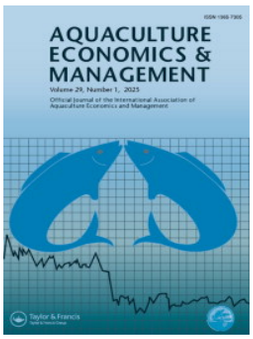

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RESEARCH ARTICLE

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Building trust: Consumer awareness, acceptance and attitudes related to European aquaculture and the potential effects of greenwashing

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ABSTRACT

The paper examines consumers' awareness, attitudes and acceptance of sustainable aquaculture practices while examining the impact of greenwashing on consumer perceptions. We conducted an online survey with 2,500 participants from five European countries: France, Germany, Italy, Spain, the UK. The results revealed that consumer awareness of aquaculture production systems remains low across European consumers, despite generally positive attitudes and acceptance toward sustainability in aquaculture. The study identifies three distinct consumer segments based on their perceptions of greenwashing: unimpressed, trusting and uninformed. Each segment differs in terms of awareness, attitudes and acceptance of aquaculture practices, with the trusting group showing the highest levels of confidence and acceptance, while the uninformed group shows the lowest levels of awareness and confidence.

KEYWORDS

Greenwashing; segmentation; consumer; sustainable aquaculture; RAS; IMTA; organic

Introduction

Over the past 50 years, global per capita fish consumption has approximately doubled (Edwards et al., 2019; Naylor et al., 2021). The expansion of aquaculture production has contributed to and stimulated this increase in fish demand and is expected to continue to do so (Falcon et al., 2022; Golden et al., 2021; Gephart et al., 2021; Garlock et al., 2022).

The expansion of aquaculture on a global scale has been driven by innovations that facilitated greater control of the production process, increased productivity, and reduced production costs (Asche & Smith, 2018; Kumar & Engle, 2016).

Sustainable seafood has become increasingly important within the policy discourse on sustainable food systems, as the increase in seafood

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production and consumption and the vulnerability of marine resources add weight to the call for a shared understanding of maintaining the natural capacity of marine ecosystems to provide food (Murray et al., 2023; Olson et al., 2014; UNEP, 2016). The public debate on the environmental impact of fisheries and aquaculture on Europe's marine ecosystem seeks to link it to other strategic leverage points for accelerating the transformation of the food system toward sustainability (Abson et al., 2017).

Aquaculture, as a rapidly growing fish production system, contributes to food security as well as income at production sites worldwide (Anderson et al., 2017; Landazuri-Tveteraas et al., 2023; Laine et al., 2024). Recent studies suggest that aquaculture can also facilitate local economic growth and poverty reduction by creating employment opportunities and reducing income inequality in rural and low-income communities (Ceballos et al., 2018; Cárdenas-Retamal et al., 2021; Hegde et al., 2022). However, this food system is also the subject of intense criticism. Perceived unsustainable practices in pursuit of economic goals have given rise to concerns about the environmental and social impacts of this production method (Garlock et al., 2024). Despite the prevalence of potential sustainability tradeoffs in the academic literature, there is an emerging body of evidence suggesting that the complementarity indicated by the three pillars of the sustainability model can also be applied to aquaculture. The findings of a recent study (Garlock et al., 2024) also demonstrate that there is considerable diversity in the extent to which aquaculture systems adhere to sustainable practices, corroborating the observation of Naylor et al. (2021) that the industry is highly heterogeneous. Asche et al. (2022) and Naylor et al. (2023) find that the aquaculture sector is highly heterogeneous, with different environmental impacts depending on the species, technology and governance system.

Consumers tend to associate sustainable aquaculture with natural, traditional, local and small-scale production systems with high animal welfare standards (Risius et al., 2017), as well as considering it relevant together with quality and country of origin (Onozaka et al., 2023). However, despite aquaculture is more sustainable compared to land-based animal production, and perceived as such when it is located near citizents that are positively impacted by, e.g. job creation (Ceballos-Concha et al., 2025; Misund et al., 2023), approximately two-thirds of fish and shellfish farming production is still feed-based (Boyd et al., 2022).

Fish is highly nutritious food source that is increasingly being produced more sustainable way, making it an affordable source of protein with benefit for overall human well-being (Mitra et al., 2024; Pradeepkiran, 2019). However, the growing demand for fishmeal and fish oil poses potential limitations to the expansion of the sector unless sustainable alternative ingredients are employed (Boyd et al., 2022). To promote long-term sustainability,

aquaculture requires further development of sustainable production systems, such as integrated multitrophic aquaculture (IMTA) and recirculating aquaculture systems (RAS), which are not yet fully economically viable and require improved regulatory frameworks (Ahmed et al., 2019; Subasinghe et al., 2009). IMTA represents a promising approach to improve the sustainability of aquaculture, involving the integrated culture of feed species. Such systems are expected to significantly improve the sustainability of aquaculture, due to a number of potential benefits, including the reuse of waste nutrients from higher trophic level species in the creation of commercially viable lower trophic level cultures (García-Poza et al., 2020; Troell et al., 2009). With regard to RAS, although they still represent a small portion of global aquaculture production, such systems are currently at the forefront of aquaculture innovation, offering the potential for improved control over multiple aspects of the production cycle compared to more traditional aquaculture production methods (Ropicki et al., 2024).

Aquaculture also interacts with the broader food system, competing with crop, livestock and fisheries sectors for high-quality feed, that could be otherwise consumed directly as human food (Troell et al., 2014). This competition raises concerns about biodiversity, nutrient flows in the food system and the nutritional needs of vulnerable social groups (Simmance et al., 2022).

From a food system perspective, communicating balanced and transparent information about aquaculture to consumers is a complex challenge. Despite industry efforts to develop certification and labeling schemes to promote sustainable practice, these initiatives often shift responsibility for making more sustainable choice from governments, producers and retailers to consumers (Thøgersen, 2005). This shift in responsibility requires that consumers are informed and able to act responsibly, which is not always the case.

Studies indicate that providing consumers with clear, science-based information improves their perception of aquaculture (Carrassón et al., 2021). However, the challenge lies in ensuring that consumers perceive this information as intended by the industry and stakeholder. In addition, a growing number of environmentally conscious consumers has led companies to adopt an "environmentally conscious public image" to meet consumer demand (Devitt, 2024). However, many organizations engage in "greenwashing," where vague or misleading claims are made about the environmental impact of their products (Devitt, 2024; Nugraha et al., 2024; Sirieix et al., 2013). From banks' investment decisions to supermarket product labeling, consumers encounter claims about ethical and green credentials without sufficient evidence to support them (Devitt, 2024). Greenwashing, defined as the exaggeration of the positive environmental

impact of products or services, undermines trust and transparency in sustainability claims (de Freitas Netto et al., 2020; Marquis et al., 2016; Nugraha et al., 2024). This practice, coupled with a weakening of corporate accountability, often leads to consumer confusion and skepticism (Boiral, 2013; Chen & Chang, 2013; Laufer, 2003; Parguel et al., 2011). EU directives (2005/29/EC and 2011/83/EU) aim to combat greenwashing by ensuring that environmental claims are verifiable and based on recognized certification schemes.

