



British Gen Z perceptions of sustainable fisheries: developing a measurement instrument

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Abstract

With continued pressure upon fisheries, alongside improved fisheries management in some places, there has been a decline in fish catches with changes in the structure of the ecosystem affecting its' functionality. The use of scientific based indicator frameworks in an attempt to pursue sustainable fisheries is a common trend, however the management decisions are often socially driven and can deviate, or even, conflict with the science. This study aimed to investigate British Gen Z perceptions upon what creates a sustainable fishing industry through a series of three studies. A compilation of 82 statements, derived from practitioner indicator systems, was used by 23 participants in a concept mapping process consisting of five steps; create statements, sort & rate statements, multi-dimensional scaling of sorted units, cluster analysis, and label the clusters. The next stage of the study looked to refine the large number of statements by statistically verifying them with exploratory factor analysis and confirmatory composite analysis using split halves of a sample containing 657 participants and generating a three-factor solution of Community, Ecological Management and, Economic. The domain was then switched to the descriptive typology and a further 179 British Gen Z evaluated the fisheries at Hastings and Brixham based upon case studies which further validated the three-factor solution. The significance of this study demonstrates that consumers, who influence policy and management of fisheries through their purchasing behaviour, interpret sustainable fisheries differently to science which is evidenced by the merging of the elements of ecologically and management.

Keywords Sustainability · Fisheries · United Kingdom · Generation Z · Concept mapping · Scale development

1 Introduction

Sustainable fishing means leaving enough fish in the ocean, respecting habitats and ensuring people who depend on fishing can maintain their livelihoods (Marine Stewardship Council 2020). Despite continuing high pressure on fisheries and the improved efficiency of fisheries management in some parts of the world, there has been a decline in global

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fish catches since the 1980s (Akpalu 2009). This critical problem of declining fish catches stems from overfishing, which leads to changes in the structure of functionality of the ecosystem, leading to species extinction (Liu and Ou 2007). This problem has been recently quantified by estimates of 34% of fish stocks are over fished, with 66% of stocks fished 'sustainably' but this interpretation of sustainability can vary widely (Huse et al. 2021). Fisheries are also affected by multiple global challenges including; climate change, habitat degradation, pollution, over-capacity of fishing vessels, illegal activities, as well as inequitable distribution of access to these fishery resources (Giron-Nava et al. 2021). This is in light of the population of the planet forecast to reach eight billion in 2023, with 10 to 12% of this population estimated to rely directly on the ocean for food. Yet, unsustainable fishing may be responsible for a loss of up to 30 times the potential yield of major fish stocks (Gaillet et al. 2022). Whilst this is undoubtedly a wicked problem, it is clear that the global fisheries need to be managed sustainably to provide food [and livelihoods] for a growing planetary population. Building upon the Brundtland reports' definition of sustainability, Kenny et al. (2018) define sustainable fisheries as '*managing fisheries sustainably requires protection of ecosystem structure and function while also considering people's current and future needs as part of the marine ecosystem*'. Yet Angel et al. (2019) suggest that a significant problem that has predominately risen in contemporary approaches to sustainable fisheries management is that the definition of sustainability has tended to be considered narrow.

A narrow definition of sustainability that has focused upon a single species of economic interests fails to take account of the concerns of fishing communities, environmental activists and recreational fishers (Angel et al. 2019). With this in mind, sustainable fisheries management has been transitioning from single species evaluation to placing more emphasis upon a broader ecosystems approach (Degnbol and Jarre 2004). This ecosystems approach to fisheries management tends to have indicator frameworks to guide the decision making process of management, with the benefits of the indicators being; (1) they describe the pressures that impact the ecosystem, (2) indicators track the progress towards the intended objectives and, (3) indicators assist in communicating to a non-technical audience the complexity of the ecosystem approach (Gaillet et al 2022; Jennings 2005). There has been a rapid development of indicators to quantify sustainable fisheries (Boyd and Charles 2006), but no single indicator model can describe all aspects of ecosystem dynamics (Gaillet et al. 2022). Thus a suite of indicators is required (Cury and Christensen 2005). Yet, although this ecosystems approach and indicators can be used to support management decisions, the higher-level objectives of the sustainable fisheries management of social concern and science can only provide a commentary on the effects of the proposed objectives (Jennings 2005). Thus, although the ecosystem approach takes a more comprehensive view of fisheries management, it still falls short of a holistic approach, especially considering the overarching objectives are socially constructed only guided by science. There is a prominent social aspect to fisheries, as they are essential for the subsistence, cultures, and livelihoods of people in coastal nations around the world and the largest employer in the ocean economy (Giron-Nava et al. 2021).

When considering the triple bottom line of sustainability (economic, environmental and social) as coined by Elkington (1998), even the broader ecosystems approach only focuses upon the environmental aspect and thus is still relatively narrow conceptually. This approach can be further criticised because even with high stock levels of target species, it does not mean that it will create economic sustainability that can support the residing community (Anderson et al. 2019). Anderson et al. (2019) further suggest that considering the triple bottom line approach requires acknowledging that the sustainability of fish stocks,

fishing industries, and fishing communities are interrelated. However, the author would suggest that this does not go far enough and that to take an even further holistic view would need to include stakeholders through the value chain, including the consumers. Yet, for over two decades, the commitment to a holistic approach to the fisheries system involving the full spectrum of stakeholders; fish, fishers, communities, ecosystems, markets, social networks and even belief systems, has gone unrealised (Angel et al. 2019).

Whilst indicators offer an objective measure of sustainable fisheries; people tend to act based on their perceptions more reliably than objective reality (Hansen et al. 2016). Hence, a fishery could be deemed sustainable objectively by indicators, but an individual's perceptions may consider it not sustainable, which may lead to negative actions being undertaken. Hence, both objective and subjective measures will be required for a holistic approach to measuring sustainable fisheries. Thus, this paper bridges the gap between objective and subjective evaluations of sustainable fishing. While interdisciplinary research on fisheries has managed to incorporate biologists, ecologists and economists, there is still a lack of social science incorporated into the study (Phillipson and Symes 2013). This piece of research collates existing indicators of sustainable fisheries. It then uses these as a basis for initially conceptualising sustainable fisheries before moving to develop a measurement instrument and testing this in real-world application with British Gen Z participants, where Gen Z are those 18–24 years of age.. British Gen Z were selected not for having expert knowledge upon fisheries to perform an objective evaluation, but for having perceptions influenced by a great manner of inputs that lead to subjective evaluations. However as pointed out by Hansen et al. (2016), people act more reliably upon these subjective perceptions. Thus, as Gen Z become responsible for households, this may influence their purchasing behaviour and as Gen Z take up managerial and political roles, these subjective perceptions may influence company and governmental policy. The paper continues next with a brief literature review of sustainable fisheries and a justification for the research conducted. The proceeding section composes the methodology and results; this section has been merged as multiple studies have been performed sequentially; hence each of the three studies in this paper discusses their methodology and reports their individual results before continuing to the next study. After all three studies have been presented, the paper then turns to the discussion of what the results mean theoretically and then discusses the methodological implications of the adopted methods. The article is then concluded, and the limitations and suggestions for future research are covered.

