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## European consumer segments with a high potential for accepting new innovative fish products based on their food-related lifestyle

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### ABSTRACT

Consumer lifestyles influence consumer behaviour towards food product choices and provide important insights about the existence of consumer segments that vary in their response to new food products. With the aim to contribute to a more market-oriented enhancement of the European aquaculture industry competitiveness, the objective of this study was to identify and profile food-related lifestyle segments of consumers that vary in terms of their willingness to buy new aquaculture fish products. Data were collected through a survey among respondents in three large European fish markets (Spain, France and Germany, N = 1500 in total). Certain core dimensions of the food-related lifestyle construct were used as segmentation bases. We identified five consumer segments across two country groups. The segments differed mainly in terms of their psychographic profile and their intention to buy new aquaculture fish products. Our results contribute to identifying the most promising European consumer segments in terms of buying intention that can be targeted when promoting new aquaculture fish products. The findings have important strategic marketing implications for the food industry and aquaculture, while highlighting the important role food-related lifestyles can play in European segmentation for new food product development.

### 1. Introduction

Aquaculture provides 52 percent of fish for human consumption worldwide (FAO, 2020), whereas in the European Union (EU), farmed fish and seafood represents a quarter of human consumption (EUMOFA, 2020). Consumption of fish and seafood at the global level has been increasing over the past years. Compared to the developed countries that register slight declines in consumption after 2007, in the developing countries consumption continued its increasing trend (FAO, 2020). In the EU, the consumption of fish and seafood in 2018 was 2 percent below the 10-year peak reached in 2016; however, household expenditure on fish and seafood has increased in 2019 compared to 2018 (EUMOFA, 2020). The market for aquaculture fish and fish products is expected to continue growing, as suggested by forecasted developments in the production and consumption of aquaculture fish and seafood across the world (FAO, 2020). This provides opportunities for the development of new aquaculture fish products to meet the increasing

consumer demand. In such an evolving international market, there is a need to understand consumer perceptions and interests in order to support effective marketing efforts. In certain respects, consumers hold less favourable attitudes towards farmed fish compared to wild fish (Claret et al., 2014); thus, the availability of consumer insights is deemed crucial for the development of effective marketing for new aquaculture products.

Consumer attitudes towards eating fish, perceptions of fish as a healthy dietary choice, involvement with fish, wider interest in healthy eating, taste as well as consumer lifestyles, all play an important role in explaining people's behaviours in relation to fish and fish products (Cantillo, Martín, & Román, 2021; Carlucci et al., 2015). Lack of convenience or lack of self-efficacy in preparing fish are some of the main barriers for fish consumption (Carlucci et al., 2015; Vanhonacker, Pieniak, & Verbeke, 2010). As the market for fish and fish products evolves, new products are developed to match consumer interests and to address some of the perceived barriers. Identifying and describing the profile of

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consumer segments that can be targeted by such products is the first step in the development of new fish products that could become successful product choices in the market.

Through segmentation, consumers can be classified into homogeneous groups based on their degree of similarity across certain characteristics. Previous studies have segmented the fish market based on consumer motives for purchasing and consuming fish (e.g. price, nutritional value) (Claret et al., 2012; Wang & Somogyi, 2020) and/or barriers and risk perceptions (Jacobs et al., 2015; Vanhonacker et al., 2010), or perceptions of aquaculture versus wild fish (Arvanitoyannis, Krystallis, Panagiotaki, & Theodorou, 2004; López-Mas et al., 2021). Others have used consumer fish quality perceptions (Verbeke, Vermeir, & Brunsø, 2007), health-related attitudes (Pieniak, Verbeke, Olsen, Hansen, & Brunsø, 2010; Sacchetti et al., 2021), perceptions of information or visual package elements (Heide & Olsen, 2017), or selected psychographic constructs (e.g. consumers' involvement in the fish category, domain-specific innovativeness, or subjective knowledge) (Reinders, Banovic, Guerrero, & Krystallis, 2016) as segmentation bases.