As the demand for ecolabels has increased, numerous companies have attempted to capitalize on this market trend by emphasizing their adherence to environmentally friendly practices and touting their products as sustainable (Nugraha et al., 2024). Furthermore, stakeholders such as investors, consumers, governments, and corporate clients have increasingly pressured companies to disclose details about their environmental performance and green products (de Freitas Netto et al., 2020; Marquis et al., 2016). Over time, however, it became clear that a significant proportion of companies lacked transparency, particularly in their interactions with consumers, and engaged in greenwashing (Testa et al., 2018; Zhang et al., 2022).

The phenomenon of greenwashing is usually associated with a weakening of corporate accountability to stakeholders and a reduction in the legitimacy of environmental efforts, as shown by the studies of Laufer (2003), Boiral (2013) and Cho et al. (2015). The spread of misleading information about corporate sustainability often leads to confusion and a loss of trust, especially among consumers, who find it increasingly difficult to recognize truly socially responsible companies (Chen & Chang, 2013; Parguel et al., 2011). As a result, consumers become skeptical of generalized sustainability claims, highlighting the need for better information transfer to build trust and increase product acceptance (Risius et al., 2017). Consumers are increasingly confused by the wide range of environmental performance labels and their trust in these claims is generally low. Misleading information gives companies a false image of their environmental impact, known as greenwashing (Szabo & Webster, 2021). Credible and verifiable ecolabels are essential to enable consumers to make informed decisions and promote competition among companies that strive to improve environmental performance.

Communicating sustainable aquaculture faces additional challenges, particularly as consumers remain generally uninformed about the production systems (Kaimakoudi, 2024). Miscommunication can have unintended consequences, as consumers may perceive sustainability efforts as greenwashing rather than transparent disclosures. Perceived greenwashing, especially in seafood production, leads to lower purchase intentions and a negative

attitude toward products (Lu et al., 2022; Jacquet et al., 2010). Trust can be enhanced through improved communication strategies that integrate emotional, functional, and legitimate factors to rebuild consumer confidence (Wang et al., 2020). Furthermore, no research has specifically segmented consumers based on their perception about greenwashing in aquaculture sector (Wendt & Weinrich, 2023).

The paper aims to explore consumer behavior and perceptions of greenwashing and their relationship with aquaculture systems. In particular, the study aims to explore the relationship between attitudes toward greenwashing, perceived consumer skepticism, green perceived risk, green consumer confusion and green trust. By analyzing these constructs, this study offers a holistic view of how greenwashing impacts consumer perceptions, with specific relevance to aquaculture, where consumers trust in sustainability practice is essential to fostering consumer confidence and promoting sustainable seafood practices. The study also attempts to define different consumer groups and highlight the differences between these segments in terms of attitudes toward four different aquaculture production methods prevalent in the European context.

The research questions are: (1) Are there consumer segments based on their perceptions of greenwashing? (2) How aware are European consumers of different aquaculture production systems? (3) What are European consumers' attitudes toward sustainable aquaculture production systems? (4) What is the acceptance of the aquaculture production system by European consumers?

In order to respond to these research questions, we conducted an online survey with 2,500 participants from five European countries: France, Germany, Italy, Spain, the UK.

In summary, this paper could contribute to uncovering new insights into one of the main current trends of the aquaculture sector, such as that of greenwashing, attempting to individuate the impact of environmental messages on purchasing decisions.

Data and method

Data gathering

To answer the research questions in this study, we conducted an online survey with a sample of 2500 consumers. This method allows for easier data collection and processing. In addition, online questionnaires provide a dynamic pool of options for framing the questions, which allows for an appropriate representation of the required measures.

Using a representative sample (age, gender, area) of population, a European cross-sectional online survey was conducted in 2019 in France,

Germany, Italy, Spain, the UK. The sample was recruited by a professional agency (YouGov), which also collected the data.

Respondents were immediately informed about the privacy and anonymity of their work and that participation was voluntary. The data collected was used for research purposes only and stored in an anonymized format on a password-protected computer system and remains accessible to the researchers involved in the project. The survey was ethically approved according to the Norwegian Center for Research Data's ethics process. This approval ensures that the study complies with the ethical guidelines that deal with the topic.

Questionnaire

This study relied on a questionnaire-based consumer survey to gain valuable insights into consumer preferences and behavior. The data collected was then used to analyze consumer segmentation and preferences in terms of preferences for farmed fish.

The questionnaire included screening questions to capture only participants who were responsible for at least 50% of purchases and/or home food preparation and did not have seafood allergies.

Before answering the questionnaire, participants were presented with the definitions of four aquaculture production systems provide context and ensure a common understanding among respondents.

Integrated multitrophic aquaculture (IMTA)

"*Integrated aquaculture provides the by-products (e.g. waste from one aquatic species) as the input (e.g. fertilizer or food) for another species.*"

Recirculating aquaculture systems (RAS)

"Aquaculture production system on land, that allows for full control of production, that re-uses water and therefore needs water treatment units to remove accumulated waste."

Organic aquaculture

"*Organic production essentially means maintaining control of production, no use of synthetic drugs or pesticides, and strict regulation of production conditions and water quality. An organic fish is also considered a domesticated animal and is not the same as a wild fish.*"

Conventional aquaculture

"*Aquaculture is the farming of fish, crustaceans, mollusks, aquatic plants, algae, and other organisms. Aquaculture involves cultivating freshwater and saltwater populations under controlled conditions in flow-through systems, ponds, netcages and longlines, and can be contrasted with commercial fishing, which is the harvesting of wild fish.*"

The questionnaire encompassed several sections including:

1. Greenwashing constructs (based on Aji & Sutikno, 2015) measured on seven-point Likert scale (1 = Strongly Disagree to 7 = Strongly Agree):
   - attitude toward greenwashing, based on Laufer (2003),
   - perceived consumer skepticism, following Matthes and Wonneberger (2014),
   - green perceived risk, based on Mohr et al. (1998),
   - green consumer confusion, constructed following Chen and Chang (2013),
   - green trust, following Chen and Chang (2012).
2. Awareness (based on Hirschman, 1986) was measured by presenting the names of the four production systems in our study and asking: "How informed do you feel about the following seafood production systems?", measured on a seven-point scale (1 = Not at all informed, to 7 = Very knowledgeable).
3. Attitudes toward the four aquaculture production systems (following Flaherty, 2019), assessed on a seven-point scale (from 1 = Very negative to 7 = Very positive).
4. Acceptance (based on Wilks & Phillips 2017) was measured by asking the willingness to purchase fish from each of the four aquaculture systems, measured on a seven-point scale (1 = Definitely no, to 7 = Definitely yes).
5. The last section collected socio-demographic information, including education, occupation, income, number of children, resident area, and marital status.

The sample

The data presented in Table 1 provides insights into the demographic characteristics of the sample population across five European countries (France, Germany, Italy, Spain, the United Kingdom). The largest number of respondents are from Spain (25.3%), followed by Italy (21.7%), France (21.20%), Germany (18.3%), and the United Kingdom (13.4%). The sample comprises slightly more male respondents (52.5%) than female respondents (47.50%). The respondents are distributed across three age groups: 18–

Table 1. Social and demographic characteristics of the total sample.

