Jun 25th, 9:00 AM

Diving in: What will it take for consumers to transition to a circular economy ready-to-cook fish product? Insights from the UK

Hayley Alter
ImaginationLancaster, Lancaster University, United Kingdom

Emmanuel Tsekleves
ImaginationLancaster, Lancaster University, United Kingdom

Serena Pollastri
ImaginationLancaster, Lancaster University, United Kingdom

Citation

Alter, H., Tsekleves, E., and Pollastri, S. (2022) Diving in: What will it take for consumers to transition to a circular economy ready-to-cook fish product? Insights from the UK, in Lockton, D., Lenzi, S., Hekkert, P., Oak, A., Sádaba, J., Lloyd, P. (eds.), *DRS2022: Bilbao*, 25 June - 3 July, Bilbao, Spain. https://doi.org/10.21606/drs.2022.744

DRS 2022
Bilbao 25th June — 3rd July

Diving in: What will it take for consumers to transition to a circular economy ready-to-cook fish product? Insights from the UK

Hayley Alter, Emmanuel Tsekleves*, Serena Pollastria

ImaginationLancaster, Lancaster University, UK

*corresponding email: e.tsekleves@lancaster.ac.uk

doi.org/10.21606/drs.2022.744

Abstract: To balance production needs with the need to sustain or regenerate the health of ocean ecosystems, stakeholders in the European fish and seafood sector are calling for transition to a circular economy. New industry methods will produce fish-based foods that consumers are not accustomed to eating so we ask, what will it take for consumers to adopt these industrial circular economy foods? Taking the Seafood-Age consortium product prototype as a basis, we have created a design method for would-be consumers to reflect on their fish consumption practices and possible adoption of the fish product prototype prompted by a design speculation. This paper reports on insights emerging from the research and recommendations for product adoption amongst consumers in the UK. Our findings have implications for food designers, design researchers and fish and seafood, plus more broadly food industry stakeholders concerned with circular economy product and method adoption in industry.

Keywords: fish; food security; circular economy; design research methods

1. Introduction

This paper describes two significant insights emerging from a design method created to research feasibility for adoption of a novel circular economy based Ready to Cook (RtC) fish product amongst consumers in the UK. This prototypical product has been developed through Seafood-AGE: a transnational and transdisciplinary consortium tackling a common social and economic challenge in the European Atlantic Area (EAA): an ageing population at risk from illbeing through increasing food-insecurity. The RtC product exploits the maritime dimension of the EAA regions to create circular economy methods including for novel eco-packaging and smart labelling, as a means of providing accessible nutrients. Key facilitators for product adoption in the market are recommended together with these insights.

The paper begins with a transdisciplinary overview of the social and environmental challenges in the European fish and seafood industry, the knock-on effects this has for nutritional security, and subsequent call for the industry to gain resilience through transition to a

circular economy. However, literature reveals a considerable gap between theory and practical transition in industry, and in particular, how best to engage prospective consumers in adopting fish products that leverage novel circular economy methods of sourcing and manufacture. In response to this call, we posit that Design can play a vital role in bridging this gap – not just as a tool for marketing but for product development and placement; through the design of methods that support participating consumers to explore current practices, speculate future ones, and to generate narratives that can be communicated to stakeholders, as a means for co-creating products and adoption in a transitioning industry.

Before exploring the fish and seafood industry in terms of circular economy, it is useful to provide a brief overview of fish consumptions habits in Europe and the UK. More precisely, a survey conducted across six European countries (Belgium, Italian, Netherlands, Norway, Poland and Spain), showed that consumers generally perceived fish as a fairly inconvenient food product with perceived inconvenience having a strong negative effect on fish consumption frequency (Carlucci et al, 2015). The main factors influencing fish intake include taste, freshness, cost and convenience of preparation (Birch et al, 2018; Bouga et al, 2018). Consumers in the UK are generally ill-informed and confused about the sustainability of their seafood and have little to no awareness of labelling (Tetley, 2016). This is in par with other studies where health related risks, nutritional knowledge and environmental practices are ranked low in terms of consumer concerns (Bouga et al, 2018). Due to their lack of knowledge, UK consumers tend to revert to habitual behaviours and safe choices tending towards the 'Big 5' (Cod, Haddock, Tuna, Salmon and Prawns) (Tetley, 2016).

2. To mitigate risk of nutritional insecurity amongst populations in Europe, its fish and seafood industry must transition to a circular economy

As human populations grow, fish and seafood are seen increasingly as a vital source of protein in a healthy and nutritionally secure diet (McCarthy et al, 2019; Fletcher et al, 2021). Fish and shellfish proteins have long been understood to have healthful properties compared to other animal protein sources (Thurstan and Roberts, 2014). They are lower in saturated fats than red meat, and oily fish is an excellent source of essential fatty acids (Calder, 2004; Thurstan and Roberts, 2014). Fish also provides a good source of micronutrients including calcium, selenium and zinc (Daviglius et al, 2002; Beveridge et al, 2013; Thurstan and Roberts, 2014). Together, these properties are thought to lower the risk of cardiovascular disease and support brain development and cognition (Thurstan and Roberts, 2014). As a result, recommendations for fish and seafood intake around the world range from 97g to 550g per week. However, richer nations currently aspire to consume more than they can produce (ibid.). For example, UK government body, the Foods Standards Agency, recommends we eat 280g per week (Food Standards Agency, 2010) but the UK can only supply 19% of that intake through wild domestic landings alone (Thurstan and Roberts, 2014).

To make up the shortfall in domestic supplies across wealthier nations over the last fifty years, complex and growth-based import and export market arrangements, and aquaculture, have been used. However, both approaches have taken a damaging toll on global aquatic eco systems which are now at or close to the limits of what they can provide (FAO, 2012a; UNHRC, 2012; Beveridge et al, 2013). Over-fishing caused by these market arrangements have resulted in the proliferation of marine debris and dwindling fish stocks (Jones and Comfort, 2018; Ruiz-Salmón et al, 2020). In the meantime, changes in water tempera ture brought about by climate change are thought to cause some fish to migrate to waters outside the regions in which countries can legally catch them (Kaiser, 2016).

Aquaculture —often marketed now as 'sustainable'—has increased overall international fish stocks by 10% (Beveridge et al, 2013; Thurstan and Roberts, 2014). However, sustainability claims are greatly undermined by key environmental, nutritional and social factors. For example, the fish feed used in aquaculture contributes to increased water temperature and acidity, harming local marine and freshwater ecologies (ibid.). Intensively farmed fish produce significantly reduced lipids making them numerous but much less nutritious than their wild counterparts, and therefore poor contributors to food security (Beveridge et al, 2013). Unethical working practices such as child labour and absence of workers' rights noted both legitimately and unfairly in large, opaque global supply chains likewise compromise claims to social sustainability such as Fairtrade certification (Bush and Duijf, 2011; Ruiz-Salmón et al, 2020). It is noted that for as long as these practices are labelled 'sustainable', publics who increasingly value social and environmental sustainability in the fish and shellfish they consume are misinformed, and true sustainable development is inhibited (FAO, 2016; Tlusty and Thorsen 2017; Ruiz-Salmón et al, 2020).