Moreover, the aquaculture fish and seafood market involves actors from across the world, being an international market that can benefit from international segmentation. The latter entails identifying groups of consumers that are homogeneous in their needs and wants, across countries or cultures. Effective international segmentation has to use segmentation bases that draw on theory (Grunert, 2019). The use of food-related lifestyles as international segmentation basis is proposed as a promising theory-driven approach (Grunert, 2019). Thus, the aims of this study are to identify and explore food-related lifestyle segments across three countries (Spain, France and Germany), and furthermore how these lifestyle segments can be described via relevant constructs developed in previous research, and how the identified segments can predict interest for new aquaculture fish product concepts. These insights can be used to develop marketing and communication strategies targeting the motives and interests of the relevant potential segments.

Food-related lifestyle represents a cognitive concept that mediates the relationship between personal values and consumer behaviour in relation to food-related objects (Brunso et al., 2021; Brunso, Scholderer, & Grunert, 2004). By its very definition, the food-related lifestyle construct is predictive of food-related behaviours, which further strengthens its relevance as segmentation basis, since food-related lifestyle segments are expected to vary in their food choices. The core dimensions of food-related lifestyle are suitable for international segmentation due to their theoretical foundation and their cross-cultural validity. This allows to understand international segments and to further predict interest for new innovative fish product concepts that are still not on the market. Furthermore, the utility of the core dimensions of food-related lifestyle as segmentation bases is supported by the relevance of its dimensions in driving fish consumption behaviour.

Food-related lifestyle has been widely used in the food domain as segmentation basis and has proven to be an important determinant of food-related behaviours (e.g. Budhathoki, Zølner, Nielsen, Rasmussen, & Reinbach, 2022; Cullen & Kingston, 2009; de Boer, McCarthy, Cowan, & Ryan, 2004; Thøgersen, 2017; Verneau, La Barbera, Amato, Rivero, & Grunert, 2020; Witzling & Shaw, 2019; Wycherley, McCarthy, & Cowan, 2008). Food-related lifestyle is conceptualised as consisting of three core dimensions, namely food involvement, food innovativeness and food responsibility (Brunso et al., 2021). Involvement, innovativeness and responsibility (or ethical considerations) are important factors in consumer behaviour towards fish and seafood (Banovic, Reinders, Claret, Guerrero, & Krystallis, 2019b; Carlucci et al., 2015; Reinders et al., 2016). Innovativeness in relation to food is particularly relevant for acceptance of new fish products by consumers. Consumer segments that vary in these constructs are thus expected to vary in their intention to buy new fish products.

The paper is structured as follows. The next section covers the conceptual background of the study that is followed by details regarding the methods employed, including the clustering analysis that used a

probabilistic approach. The results of our empirical study are then presented, and finally, the main findings are discussed, and implications are derived.

## 2. Conceptual background

The present study draws on the food-related lifestyle concept and previous literature on consumer segmentation in the fish and seafood market. Consumer perceptions of drivers and barriers towards fish and seafood purchase and consumption are considered as relevant in profiling consumer segments in this market. The identification and profiling of consumer segments with interest in adopting new fish and seafood products is seen to contribute to the success of new product development in this market.

### 2.1. The food-related lifestyle approach to segmentation

There is a long history in marketing research of using lifestyle to segment consumers (Brunso & Grunert, 1998; Grunert, 2019). In the food domain, the food-related lifestyle concept is defined as a mental construct that explains consumers' food-related behaviour (Brunso & Grunert, 1998). Conceptually, it represents a system of cognitive categories, scripts and their associations that acts as a mediator of the relationships between personal values and consumers' food-related behaviours (Brunso et al., 2004). Not only does the food-related lifestyle approach to segmentation draw on theory, but it also was successfully used in previous literature to segment consumers in various countries or parts of the world (de Boer, McCarthy, & Cowan, 2004; Grunert et al., 2011; Thøgersen, 2017; Wycherley et al., 2008). Both the theoretical grounding and the empirical evidence support the food-related lifestyle as a promising approach to international segmentation (Grunert, 2019). Food-related lifestyle is predictive of consumer food-related behaviour (Brunso & Grunert, 1998; Brunso et al., 2004; Brunso et al., 2021), which implies that segments based on it can be expected to vary in their interest to adopt new food products such as fish and seafood products. The suitability of the food-related lifestyle approach as segmentation basis is strengthened by the high relevance of its core dimensions in consumers' purchase and consumption of fish (Banovic et al., 2019b; Carlucci et al., 2015; Reinders et al., 2016). Indeed, segments based on the three core dimensions of food-related lifestyle differ significantly in terms of their consumption of fish or frequency of shopping at fishmongers (Brunso et al., 2021).