		Frequency	Percentage
Country	United Kingdom	335	13.4%
	Germany	457	18.3%
	France	530	21.2%
	Italy	543	21.7%
	Spain	633	25.3%
Gender	Female	1188	47.5%
	Male	1312	52.5%
Age	18–34	610	24.4%
	35–54	957	38.3%
	55–99	933	37.3%
Education	Primary	83	3.3%
	Secondary	588	23.5%
	Professional qualification of degree level	685	27.4%
	College/university degree	822	32.9%
	Post-graduate education	325	13.0%
Occupation	Not employed – retired	490	19.6%
	Not employed – unemployed, on welfare, in practical job training	140	5.6%
	Homemaker	170	6.8%
	Student/apprentice/intern	160	6.4%
	Employed – office job, teaching etc.	765	30.6%
	Employed – craftsman, trade and service employee, health worker etc.	478	19.1%
	Self-employed	168	6.7%
	Other	128	5.1%
Residential area	A village or rural area	605	24.2%
	A small town or a medium-sized city	1138	45.5%
	A big city	743	29.7%
	Don't know	15	0.6%
Marital status	Married	1113	44.5%
	In a civil partnership	145	5.8%
	Separated but still legally married or in a civil partnership	33	1.3%
	Living with a partner but neither married nor in a civil partnership	330	13.2%
	In a relationship, but not living together	128	5.1%
	Single	490	19.6%
	Divorced	215	8.6%
	Widowed	48	1.9%

34 years (24.4%), 35–54 years (38.30%), and 55–99 years (37.3%). The largest number of respondents have attained either a College/University Degree (32.9%) or a Professional qualification of degree level (27.4%). A smaller percentage have completed Secondary education (23.5%), followed by Post-Graduate Education (13.0%) and Primary education (3.3%). The largest proportion of respondents are employed in office jobs, teaching, etc. (30.6%), followed by those employed in craftsman, trade, and service roles, as well as health workers (19.1%). A significant portion are retired (19.6%), while smaller percentages are unemployed, homemakers, students/apprentices/interns, self-employed, or fall into other categories. Respondents are primarily from small towns or medium-sized cities (45.5%), followed by big cities (29.7%) and villages or rural areas (24.2%). The largest proportion of respondents are married (44.5%), followed by single individuals (19.6%) and those living with a partner but neither married nor in a civil partnership (13.2%). Smaller percentages are in a civil partnership, separated but

still legally married or in a civil partnership, in a relationship but not living together, divorced, or widowed.

Data analysis

In order to test the research hypotheses, several statistical analyses were conducted. Cluster analysis was used to segment consumers based on their perceptions of greenwashing. Cronbach's alpha was calculated to assess the reliability of the constructs. ANOVA and post hoc tests were used to investigate differences between consumer segments. Chi-square tests were used for the analysis of socio-demographic variables.

Using a hierarchical cluster analysis, we found a three-cluster solution appropriate due to the large change of the coefficients in the Agglomeration Schedule. K-Means cluster analysis followed, forcing a three-cluster solution, which provided the solution described in the results.

Comparisons of means were tested using an analysis of variance test, followed by post-hoc tests that defined the pairs where the differences were significant. Socio-demographic characteristics were tested using chi-square tests.

Cronbach's alpha analysis was used to test the internal consistency and reliability of the constructs attitude toward greenwashing, perceived consumer skepticism, perceived green risk, green consumer confusion and green trust included in the study. The Cronbach's alpha values above the commonly accepted threshold of 0.7. indicated that each construct has good to excellent internal consistency.

Results

Table 2 presents the key constructs used to measure consumer perceptions of greenwashing in aquaculture, along with their corresponding Cronbach's alpha values. The Cronbach's alpha values are all above the commonly accepted threshold of 0.7, which indicates good to excellent internal consistency, meaning that there is a good correlation between the items within each framework and that they are effectively measuring the same underlying concept. Overall, Table 2 shows that the questionnaire is reliable in assessing consumer attitudes, skepticism, perceived risk, confusion and trust regarding aquaculture greenwashing.

Attitude toward greenwashing (Cronbach's alpha = 0.860): This construct captures the perception of the presence of greenwashing in the marketing and labeling of aquaculture products. A high Cronbach's alpha indicates high item consistency in measuring consumer attitudes toward greenwashing.

Table 2. Greenwashing constructs, items and associated Cronbach's alpha test results.

Greenwashing constructs	Cronbach's alpha
(1) Attitude toward greenwashing	0.860
Fish products from sustainable aquaculture in Europe mislead with words in their environmental features.	
Fish products from sustainable aquaculture in Europe mislead with visuals or graphics in their environmental features.	
Fish products from sustainable aquaculture in Europe have a green claim that is vague or seemingly unprovable.	
Fish products from sustainable aquaculture in Europe overstate or exaggerate how their green functionality actually is.	
Fish products from sustainable aquaculture in Europe leave out or mask important information, making the green claim sound better than it is.	
(2) Perceived consumer skepticism	0.794
Most green claims in advertising are intended to mislead rather than to inform customers.	
I do not believe most green claims made in advertising.	
Because green claims are so exaggerated, consumers would be better off if such claims in advertising were eliminated.	
(3) Green perceived risk	0.828
There is a chance that there will be something wrong with the environmental performance of fish products from sustainable aquaculture in Europe.	
There is a chance that fish products from sustainable aquaculture in Europe will not work properly with respect to their environmental design.	
There is a chance that you will get a penalty for using fish products from sustainable aquaculture in Europe.	
There is a chance that using fish products from sustainable aquaculture in Europe will negatively affect the environment.	
Using fish products from sustainable aquaculture in Europe would damage your green reputation or image.	
(4) Green consumer confusion	0.830
It is difficult to detect fish products from sustainable aquaculture in Europe in terms of environmental features.	
It is difficult to recognize the differences among environmental-claimed products.	
You are confused about deciding which green products should be purchased.	
You rarely feel sufficiently informed about environmental features.	
You feel uncertain about environmental features.	
(5) Green trust	0.886
You feel that the environmental reputation of fish products from sustainable aquaculture in Europe is generally reliable.	
You feel that the environmental performance of fish products from sustainable aquaculture in Europe is generally dependable.	
You feel that the environmental claims of fish products from sustainable aquaculture in Europe are generally trustworthy.	
The environmental of fish products from sustainable aquaculture in Europe concern meets your expectation.	
Fish products from sustainable aquaculture in Europe keep promises and commitment for environmental protection.	

Perceived consumer skepticism (Cronbach's alpha = 0.794): This construct assesses the degree of skepticism that consumers have toward claims of sustainability. The alpha value indicates good reliability. This indicates that consumer skepticism is measured consistently across items.

Consumer perceived risk (Cronbach's alpha = 0.828): This construct reflects consumers' perception of the risk associated with the purchase of products that are labeled as sustainable but are potentially misleading. The alpha value indicates that the construct reliably captures the perception of risk of greenwashing.

Table 3. Mean values of and differences between the segmentation variables related to greenwashing.

	Segment				
	Unimpressed	Trusting	Uninformed	F*	p-value
N (total = 1434**)	463	161	810		
% of sample	32.3	11.2	56.5		
Attitude toward greenwashing	5.55a	2.79c	4.26b	1018.68	<0.001
Perceived consumer skepticism	5.77a	2.39c	4.32b	1320.59	<0.001
Green perceived risk	5.21a	2.64c	4.06b	769.55	<0.001
Green consumer confusion	5.90a	3.70c	4.63b	585.94	<0.001
Green trust	4.58b	4.93a	4.20c	44.21	<0.001

*Based on analysis of variance tests;
**Sample size of complete responses; a-c indicate significant differences between segments based on post-hoc tests.