To balance production needs with the need to sustain and even regenerate the health of ocean ecosystems (Laso et al, 2019), stakeholders in the European fish and seafood sector have long since called for transition to a circular economy (FAO, 2009; FAO, 2016; Ruiz-Salmón et al, 2020; Fletcher, St Claire and Sharmina, 2021). While there is a growing canon on models for transition (ibid.), the gap between concept and practical application remains, pointing to a need for increased communication and knowledge exchange between all stakeholders (Ruiz-Salmón et al, 2020). For those who are the would-be consumers, new industry practices will inevitably give rise to products that populations are not yet accustomed to eating. Here lies a question and opportunity on how Food and Design can help us address global sustainability challenges while enhancing overall health and wellbeing. The following section maps out potential key barriers and facilitators in supporting populations, particularly across Europe, to adopt foods designed and produced in a circular economy.

3. But will it taste good?

Taking publication, the International Journal of Food Design, as an example, at the time of writing, a search dating back to when it was established in 2016 revealed numerous articles on matters of sustainability. However, only one (Campagnaro and Ceraolo, 2017) featured

the term ‘circular economy’ in the text. The article like others that connect matters of circular economy and food (for example, Fassio and Minotti, 2019) is written from the perspective of food and food systems in closed loop urban environments. This indicates a scarcity of literature focusing on adoption of industrialised circular economy products at scale, and the difference between perceptions of sustainability and circular economy.

What would it take for consumers to buy, prepare and eat circular economy fish products that appear different to the kind of fish products they are used to consuming? Attempting to ‘educate’ consumers on these new alternatives and convince them of moral imperatives are not enough, argues Højlund (2020). This may be especially true in the case of fish as it problematises common perceptions of sustainable food due to the industrialised processing required. Consumers across Europe commonly associate the concept of ‘processed’ with unhealthy foods of limited nutritional value that can lead to obesity and other diet related disease (Fischler, 1988; Wrigley and Ramsey, 2016; Højlund, 2020). This is, of course, a problem of the food industry’s own making through longstanding, successful marketing of these foods to elicit positive emotions (Wrigley and Ramsey, 2016), and the backlash in countless popular sources over the last twenty-five years such as, Supersize Me (Spurlock, 2004), Fast Food Nation (Schlosser, 2002) and Food Inc (Kenner, 2009) that demonstrated how consumers have been manipulated, turning the link between notions of “processed”, dishonesty and manipulation into commonly accepted wisdom. By contrast, the concept of ‘sustainable’ food is linked to honesty and ‘knowing’—knowing the provenance, having short ingredient lists, being able to clearly see and identify ingredients in the physical product (Højlund, 2020; Ruiz-Salmòn et al, 2020).

Much like the concepts described above, consumer taste preferences are socially and culturally constructed (Howes and Classen 2014; Højlund, 2020). Evidenced in the fact that tastes in food change between communities and regions, we depend on each other to shape our tastes and open ourselves to new alternatives. Matta (2019) illustrates a particularly fascinating example in the case of celebrity chefs and other food commentators who have in recent decades increasingly assumed political and social roles, shaping practice, policy and dis course around how and what to buy, prepare and eat, enforcing the connection between food, and matters of political morality, citizenship, humanity, and ecology. They have done this though being able to leverage traditional and broadcast media as well as proliferating online and social media channels (Barnes 2017; Johnston and Goodman 2015; Piper 2015; Sassatelli 2004 et al in Matta, 2019). New alternatives must therefore be ‘felt’ and experienced while we take our cues from developing new food preferences and practices from each other and from those, such as celebrity chefs, already in a position of influence over what and how we eat (Carolan, 2016; Højlund, 2020).

4. The seafood age prototype

The collective aim of Seafood Age is to create a new Ready to Cook (RtC) fish product prototype that is intended to be accessible, easy to prepare and eat and is nutritionally enhanced

to support ageing populations at risk of food insecurity and to improve health. Partners across the project have developed novel circular economy methods for:

- Sourcing, processing and forming fish from local catch across the Atlantic Area region that would otherwise be discarded.
- Growing and converting farmed seaweed into a base for a nutritious sauce and into the product packaging
- Monitoring the product for safety throughout its lifetime to reduce waste. In particular, smart labelling on the packaging that connects a temperature sensor to digital information on product provenance.

As such the approach to this challenge is very much interdisciplinary exploring the intersections of seafood with nutritional ingredients, design, packaging and eco-innovation.

As an academic partner in this pan-European Atlantic Area project, the aim at SeaFood-Age is to: inform prototype development and support stakeholder buy-in across RtC value chains in At lantic Area regions; establish feasibility and identify regional barriers to buying, preparing and eating a RtC fish product such as the Seafood-Age prototype Our key objective is to help establish this feasibility through the design and delivery of research methods and tools that can eventually be deployed across European Atlantic Area regions. The data they generate are intended to evidence for where and how in the market such a product could be placed, and communicate what it will take for would-be consumers to adopt a product that may, through its different innovations, represent a change in their own fish consumption practices.

5. Our approach

Given the goal of our work, our approach to design covered in this paper was shaped by a research aim to be able to describe existing practices of fish and seafood, buying, preparing and eating from the perspectives of those taking part. Informed by Elizabeth's Shove's thesis on social practices, what we eat, when we eat, how we eat, how we prepare food are as Shove et al say 'partly constituted by, and away embedded in material arrangements' (2015). By investigating them, we have a way of seeing, analysing and reconfiguring the structures intersecting and shaping those practices, often many at a time, making such an approach especially pertinent in the realm of sustainability, where the intention is to influence behaviour change (Skene, 2021; Schifferstein, 2020). Creating a point for exchange to reflect together on existing fish consumption practices is intended to produce a 'crucible' for participants to have tacit, deeply embedded knowledge surfaced, re-presented back to the participant and explored to elicit new perspectives (Heron and Reason, 2008).