2 Literature review

The contemporary idea of sustainability is based upon the notion of sustainable development (Rego et al. 2017), which is defined as "development that meets the needs of the present without comprising the ability of future generations to meet their own needs" (WCED 1987). This notion generally adopts the triple bottom line model, which consists of people [social], the planet [environment] and profit [economic] elements (Strand 2014). The immediate issue with this model is that the dimensions have an inherent paradoxical tension between them (Gallagher et al. 2018). Thus, sustainability is difficult to objectively interpret, with the nature of the concept lending itself to subjectivity as many intangible elements are involved. However, whilst fisheries may aspire to achieve sustainability, many fisheries consist of a multi-species, multi-fleet nature means many fisheries would not fulfil current sustainable fisheries certifications (Jaffry et al. 2004). Additionally, there is huge

discrepancies across the planet of the implementation of sustainable fishing practices, suggesting a wide range of interpretations (Huse et al. 2021). Fisheries add additional complexities to the sustainability concept, such as; the logistical complexity of monitoring and management, including the absence of easily observable effects of non-compliance and multiple access rights to the resources (Kaiser and Edwards-Jones 2006). Simultaneously, the natural marine ecosystem is interdependent and complex, where the loss of a species could create cascading changes and an exponential impact that has unexpected repercussions (Akpalu 2009). Thus, sustainable fisheries are a multi-faceted and complex notion. Yet, a growing body of research demonstrates improved fisheries management will assist the recovery of overfished stocks and improve a wide range of ecosystems across the world (Giron-Nava et al. 2021).

Many other fields of study have attempted to overcome the complexities of sustainability by adopting the quadruple, where the quadruple bottom line proposes that the triple bottom line is not enough and an additional, more specific factor is needed to achieve sustainability within a given context (Michael and Elser 2019). However, this may be insufficient, too, as it is noted that even when social elements are considered, only those elements align with effective fisheries stock management and not the social and economic desired outcomes of stakeholders (Anderson et al. 2019). Even further issues arise that, although acknowledged that sustainability should incorporate social, institutional and ethical considerations, these are usually overlooked to emphasise biological and economic factors (Angel et al. 2019). Current approaches to fisheries management in an attempt to make them sustainable which has relied on an emphasis on the biological or ecological aspects, have failed to deliver a knowledge base for fisheries management that stakeholder accepts. Thus current approaches have lost legitimacy (Degnbol and Jarre 2004). While governments and agencies have made commitments to sustainable fisheries; the implementation has been lacking considering the time the sustainable fisheries concept has been in use (Shelton and Sinclair 2008). At present, the planet will not meet the sustainable development goal (SDG) on Life Below Water, even though most of the world's government have agreed to this target (Huse et al. 2021).

The term 'sustainability' has connotations of ambiguity, as described by Shelton and Sinclair (2008), with a narrow interpretation focusing upon a single species of economic interest which fails to incorporate the concerns of the wider fishing communities, environmental activists and recreational fishers (Angel et al. 2019) with policy documents containing the word 'sustainable' but with little detail of its' meaning or how to implement it (Shelton and Sinclair 2008). There is an expectation that should fishing be conducted responsibly or 'sustainably', it will provide a long-term source of natural healthy food (Shelton and Sinclair 2008). An over-simplistic view would be to reduce the number of fishing vessels; however, this reduction does not necessarily imply a reduction of catch capacity, as improved technology increases vessels' catchability suggested by Standal (2005), however even with this improved technology, fish landings have plateaued at approximately 35 million tonnes a year in the 1990s (Huse et al. 2021). With this in mind and simplistic view disregarded, there are a range of management strategies available; co-management, rights-based management, quotas and marine protected areas to name a few (Giron-Nava et al. 2021). However, sustainable fisheries management has been transitioning from single species evaluation to placing more emphasis upon a broader ecosystems approach (Degnbol and Jarre 2004; Gaillet et al. 2022). This ecosystems approach to fisheries management intends to ensure that the aspects of planning and development of management will meet the economic and social needs of the present whilst ensuring that future generations benefit from the marine ecosystem (Huse et al. 2021; Jennings, 2005). This is

because single species management does not consider effects upon dependent or competing non-target species that share the habitat proposed by Cury and Christsen (2005) and reasserted by Gaillet et al. (2022) stating that impacts spread across all levels of biodiversity. However, the ecosystem approach maybe critiqued by the lack of understanding of the marine ecology which does not allow for a comparison between marine species importance in their ecosystems which would lead to the determination of overexploitation's impact on intrinsic biodiversity (Gaillet et al. 2022). Yet, although this ecosystems approach can be used to support management decisions, the higher-level objectives of the sustainable fisheries management of social concern and science can only provide a commentary on the effects of the proposed goals (Jennings 2005). Even with an ecosystem approach to management there have been cases where fishing pressure was not reduced, and cases where fishing pressure was reduced but stocks nevertheless did not recover (Melnychuck et al. 2021). Whilst political commitments to the ecosystems approach have increased (Jennings 2005), there is a clear disconnection between the ecological goals and social desires (Kenny et al., 2018); hence there is a need to 'sharpen' the definition of sustainable fisheries, as fisheries can be considered 'sustainable' over a broad range without fully realising the benefits (Shelton and Sinclair 2008). Thus, although the ecosystem approach takes a more comprehensive view of fisheries management, it still falls short of a holistic approach, especially considering the overarching objectives are socially constructed only guided by science. Despite, the emphasis within the literature on adopting the ecosystem approach, systems of sustainability indicators in evaluations of fisheries remain largely focused on individual stocks and their management alternatives (Marentette and Zhang 2022). With Gaillet, Asselin, and Wermeille (2022) proposing the transition from the traditional, single species management system to a new more adapted ecosystem one is slow but possible.

In the pursuit of sustainability, there are several aspects that are essential: scientifically based stock assessment and management advice, regulation of access to fisheries and catch restrictions, and enforcement of regulations (Huse et al. 2021). However, the limited understanding of the effectiveness of different management approaches hinders fishery-rebuilding initiatives around the world, impedes progress towards zero-overfishing and diminishes potential global food production from capture fisheries (Melnychuk et al. 2021). To evaluate and track progress in seeking sustainability, many management and policy bodies that focus on marine systems have backed the use of indicator-based approaches to managing these fisheries (Rice and Rochet 2005). Indicators can be defined as pointers, variables or indices of a phenomenon commonly used within environmental reporting, research and management (Jennings 2005). Whilst indicators do offer benefits to fisheries management, several drawbacks hinder sustainable fisheries management. These drawbacks include that even with the selection of a moderate number of indicators leads to arguments about incompatible management actions, with the choice of indicators becoming based upon the agenda of the agent in charge, who is likely to select indicators whose values will support the decision they desire (Rice and Rochet 2005). Additionally, there has been a lack of 'success stories' with the use of indicator-based systems (Potts 2006), with scientists asked to evaluate the effects of fishing and management over a short time frame (Rochet and Trenkel 2003), which runs contrary to the long term perspective of sustainability; thus creating a reluctance for further widespread adoption.

When determining objectives for fisheries management, they are often grouped into conceptual (general but vague statements) versus operational (specific, practical or direct statements) categories (Marentette and Zhang 2022). With the successful implementation of an indicator-based system needing to consider the arrangement of governance to which it is linked, including reference points, decision tools and stakeholder engagement

(Potts 2006). The author would like to emphasise the stakeholder engagement element as previously discussed; the higher-level objectives of sustainable fisheries management are of social concern (Jennings 2005); thus, incorporating stakeholders throughout the entire value chain of fisheries is necessary. This argument is in-line with an emerging debate on incorporating different competencies in the decision making process and defining who are the legitimate stakeholders to be involved (Standal 2005). Whilst, effective fishery management is crucial in the long-term sustainability of fisheries, only focusing upon ecological sustainability risks disregarding ultimate goals related to well-being that must be achieved through broader social policy (Giron-Nava et al. 2021). This acknowledgement further supports the incorporation of a broad range of stakeholder within the development of evaluative tools such as the objectives and measures, however, when engaging non-technical stakeholders the objectives may remain conceptual as highlight by Marentette and Zhang (2022) prior. Still, other elements, such as the reporting or even feedback mechanisms through the stakeholders, are often overlooked (Potts 2006). This is despite the societal value placed upon the maintenance of biodiversity and the ecosystem's functionality, as social actors place more value upon non-value use, recreational importance, and safeguarding of future options (Shelton and Sinclair 2008).