Green consumer confusion (Cronbach's alpha = 0.830): This construct measures the degree of confusion experienced by consumers in the interpretation of green claims in the aquaculture sector. The high alpha suggests that the confusion experienced by consumers in relation to greenwashing is consistently measured.

Green trust (Cronbach's alpha = 0.886): This construct measures the level of trust consumers have in sustainability claims for aquaculture products. The high alpha value is an indication that the measurement of this construct has a high degree of reliability.

Cluster analysis

The description of the way the three consumer segments differed from each other regarding the segmentation variables is presented in Table 3. This table displays the mean values and differences between segmentation variables related to greenwashing across three consumer segments, named by the authors according to the characteristics that describe them: Unimpressed, Trusting, and Uninformed.

The first segment, the Unimpressed cluster, scored the highest in all greenwashing constructs, except green trust, for which they had the second highest score. Most mean values for this segment were around or above five, one point above the scale's mid-point.

The second and smallest segment, the Trusting cluster, reported the lowest scores on all Greenwashing constructs, except for green trust. The Trusting had the highest score for green trust, which was near five.

The final and largest segment, the Uninformed cluster, scored mostly near the scale's mid-point, including green trust.

The differences between the segments are statistically significant ($p < 0.001$). The post-hoc test confirms significant differences in all segments.

Table 4. Social and demographic characteristics of the total sample and the three segments.

		Segment				
		Unimpressed	Trusting	Uninformed	Total	p-value*
Country	United Kingdom	11.9%	9.6%	15.1%	13.4%	0.229
	Germany	19.9%	21.7%	16.8%	18.3%	
	France	21.6%	15.9%	21.9%	21.2%	
	Italy	21.6%	23.6%	21.4%	21.7%	
	Spain	24.9%	29.3%	24.8%	25.3%	
Gender	Female	46.8%	43.9%	48.7%	47.5%	0.514
	Male	53.2%	56.1%	51.3%	52.5%	
Age	18–34	21.9%	22.2%	26.2%	24.4%	0.055
	35–54	41.0%	31.6%	38.1%	38.3%	
	55–99	37.1%	46.2%	35.7%	37.3%	
Education	Primary	3.0%	3.2%	3.6%	3.3%	0.616
	Secondary	21.9%	22.2%	24.6%	23.5%	
	Professional qualification of degree level	27.9%	23.4%	27.8%	27.4%	
	College/university degree	34.6%	33.5%	31.7%	32.9%	
	Post-graduate education	12.6%	17.7%	12.3%	13.0%	
Occupation	Not employed – retired	22.1%	24.1%	17.4%	19.6%	0.410
	Not employed – unemployed, on welfare, in practical job training	5.9%	3.8%	5.7%	5.6%	
	Homemaker	5.2%	5.1%	8.1%	6.8%	
	Student/apprentice/intern	6.3%	7.6%	6.2%	6.4%	
	Employed – office job, teaching etc.	29.3%	32.3%	31.1%	30.6%	
	Employed – craftsman, trade and service employee, health worker etc.	19.5%	13.9%	19.9%	19.1%	
	Self-employed	6.9%	7.6%	6.4%	6.7%	
	Other	4.8%	5.7%	5.3%	5.1%	
Residential area	A village or rural area	25.5%	19.0%	24.4%	24.2%	0.015
	A small town or a medium-sized city	40.9%	45.6%	48.2%	45.5%	
	A big city	33.5%	34.8%	26.6%	29.7%	
	Don't know	0.0%	0.6%	0.9%	0.6%	
Marital status	Married	48.6%	51.9%	40.8%	44.5%	0.063
	In a civil partnership	6.1%	5.1%	5.8%	5.8%	
	Separated but still legally married or in a civil partnership	1.1%	1.9%	1.3%	1.3%	
	Living with a partner but neither married nor in a civil partnership	10.8%	8.2%	15.4%	13.2%	
	In a relationship, but not living together	4.3%	5.1%	5.5%	5.1%	
	Single	16.9%	17.7%	21.4%	19.6%	
	Divorced	10.6%	8.2%	7.6%	8.6%	
	Widowed	1.5%	1.9%	2.1%	1.9%	

*Based on chi-square tests.

The socio-demographic characteristics of the total sample and each of the segments are presented in Table 4. Comparisons of the segments regarding socio-demographic characteristics showed that the three groups were comparable in distribution among countries, gender, age categories, occupation and marital status.

Table 5. Mean awareness about four types of European aquaculture production systems, among the three segments.

	Segment				
	Unimpressed	Trusting	Uninformed	F*	p-value
RAS	2.90a	2.61ab	2.43b	12.661	<0.001
IMTA	2.66a	2.21b	2.26b	9.958	<0.001
Organic	3.26a	3.30a	2.70b	20.316	<0.001
Conventional	3.35a	3.39a	2.80b	19.237	<0.001

*Based on analysis of variance tests; a-b indicate significant differences between segments based on post-hoc tests.

The sample covers five European countries: France, Germany, Italy, Spain, the UK. No statistically significant differences were found between the segments based on country. There is no significant difference between the segments according to gender ($p = 0.514$). There are some interesting trends in the age distribution across the segments, although not statistically significant ($p = 0.055$). No significant differences in the level of education were found between the segments ($p = 0.616$), although there are a number of notable trends. There are no significant differences between the segments in terms of occupation ($p = 0.410$). It was also found that the marital status was not statistically significant ($p = 0.063$). The only significant difference observed was regarding the area where the participants resided ($p = 0.015$). A higher proportion of the Trusting group live in large cities (34.80 per cent), while the Uninformed group are more likely to live in small towns or medium-sized cities (48.2 per cent). The Trusting group has the highest proportion living in rural areas or villages (25.5%) and a tendency to be older (46.2% in the 55–99 age group). However, the difference in residential area is only slightly higher than the Uninformed group (24.40%).

Table 5 compares the mean awareness levels for four types of aquaculture production systems across the three consumer segments: Unimpressed, Trusting and Uninformed. Awareness was measured on a seven-point scale (1 = not informed at all to 7 = very informed). An ANOVA test was performed to identify statistically significant differences between the segments.The comparison of the consumer segments in terms of their awareness of the four types of European aquaculture production systems indicated significant differences (Table 5). The Unimpressed reported the highest awareness for RAS and IMTA, while The Trusting reported the highest awareness for conventional and organic systems. The awareness the Trusting reported related to IMTA was significantly lower than the one reported by the Unimpressed. The Trusting did not report an awareness related to RAS significantly different from the other two segments. The Uninformed reported the lowest awareness related to all four production systems. All mean awareness values were below the mid-point of the scales.

Table 6. Mean attitudes about four types of European aquaculture production systems, among the three segments.

	Segment				
	Unimpressed	Trusting	Uninformed	F*	p-value
RAS	4.63b	4.96a	4.33c	16.587	<0.001
IMTA	4.53a	4.76a	4.23b	12.499	<0.001
Organic	5.08b	5.66a	4.74c	28.507	<0.001
Conventional	4.73b	5.13a	4.49b	15.204	<0.001

*Based on analysis of variance tests; a-c indicate significant differences between segments based on post-hoc tests.

Table 7. Mean acceptance about four types of European aquaculture production systems, among the three segments.