Literature that tackles the adoption of new day to day consumption practices—including literature highlighted in section 3— indicates pro-social approaches to change. They describe methods designed to share and exchange knowledge, believed to support stakeholders to build trust, engender changes of mindset, generating capacity and feasibility for change

(Watson and Meah, 2012; Herrero et al, 2020). Integrating would-be consumers into knowledge sharing can help: shape the design of new products, address anxieties around preparing and eating fish and seafood, and generate public investment in novel practices (Watson and Meah, 2012; Lusk et al, 2014; Camacho-Otero et al, 2018; Chamberlin and Boks, 2018; Herrero et al, 2020). Additionally, taking a collaborative approach enables research participants to document the broadest possible diversity of ideas, perspectives and other contributions in 'their own voices' unfiltered and unaggregated and by the researchers alone, and unimpeded by barriers as far as possible. As Galabo et al (2020) describe in the case of co-design research and practice, the purpose of generating a high volume of contribution is thought to be conducive to democratic, co-constructed, jointly owned, and ultimately, better synthesised design responses.

Our approach was also informed by the challenges of lockdown and social distancing during the Covid-19 pandemic. To create an accessible alternative to meeting in person, we looked to digitally mediate dialogue and participation through combining video conferencing with Facebook which we cover in the next section. However, this also presented an opportunity with respect to engaging older participants. For instance, Tabassum (2020) cited that prior to the Covid-19 pandemic 47% of people aged 75 and over had never used the Internet according to 2019 ONS figures on Internet users in the UK. Given this new reliance on the Internet, we saw that added value could be generated if the research method was designed in a way that was simple to use and supported the development and familiarisation with digital and online skills.

6. The research method: Using Facebook to explore and document fish and seafood consumption practices

We utilised a private Facebook 'Social Learning' Group to support research participants to describe their practices of fish and seafood product consumption during an one-to-one, approximately one-hour, conversation with the researcher. The group structure was divided into six 'guides' designed to engage and prompt reflections on thoughts, experiences and memories connected to different aspects of their practices using images. See figs 1 to 12. Guide 1 used images of products to spark response, memories, experiences and so on. Guide 2 prompted recollection of the last fish meal the participant had. Guide 3 asked the participant to describe the fish products they have in their kitchen including whatever they anticipate discarding. Guide 4 explored participants' general values and how they may link to the food participants buy, store, prepare and eat, when, how and why they do it. Having explored existing practices, Guide 5 was a design speculation, presenting a realistic fictional version of a new Seafood Ready to Cook (RtC) fish 'fillet' prototype, encountered in ASDA, a UK supermarket, as if it was a supermarket own-branded product. The speculation prompts response to the product, discussion about the circular economy methods used to make it, perceptions of those methods and discussion around what it would take to buy and eat it. The final guide asks participants to evaluate their experience of engaging with this research

method. The design decisions behind the development of the tool are beyond the scope of this paper and have already been reported in Alter et al (2021).

Participants could record their responses to the posts and view the responses of other participants in each guide by using the 'comments' function. With conversation supported by video conferencing software, the researcher shared access to the Facebook group if the participant had a Facebook account and wanted to access the site for themselves. Alternatively, the researcher used screensharing on video conferencing to show the participant the Guides and the comments being recorded on their behalf. However, as social distancing policies relaxed throughout 2021, new opportunities emerged to speak to participants either online or in person. Provided the participant was given a way of recording comments that suited their needs, and could see the images either online or offline, the method could be transferred without effecting the structure or the richness of the data generated.

The emerging insights from this research described in the next section are based on conversations with 15 participants (n=15), ranging from 33 to 70 years old. 12 participants lived around North-West England, one participant was based in South England, one participant was based in South-East England. Six participants described their gender as male and nine participants described their gender as female. Participants represented different household arrangements including living alone, living with a partner or spouse, having children at home of different ages, having adult children who return periodically. No participants had caring responsibilities for dependants other than their children (and pets). 12 participants described themselves as having good health. One participant described their health as poor. One participant described challenges they experience with ongoing acute stomach sensitivity and the restrictions they need to place on their diet to reduce pain. One participant also discussed stomach sensitivities which influenced their diet but they did not describe those issues as acute. One participant described themselves as legally blind. 13 participants had an occupation. One participant described themselves as vegetarian for ethical reasons linked to environment conservation and did not eat fish.

6.1 Limitations

The limitations of this method included the absence of collaboration with research participants as would-be stakeholders in the future of the product beyond an exploration of existing practices and responses to the speculation. Despite the apparent accessibility of using the Facebook platform, a facilitated conversation remained central while the platform is used to facilitate and document participation. This method produced detailed reflections on fish consumption practices which participants noted as being an enjoyable and informative experience, but it also limited the numbers of people able to participate and prevented exchange between participants afforded by the comments function, as opposed to exchange between participant and researcher.

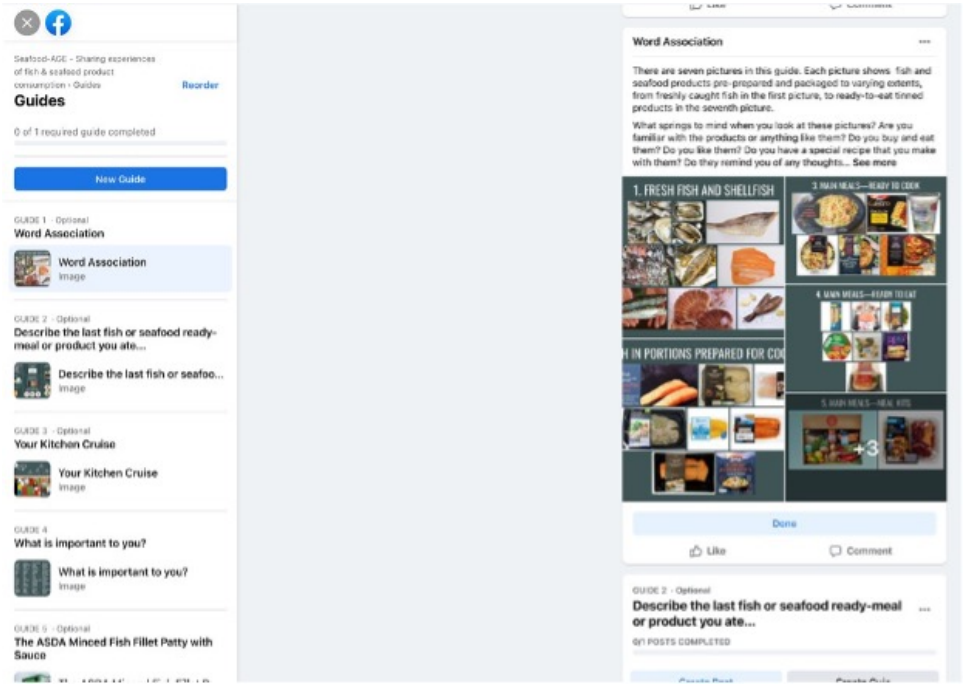

Figure 1. overview of Guides tab in the Facebook Social Learning Group. Guide 1 is selected here