This study focuses on the consumers' perspective of sustainable fisheries, as consumer choices concerning food significantly impact the environment (Kamenidou et al. 2019). Consumers may not know how to evaluate fisheries effectively. Still, although subjective, their perceptions around fisheries can drive their purchasing behaviours and thus the demand for different target species or the origin of the seafood. One way fisheries sustainability is brought to the forefront of the consumers' perceptions is through ecolabelling, which is based on the assumption that the public is concerned enough that purchases are moderated based upon certain sustainability criteria have been met (Shelton and Sinclair 2008). "Ecolabelling schemes provide consumers with information about the environmental quality of individual products, at the point of purchase, to enable them to choose acceptable products from an environmental point of view" (Thogersen et al. 2010, p. 1787). What should be noted by this quotation is the continued emphasis on the environmental impact. With ecolabels emphasising the ecological aspect of sustainable fisheries, it may be that consumers are being conditioned into believing the ecological aspect is the predominant aspect. However, considering the ecolabel of Fairtrade, the change in the sector also creates a shift in emphasis. Within the Fairtrade concept, the farmers themselves are the emphasis of the label as they are rewarded for farming in an environmentally friendly manner; "Fairtrade is a simple way to make a difference to the lives of the people who grow and create the things we love. It's all about making trade fair" (International, 2020). There are such projects in the UK fisheries, such as South West Handline Fisherman's Association (www.linecaught.org.uk), where consumers can see which fisherman landed their fish. These projects are small and geographically isolated. Thus, the communities reliant on fisheries for their livelihood may continue to be prioritised after the environmental impacts.

The study will focus on British Generation Z (Gen Z), where Gen Z are those 18–24 years of age. Previous studies have acknowledged the significance of using generational cohorts in consumer behaviour (Eastman et al. 2013). Generational cohorts are individuals born within a specific time range and at a particular place who undergo the same life-changing events while 17–23 years of age (Mannheim 1952). It is suggested that a generational cohort has a uniform behaviour (Meredith, Schewe, and Karlovich, 2002) and thus makes an ideal unit of analysis. The specific generation cohort of Gen Z has been selected since Gen Z will be inheriting the sustainability challenges the planet is currently facing. Whilst Britain was chosen because of its' proximity to the North Sea, this

is important as the North Sea is one of the most productive fishing grounds in the world and has been exploited on an industrial scale for more than a century (Probst et al. 2013). The North Sea fish stocks have been impacted by fishing, which has changed the stock's diversity, size structure, and trophic structure (Probst et al. 2013). When discussing fisheries management within developed countries, it is generally based upon mandated research from specialised institutions, which then guides the management decisions and the implementation through centralised bureaucracy and can be defined as 'Modern Fisheries Management Model' (Degnbol and Jarre 2004). However, issues such as overfishing, overcapacity, damage to ecosystems, and an inherent uncertainty require a holistic approach that engages not only the ecosystem but the entire industry and views sustainable fisheries as a cultural and socio-economic problem (Potts 2006). Thus, this further demonstrates the importance of incorporating consumers' perspectives on sustainable fisheries. Whilst sustainable fisheries management approaches that can attain the best possible outcomes in a given fishery depend on goals and on resources, which differ especially among regions varying in management capacity (Melnychuk et al. 2021). This is why the UK was selected, as a developed country there should be sufficient management capacity, however there may well be a lack of knowledge amongst the general population and thus their interpretation stays abstract and subjective.

3 Methodology and results

The methodology for this paper consists of a scale development process comprising three studies that build upon each previous one. The three studies consist of study 1, mapping the entire domain using concept mapping, study 2; refinement and confirmation using factor analysis and finally, study 3; application within a real-world context.

3.1 Study 1

The selected method of concept mapping is a structural conceptualisation method that allows the organisation and representation of ideas from an identified group (Rosas and Kane 2012) and can be used to conceptualise a vast array of phenomena such as Sustainable University (Homer and Khor 2021b) to the impact COVID-19 has had on sustainable development (Homer and Khor 2021a). The method adds structure to diverse and subjective ideas systematically. The concept mapping approach is also supported by grounded theory in which grounded theory is the research process of being guided by knowledge gathered during the study and not by conventional practices (Sarantakos 2005), this was deemed essential for the proposed exploratory nature of the study. This is because there was a desire to capture new knowledge that may be overlooked by conventional practices, in this case the cognitive relationship between elements on sustainable fisheries from the perceptions of British Gen Z. Thus, no over arching theory was used as the study wished to apply the conceptualisation to form without interference. The process of concept mapping involves five steps; create statements, sort statements, multi-dimensional scaling (MDS) of sorted statements, cluster analysis, and label clusters (Jackson and Trochim 2002). The Concept System® Global MAX© browser-based data collection and analysis tool was used throughout the project, as this software was specifically designed for the concept mapping method.

3.1.1 Create statements

To create statements, the literature on sustainable fisheries indicators was reviewed to ensure a holistic approach to mapping the conceptual domain was covered. While the use of literature limited the initial qualitative input from participants, it would allow for the objective indicators to work in unison with the participants' subjective perceptions. This was deemed the most appropriate approach as the target participants of British Gen Z consumers are unlikely to have the expertise and knowledge to develop the qualitative component of concept mapping themselves. However, the concept mapping process would allow for participant cognitive relationship between the statements and their perceptions of the relative importance of each statement to be captured. As discussed prior people tend to act based on their perceptions more reliably than objective reality (Hansen et al. 2016). Hence, a fishery could be deemed sustainable objectively by indicators, but an individual's perceptions may consider it not sustainable, which may lead to negative actions being undertaken. Hence, both objective and subjective measures will be required for a holistic approach to measuring sustainable fisheries. Thus, combining objective indicators with the subjective perceptions of British Gen Z consumers should begin to tackle this issue.

The list of statements was compiled from academic papers and practitioner texts which presented sustainable fisheries indication frameworks. As the list was compiled, any statements which were double redundant were removed immediately. Once the list had been compiled, KeyWord In Context was used to reduce the list, in which a keyword is identified and statements that contain this keyword are evaluated for similarities and redundancies. This is then followed by a thematic analysis, where themes are evaluated that may not have been flagged up in the KWIC reduction, i.e. if indicator statements use 'jobs' and 'employment'. This method of KWIC and thematic analysis has been used prior in Homer (2021), Homer and Khor (2021a; 2021b) and is recommended by Rosas and Kane (2012). Whilst this process may introduce some subjective, having a larger number of statements (80–120) for the concept mapping process allows for this. The indicators were reworded to be positively phrased so that the participants could rate the item on importance using a Likert scale. The paper by Boyd and Charles (2006) was of particular use as the authors have evaluated and tabulated sustainable fisheries indicators in great detail. From the literature, a statement list of 82 was developed (see Table 1).

3.1.2 Sort statements

A sample of between 20 and 25 participants was appropriate for the sorting and importance rating exercise as a homogeneous group of participants was used. According to Rosas and Camphausen (2007), a sample of over 30 offers little improvement on the overstress value when conducting MDS, some studies use a sample size of as little as 15. The list of 82 statements was then presented to 23 participants that were British and within the Gen Z age range (18–24). Participants were asked to sort the statements into piles that made sense when considering what creates a sustainable fishery and then label the piles with a name deemed appropriate. Statements cannot all be placed in one pile, nor can they be placed in individual piles. Participants were asked to refrain from also creating a miscellaneous pile of statements. Furthermore, participants were asked to rate the statements on relative importance to achieving sustainable fisheries using a scale of seven points from 'not so important' to 'very important'.