	Segment				
	Unimpressed	Trusting	Uninformed	F*	p-value
RAS	4.61ab	4.78a	4.42b	4.934	0.007
IMTA	4.57	4.58	4.42	1.75	0.174
Organic	4.97b	5.39a	4.79b	11.69	<0.001
Conventional	4.80ab	5.00a	4.52b	9.619	<0.001

*Based on analysis of variance tests; a-c indicate significant differences between segments based on post-hoc tests.

Table 6 shows the mean attitudes of consumers toward four aquaculture production systems across the three identified segments. Attitudes were measured on a seven-point scale (1 = very negative to 7 = very positive). The table shows the results of an ANOVA test indicating statistically significant differences between the segments. The Trusting reported the most positive attitudes toward all four systems. The Unimpressed and the Trusting reported the most positive attitudes about IMTA but significantly less positive attitudes regarding the RAS and Organic. The Uninformed and Unimpressed reported the least positive attitudes toward conventional aquaculture. The Uninformed also reported the least positive attitudes about RAS, IMTA and organic. All mean attitude values were above the mid-point of the scales.

Table 7 compares the mean acceptance levels for four types of aquaculture production systems across the three identified consumer segments. Acceptance was measured on a seven-point scale (1 = definitely no to 7 = definitely yes) and the table includes the results of an ANOVA test showing statistically significant differences between segments.

The Trusting segment reported the highest acceptance for all systems. The acceptance scores of the Unimpressed were not significantly different from those of the Trusting for all production systems except for Organic, where they reported a significantly lower acceptance than the Trusting. The Uninformed Reported a significantly lower acceptance for RAS, organic and conventional. The scores for IMTA were not significantly different. All mean acceptance values were above the mid-point of the scales.

Discussion

This paper contributes to the debate on sustainable aquaculture by examining the consumers' perception related to the greenwashing of aquaculture in some European countries. It provides insights into how consumer segments based on greenwashing perceptions vary in terms of their awareness, attitudes, and acceptance of four European aquaculture production methods.

Although the attitude and acceptance constructs are closely related, they nevertheless measure distinct dimensions of consumer response. Attitudes are reflected in abstract evaluations and feelings about aquaculture systems and are influenced by various factors, including perceptions of sustainability and ethicality. In contrast, acceptance is reflective of a practical willingness to purchase, and is influenced by factors such as price and accessibility. The similarity in scores observed in this study indicates a notable alignment between consumers' perceptions and their stated purchase intentions. This alignment suggests that practical barriers may not be the main factor preventing consumers from purchasing aquaculture systems such as IMTA and RAS. Rather, it indicates the necessity for building trust and ensuring transparent communication to further enhance consumer acceptance.

The results show that low consumer awareness of specific production methods such as recirculating aquaculture systems (RAS) and integrated multi-trophic aquaculture (IMTA) is a challenge for the sector, although attitudes toward sustainable aquaculture are generally positive. This aligns with the findings of Feucht and Zander (2015) that consumers have limited knowledge of aquaculture, as argued by Chen and Chang (2013). The complexity of aquaculture systems and vague sustainability claims make it difficult for consumers to distinguish between genuine and misleading green claims. This highlights the need for more transparent and educational communication. It is noteworthy that conventional aquaculture is perceived more favorably than other methods, including RAS and IMTA, by consumers in all three segments. Consumers are likely to be more familiar with conventional aquaculture practices, as they have been the dominant production method for several decades. Consumers' greater familiarity with conventional aquaculture practices may lead them to perceive it as a more "proven" system, which in turn may lead to greater acceptance and more positive attitudes. Low awareness scores indicate that there is a lack of understanding among many consumers regarding the benefits of RAS and IMTA. This may, therefore, be a limiting factor influencing their acceptance of these methods. Furthermore, the terminology used to describe RAS and IMTA is often technical or environmental in nature (e.g. nutrient recycling, water treatment), which may be perceived as abstract or overly

complex by consumers. There is a possibility that consumers may associate the term "recirculating aquaculture system" (RAS) with industrialization and artificial environments. This could potentially lead to a negative perception of RAS compared to alternative, more "natural" farming methods. Additionally, the intricate nature of IMTA and its reliance on interspecies integration could raise concerns about its feasibility and scalability in the minds of consumers who lack relevant knowledge on the topic.

Greenwashing poses a significant threat to consumer trust, particularly in the "unimpressed" and "uninformed" segments, where skepticism is evident. This is also noted by Chen and Chang (2013). These segments are generally supportive of sustainability, but have difficulty dealing with green claims. This echoes the findings of Szabo and Webster (2021) that greenwashing increases confusion and undermines trust. In contrast, the trusting segment showed higher trust in sustainability labels. This supports Matthes and Wonneberger (2014) argument that trust plays a crucial role in influencing consumer behavior. This highlights the importance of clear and transparent communication to mitigate the effects of greenwashing. Perceived risk, particularly in the unimpressed and uninformed segments, further shapes consumer attitudes toward aquaculture. Mohr et al. (1998) found that a high perceived risk of environmental claims discourages consumers from purchasing. This pattern was observed also in this study. An effective strategy to increase the acceptance of aquaculture products may be to reduce perceived risk through verified sustainability certifications.

To understand consumer behavior, it is important to segment consumers based on their skepticism toward greenwashing, as suggested by Aji and Sutikno (2015). The Trusting segment, representing only 11% of the sample, showed the high level of attitudes and acceptance of all aquaculture systems. Their positive disposition suggests that they may not require significant educational efforts compared to other segments to maintain or improve their trust levels.

In contrast, the Uninformed segment, which represented the largest group, had low awareness and less positive attitudes. This is consistent with Baumgartner and Steenkamp (2001) observation that low knowledge correlates with neutral or indifferent attitudes. In addition, the three segments had Green Trust scores above the mean. This suggests a foundation of trust that could be strengthened through clear communication. Low awareness of all aquaculture systems, particularly RAS and IMTA, presents an opportunity for industry stakeholders to improve consumer education, especially given the positive attitudes and acceptance that already exist, particularly for organic aquaculture. The results of the study highlight the need for targeted communication strategies. These should take into account the different information needs of each segment. For example, the uninformed

segment, over-represented by young people living in smaller cities, could benefit from balanced, science-based information to improve their understanding of sustainable aquaculture. Feucht and Zander (2015) and Altintzoglou et al. (2010) suggested that improvements in transparency and trust building around sustainable aquaculture practices could transform Uninformed consumers into more confident and informed buyers. Furthermore, our results suggest a potential halo effect from other organic food products, with organic aquaculture receiving higher attitudes and acceptance despite low awareness. This indicates the wider potential for consumer confidence building through large-scale communication campaigns (Risius et al., 2017; Tandon et al., 2020). Interactive websites and consumer engagement could further reduce perceived greenwashing, especially for the uninformed segment. This is suggested also by Szabo and Webster (2021).

The Unimpressed segment, which is more knowledgeable, exhibited skepticism toward specific aquaculture systems, including RAS and IMTA, which they regarded as unproven. These findings suggest that increased awareness or information does not lead to a uniform increase in trust. Conversely, it may prompt consumers to undertake a critical analysis of the systems in question, potentially identifying aspects that they find less appealing or trustworthy. This pattern gives rise to questions as to whether enhanced knowledge leads individuals to shift their perception of trust toward skepticism. Such a transition may occur when the information presented challenges preexisting assumptions or introduces perceived risks.