Figure 2. Example of post in guide 1

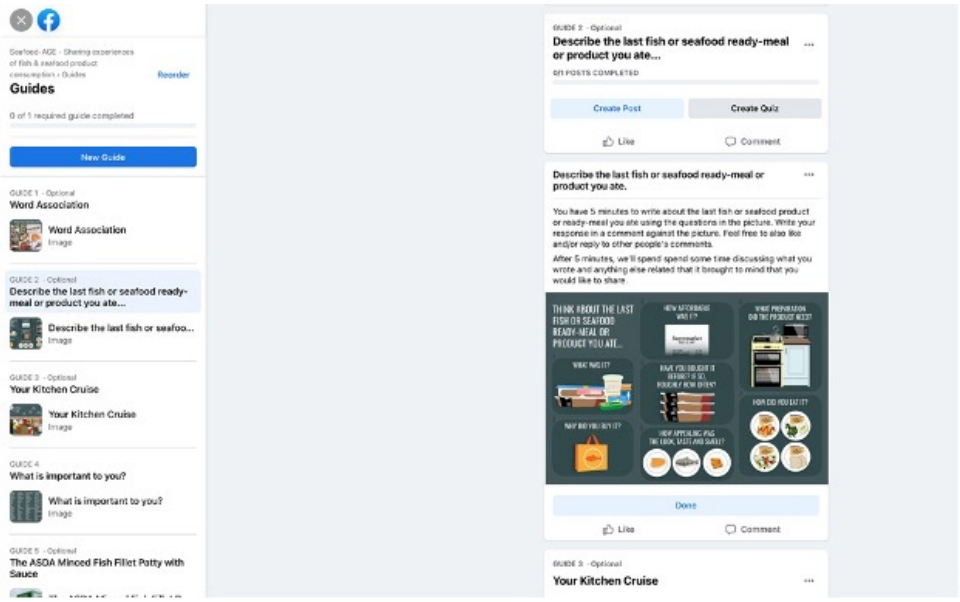

Figure 3. Guide tab view of Guide 2

Figure 4. Guide 2 post

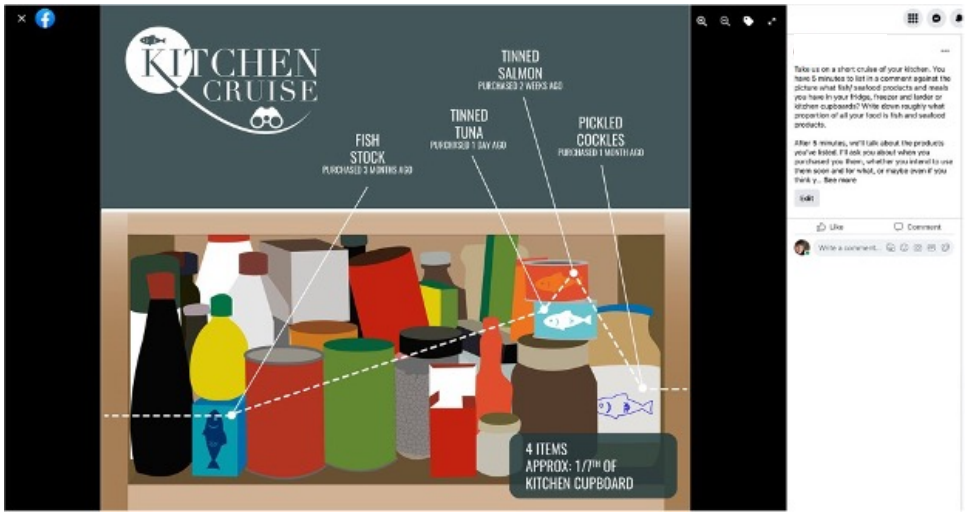

Figure 5. Guide 3 post

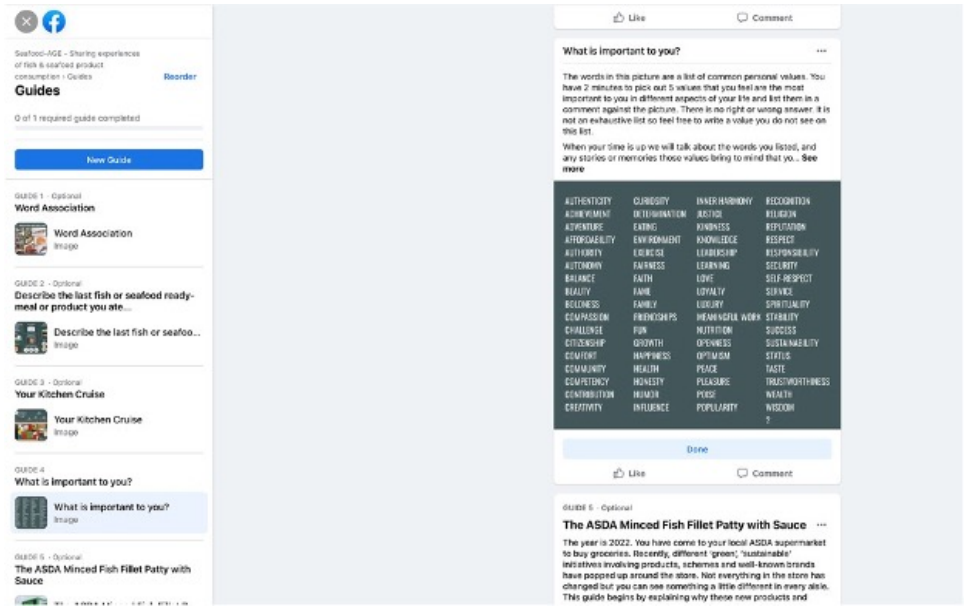

Figure 6. Guide 4 post

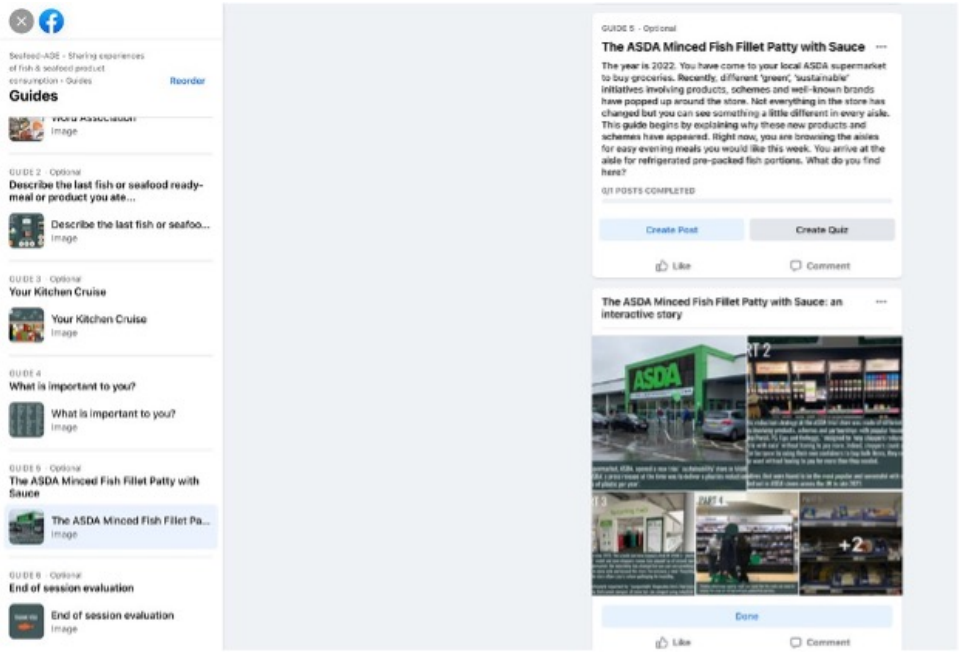

Figure 7. Guide 5 overview from Guide tab

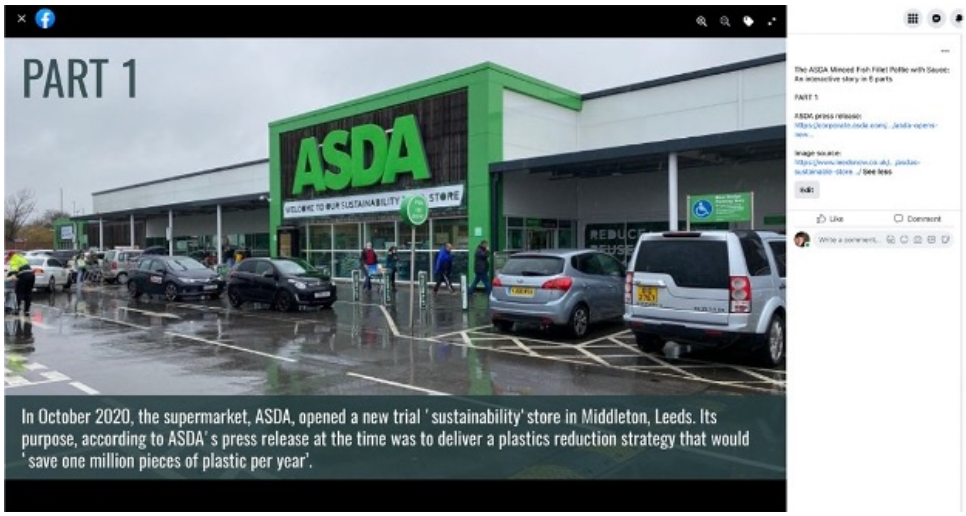

Figure 8. Guide 5, post 1

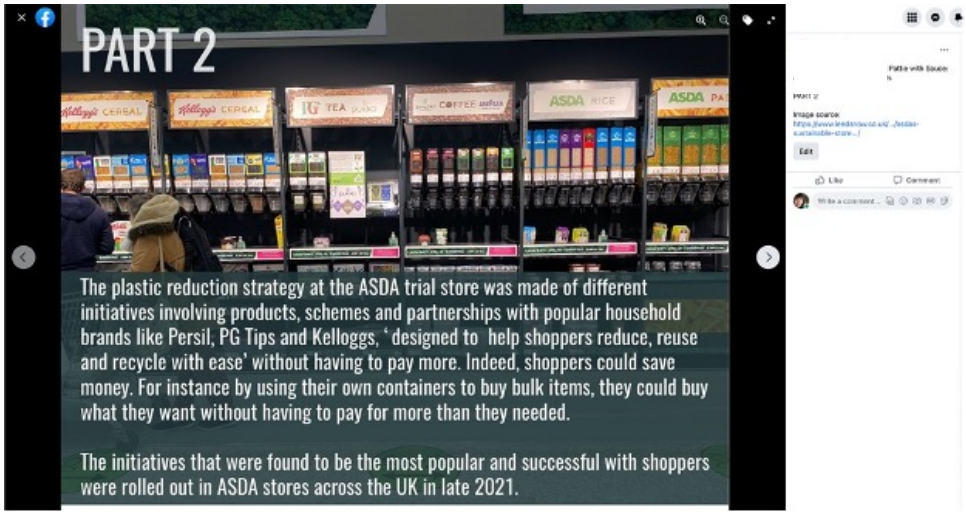

Figure 9. Guide 5, post 2

Figure 10. Guide 5, post 3

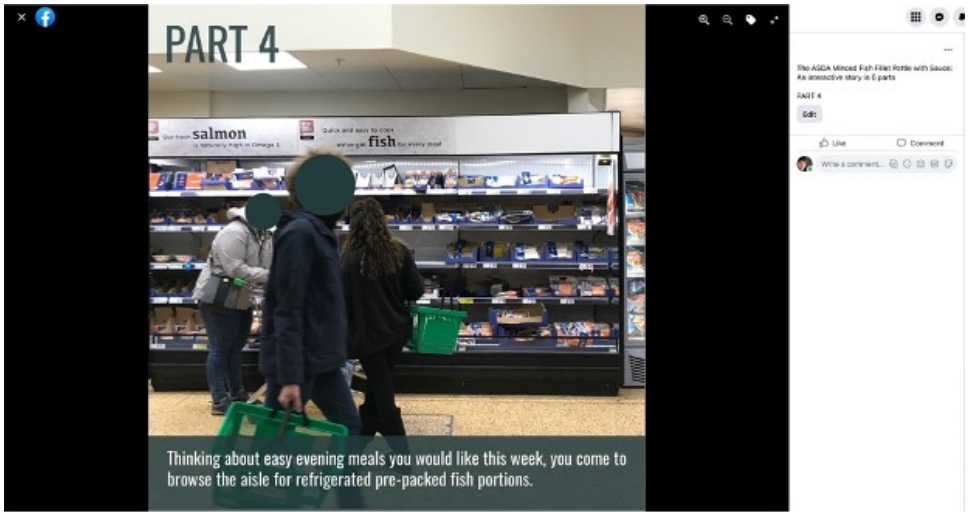

Figure 11. Guide 5, post 4

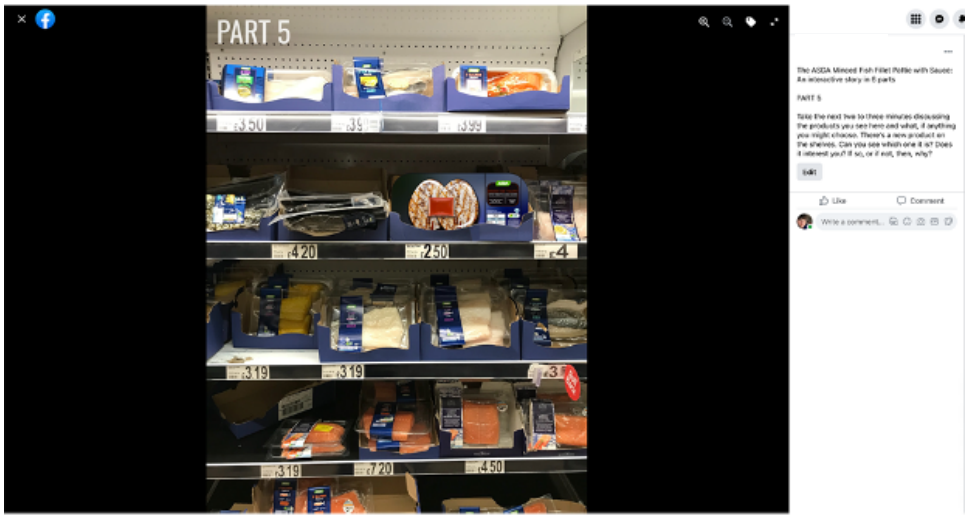

Figure 12. Guide 5, post 5

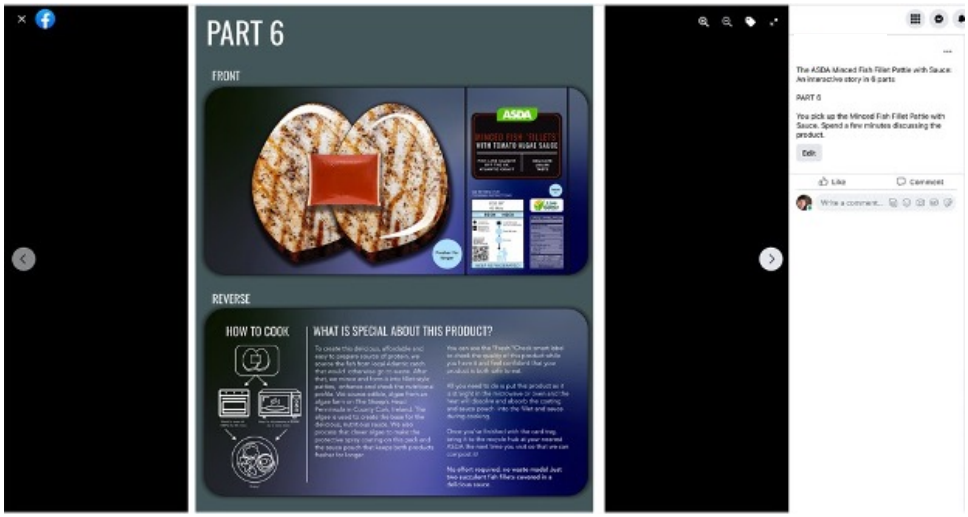

Figure 13. Guide 5, post 6

7. Emerging insights

This section describes two significant insights emerging so far for future adoption of the Seafood-Age RtC fish product from conversations designed to share experiences of fish and seafood product consumption. Those insights are: 1) Consumers need to learn more about circular economy food and be assured of its safety by peers and experts and; 2) For market placement – the product is a staple that can be used in different ways to provide a healthy source of protein. Building on a nascent understanding in literature of industrial circular economy food product adoption described in section 3, they highlight key areas that we recommend should be addressed for product acceptance and adoption amongst consumers in the UK. They offer a basis for understanding as we build a picture of acceptance across Atlantic Area European regions. In the Figure below we summarise the key findings