Table 1 Cluster, statement and rating table

#	Community (Cluster rating: 4.91)	Ave #	Ecology (Cluster rating: 5.75)	Ave
2	Fishery community has access to enough sustainability knowledge	6.22	There is minimal degradation of marine habitat	6.39
6	Those dependent on local fishing have access to the fishery	5.43	Fishing gear does little or no damage to the ecosystem	6.26
76	Fishery provides sufficient fish for consumption	5.39	Fisheries are not exploited to an unsustainable level	6.17
65	Appropriate considerations are given to fisheries in developing countries	5.39	Fisheries are harvested to within their biologically sustainable levels	6.04
52	The fisheries industry has sufficient resilience to take shocks and disruption	5.35	Adequate resources are in the habitat to support the current species	6.04
7	There is cooperation between the fishery community	5.26	There is acceptable amount of biodiversity of species	6.00
43	Fisheries offer adequate employment for the community	5.09	There is sufficient reproductive potential of target species to maintain numbers	5.91
75	Fishery communities have acceptable levels of education	5.04	There is an improving quality of critical habitats	5.87
9	There are enough dispute resolution mechanisms within the fishery community	5.04	Resource waste (nets, traps, etc.) is disposed of in an environmentally friendly way	5.83
42	Fisheries generate sufficient income for the community	5.00	Fisheries do not exceed maximum sustainable yield based on biological characteristics	5.74
73	The fishery community has suitable participation from all members	5.00	There are adequate protected marine areas compared to non-protected areas	5.70
8	There is a coming together of the fishery community	4.96	Unexpected impacts on food web from ecological degradation are considered	5.65
3	Decision making within the fishery community has contribution from all groups	4.96	Enough areas are unfished compared to areas that are fished	5.61
30	Participation of all parties are involved in the management of the fishery	4.74	There are sufficient coastal and marine conservation areas based on scientific information	5.61
74	Fishery communities have an acceptable level of literacy	4.74	Adequate resilience has been built into the ecosystem	5.61
10	There is sufficient resilience within the fishery community	4.74	Minimal or no impact to non-target species from fishing effort	5.61
50	Fisheries provide adequate quality protein to feed the community	4.74	Target fish species are relatively abundant	5.61
1	The fisheries community has a wide demographic (age, sex, race, etc.)	4.22	Fish waste (guts, heads, etc.) is disposed of in an environmentally friendly way	5.57

Table 1 (continued)

#	Community (Cluster rating: 4.91)	Ave #	Ecology (Cluster rating: 5.75)	Ave
81	The Local population have property rights over the fisheries	4.22	78	5.26
5	Fishing culture is observed within the community	4.00	14	5.22
4	Fishing traditions are observed within the community	3.57	21	5.13
#	Management (Cluster rating: 5.40)	Ave #	Economic (Cluster rating: 4.95)	Ave
56	Overfishing has been stopped in all forms	6.00	53	5.52
34	Sufficient research is carried out to effectively manage fish stocks	5.91	46	5.35
58	Destructive fishing practices have been stopped	5.87	49	5.26
57	Illegal, unreported and unregulated has been fishing stopped	5.83	66	5.13
33	Management of fisheries is dynamic with a long-term vision	5.83	69	5.09
59	Fisheries management plans based upon science are implemented	5.70	72	5.09
55	Fishery harvesting is effectively regulated	5.65	39	5.00
51	Fishermen practice adequate health and safety standards	5.65	38	4.96
31	Full transparency is used in the management of fisheries	5.52	45	4.91
64	There is sufficient reduction in subsidies to reduce illegal, unreported and unregulated fishing	5.48	44	4.91
20	Unexpected impacts from ecological degradation are considered on the community	5.43	67	4.91
36	Management institutes (government, agencies, etc.) adequately cooperate with one another	5.35	68	4.91
28	Integrated Coastal Zone Management (resource management system) is recognised by all parties involved in the fisheries	5.35	48	4.87
32	Management of fisheries is locally tailored and appropriate	5.30	70	4.87
80	There is a well-designed, applied and monitored fisheries compliance regime	5.30	41	4.83

Table 1 (continued)

#	Community (Cluster rating: 4.91)	Ave #	Ecology (Cluster rating: 5.75)	Ave
35	Conflicts raised against management institutes (government, agencies, etc.) can be resolved	5.13	An adequate amount of fish can be harvested to meet economic needs	4.78
29	Management of fisheries adopts a holistic and integrated approach	5.04	The export value of fish is appropriate for its economic purpose	4.74
54	Fisherman are adequately geographically distributed	4.87	Fisheries receive an appropriate amount of subsidies	4.65
82	There is sufficient capacity for the governance management of the fishery	4.78	Public funds are not excessively used to support fishermen	4.35
27	Fishery resources are adequately managed by institutions (government, agencies, etc.)	4.70		
77	Both men and women are involved in fisheries-based decisions	4.65		

3.1.3 MDS of sorted statements and cluster analysis

The sorted statements then have MDS run to develop a point map of statements, with the MDS forcing the data to fit within a two-dimensional space to generate this point map. From this forcing a 'stress' value is created with Sturrock and Rocha (2000) suggesting that the upper limit of the stress value should be 0.39, providing only a 1% chance of items having a random arrangement. However, from the concept mapping literature Rosas and Camphausen (2007) suggest a stress value of under 0.32 is acceptable. The cluster analysis directly proceeds with the MDS, which introduces some subjectivity as there are no objective means to deduce the best solution. Rather the solution is generated through a literature review and which explanation is most logical. The MDS results can be seen in Fig. 1 as the yellow dots with their corresponding statement number regarding Table 1. The stress value for the MDS was 0.24, which is within the acceptable threshold. Using Concept System® Global MAX© the cluster replay function evaluated the varying cluster solutions, with the most logical solution being four clusters, as seen in Fig. 1. The average importance rating for each cluster was then laid over the cluster map to produce the rating cluster map that can be seen in Fig. 2.

3.1.4 Label clusters

Participants were asked to label their groups of sorted statements, and thus this list was used to name the clusters generated in the analysis. Finally, the most relevant names from participants were selected to label the clusters, guided by current literature.