Conclusion and implications

This study provides new insights into consumer perceptions of greenwashing in the context of sustainable aquaculture by identifying three distinct consumer segments based on their awareness, attitudes and trust in sustainability claims. The results show that low awareness of specific production systems such as RAS and IMTA, combined with confusion and skepticism about green claims, poses a significant challenge to the industry. However, consumers from five European countries have generally positive attitudes toward sustainable aquaculture. The negative impact of greenwashing on consumer confidence and trust highlights the need for clear, transparent and credible communication strategies. In order for the aquaculture industry to promote greater acceptance of sustainable practices, it must prioritize the filling of the information gap, especially for the uninformed segment, which is the largest group of consumers. By using transparent certification schemes, providing science-based information and improving consumer engagement through interactive platforms, the industry can rebuild trust

and reduce perceived risks associated with green claims. In addition, particularly in the face of growing concerns about greenwashing, targeted communication strategies should focus on reducing consumer confusion, raising awareness and strengthening the credibility of sustainability efforts.

Finally, this study highlights the critical role of trust in shaping the behavior of consumers concerning sustainable aquaculture products. To overcome the challenges posed by greenwashing and to foster long-term consumer confidence in the aquaculture sector, building trust through consistent, clear and verifiable sustainability claims will be essential.

The findings have important implications for policy makers, industry stakeholders and marketers who are seeking to improve the effectiveness of sustainability communication and to promote a more transparent and resilient aquaculture sector in Europe.

The growing interest of consumers in sustainable aquaculture has the potential to have a significant impact on the food system as a whole. Systems thinking, as discussed by Dentoni et al. (2023), provides a framework for understanding how consumer demand can drive strategic decision-making in the agri-food sector, potentially accelerating the transition to more sustainable production systems. The findings suggest also that it is essential to build consumer confidence in sustainable aquaculture through transparent reporting and certifying schemes. This could guide policymakers in the design of regulations that support clearer labeling, more rigorous enforcement of sustainability claims and broader public education efforts to mitigate greenwashing.

The study provides insights into consumer attitudes in five European countries (France, Germany, Italy, Spain and the United Kingdom) toward sustainable aquaculture, which may not be wholly representative of the diversity of consumer perspectives across Europe. It is acknowledged by the authors that while the findings offer insights into the specific contexts under discussion, they are unable to be extrapolated to represent the experiences of all European consumers.

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References

Abson, D. J., Fischer, J., Leventon, J., Newig, J., Schomerus, T., Vilsmaier, U., von Wehrden, H., Abernethy, P., Ives, C. D., Jager, N. W., & Lang, D. J. (2017). Leverage points for sustainability transformation. *Ambio*, *46*(1), 30–39. https://doi.org/10.1007/s13280-016-0800-y

Ahmed, N., Thompson, S., & Glaser, M. (2019). Global aquaculture productivity, environmental sustainability, and climate change adaptability. *Environmental Management*, *63*(2), 159–172. https://doi.org/10.1007/s00267-018-1117-3

Aji, H. M., & Sutikno, B. (2015). The extended consequence of greenwashing: Perceived consumer skepticism. *International Journal of Business and Information*, *10*(4), 433.

Altintzoglou, T., Verbeke, W., Vanhonacker, F., & Luten, J. (2010). The image of fish from aquaculture among Europeans: Impact of exposure to balanced information. *Journal of Aquatic Food Product Technology*, *19*(2), 103–119. https://doi.org/10.1080/10498850.2010.492093

Anderson, J. L., Asche, F., Garlock, T., & Chu, J. (2017). Aquaculture: Its role in the future of food. In *World agricultural resources and food security* (Vol. 17, pp. 159–173). Emerald Publishing.

Asche, F., & Smith, M. D. (2018). Induced innovation in fisheries and aquaculture. *Food Policy*, *76*, 1–7. https://doi.org/10.1016/j.foodpol.2018.02.002

Asche, F., Eggert, H., Oglend, A., Roheim, C. A., & Smith, M. D. (2022). Aquaculture: Externalities and policy options. *Review of Environmental Economics and Policy*, *16*(2), 282–305. https://doi.org/10.1086/721055

Baumgartner, H., & Steenkamp, J. B. E. (2001). Response styles in marketing research: A cross-national investigation. *Journal of Marketing Research*, *38*(2), 143–156. https://doi.org/10.1509/jmkr.38.2.143.18840

Boiral, O. (2013). Sustainability reports as simulacra? A counter-account of A and A + GRI reports. *Accounting, Auditing & Accountability Journal*, *26*(7), 1036–1071. https://doi.org/10.1108/AAAJ-04-2012-00998

Boyd, C. E., McNevin, A. A., & Davis, R. P. (2022). The contribution of fisheries and aquaculture to the global protein supply. *Food Security*, *14*(3), 805–827. https://doi.org/10.1007/s12571-021-01246-9

Cárdenas-Retamal, R., Dresdner-Cid, J., & Ceballos-Concha, A. (2021). Impact assessment of salmon farming on income distribution in remote coastal areas: The Chilean case. *Food Policy*, *101*, 102078. https://doi.org/10.1016/j.foodpol.2021.102078

Carrassón, M., Soler-Membrives, A., Constenla, M., Escobar, C., Flos, R., Gil, J. M., Luzón, V., Piferrer, F., & Reig, L. (2021). Information impact on consumers' perceptions towards aquaculture: Dismantling the myth about feeds for farmed fish. *Aquaculture*, *544*, 737137. https://doi.org/10.1016/j.aquaculture.2021.737137

Ceballos, A., Dresdner-Cid, J. D., & Quiroga-Suazo, M. Á. (2018). Does the location of salmon farms contribute to the reduction of poverty in remote coastal areas? An impact assessment using a Chilean case study. *Food Policy*, *75*, 68–79. https://doi.org/10.1016/j.foodpol.2018.01.009

Ceballos-Concha, A., Asche, F., & Cárdenas-Retamal, R. (2025). Salmon aquaculture in Chile: Production growth and socio-economic impacts. *Reviews in Aquaculture*, *17*(1), e12993. https://doi.org/10.1111/raq.12993

Chen, Y. S., & Chang, C. H. (2013). Greenwash and green trust: The mediation effects of green consumer confusion and green perceived risk. *Journal of Business Ethics*, *114*(3), 489–500. https://doi.org/10.1007/s10551-012-1360-0

Chen, Y. S., & Chang, C.-H. (2012). Enhance green purchase intentions: The roles of green perceived value, green perceived risk, and green trust. *Management Decision*, *50*(3), 502–520. https://doi.org/10.1108/00251741211216250

Cho, C. H., Laine, M., Roberts, R. W., & Rodrigue, M. (2015). Organized hypocrisy, organizational façades, and sustainability reporting. *Accounting, Organizations and Society*, *40*, 78–94. https://doi.org/10.1016/j.aos.2014.12.003

de Freitas Netto, S. V., Sobral, M. F. F., Ribeiro, A. R. B., & Soares, G. R. D L. (2020). Concepts and forms of greenwashing: A systematic review. *Environmental Sciences Europe*, *32*(1), 19. https://doi.org/10.1186/s12302-020-0300-3

Dentoni, D., Cucchi, C., Roglic, M., Lubberink, R., Bender-Salazar, R., & Manyise, T. (2023). Systems thinking, mapping and change in food and agriculture. *Bio-Based and Applied Economics*, *11*(4), 277–301. https://doi.org/10.36253/bae-13930

