey. *Int J Behavioural Nutr Physical Act* **12**(99), 1–13. doi: [10.1186/s12966-015-0261-x](https://doi.org/10.1186/s12966-015-0261-x).
40. Burns JL, Bhattacharjee A & Darlington G (2024) The guelph family health study. Parental cooking confidence is associated with children's intake of fish and seafood. *Canadian J Dietetic Pract Res* **85**(1), 54–57. doi: [10.3148/cjdpr-2023-012](https://doi.org/10.3148/cjdpr-2023-012).
41. Clarke BM, McKinley E & Ballinger RC (2025) UK public attitudes and perceptions of seafood sustainability: a case study of the marine conservation society's good fish guide. *Sustainability* **17**(2), 587. doi: [10.3390/su17020587](https://doi.org/10.3390/su17020587).
42. FAO. Review of the state of the world marine fishery resources – 2025 report <https://openknowledge.fao.org/items/8bflf881-9208-4c59-86e2-9ada635960dd> (accessed 8 September 2025).
43. BDA (British Dietetic Association) One Blue Dot: Environmentally Sustainable Diet Project (2018) <https://www.bda.uk.com/resource-report/one-blue-dot.html> (accessed 8 September 2025).
44. Roberts K, Cade J, Dawson J, *et al.* (2018) Empirically derived dietary patterns in UK adults are associated with sociodemographic characteristics, lifestyle, and diet quality. *Nutrients* **10**, 177. <https://pubmed.ncbi.nlm.nih.gov/29415478/>.
45. Maguire ER & Monsivais P (2015) Socio-economic dietary inequalities in UK adults: an updated picture of key food groups and nutrients from national surveillance data. *Br J Nutr* **113**, 181–189. <https://pubmed.ncbi.nlm.nih.gov/25399952/>.
46. House of Commons library (2025) Coastal communities <https://researchbriefings.files.parliament.uk/documents/CDP-2025-0059/CDP-2025-0059.pdf>.
47. Argawal S, Jakes S, Essex S, *et al.* (2018) Disadvantage in english seaside resorts: a typology of deprived neighbourhoods. *Tourism Manage.* **69**, 440–459. doi: [10.1016/j.tourman.2018.06.012](https://doi.org/10.1016/j.tourman.2018.06.012).
48. Burnett R, Hallam C, Kirby R, *et al.* (2016) Exploring food experiences and challenges in traditionally hard to reach adults through a cross-sectional questionnaire. *Journal of Human Nutrition & Dietetics* **29**(Suppl.1), 40–63 (abstracts). <https://tinyurl.com/ysskdfsf>.
49. Pettinger C & Elwood J (2019) Food on the Margins in Plymouth. Documentary film <https://vimeo.com/352716913> (accessed 8 September 2025).
50. Smith DM, Rixson L, Grove G, *et al.* (2022) Household food insecurity risk indices for English neighbourhoods: measures to support local policy decisions. *PLOS One* **17**(12), e0267260. doi: [10.1371/journal.pone.0267260](https://doi.org/10.1371/journal.pone.0267260).
51. My local map (n.d.) Updated data came from <https://mylocalmap.org.uk/>.
52. Bates B, Lennox A & Swan G (2010) National diet and nutrition survey: headline results from year 1 of the rolling programme (2008/2009). London: Food Standards Agency. Available from: [https://assets.publishing.service.gov.uk/media/5a7b9a4f40f0b645ba3c561d/dh\\_128542.pdf](https://assets.publishing.service.gov.uk/media/5a7b9a4f40f0b645ba3c561d/dh_128542.pdf) (Accessed 8 September 25).
53. Lewis P, Hatt A & Coulthard S (2025) The UK is losing its small fishing boats - and the communities they support. The Conversation <https://theconversation.com/the-uk-is-losing-its-small-fishing-boats-and-the-communities-they-support-262092> (accessed 8 September 2025).