A further advantage of the food-related lifestyle for international segmentation is that it provides a cross-culturally validated instrument for operationalization of its dimensions (Brunso et al., 2021). The original food-related lifestyle instrument was developed by Brunso and Grunert (1995) and showed great validity and reliability (Scholderer, Brunso, Bredahl, & Grunert, 2004). Recently, a revised version has been developed that consists of three main dimensions – food involvement, food innovativeness and food responsibility – providing both technical and substantial benefits (Brunso et al., 2021). First, it provides a shorter set of items (i.e. fifteen items) to measure its core dimensions. Second, the food responsibility dimension has been added to account for the increasing importance that sustainability and ethical aspects play nowadays in food decisions. The fifteen items that measure the three core dimensions of the revised food-related lifestyle instrument show great cross-cultural validity as proven by their high degree of cross-cultural measurement invariance (Brunso et al., 2021).

Overall, segmentation based on the core dimensions of food-related lifestyle has the advantages of being theoretically driven, predictive of food choices and consumption of fish, and validated in terms of its operationalization as a data collection instrument (Brunso et al., 2004, 2021; Grunert, 2019). The core dimensions of food-related lifestyle are closely linked to consumers' innovativeness (Reinders et al., 2016), their general involvement with food (Verbeke et al., 2007), and their concern regarding sustainability or ethical beliefs (Banovic et al., 2019b;

Carlucci et al., 2015), which all play an important role in consumer behaviour towards fish and seafood.

## 2.2. Drivers and barriers towards consumption of fish and seafood products

Previous literature identifies various drivers and barriers towards consumption of fish and seafood products (for a review see Carlucci et al., 2015). Consumers who have positive *general attitudes towards fish* consume fish and seafood more regularly (Birch & Lawley, 2014) and this attitude is one of the main drivers of fish and seafood consumption (Carlucci et al., 2015), even though there could be differences between countries. The sensory characteristics of fish are critical drivers of consumption. Yet, due to the challenge of assessing these for the whole category of fish and seafood, previous studies use people's attitude towards fish and seafood as a proxy for their liking of fish (Carlucci et al., 2015).

Involvement is a strong predictor of consumer behaviour (Zaichkowsky, 1985). Whereas the core dimensions of the food-related lifestyle capture involvement with food in general (Brunso et al., 2021), consumers' *involvement with the fish and seafood category* has played an important role in segmenting the fish market or explaining people's behaviour towards products from this category (Carlucci et al., 2015; Reinders et al., 2016). Fish and seafood are generally perceived as healthy (Carlucci et al., 2015). In addition to involvement with the fish category, consumers' *health involvement* is an important driver of fish consumption (Carlucci et al., 2015; Heide & Olsen, 2017; Olsen, Tuu, & Grunert, 2017; Pieniak et al., 2010; Sacchetti et al., 2021).

Food *choice motives* are relevant for the choice and consumption of fish and seafood products. Motives such as health, sensory appeal or weight control promote the consumption of fish and seafood, whereas convenience motives have a negative relationship with consuming such products (Thong & Solgaard, 2017). Consumers that varied in the importance they placed on motives related to nutrition, taste or safety and in their perceived barriers and risks to eat fish were also found to vary in the frequency of purchase and consumption of fish (Vanhonacker et al., 2010).