Devitt, I. (2024). Greenwashing in the meat and seafood industry. *University of South Australia Law Review*, *6*, 21–21. https://doi.org/10.21913/USLRunisalr.v6.1689

Edwards, P., Zhang, W., Belton, B., & Little, D. C. (2019). Misunderstandings, myths and mantras in aquaculture: Its contribution to world food supplies has been systematically over reported. *Marine Policy*, *106*, 103547. https://doi.org/10.1016/j.marpol.2019.103547

Falcon, W. P., Naylor, R. L., & Shankar, N. D. (2022). Rethinking global food demand for 2050. *Population and Development Review*, *48*(4), 921–957. https://doi.org/10.1111/padr.12508

Feucht, Y., & Zander, K. (2015). Of earth ponds, flow-through and closed recirculation systems—German consumers' understanding of sustainable aquaculture and its communication. *Aquaculture*, *438*, 151–158. https://doi.org/10.1016/j.aquaculture.2015.01.005

Flaherty, M., Reid, G., Chopin, T., & Latham, E. (2019). Public attitudes towards marine aquaculture in Canada: insights from the Pacific and Atlantic coasts. *Aquaculture International*, *27*, 9–32.

García-Poza, S., Leandro, A., Cotas, C., Cotas, J., Marques, J. C., Pereira, L., & Gonçalves, A. M. (2020). The evolution road of seaweed aquaculture: Cultivation technologies and the industry 4.0. *International Journal of Environmental Research and Public Health*, *17*(18), 6528. https://doi.org/10.3390/ijerph17186528

Garlock, T. M., Asche, F., Anderson, J. L., Eggert, H., Anderson, T. M., Che, B., Chávez, C. A., Chu, J., Chukwuone, N., Dey, M. M., Fitzsimmons, K., Flores, J., Guillen, J., Kumar, G., Liu, L., Llorente, I., Nguyen, L., Nielsen, R., Pincinato, R. B. M., … Tveteras, R. (2024). Environmental, economic, and social sustainability in aquaculture: The aquaculture performance indicators. *Nature Communications*, *15*(1), 5274. https://doi.org/10.1038/s41467-024-49556-8

Garlock, T., Asche, F., Anderson, J., Ceballos-Concha, A., Love, D. C., Osmundsen, T. C., & Pincinato, R. B. M. (2022). Aquaculture: The missing contributor in the food security agenda. *Global Food Security*, *32*, 100620. https://doi.org/10.1016/j.gfs.2022.100620

Gephart, J. A., Henriksson, P. J. G., Parker, R. W. R., Shepon, A., Gorospe, K. D., Bergman, K., Eshel, G., Golden, C. D., Halpern, B. S., Hornborg, S., Jonell, M., Metian, M., Mifflin, K., Newton, R., Tyedmers, P., Zhang, W., Ziegler, F., & Troell, M. (2021). Environmental performance of blue foods. *Nature*, *597*(7876), 360–365. https://doi.org/10.1038/s41586-021-03889-2

Golden, C. D., Koehn, J. Z., Shepon, A., Passarelli, S., Free, C. M., Viana, D. F., Matthey, H., Eurich, J. G., Gephart, J. A., Fluet-Chouinard, E., Nyboer, E. A., Lynch, A. J., Kjellevold, M., Bromage, S., Charlebois, P., Barange, M., Vannuccini, S., Cao, L., Kleisner, K. M., … Thilsted, S. H. (2021). Aquatic foods to nourish nations. *Nature*, *598*(7880), 315–320. https://doi.org/10.1038/s41586-021-03917-1

Hegde, S., Kumar, G., Engle, C., Hanson, T., Roy, L. A., van Senten, J., Johnson, J., Avery, J., Aarattuthodi, S., Dahl, S., Dorman, L., & Peterman, M. (2022). Economic contribution of the US catfish industry. *Aquaculture Economics & Management*, *26*(4), 384–413. https://doi.org/10.1080/13657305.2021.2008050

Hirschman, E. C. (1986). The effect of verbal and pictorial advertising stimuli on aesthetic, utilitarian and familiarity perceptions. *Journal of Advertising*, *15*(2), 27–34. https://doi.org/10.1080/00913367.1986.10673002

Jacquet, J., Pauly, D., Ainley, D., Holt, S., Dayton, P., & Jackson, J. (2010). Seafood stewardship in crisis. *Nature*, *467*(7311), 28–29. https://doi.org/10.1038/467028a

Kaimakoudi, E. (2024). Policy initiatives towards enhancing consumer knowledge and tackling consumer confusion in aquaculture sector. *Aquaculture International*, *32*(1), 1–9. https://doi.org/10.1007/s10499-023-01143-2

Kumar, G., & Engle, C. R. (2016). Technological advances that led to growth of shrimp, salmon, and tilapia farming. *Reviews in Fisheries Science & Aquaculture*, *24*(2), 136–152. https://doi.org/10.1080/23308249.2015.1112357

Laine, C., Ollikainen, M., Kankainen, M., Setälä, J., & Vielma, J. (2024). Social net benefits from aquaculture production: A comparison of net cage cultivation and recirculating aquaculture systems. *Aquaculture Economics & Management*, *28*(1), 1–31. https://doi.org/10.1080/13657305.2023.2222681

Landazuri-Tveteraas, U., Misund, B., Tveterås, R., & Zhang, D. (2023). Determinants of investment behavior in Norwegian salmon aquaculture. *Aquaculture Economics & Management*, *27*(4), 790–808. https://doi.org/10.1080/13657305.2023.2208541

Laufer, W. S. (2003). Social accountability and corporate greenwashing. *Journal of Business Ethics*, *43*(3), 253–261. https://doi.org/10.1023/A:1022962719299

Lu, X., Sheng, T., Zhou, X., Shen, C., & Fang, B. (2022). How does young consumers' greenwashing perception impact their green purchase intention in the fast fashion industry? An analysis from the perspective of perceived risk theory. *Sustainability*, *14*(20), 13473. https://doi.org/10.3390/su142013473

Marquis, C., Toffel, M. W., & Zhou, Y. (2016). Scrutiny, norms, and selective disclosure: A global study of greenwashing. *Organization Science*, *27*(2), 483–504. https://doi.org/10.1287/orsc.2015.1039

Matthes, J., & Wonneberger, A. (2014). The skeptical green consumer revisited: Testing the relationship between green consumerism and skepticism toward advertising. *Journal of Advertising*, *43*(2), 115–127. https://doi.org/10.1080/00913367.2013.834804

Misund, B., Olsen, M. S., Osmundsen, T. C., & Tveterås, R. (2023). The political economy of salmon aquaculture: Value sharing and societal support for aquaculture in Norway. *Marine Resource Economics*, *38*(4), 365–390. https://doi.org/10.1086/726242

Mitra, S., Ankon, Y. I., Anik, A. R., Khatun, N., & Ashraf, M. (2024). Do consumer beliefs matter for consumer preferences and willingness to pay for wild and farmed fish? *Aquaculture Economics & Management*, *29*(1), 1–15. https://doi.org/10.1080/13657305.2024.2379804

Mohr, L. A., Eroğlu, D., & Ellen, P. S. (1998). The development and testing of a measure of skepticism toward environmental claims in marketers' communications. *Journal of Consumer Affairs*, *32*(1), 30–55. https://doi.org/10.1111/j.1745-6606.1998.tb00399.x