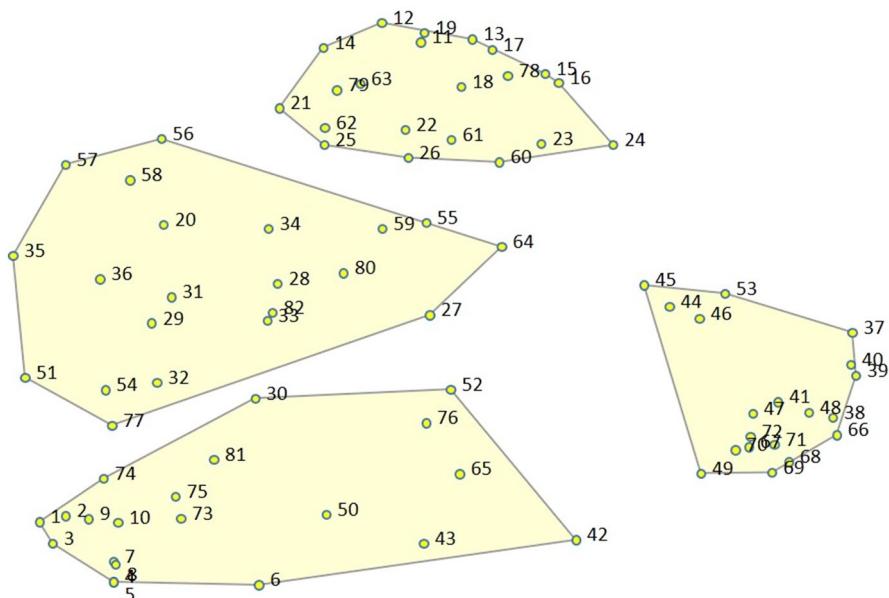


Fig. 1 Cluster Map

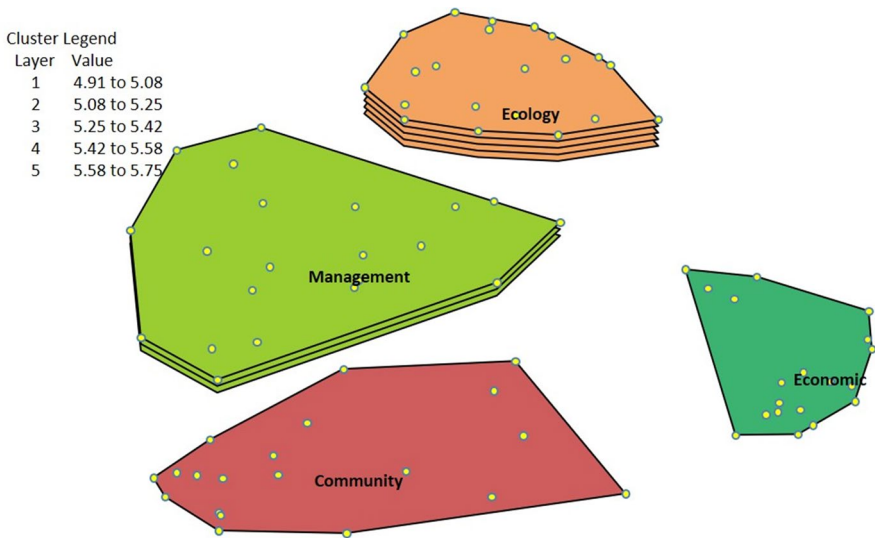


Fig. 2 Rating Cluster Map

3.2 Study 2

To begin statistically refining the statement list developed in study 1, the review paper on the topic of using concept mapping to create measurement instruments by Rosas and Ridings (2016) was used as a guide to the validation of the measurement instrument. The initial step entails reducing the statement list; however, consideration needs to be given to cover the domain adequately. This was done by retaining the eight most important statements from each cluster with the concept mapping, reducing the list by a little more than half. This thus creates a balance between adequately covering the domain while not overburdening participants and creating fatigue.

Rosas and Riding (2016) propose the best way to address the dimensionality of the measurement instrument is through factor analysis, with studies using exploratory factor analysis preceded by a confirmatory factor analysis which will determine the stability of the factors demonstrated in Homer (2021). This study has adopted this approach to strengthen the scale development process and enhance the validation procedure. This study remained within the normative domain, i.e. how the world should be, and thus asked participants evaluate the items on their importance to achieving sustainable fisheries, the same as what was conducted within Study 1. The scale used was a seven point Likert ranging from Very Unimportant through to Very Important. The choice for the process of factor analysis is justified as concept mapping from the prior study uses Hierarchical Cluster Analysis and has not been statistically verified. For this study, a single sample of approximately 650 participants will then be split in half. Half will be used in the exploratory factor analysis and the other half to verify the results using confirmatory factor analysis (CFA). This approach was adopted through suggestions of Anderson and Gerbing (1988, p. 421), where they state: "Ideally, a researcher would want to split a sample, using one half to develop a model and the other half to validate the solution obtained from the first half" and is widely adopted approach.

The exploratory factor analysis was conducted upon SPSS software. Another reduction in the number of statements can be achieved by identifying representative variables (Hair et al. 2014), thus further reducing participant fatigue within subsequent stages. The CFA was performed upon the SmartPLS software, with the PLS-SEM variation of CFA being Confirmatory Composite Analysis (CCA), as suggested by Schuberth et al. 2018. The choice to use PLS had been made as it has been advised that researchers should particularly use PLS-SEM with CCA in the case of measurement models that are indirectly measuring abstract concepts (Hair and Sarstedt 2019), with the CCA procedure being outlined by Hair et al. (2020).

The third-party survey site Prolific was used to recruit British Gen Z by using the sites' screen functions to ensure participants were within the correct ages range. The total number of participants came to 657, split into 329 for the EFA and 328 for the CFA. The responses were divided in the middle of the data set as early or late responses were deemed to have a negligible effect as data collection was conducted over a short period of only 24 h. The 1st split half of 329 participants was then put into the EFA on SPSS 27 software, and a principal component exploratory factor analysis with Varimax rotation was performed. The Kaiser–Meyer–Olkin Measure of Sampling Adequacy was 0.959, thus considered 'marvellous'. The results from the EFA can be viewed in Table 2, with all loadings over 0.400 being selected as used as a cut-off by Dyer et al. (2007). The results present an interesting solution. The conceptualisation clusters of ecology and management appear to have merged into one factor. The community cluster has appeared to split into two factors and adopted some of the management aspects in cross-loadings.

The second half of the second sample of 328 was then entered into Smart-PLS 3. The four-factor model derived from the EFA was constructed; however, factors 3 and 4 presented multiple cross-loading items and were then re-examined as a single composite in the CCA, which produced an improved result, as seen in Table 3. Thus, the conceptual cluster of community was retained. Supporting the results from the EFA, the ecological and management conceptual cluster retained their merging. However, items' *Fishery provides sufficient fish for consumption*, and *Fisheries contribute to the gross domestic product (GDP) of the nation* were removed from the CCA as their loadings were less than 0.600. Five items are below the threshold of 0.700 for loadings but above 0.600. These were retained and can be seen in bold in Table 3, as Hulland (1999) suggests that loadings above 0.600 can be acceptable within exploratory studies. The results presented a good fit with construct reliability and validity being above the accepted values of Cronbach's alpha (α) > 0.700, rho_A > 0.700, Composite Reliability (CR) > 0.700 and Average Variance Extracted (AVE) > 0.500. Whilst discriminate validity was acceptable, being well below the ambiguous cut-off point, Kline (2011) suggests 0.850, and Gold et al. (2001) suggest 0.900. Once the stability of the composites had been confirmed, they were then named. Following the names from the original conceptualisation, the composites were named Community, Economic and the merger of Ecological Management.

3.3 Study 3

This study now moved to test the measurement instrument in the descriptive typology. It is applied to specific fishing methods using mini case studies, effectively moving from the normative or desired sustainable fisheries in studies 1 and 2 to the real-world evaluation. Thus, the study transitioned to the descriptive domain, i.e. how the world is. The scale used was a seven point Likert ranging from Never Seen through to Always Seen. Confirmatory

Table 2 Rotated component matrix

Statement	Component			
	1	2	3	4
Fishery community has access to enough sustainability knowledge			.600	
Those dependent on local fishing have access to the fishery			.735	
Fishery provides sufficient fish for consumption			.696	
Appropriate considerations are given to fisheries in developing countries				.683
The fisheries industry has sufficient resilience to take shocks and disruption			.604	
There is cooperation between the fishery community			.494	.523
Fisheries offer adequate employment for the community				.631
Fishery communities have acceptable levels of education				.626
Overfishing has been stopped in all forms	.694			.459
Sufficient research is carried out to effectively manage fish stocks	.627		.471	
Destructive fishing practices have been stopped	.717			.455
Illegal, unreported and unregulated has been fishing stopped	.693			.477
Management of fisheries is dynamic with a long-term vision	.519		.460	
Fisheries management plans based upon science are implemented	.573		.485	
Fishery harvesting is effectively regulated	.638		.537	
Fishermen practice adequate health and safety standards	.546			
There is minimal degradation of marine habitat	.804			
Fishing gear does little or no damage to the ecosystem	.795			
Fisheries are not exploited to an unsustainable level	.815			
Fisheries are harvested to within their biologically sustainable levels	.791			
Adequate resources are in the habitat to support the current species	.830			
There is acceptable amount of biodiversity of species	.780			
There is sufficient reproductive potential of target species to maintain numbers	.744			
There is an improving quality of critical habitats	.758			
There is enough natural capital to sustain the fishery industry	.477	.528		
There is satisfactory fishing effort to maintain supply of fish	.477	.577		
Fishermen are not in excessive debt		.509		
Fisheries contribute to the gross domestic product (GDP) of the nation		.825		
There is adequate investment within the fish processing facilities		.766		
Net revenues from fisheries are enough to maintain the industry		.785		
Enough value is generated with fish products to maintain adequate economic benefit		.824		
There is sufficient value from the amount of fish to maintain adequate economic benefit		.836		