54. Cohen PJ, Allison EH, Andres NL, *et al.* (2019) Securing a just space for small-scale fisheries in the blue economy frontiers of marine science sec. *Mar Fisheries, Aquacult Living Resour* **6**, 171. doi: [10.3389/fmars.2019.00171](https://doi.org/10.3389/fmars.2019.00171).
55. UN (2019) Rotten fish: a guide on addressing corruption in the fisheries sector. [https://www.unodc.org/documents/Rotten\\_Fish.pdf](https://www.unodc.org/documents/Rotten_Fish.pdf) (accessed 8 September 2025).
56. Rice ED, Bennett AE, Smith MD, *et al.* (2024) Price volatility in fish food systems: spatial arbitrage as an adaptive strategy for small-scale fish traders. *Ecol. Society* **29**(2), 13. doi: [10.5751/ES-15076-290213](https://doi.org/10.5751/ES-15076-290213).
57. Gray T (2024) Fishing for principles: the fairness of fishing quota allocations. *Sustainability* **16**(12), 5064. doi: [10.3390/su16125064](https://doi.org/10.3390/su16125064).
58. UNEP, FAO and UNDP (2023) Rethinking our food systems: a guide for multi-stakeholder collaboration. m Nairobi, Rome and New York. <https://doi.org/10.4060/cc6325en>.
59. Warren AM, Constantinides SV, Blake CE, *et al.* (2021) Advancing knowledge about stakeholder engagement in multisectoral nutrition research. *Glob Food Secur.* **29**, 100521. doi: [10.1016/j.gfs.2021.100521](https://doi.org/10.1016/j.gfs.2021.100521).
60. Tigchelaar M, Honig M, Mega Laidha G, *et al.* (2022b) Policy brief: integrating blue foods into food system policy and practice. The Global Solutions Initiative. Available at: [https://www.t20indonesia.org/wp-content/uploads/2022/08/Integrating-Blue-Foods-into-Food-System-Policy-and-Practice\\_Tf4.pdf](https://www.t20indonesia.org/wp-content/uploads/2022/08/Integrating-Blue-Foods-into-Food-System-Policy-and-Practice_Tf4.pdf) (accessed 8 September 2025).
61. Lyon F, Doherty B, Psarikidou K, *et al.* (2025) Exploring social innovation for transforming food systems. *Philos Trans R Soc Lond B Biol Sci* **1935**, 20240156. doi: [10.1098/rstb.2024.0156](https://doi.org/10.1098/rstb.2024.0156).
62. Pettinger C (2024a) The secret to healthy and sustainable fish fingers, an expert explains. The Conversation. 3.10.2024. <https://theconversation.com/the-secret-to-healthy-and-sustainable-fish-fingers-an-expert-explains-237899> (accessed 8 September 2025).
63. Pettinger C (2024b) FoodSEqual – The Plymouth fish finger. A short documentary film produced by Fotonow CIC. Available at: <https://vimeo.com/966053624?share=copy> (accessed 8 September 2025).
64. Pettinger C, Hunt L, Gardiner H, *et al.* (2023) Engaging with 'less affluent' communities for food system transformation: a community food researcher model (FoodSEqual project). *Proc Nutr Soc* **83**(3), 180–194. doi: [10.1017/S0029665123004913](https://doi.org/10.1017/S0029665123004913).
65. Lavado A, Navarrete Frias C, Declerck F, *et al.* (2024) Stakeholder engagement strategy for developing integrated food and land use pathways. 53 p. <https://cgspace.cgiar.org/items/0f78ebe4-d959-4fa0-a923-fac55f3aa46b> (accessed 8 September 2025).
66. Ghodvali M, Krishnamurthy S & De Vries B (2019) Review of transdisciplinary approaches to food-water-energy nexus: a guide towards sustainable development. *Environ Sci Policy* **101**, 266–278. doi: [10.1016/j.envsci.2019.09.003](https://doi.org/10.1016/j.envsci.2019.09.003).