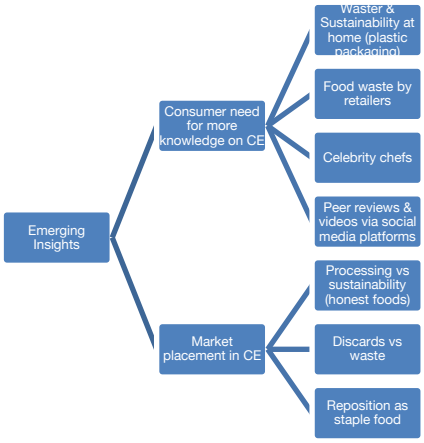

Figure 14. Summary of key emerging insights from the study

7.1 Consumers need to learn more about circular economy food and be assured by peers and experts.

> 'Its about being compassionate to our environment and recognising that we're only - that we don't own the earth, we're just part of the while eco system and that human existence is fragile'

The participants demonstrated an accepting attitude towards eating foods that supported them to make sustainable choices. In particular, some discussed waste, with respect to sustainability. Many expressed their concerns with the amount of plastic packaging that's used on refrigerated ready to cook and ready to eat fish products and believed it to be excessive.

There was also concern expressed about how much wrapped, ready-to-eat fish (for example, tuna sandwiches) was thrown away by retailers every day. 6 out of 14 of the participants were familiar with the term, 'circular economy'. However, none of the participants had previously associated the term with the possible need to process fish discards. This leads us to believe that education around the circular economy is required. Likewise, expectations for what it means consumers will eat should also be part of that communication. Five participants discussed their willingness to try new foods, discussing how they like to experiment with them, together with friends, and enjoy the learning and sense of adventure that trying new foods can offer. Communicating and exchanging knowledge about an adventurous new product, treated as a journey into a circular economy food experience could be a way of shaping public knowledge exchange around the Seafood Age food prototype.

Section 3 of this paper described the phenomenon of celebrity chefs and other food commentators on broadcast and social media shaping our discourse and attitudes around what and how we eat [Matta, 2018, Carolan, 2016; Højlund, 2020]. This idea was reflected in the comments of three participants taking their cues and ideas for what to eat from a range of platforms and outlets. These responses offer an idea of how and where the product could be communicated and the opportunity that such a product could provide to bring about greater awareness of circular economy food and the use of novel ingredients. One participant de-

scribed how they use the social media platform Pinterest to get recipe ideas on a regular basis. One commented on their use of recipe social media platform, 'BBC good food', talking about how useful they find the reviews of listed recipes written by other readers. One partic ipant discussed an idea to create films of members of the public eating the food that tied in with education on the circular economy. Another participant suggested introducing each innovation separately to the market through reputable vendors synonymous with high quality, luxury food.