Murray, G. D., Fail, R., Fairbanks, L., Campbell, L. M., D'Anna, L., & Stoll, J. (2023). Seafood consumption and the management of shellfish aquaculture. *Marine Policy*, *150*, 105534. https://doi.org/10.1016/j.marpol.2023.105534

Naylor, R. L., Hardy, R. W., Buschmann, A. H., Bush, S. R., Cao, L., Klinger, D. H., Little, D. C., Lubchenco, J., Shumway, S. E., & Troell, M. (2021). A 20-year retrospective review

of global aquaculture. *Nature*, *591*(7851), 551–563. https://doi.org/10.1038/s41586-021-03308-6

Naylor, R. L., Kishore, A., Sumaila, U. R., Issifu, I., Hunter, B. P., Belton, B., Bush, S. R., Cao, L., Gelcich, S., Gephart, J. A., Golden, C. D., Jonell, M., Koehn, J. Z., Little, D. C., Thilsted, S. H., Tigchelaar, M., & Crona, B. (2021). Blue food demand across geographic and temporal scales. *Nature Communications*, *12*(1), 5413. https://doi.org/10.1038/s41467-021-25516-4

Naylor, R., Fang, S., & Fanzo, J. (2023). A global view of aquaculture policy. *Food Policy*, *116*, 102422. https://doi.org/10.1016/j.foodpol.2023.102422

Nugraha, W. S., Szakos, D., Süth, M., & Kasza, G. (2024). Greenwashing in the food industry: A systematic review exploring the current situation and possible countermeasures. *Cleaner and Responsible Consumption*, *15*, 100227. https://doi.org/10.1016/j.clrc.2024.100227

Olson, J., Clay, P. M., & da Silva, P. P. (2014). Putting the seafood in sustainable food systems. *Marine Policy*, *43*, 104–111. https://doi.org/10.1016/j.marpol.2013.05.001

Onozaka, Y., Honkanen, P., & Altintzoglou, T. (2023). Sustainability, perceived quality and country of origin of farmed salmon: Impact on consumer choices in the USA, France and Japan. *Food Policy*, *117*, 102452. https://doi.org/10.1016/j.foodpol.2023.102452

Parguel, B., Benoît-Moreau, F., & Larceneux, F. (2011). How sustainability ratings might deter 'greenwashing': A closer look at ethical corporate communication. *Journal of Business Ethics*, *102*(1), 15–28. https://doi.org/10.1007/s10551-011-0901-2

Pradeepkiran, J. A. (2019). Aquaculture role in global food security with nutritional value: A review. *Translational Animal Science*, *3*(2), 903–910. https://doi.org/10.1093/tas/txz012

Risius, A., Janssen, M., & Hamm, U. (2017). Consumer preferences for sustainable aquaculture products: Evidence from in-depth interviews, think aloud protocols and choice experiments. *Appetite*, *113*, 246–254. https://doi.org/10.1016/j.appet.2017.02.021

Ropicki, A., Garlock, T., Farzad, R., & Hazell, J. E. (2024). Recirculating aquaculture system-based production as a pathway to increase aquaculture in developed countries: The case of United States aquaculture. *Aquaculture Economics & Management*, *28*(3), 515–536.

Simmance, F. A., Cohen, P. J., Huchery, C., Sutcliffe, S., Suri, S. K., Tezzo, X., Thilsted, S. H., Oosterveer, P., McDougall, C., Ahern, M., Freed, S., Byrd, K. A., Wesana, J., Cowx, I. G., Mills, D. J., Akester, M., Chan, C. Y., Nagoli, J., Wate, J. T., & Phillips, M. J. (2022). Nudging fisheries and aquaculture research towards food systems. *Fish and Fisheries*, *23*(1), 34–53. https://doi.org/10.1111/faf.12597

Sirieix, L., Delanchy, M., Remaud, H., Zepeda, L., & Gurviez, P. (2013). Consumers' perceptions of individual and combined sustainable food labels: A UK pilot investigation. *International Journal of Consumer Studies*, *37*(2), 143–151. https://doi.org/10.1111/j.1470-6431.2012.01109.x

Subasinghe, R., Soto, D., & Jia, J. (2009). Global aquaculture and its role in sustainable development. *Reviews in Aquaculture*, *1*(1), 2–9. https://doi.org/10.1111/j.1470-6431.2012.01109.x

Szabo, S., & Webster, J. (2021). Perceived greenwashing: The effects of green marketing of environmental and product perceptions. *Journal of Business Ethics*, *171*(4), 719–739. https://doi.org/10.1007/s10551-020-04461-0

Tandon, A., Dhir, A., Kaur, P., Kushwah, S., & Salo, J. (2020). Why do people buy organic food? The moderating role of environmental concerns and trust. *Journal of Retailing and Consumer Services*, *57*, 102247. https://doi.org/10.1016/j.jretconser.2020.102247

Testa, F., Boiral, O., & Iraldo, F. (2018). Internalization of environmental practices and institutional complexity: Can stakeholders pressures encourage greenwashing? *Journal of Business Ethics*, *147*(2), 287–307. https://doi.org/10.1007/s10551-015-2960-2

Thøgersen, J. (2005). How may consumer policy empower consumers for sustainable lifestyles? *Journal of consumer policy*, *28*(2), 143–177.

Troell, M., Joyce, A., Chopin, T., Neori, A., Buschmann, A. H., & Fang, J. G. (2009). Ecological engineering in aquaculture—potential for integrated multi-trophic aquaculture (IMTA) in marine offshore systems. *Aquaculture*, *297*(1–4), 1–9. https://doi.org/10.1016/j.aquaculture.2009.09.010

Troell, M., Naylor, R. L., Metian, M., Beveridge, M., Tyedmers, P. H., Folke, C., Arrow, K. J., Barrett, S., Crépin, A.-S., Ehrlich, P. R., Gren, A., Kautsky, N., Levin, S. A., Nyborg, K., Österblom, H., Polasky, S., Scheffer, M., Walker, B. H., Xepapadeas, T., & de Zeeuw, A. (2014). Does aquaculture add resilience to the global food system? *Proceedings of the National Academy of Sciences of the United States of America*, *111*(37), 13257–13263. https://doi.org/10.1073/pnas.1404067111

UNEP. (2016). *Food systems and natural resources, working group on food systems of the international resource panel*. United Nations Environment Programme.

Wang, D., Walker, T., & Barabanov, S. (2020). A psychological approach to regaining consumer trust after greenwashing: The case of Chinese green consumers. *Journal of Consumer Marketing*, *37*(6), 593–603. https://doi.org/10.1108/JCM-06-2019-3257

Wendt, M. C., & Weinrich, R. (2023). A systematic review of consumer studies applying the Food Technology Neophobia Scale: Lessons and applications. *Food Quality and Preference*, *106*, 104811. https://doi.org/10.1016/j.foodqual.2023.104811

Wilks, M., & Phillips, C. J. (2017). Attitudes to in vitro meat: A survey of potential consumers in the United States. *PloS one*, *12*(2), e0171904.

Zhang, H., Ul Ainn, Q., Bashir, I., Ul Haq, J., & Bonn, M. A. (2022). Does greenwashing influence the green product experience in emerging hospitality markets post-COVID-19? *Sustainability*, *14*(19), 12313. https://doi.org/10.3390/su141912313