67. Kujala J, Sachs S, Leinonen H, *et al.* (2022) Stakeholder engagement: past, present, and future. *Bus Society* **61**(5), 1136–1196. doi: [10.1177/00076503211066595](https://doi.org/10.1177/00076503211066595).

68. Sterner R & Trouvé A (2024) Stakeholder collaboration and engagement in the food sector for sustainability exploring swedish multi-stakeholder networks. <https://www.diva-portal.org/smash/get/diva2:1886785/FULLTEXT01.pdf> (accessed 8 September 2025).
69. Caveen AJ, Stewart BD, Moffat C, *et al.* (2025) Globalism, localism and blue food systems – How can cross-scale tensions be reduced? A production perspective from UK seafood stakeholders. *Marine Policy* **181**, 106819. <https://www.sciencedirect.com/science/article/pii/S0308597X25002349>.
70. Schwarz G, Vanni F & Miller D (2021) The role of transdisciplinary research in the transformation of food systems. *Agric Econ* **9**, 35. doi: [10.1186/s40100-021-00207-2](https://doi.org/10.1186/s40100-021-00207-2).
71. Den Boer ACL, Broerse JEW & Regeer BJ (2021) The need for capacity building to accelerate food system transformation. *Curr Opin Food Sci* **42**, 119–126. doi: [10.1016/j.cofs.2021.05.009](https://doi.org/10.1016/j.cofs.2021.05.009).
72. Wagstaff C, Pettinger C, Relton C, *et al.* (2025) Addressing food system determinants of health inequalities in urban environments: learnings from the FoodSEqual and FoodSEqual-Health projects. *R Soc Lond B Biol Sci* **380**(1935), 0240150. doi: [10.1098/rstb.2024.0150](https://doi.org/10.1098/rstb.2024.0150).
73. Pettinger C, Parsons JM, Letherby G, *et al.* (2019) Participatory food events as collaborative public engagement opportunities. *Methodol. Innovations* **12**(2), 2059799119863283. doi: [10.1177/2059799119863283](https://doi.org/10.1177/2059799119863283).
74. Pettinger C, Hunt L, Gardiner H, *et al.* (2024c) Community-led workshops to engage action for food system change (FoodSEqual). Abstract international congress of nutrition & dietetics. <https://researchportal.plymouth.ac.uk/en/publications/community-led-workshops-to-engage-action-for-food-system-change-f> (accessed 9 September 2025).
75. Methven L, Smith R, Zischka L, *et al.* (2022) ‘Co-creation with disadvantaged communities: a participatory “shopping basket” method exploring what people eat and potential for change’. Eurosense Open access <https://researchportal.plymouth.ac.uk/en/publications/co-creation-with-disadvantaged-communities-a-participatory-shoppi>.
76. Pettinger C Engaging Secondary Schools in Food Activities – Curriculum Enrichment (FoodSEqual) PEARL repository (2024d) <https://researchportal.plymouth.ac.uk/en/publications/engaging-secondary-schools-in-food-activities-curriculum-enrichme> (accessed 9 September 2025).
77. Pettinger C (2022) FoodSEqual Plymouth – collaborating with a local school. Short film by Fotonow CIC. <https://vimeo.com/737948107> (accessed 9 September 2025).
78. Ares G, De Rossa S, Mueller C, *et al.* (2024) Development of food literacy in children and adolescents: implications for the design of strategies to promote healthier and more sustainable diets. *Nutr Rev* **82**(4), 536–522. <https://doi.org/10.1093/nutrit/nuad072>.
79. Carroll N, Perreault M, Ma DWL, *et al.* (2021) Assessing food and nutrition literacy in children and adolescents: a systematic review of existing tools. *Public Health Nutr* **25**(4). doi: [10.1017/S1368980021004389](https://doi.org/10.1017/S1368980021004389).