Composite Analysis (CCA) is used to test the measurement instrument within these new contexts, with each participant asked for an assessment of 2 different fisheries. Mini cases of approximately 200 words and a header picture of the fishing vessels were used as participants would likely be unable to recall sufficient information to evaluate the fishery within prompts (see in the appendix). The two fisheries selected for this were Hastings and Brixham. They contrast sharply in many factors, from the size of the vessels, the number of vessels and the number of fishers employed, to name but a few. Additionally, the methods

Table 3 Confirmatory Composite Analysis Results

Loading results	Community	Ecological management	Economic
Fishery community has access to enough sustainability knowledge	0.651		
Those dependent on local fishing have access to the fishery	0.700		
Appropriate considerations are given to fisheries in developing countries	0.742		
The fisheries industry has sufficient resilience to take shocks and disruption	0.696		
There is cooperation between the fishery community	0.780		
Fisheries offer adequate employment for the community	0.739		
Fishery communities have acceptable levels of education	0.682		
Overfishing has been stopped in all forms		0.744	
Sufficient research is carried out to effectively manage fish stocks		0.794	
Destructive fishing practices have been stopped		0.787	
Illegal, unreported and unregulated has been fishing stopped		0.829	
Management of fisheries is dynamic with a long-term vision		0.649	
Fisheries management plans based upon science are implemented		0.757	
Fishery harvesting is effectively regulated		0.773	
Fishermen practice adequate health and safety standards		0.738	
There is minimal degradation of marine habitat		0.893	
Fishing gear does little or no damage to the ecosystem		0.817	
Fisheries are not exploited to an unsustainable level		0.903	
Fisheries are harvested to within their biologically sustainable levels		0.882	
Adequate resources are in the habitat to support the current species		0.863	
There is acceptable amount of biodiversity of species		0.811	
There is sufficient reproductive potential of target species to maintain numbers		0.864	
There is an improving quality of critical habitats		0.833	
There is enough natural capital to sustain the fishery industry			0.781
There is satisfactory fishing effort to maintain supply of fish			0.781

Table 3 (continued)

Loading results	Community	Ecological management	Economic
Fishermen are not in excessive debt			0.685
There is adequate investment within the fish processing facilities			0.814
Net revenues from fisheries are enough to maintain the industry			0.859
Enough value is generated with fish products to maintain adequate economic benefit			0.842
There is sufficient value from the amount of fish to maintain adequate economic benefit			0.808
α	rho_A	CR	AVE
<i>Construct Reliability and Validity</i>			
Community	0.839	0.879	0.509
Ecological Management	0.965	0.968	0.658
Economic	0.904	0.924	0.636
<i>Heterotrait-Monotrait Ratio (HTMT)</i>			
Community		Ecological management	Economic
Ecological Management	0.730		
Economic	0.745	0.626	

used varied drastically, with Hastings tending towards passive fishing gear, which is noted for considerably less environmental damage than the predominately active, towed fishing gear used by Brixham, which has been compared to 'ploughing the sea floor'.

The sample aimed to consist of approximately 200 participants, with each evaluating the two different fisheries creating an estimated 400 evaluations. Additionally, Known Group Validity is conducted; this involves the instruments' ability to differentiate among groups. The groups were expected to rate different on specific traits or aspects (Netemeyer et al. 2003). The groups in this instance will be the different fisheries and their perceived sustainability, thus creating a contrast between the groups when compared. Known group validity can be analysed by a t-test (Rosas and Ridings 2016); however, a one-way ANOVA was applied to a composite score with three stakeholder groups.

The sample continued to consist of participants that were Gen Z and UK nationals and were again recruited through the third-party survey website; Prolific. The sample consisted of 179 individuals, creating 358 evaluations to be scrutinised. The three factors result from study 2 were then tested for their fit within a confirmatory composite analysis using Smart-PLS 3.3.5. The results of this confirmatory composite analysis can be seen in Table 4. The construct reliability and validity were above the accepted values of Cronbach's alpha (α) > 0.700, ρ_A > 0.700, Composite Reliability (CR) > 0.700 and Average Variance Extracted (AVE) > 0.500, the loadings improved upon the initial confirmatory composite analysis in study 2, which had several items loading below the recommended 0.700 thresholds. However, whilst the discriminate validity was acceptable, there was one value borderline (in bold & italics in Table 4) due to the ambiguity about the cut-off point; Kline (2011) suggests 0.85, and Gold et al. (2001) recommend 0.90. Overall, the fit of the measurement instrument was good, especially considering that the domain now had shifted from important (normative typology) to a now real-world application (descriptive typology).

An independent 2-tailed T-test was conducted between a composite average score for each factor of the measurement instrument between the two fisheries, Hastings and Brixham. Within factor Community, the evaluation for Hastings had a mean (M) of 3.74 and a Standard Deviation (SD) of 1.03, whilst the evaluation for Brixham had an M of 4.34 and an SD of 1.05 with a significant difference in mean scores, $t(356) = -5.45$, $p = < 0.001$. Within factor Ecological Management, the evaluation for Hastings ($M = 3.25$, $SD = 1.17$) compared to the evaluation of Brixham ($M = 4.21$, $SD = 1.29$) with a significant difference in mean scores, $t(356) = -7.36$, $p = < 0.001$. Whilst, within factor Economic, the evaluation for Hastings ($M = 3.24$, $SD = 1.33$) compared to the evaluation of Brixham ($M = 4.18$, $SD = 1.25$) with a significant difference in mean scores, $t(356) = -7.45$, $p = < 0.001$. These results suggest that the measurement instrument is validated through known group validity. All factors have significant differences, which is to be expected, and the fisheries evaluated are drastically different in operation.

4 Discussion

The paper continues with the discussion section, separated into theoretical contributions and methodological implications. The academic contribution component discusses what this research can contribute to the body of knowledge around sustainable fisheries as the studies tried to begin bridging the gap between the objective sciences and the more subjective social sciences. This is then followed by the methodological implications of the research by discussing the methodology adopted and the processes used.