> 'If it was in Booths or Waitrose or M&S and they were selling a normal fish to test the algae sauce. Like a, "why not try this algae with your seabass". That marketing would get me comfortable and I would fall for it. If a chef in a restaurant introduced [the sauce] to me and said "Look, here is something very innovative and we think it's the future." And they described it to me, and it was on offer, then I would say yes. Served on a nice plate that looks a bit more posh! Not necessarily a celebrity chef, but a chef at a restaurant that was prepared to risk their reputation and business on getting people to try it. [That would] make it trustworthy and not something that will kill me."

In the final line above, the participant is looking for assurance that a new product made using novel circular economy methods is safe to eat. This is especially pertinent to fish products that carry considerable associations around risk to health.

> 'I'm very careful when it comes to seafood. I do perceive it as the most high risk type of food and because of bad experiences, I don't feel guilty about throwing it out. I'm quite well organised though so it's quite rare and the type of seafood I get, I can freeze. Fresh prawns and fish go straight into the freezer.'

An element of the product that most of the participants discussed with concern was the idea of a spray algae-based coating that effectively dissolved in cooking. Though this element of the product is still under development, the design speculation presented it without an outer sleeve, describing the coating as dissolving in the cooking process. They viewed it as unsafe and open to wide range of risks including exposure to contaminants along the cold-chain and on supermarket shelves which they saw as likewise absorbing into the product. One participant said:

> 'It's just the idea that it's sat on a supermarket shelf as a package and then becomes food. I don't like that, even though it's actually a good idea. I'd rather just see something compostable as the package—something you can take off and put on your compost heap yourself like an algae based "plastic"'.

7.2 For market placement: The product is a staple that can be used in different ways to provide a healthy source of protein

While some said they agreed with the principles behind the product, this attitude did not override perceptions of quality, which dominated most of the conversations. Linking to existing concepts of food sustainability as 'honest' food in which the provenance of short ingredient lists is known and visibly identifiable in the product [Højlund, 2020; Ruiz-Salmòn et al, 2020], the fish mincing and processing required to make the discards accessible, edible and

nutritionally enhanced puts the product at odds with our expectations for quality. Considerable efforts would therefore be required to clearly communicate the provenance of the fish, the value of using discards and by-products and the nutritional profile for consumers who associate good quality with good health. Quality with respect to fish is perceived as being able to clearly see the flesh of the fish which one participant commented that they are care ful to check.

> 'I buy both the frozen and fresh fillets. Sometimes It's a bit like buying chicken products. You have to really read the label to make sure you're getting proper fillets and not mashed up bits. If you want the fillet flakes, you have to be careful and look. We just don't like mashed up bits. We want to see the filleted flakes. We want to see the fish steak.'

Three of the participants expressed disgust at the idea of eating a minced fish product. The product's use of fish discards from local Atlantic catch was translated as 'waste'. One participant associated the product with the 1973 ecological dystopic science fiction film, Soylent Green,pointing to the stigma and barrier of eating parts of fish we have been conditioned not to eat. This was highlighted by a participant who described the efforts made by processed fast food chain, McDonalds, in the past to make it clear they were not using waste product, linking to our recent cultural experiences of marketing used to elicit positive emotions around processed nutritionally poor foods (Wrigley and Ramsey, 2016):

> '…a while ago, McDonald's did an advert about chicken nuggets, saying it's not full of knee caps and feet and all the unsavoury bits. There's generally a stigma with the bits not used.'

Forming the Seafood Age mince into a fillet-style product further undermined the perception of quality and trust participants had for the product. To those that noted this, the problem they highlighted was in calling the product something other than what it really was.

> 'It's very personal, but when I see the packaging says minced fish but a "fillet" should be an adulterated actual piece of fish. If you buy a bag of Quorn mince and the mince relates to its texture and consistency - you should make it not try to be something that it isn't.'

> 'It's not a fillet, it's a patty and I would never describe a patty as succulent… I don't have a problem with a patty, it just doesn't appeal. I just like the flakes of fish, to know it's come from a fish. I wouldn't want a replication of flakiness.'

A number of participants discussed how this product was much more like a fish cake and should not be placed in supermarkets in the same section as fresh fish fillet portions. Another participant who was raised in South Korea discussed the product's similarity to a commonly used dried fish cake product that consumers use in different ways, such as frying small pieces of it and adding it to soups. These alternatives suggest a placement for the Seafood-Age product as a useful, simple, staple item that can be added to meals in different ways to provide a nutritious a source of protein. Products like fish cakes already carry existing expectations for economical use of fish.

8. Conclusion

In this paper we have described why the European fish and seafood industry needs to transition to a circular economy in light of the knock-on effects current industry arrangement have on nutritional security. We also described an existing literature in its nascence on industrial circular economy fish product adoption amongst populations and the potential shifts needed in perception of those products. We have described how we have used a circular economy fish product prototype developed by the Seafood Age consortium as a basis for engaging research participants in a research method designed to explore and reflect on existing fish consumption practices through a series of visual prompts and probes, and test perceptions on product adoption and exchanging knowledge on market placement using a design speculation. We end the paper with two key insights emerging from the research together with rec ommendations for product acceptance and adoption amongst consumers in the UK: 1. Con sumers need to learn more about circular economy food and be assured of its safety by peers and experts and; 2. For market placement – the product is a staple that can be used in different ways to provide a healthy source of protein. We posit that exploring the transdisciplinary intersections between Seafood and Design can help us address some of societal inter-related challenges of planetary health and sustainability.

We are currently analysing and synthesizing all data gathered in order to develop material to be disseminated to relevant industries and we expect to report the findings and recommendation to the product design and design research communities in a future publication.

Acknowledgements: The authors would like to thank the participants who have kindly given their time to participate in the research described in this paper. The authors would also like to thank the Seafood Age Project partners for the opportunity to contribute to this important work, and for helping to guide and inform the research method development documented in this paper. A full list of the project partners, together with links to more information on the project can be found online at http://seafoodage.eu/partners. Seafood Age project is co-financed by the Interreg Atlantic Area Programme through the European Regional Development Fund.

9. References

Alter, H., Tsekleves, E., Hands, D. (2021) Mapping unchartered waters: Towards a Design methodology for researching the feasibility of circular economy practice adoption in the Ready-To-Cook fish product value chain. In proceedings of European Academy of Design Conference, 14th EAD Conference: Safe Harbors, 11-16 October 2021. 373-393. https://dx.doi.org/10.5151/ead2021-193

Beveridge, M.C., Thilsted, S.H., Phillips, M.J., Metian, M., Troell, M. and Hall, S.J., 2013. Meeting the food and nutrition needs of the poor: the role of fish and the opportunities and challenges emerging from the rise of aquaculturea.

Bush, S.R. and Duijf, M., 2011. Searching for (un) sustainabilty in pangasius aquaculture: A political economy of quality in European retail. Geoforum, 42(2), pp.185-196.