80. Sabat F & Bohm S (2024) Towards sustainable school food: an experiential planetary health framework integrating meals and food education. *Br Educ Res J* **51**(2), 826–847. <https://bera-journals.onlinelibrary.wiley.com/doi/full/10.1002/berj.4100>.
81. Plymouth Fish Finger Educators pack – available via University of Plymouth Fish Finger website <https://www.plymouth.ac.uk/research/plymouth-fish-finger> (accessed 4 December 2025).
82. University of Plymouth (2024) The Plymouth fish finger ZINE by Fotonow CIC <https://issuu.com/fotonowpublishing/docs/theplymouthfishfinger> (accessed 9 September 2025).
83. Pettinger C and research team (2024) The Plymouth fish finger sea shanty – a public engagement presentation. <https://www.youtube.com/watch?v=15ph4Bv80l8> (accessed 9 September 2025).
84. Thomas Hughes H (2018) Critical conversations with community researcher: making co-production happen? Report. <https://research-information.bris.ac.uk/en/publications/critical-conversations-with-community-researchers-making-co-produ> (accessed 9 September 2025).
85. UKRI (2021) Transforming the UK food system programme of research <https://ukfoodsystems.ukri.org/> (accessed 9 September 2025).
86. IFSTAL (nd) Interdisciplinary food systems teaching and learning. Courses <https://www.ifstal.ac.uk/courses> (accessed 9 September 2025).
87. Walsh BH (2015) System thinking: approaches and methodologies an overview of the soft systems methodology, 1–14. <https://www.eindhovenengine.nl/wp-content/uploads/2023/01/Soft-Systems-Methodology-source-2.pdf> (accessed 9 September 2025).
88. Midgley G & Reynolds M (2001) *Operational Research and Environmental Management: A New Agenda*. Birmingham: Operational Research Society.
89. Remans R, Zornetzer H, Mason-D'Croz D, *et al.* (2024) Backcasting supports cross-sectoral collaboration and social-technical innovation bundling: case studies in agri-food systems. COMMUNITY CASE STUDY article, *Frontiers of Sustainable Food Systems*, **8**, 1–12; Sec. Climate-Smart Food Systems. doi: [10.3389/fsufs.2024.1378883](https://doi.org/10.3389/fsufs.2024.1378883).
90. Robinson JB (1982) Energy backcasting: a proposed method of policy analysis. *Energy Policy* **10**(4), 337–344.
91. Thornton P, Mason D'Croz D, *et al.* (2024) Enabling food system innovation: accelerators for change, *Glob Food Secur*. **40**, 100738. doi: [10.1016/j.gfs.2023.100738](https://doi.org/10.1016/j.gfs.2023.100738).
92. Pettinger C, Hardman C & Shaw N (2023; 2025) Synergy project: co-production of research for food systems transformation TOOLKIT: <https://www.plymouth.ac.uk/research/synergy> and illustrated checklist for ‘Practical Considerations for Co-production for Food Systems Transformation research’ [https://www.plymouth.ac.uk/rails/active\\_storage/blobs/proxy/eyJfcmFpbHMiOnsibWVzc2FnZSI6IkJBaHBBd2xtRVEyPjZmV4cCjE6bnVsbnVsbCwicHVyIjoiYmxvYy9pZCZj9fQ==e353d3cfd72b2f27372b777e9e2e6c275de8a608/Synergy\\_Illustrated\\_Checklist.pdf](https://www.plymouth.ac.uk/rails/active_storage/blobs/proxy/eyJfcmFpbHMiOnsibWVzc2FnZSI6IkJBaHBBd2xtRVEyPjZmV4cCjE6bnVsbnVsbCwicHVyIjoiYmxvYy9pZCZj9fQ==e353d3cfd72b2f27372b777e9e2e6c275de8a608/Synergy_Illustrated_Checklist.pdf) (accessed 9 September 2025).