Table 4 Applied confirmatory composite analysis results

Loadings results	Community	Ecological management	Economic	
Fishery community has access to enough sustainability knowledge	0.805			
Those dependent on local fishing have access to the fishery	0.768			
Appropriate considerations are given to fisheries in developing countries	0.717			
The fisheries industry has sufficient resilience to take shocks and disruption	0.776			
There is cooperation between the fishery community	0.823			
Fisheries offer adequate employment for the community	0.735			
Fishery communities have acceptable levels of education	0.821			
Overfishing has been stopped in all forms		0.746		
Sufficient research is carried out to effectively manage fish stocks		0.811		
Destructive fishing practices have been stopped		0.854		
Illegal, unreported and unregulated has been fishing stopped		0.770		
Management of fisheries is dynamic with a long-term vision		0.863		
Fisheries management plans based upon science are implemented		0.876		
Fishery harvesting is effectively regulated		0.874		
Fishermen practice adequate health and safety standards		0.804		
There is minimal degradation of marine habitat		0.830		
Fishing gear does little or no damage to the ecosystem		0.826		
Fisheries are not exploited to an unsustainable level			0.832	
Fisheries are harvested to within their biologically sustainable levels			0.812	
Adequate resources are in the habitat to support the current species			0.763	
There is acceptable amount of biodiversity of species			0.855	
There is sufficient reproductive potential of target species to maintain numbers			0.884	
There is an improving quality of critical habitats			0.889	
There is enough natural capital to sustain the fishery industry			0.884	
	α	rho_A	CR	AVE
<i>Construct reliability and validity</i>				
Community	0.891	0.897	0.915	0.606
Ecological management	0.968	0.969	0.971	0.676
Economic	0.934	0.936	0.946	0.717
	Community	Ecological management	Economic	
<i>Heterotrait-monotrait ratio (HTMT)</i>				
Community				
Ecological management	0.782			
Economic	0.842	0.862		

4.1 Theoretical contribution

To begin the discussion around the theoretical contribution, attention will first be given to the conceptualisation within study 1. The results here were in line with the sustainability literature, which proposes a quadruple bottom line consisting of the triple bottom line and a specific contextual element (Taback and Ramanan 2013). In this instance, the specific contextual component appears to have been management, which includes the regulation and decision making of fisheries. This is supported by the model Charles (1994) proposed, which consisted of; ecological, socio-economic, community, and institutional. Each cluster from this study will now be reviewed.

4.1.1 Ecology cluster

The Ecology cluster has been rated most important by participants; this may stem from consumers growing awareness of the environmental issues around fisheries and a willingness to pay for products that have assurances (Jaffry et al. 2004). There is also the argument which has been encapsulated by Lawrence Summers' now famous memo from his time at the World Bank, where he stated that the demand for a clean environment for aesthetic and health reasons is likely to have very high income elasticity. With the UK being a developed country there is a high demand for this clean environment, individuals do not wish to spend time on a beach covered in litter or swim in water which is highly polluted. Thus there is increasing public pressure to maintain and improve the nations ecology and with the UK being an island nation, this may well lead to emphasis upon the marine environment. From the consumer perspective this growing awareness has led to large chain supermarkets now widely adopting ecolabel products, such as the Marine Stewardship Council, the environmental challenges of sustainable fisheries are thrust into the forefront of the consumers purchasing decisions (Thogersen et al. 2010). However, the results from damaging fisheries practices are unlikely to be visible (Kaiser and Edwards-Jones 2006), especially to the consumer who is somewhat detached from the actual practice. This may suggest why Ecology and Management are rated 1st and 2nd in importance, as management is needed to maintain the ecological sustainability of the fishery. The participants presented an interesting shift in terminology; from 'environmental' to 'ecological' when discussing the underwater habitat. Within the triple bottom line model of sustainability, the factors are; economic, environmental and social; however, multiple participants had named the cluster ecology[ical] within the study's context. This presents an alluring variation from terrestrial ecosystems.

4.1.2 Management cluster

Fisheries management is the management of human interaction with fish and requires an understanding of fisheries' dynamics and current status (Boyd and Charles 2006). The literature suggests three methods of fisheries management; fixed (long term > 5 years), adaptive (seasonal/annual) and dynamic (near real-time) (Holsman et al. 2019). Assessments of these management methods found that fixed management performed better when there was more uncertainty, whilst more data with a better understanding of the dynamics allowed the other management methods to perform better (Fulton et al. 2015; Punt et al. 2014). This would suggest a mixed management approach as no one method could manage the

fishery entirely as there are various dynamics at work in the system. To better understand the dynamics of the fishing, data from the other three elements (ecology, economic and community) will be required inputs. Thus, fisheries management is interdependent on the different aspects of sustainable fisheries to encompass a holistic approach. This complexity of fisheries management would suggest that although the British Gen Z consumers believe that fisheries management is important in achieving sustainable fisheries, they are unlikely to understand the application of such management.

4.1.3 Economic cluster

The participants rated the economic cluster considerably lower than the management and ecological clusters. This may be due to fisheries generating only £1.4bn to UK GDP in 2019, accounting for 0.0633% of the £2.21tn. With such a small contribution to GDP, British Gen Z may not acknowledge the economic value of the fisheries industry. Further to this, the UK imports 70% of the fish it eats and exports 80% of what it catches, so most of the fish eaten within the UK is imported from other countries; thus, this may lessen the perception of the economic value of the industry further. Even the traditional British fish and chips dish may no longer be considered a British product, with 83% of the cod consumed in the UK coming from abroad, alongside 58% of haddock (Harper 2019). This may well further dilute the economic value of the fishery industry, as the industry is not supplying the fish that consumers want to eat. It maybe that the prioritisation of management is impacting the economics of fishing industry, as although the study has discussed the ecosystem approach, the UK has implemented quotas on key species and thus focuses on single species rather than the ecosystem. The critique being the lack of understanding of the marine ecology which does not allow for a comparison between marine species importance in their ecosystems suggested by Gaillet et al. (2022). However, as shown by Marine Management Organization (2019) there was a 2% reduction in value of landings because of reduced quota on a single species (mackerel) between 2018 and 2019. The question arising, that although less mackerel and other key pelagic fish were landed based on the quota system, what was the impact on the ecosystem? And was sustainable fisheries achieved?

4.1.4 Community cluster

The community cluster represented an interesting point as it was rated similarly of lower importance than the economic cluster. This may be due to there being only an estimated 24,000 people directly employed by the fisheries industry (Harper 2019) and approximately 12,000 of these are fishers (Marine Management Organisation 2018). These numbers represent under 0.1% of the UK workforce. Such a small number of people paired with the small economic contribution may well be why British Gen Z overlooked the communities within sustainable fisheries. The traditional fishery communities may no longer exist as locals are priced out of the housing market (Hurst 2018) and other societal factors having an impact. However, as discussed by Giron-Nava et al. (2021), focusing only on ecological sustainability risks disregarding ultimate goals related to well-being that must be achieved through broader social policy. This broader social policy would look at the fishermen and women well-being, as Giron-Nava et al. point out that 70% of fishers worldwide do not meet minimum living wages and thus the benefits of fisheries are not be realised by the fishers' households. Yet, within the conceptualisation formed in the study, there was considerably more emphasis placed upon ecology and management. It may simply be that

British Gen Z are not concerned with the fishers, as they are disconnected from the communities which is not surprising with the UK being a net importer of fish and a continuing reduction in fishing effort (Marine Management Organisation, 2019). The environmental elasticity of developed countries, may be seeking improved ecology for recreational purposes (angling and diving), rather than giving priority to a decreasing number of fishers and the communities in which they live.

As the study progressed from conceptualisation to operationalising the instrument, the factors of ecology and management merged into a single factor which presented an interesting point. This may suggest that rather than the ecological element being independent, such emphasis has been placed upon the importance of ecology. It needs to be conscientiously and fully managed to achieve the desired sustainability. This appears to be counter-intuitive, like ecology, if left alone and all things being equal, would effectively regenerate itself and find its equilibrium. An additional point of interest that was raised through operationalising the conceptualisation was that it was only necessary to remove two items from the confirmatory factor analysis; '*Fishery provides sufficient fish for consumption*', and '*Fisheries contribute to the gross domestic product (GDP) of the nation*' were removed. These items cross-loaded across all three factors and thus made it necessary for their removal; however, providing food for consumption and contributing to the country's economy would be considered fundamental elements for a sustainable fishery. Thus, the question raised is, were these items removed because they were fundamental in creating sustainability and thus were equally important in all three factors derived, or were these items considered less important and didn't fit into any of the three factors? Unfortunately, this question and why ecology and management factors merged are outside of the scope of this study to answer but may indicate how the perceptions of sustainable fisheries diverge from strict science-based interpretations.