Camacho-Otero, J., Boks, C. and Pettersen, I.N., 2018. Consumption in the circular economy: A literature review. Sustainability, 10(8), p.2758.

Campagnaro, C. and Ceraolo, S., 2017. Fighting food waste towards a new social food chain: The egg of Columbus workshop. International Journal of Food Design, 2(1), pp.103-117.

Chamberlin, L., & Boks, C. (2018). Marketing approaches for a circular economy: Using design frameworks to interpret online communications. Sustainability, 10(6), 2070.

Daviglus, M., Sheeshka, J. and Murkin, E., 2002. Health benefits from eating fish. Comments on Toxicology, 8(4-6), pp.345-374.

Fassio, F. and Minotti, B., 2019. Circular economy for food policy: the case of the RePoPP project in the City of Turin (Italy). Sustainability, 11(21), p.6078.

FAO, 2009. Food and Agriculture Organization of the United Nations. Factors of Unsustainability and Overexploitation in Marine Fisheries. Views from the Southern Mediterranean, West Africa, Southeast Asia and the Caribbean. FAO Fisheries and Aquaculture Circular No. 1037. Rome.

FAO, 2016. Food and Agriculture Organization of the United Nations. The State of the World Fisheries and Aquaculture. Contributing to Food Security and Nutrition for All. Rome.

Fischler, C. (1988), 'Food, self and identity', Social Science Information, 27:275, pp. 275–92.

Fletcher, C.A., St Clair, R. and Sharmina, M., 2021. Seafood businesses' resilience can benefit from circular economy principles. Nature Food, 2(4), pp.228-232.

Galabo, R., Cruickshank, L., and Peréz, D., (2020). DisCO: A distributed co-design approach. Available at http://imagination.lancaster.ac.uk/update/disco-a-distributed-co-design-approach/ (Accessed: 14 June 2021)

Heron, J. and Reason, P., 2008. Extending epistemology within a co-operative inquiry. The Sage handbook of action research: Participative inquiry and practice, pp.366-380.

Herrero, M., Thornton, P.K., Mason-D'Croz, D., Palmer, J., Benton, T.G., Bodirsky, B.L., Bogard, J.R., Hall, A., Lee, B., Nyborg, K. and Pradhan, P., 2020. Innovation can accelerate the transition towards a sustainable food system. Nature Food, 1(5), pp.266-272.

Højlund, S., 2020. Figurations of taste: Sensing sustainable alternatives together. International Journal of Food Design, 5(1-2), pp.133-138.

Howes, D. and Classen, C. (2014), Ways of Sensing: Understanding the Senses in Society, New York: Routledge.

Jones, P., Comfort, D. and Hillier, D. (2011) 'Sustainability in the European Shop Window',European Retail Research, Vol. 26, No. 1, pp. 1-19

Kenner, R. (Producer & Director). (2009). Food, inc. [Film]. United States: ParticipantMedia.

Laso, J., García-Herrero, I., Margallo, M., Vázquez-Rowe, I., Fullana, P., Bala, A., Gazulla, C., Irabien, Á. and Aldaco, R., 2018. Finding an economic and environmental balance in value chains based on circular economy thinking: An eco-efficiency methodology applied to the fish canning industry.

Resources, Conservation and Recycling, 133, pp.428-437.

Lusk, J. L., Roosen, J., & Bieberstein, A. (2014). Consumer acceptance of controversial new food technologies: Causes and roots of controversies. Annual Review of Resource Economics, 6, 381–405.

Matta, R., 2019. Celebrity chefs and the limits of playing politics from the kitchen. In Globalized eating cultures (pp. 183-201). Palgrave Macmillan, Cham.

McCarthy, B., Kapetanaki, A.B. and Wang, P., 2019. Circular agri-food approaches: will consumers buy novel products made from vegetable waste?. Rural Society, 28(2), pp.91-107.

Ruiz-Salmón, I., Margallo, M., Laso, J., Villanueva-Rey, P., Mariño, D., Quinteiro, P., Dias, A.C., Nunes, M.L., Marques, A., Feijoo, G. and Moreira, M.T., 2020. Addressing challenges and opportunities ofthe European seafood sector under a circular economy framework. Current Opinion in Environmental Science & Health, 13, pp.101-106.

Schifferstein H.N.J. (2020) Designing Eating and Drinking Experiences. In: Meiselman H. (eds) Handbook of Eating and Drinking. Springer, Cham.

Schlosser, E. (2002). Fast food nation. Boston, MA: Houghton Mifflin

Shove, E., Watson, M. and Spurling, N., 2015. Conceptualizing connections: Energy demand, infrastructures and social practices. European journal of social theory, 18(3), pp.274-287.

Skene, K.R., 2021. What is the Unit of Empowerment? An Ecological Perspective. The British Journal of Social Work.

Spurlock, M. (Producer & Director). (2004). Super size me [Film]. New York, NY: Hart Sharp Video, LLC Tabassum, N. (2020) 'How are older people adapting to digital technology during the COVID-19 pan-

demic', Centre for Ageing Better, 16 July 2020 [Blog]. Available at https://ageing-better.org.uk/blogs/how-are-older-people-adapting-digital-technology-during-covid-19-pandemic (Accessed 1 Dec 2021).

Thurstan, R.H. and Roberts, C.M., 2014. The past and future of fish consumption: can supplies meet healthy eating recommendations?. Marine pollution bulletin, 89(1-2), pp.5-11.

Tlusty, M.F. and Thorsen, Ø., 2017. Claiming seafood is 'sustainable'risks limiting improvements. Fish and Fisheries, 18(2), pp.340-346.

Watson, M., & Meah, A. (2012). Food, waste and safety: Negotiating conflicting social anxieties into the practices of domestic provisioning. The Sociological Review, 60(S2), 102–120.

Wrigley, C. and Ramsey, R., 2016. Emotional food design: From designing food products to designing food systems. International Journal of Food Design, 1(1), pp.11-28.

About the Authors:

Hayley Alter is the Research Associate for Seafood Age at Imagination-Lancaster. Also completing her PhD, Hayley brings expertise in creating codesign tools for research and engagement. Through Seafood Age, she is developing it in a cross-sectoral, food, sustainability and policy context.

Emmanuel Tsekleves is a professor of global Health Design Innovation at Lancaster University and the Co-Director of the Future Cities Research Institute. He leads international research in design for global and planetary health. He is the author of the Routledge books on Design for Health, Design for Global Challenges and Goals.

Serena Pollastri is a lecturer in urban futures at ImaginationLancaster. She explores ways in which information visualisation processes can be employed to bring together multiple voices exploring pluralistic or contested pasts, presents, and (possible) futures.