93. Arthur M (2020) Multi-stakeholder engagement in governing food systems: review and synthesis Final Technical Report. Available at: <https://idl-bnc-idrc.dspacedirect.org/server/api/core/bitstreams/11310ab2-ba6e-4682-a7c4-d3ac79b3b795/content> (accessed 9 September 2025).
94. Carlsson L & Callaghan E (2022) The social license to practice sustainability: concepts, barriers and actions to support nutrition and dietetic practitioners in contributing to sustainable food systems *J Hunger Environ Nutr* **19**(2), 198–216. doi: [10.1080/19320248.2022.2034559](https://doi.org/10.1080/19320248.2022.2034559).
95. Pettinger C, Tripathi S, Shoker B, *et al.* (2023) Collaborative leadership to support sustainability in practice for dietitians as allied health professionals. *J Hum Nutr Diet* **36**(6), 2323–2335. doi: [10.1111/jhn.13211](https://doi.org/10.1111/jhn.13211).
96. Midgley G (2011) Systems thinking (Volumes 1–4). Available via ResearchGate at [https://www.researchgate.net/publication/43527100\\_Systems\\_Thinking\\_Volumes\\_1-4](https://www.researchgate.net/publication/43527100_Systems_Thinking_Volumes_1-4) (accessed 9 September 2025).
97. Gates E, Walton M, Videira P, *et al.* (2012) Introducing systems- and complexity-informed evaluation. *New Directions for Evaluation* **2021**(170), 13–25. doi: [10.1002/ev.20466](https://doi.org/10.1002/ev.20466).
98. Bustamante M, Videira P & Baker L (2024) Insights from systems thinking and complexity science to strengthen food systems frameworks. *Glob Food Secur* **42**, 100777. doi: [10.1016/j.gfs.2024.100777](https://doi.org/10.1016/j.gfs.2024.100777).
99. Pettinger C, Parsons K, Chavez-Ugalde YI, *et al.* Using expert elicitation and systems mapping to support social innovation in the (blue) food system: the case of the UK's Plymouth Fish Finger. *J Human Nutr Diet* (2025) (under review).
100. Bergquist E, Buyckingham-Schutt L, Smalley S, *et al.* (2025) Integrating systems thinking in nutrition and dietetics education. *J Hum Nutr Diet* **38**(2), e70036. doi: [10.1111/jhn.70036](https://doi.org/10.1111/jhn.70036).
101. Buckton SJ, Fazey I, Ball P, *et al.* (2025) Twelve principles for transformation-focused evaluation. *PLOS Sustainability Transformation* **4**(4), e0000164. <https://doi.org/10.1371/journal.pstr.0000164>.
102. Pettinger C (2021) A creative response to food issues during the Covid-19 lockdown: Singing over the anger. *J Crit Dietet* **5**(3), 4. doi: [10.32920/cd.v5i3.1434](https://doi.org/10.32920/cd.v5i3.1434).
103. Cottam H (2018) *Radical Help: How can we remake the relationships between us and revolutionise the welfare state*. London: Virago Press.
104. Gilbert E (2015) *Big Magic: Creative Living beyond fear*. London: Bloomsbury Press.

105. Pettinger C (2022) How dietitians can protect the planet. Elsie Widdowson lecture. Available at: <https://youtu.be/Utyf8ny55EQ?list=TLGGScmW4636t3EwOTA5MjAyNQ> (accessed 9 September 2025).
106. Aphramor L (2020) Transmuting trauma through food and body stories. Blog. Available at: <https://lucyaphramor.com/> (accessed 12 December 2025).
107. Rizwan D, Kirmani SBR & Masoodi FA (2025) Circular economy in the food systems: a review. *Environ. Qual. Manage.* 34(4), e70096. doi: 10.1002/tqem.70096.
108. Burton C, Balogun B, Brien P, *et al.* (2025) Coastal communities, debate pack, house of commons library. Available at <https://researchbriefings.files.parliament.uk/documents/CDP-2025-0059/CDP-2025-0059.pdf> (accessed 11 September 2025).