4.2 Methodological implications

The methodology process within this study consisted of a rigorous refinement process. The initial study used the concept mapping method to conceptualise sustainable fisheries from the perspective of British Gen Z using pre-existing statements from sustainable fisheries indicator frameworks. This is an important initial stage. Although only a small number of participants were used but appropriate for the method used, it allowed for a far greater number of statements than what would usually be included within a quantitative survey measurement instrument, with subsequent stages using much larger sized samples to validate the results. This step also enables the expression of cognitive relationships through the card sorting exercise analysed with multi-dimensional scaling. Through studies 2 and 3, the instrument was refined and produced a three-factor solution; Community, Ecological Management and Economic. The number of items of the instrument was maintained. Although participant fatigue may become of concern until the measurement instrument has been used in several other contexts, it was deemed inappropriate to truncate it. A significant methodological implication comes from study 3, in which the typology is switched from the normative [importance] of the prior two studies to the descriptive [evaluating] typology. This is adopting stakeholder theory using Donaldson and Preston's (1995) three typologies of stakeholder theory; instrumental, normative and descriptive, and are defined as; descriptive typology consists of the way the world is, normative typology prescribes how the world should and, instrumental typology links the means to the ends (Freeman 1999). Trevino and Weaver (1999) questioned whether there is an empirical stakeholder theory

(descriptive or instrumental) to integrate with normative theory. How things should be is usually quite different from how the world is. This questioning by Trevino and Weaver is addressed by this switching of typologies, as the measurement instrument is developed in the normative typology of how Gen Z thinks sustainable fisheries should be before transitioning to descriptive typology to evaluate how sustainable specific fisheries are perceived to be.

Another important practice adopted within this study is known group validity; this links how the measurement instrument can distinguish between groups of individuals (or, in this instance, fisheries), which are expected to score differently on specific attributes (Netemeyer et al. 2003). This study used known group validity within study 3, where two significantly different fisheries were then contrasted within the descriptive typology. This known group validity only consisted of a small number of comparisons that could have been made. The implications for the methodology are that known group validity can be incorporated easily into many studies with minimal forward-thinking and can give extra depth to the validation process. Furthermore, known group validity should not be used simply as a simple 'add on' to the methodology. Still, it should be used strategically and holistically to construct a network of comparisons, like how nomological networks are built.

5 Conclusion

Sustainable fisheries are a global challenge to achieve, as the planetary population increases alongside a growing fishing capacity. Yet, the global fish catches peaked in the 1980s and are now on a decline through the immense pressure on fish stocks. This study sought to bridge the gap between scientific indicator systems and the more subjective consumer perspectives of sustainable fisheries. Through three studies, British Gen Z first conceptualised sustainable fisheries within the normative domain using 82 indicator statements. This was then proceeded by statistical validation using exploratory factor analysis and confirmatory composite analysis using 657 participants and generating a three-factor solution of Community, Ecological Management and Economic. The domain was then switched to the descriptive typology. A further 179 British Gen Z evaluated the fisheries at Hastings and Brixham based upon case studies that further validated the three-factor solution. The significance of this study demonstrates that consumers, who influence policy and management of fisheries through their purchasing behaviour, interpret sustainable fisheries differently from science which is evidenced by the merging of the elements of ecologically and management. In closing, there is a clear demonstration that stakeholders need to be engaged throughout the value chain of fisheries and not just focus upon ecological aspects, as there are clear discrepancies (if not conflicts) in the interpretations of achieving sustainable fisheries. Thus, only with a truly holistic approach, embracing all considerations, can sustainable fisheries be fully realised.

5.1 Limitations

The study has a few limitations; namely, statements are derived from literature rather than a qualitative research involving the participants. Whilst a qualitative research would have brought greater face validity, it would have also extended the duration and complexity of the study. A further limitation is the limited number of participants used within the concept mapping method, which may affect generalisability.

Additionally, a limitation stems from the narrow demographic of only British Gen Z, as they are likely to be highly influenced by external factors and are unlikely to possess sufficient knowledge to make objective evaluation based upon reality. However, the subjective evaluation of sustainable fisheries generated here are important for public opinion, stakeholder engagement and other interaction with parties that may not have sufficient information or knowledge to develop objective opinions. Thus, the developed conceptualisation stays in the normative domain, of how sustainable fisheries *should be*, and not necessarily how they are. Whilst this presents a limitation, having both subjective and objective evaluations of sustainable fisheries is vital for a holistic approach to the appraisal of sustainable fisheries.

5.2 Suggestions for future research

Future research may wish to validate the measurement instrument in additional geographical contexts alongside broader demographics. However, to expand the body of knowledge further, future research may want to move more towards the normative stakeholder typology by beginning the scale development process from an initial qualitative study. This would add strong face validity to the items, as the participants have created the statements in their own words (Hardesty and Bearden, 2004). However, with consumers being quite detached from the actual fisheries management practices, the level of knowledge may not be sufficient to explore the phenomenon fully.

Appendix

Below can be seen the two mini case studies used for study 3.

Case 1

Hastings is one of Britain's oldest fishing ports with boats launched from the shingle beach in front of the Old Town (an area known as the Stade) for over 1000 years. Once a medieval Cinque port, today it is home to one of the largest beach-launched fishing fleets in Europe (approximately 23 boats). All the boats are under ten metre inshore vessels. Hastings is a mixed fishery with MSC (Marine Stewardship Council) certification for its Dover Sole, Mackerel and Herring fisheries. Hastings is an urban coastal town situated on the southeast coast of England with a population of 86,000. It has a rich historical and cultural history, including its association with nearby Battle and the 11th Century Norman Conquest. This was followed by many centuries as a successful fishing town and the 19th Century emergence as a popular and affluent Victorian spa resort. Sadly, this was followed by a well-documented economic decline from the mid-twentieth century onwards. Hastings is ranked in the 2010 Indices of Multiple Deprivation (IMD) as the 19th most deprived district in England. Hastings has sought to address pockets of severe social and economic deprivation through intensive government and community led regeneration interventions over the last twenty years. (Adapted from; https://www.marinespecies.org/introduced/wiki/Case_study_Hastings).

Case 2

Brixham fishermen have been introducing new ideas to help improve fish stocks by ensuring that smaller fish escape, rather than discarded because they are too small or there is no available market to sell them. Legally fishermen can use an 80 mm mesh at the cod end of the net but most Brixham fishermen use 100 mm cod ends, with this larger mesh allowing a high percentage of the smaller fish to escape by swimming straight through. Many fishermen design their nets and one local fisherman won a national prize for changing the normal diamond shaped net, that close as the weight of the net increases, to a square panel in the lower part of the trawl that keeps open and allows the smaller fish to escape the net. This idea has been picked up by fishermen in other countries. The team at Brixham Trawler Agents Ltd work with the Centre for Environment, Fisheries and Aquaculture Science (Cefas) who visit Brixham weekly to carry out analysis of the fish caught, where they have access to the data from the fish grading machines which allows for comparison measurements over time. This continual monitoring gives an insight into fish stocks and is fed into the process to determine fish quotas. These ideas seem to be working as over the last few years Brixham fishermen have seen a steady increase in their quota for sole and plaice, some of the most important fish species for the local economy. (Adapted from; <https://brixhamfishmarket.co.uk/responsible-sourcing/>).

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Data availability Considerations will be made whether to share data based on requests.

Code availability Not applicable.

Declarations

Conflict of interest The authors have no conflicts of interest to declare that are relevant to the content of this article.

Ethics statement All three rounds of data collection were approved by Sunway University Research Ethics Committee under the following codes; Study 1: EASUREC 2020/007, Study 2: SUREC 2021/049, Study 3: SUREC 2022/010.

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