Consumer innovativeness is an important driver of their willingness to try or buy new food products (Huutilainen, Pirttilä-backman, & Tuorila, 2006; Sogari et al., 2021) and a key factor in consumers' willingness to participate in new food product development activities (Hoppe, De Barcellos Marcia, Perin Marcelo, Jacobsen, & Lähteenmäki, 2018). Whereas the core dimensions of the food-related lifestyle capture food innovativeness in general, *domain-specific innovativeness* in relation to new fish products was shown to play a role in consumers' responses to new fish products (Reinders et al., 2016).

Feeling competent in choosing fish products, preparing fish or judging its quality has a positive impact on fish consumption, whereas lack of such competences can be a barrier for fish consumption or purchase (Brunso, Verbeke, Ottar Olsen, & Fruensgaard Jeppesen, 2009; Carlucci et al., 2015; Pieniak et al., 2010; Vanhonacker et al., 2010). Thus, people's *perceived difficulty in preparing fish or fish products* can discourage consumption and purchase of such products.

The importance of habits in explaining consumer behaviour is well established (Conner & Armitage, 1998). Similarly, previous studies show that consumers' *fish eating habits* make a significant contribution in explaining their behaviour (Birch & Lawley, 2014; Budhathoki et al., 2022; Carlucci et al., 2015).

*Objective knowledge* about fish is also important in explaining consumers' behaviour or in profiling different segments of fish and seafood consumers (Altintzoglou & Nøstvold, 2014; Pieniak et al., 2010). Moreover, consumers' perceptions of farmed fish differ depending on their levels of objective knowledge (Claret et al., 2014).

Lastly, several *socio-demographics* play a role in people's purchase or consumption of fish and seafood, such as age, gender, household size, social class or country (Cantillo et al., 2021; Pieniak et al., 2010;

Reinders et al., 2016; Verbeke et al., 2007).

## 2.3. Consumer perceptions and responses to new product development in fish and seafood

Previous literature has made contributions to new product development in the fish and seafood area by eliciting new product ideas from consumers (Banović, Krystallis, Guerrero, & Reinders, 2016), testing certain product concepts with consumers (De Devitiis et al., 2018) or assessing people's willingness to accept fish products (Banovic, Reinders, Claret, Guerrero, & Krystallis, 2019a; Risius, Hamm, & Janssen, 2019). Consumers show positive perceptions of new product concepts that can help bypass barriers to fish consumption by combining convenience and health benefits (De Devitiis et al., 2018). Moreover, involving consumers in new product development through co-creation was shown to lead to actionable insights for the marketing of new fish products (Banović et al., 2016).

Consumer-related insights are highly relevant in the success of new food product development and many types of consumer data are used by food companies when developing new products and product concepts (Horvat, Granato, Fogliano, & Luning, 2019). The present study can contribute to the success of new fish products by drawing on food-related lifestyle to derive consumer segments that vary in their interest for new fish products. Therefore, we investigate the relationship between food-related lifestyle segments and people's *intention to buy new aquaculture fish products* and *frequency of using and buying fish or fish products*.

## 3. Method

An online cross-sectional survey was conducted to collect data in three EU fish markets (Spain, France and Germany). These countries were selected based on fish consumption per capita and household expenditure for fishery and aquaculture products, representing three of the largest fish markets in the EU (EUMOFA, 2017c; EUMOFA, 2017a; EUMOFA, 2017b). The data were collected in collaboration with an international market research agency, Adimen, in July 2018. The questionnaire was developed in English and then translated by the market agency into the native languages for each of the three EU countries. The translated surveys were then checked by native speakers who were not involved in the original translation.

### 3.1. Participants

In each of the three countries – Spain, France and Germany – 500 respondents completed the online survey. The target participants were screened to be above 18 years of age, to have main or shared responsibility for cooking or shopping in their household, to be fish consumers (i.e. were excluded if they reported never eating and buying fish or fish products), and not to be professionals from the fish industry. Additionally, a quota was set for gender distribution, i.e. 60 percent of respondents would be females, considering that females have more responsibility for food-related activities like cooking in households compared to men (Wolfson et al., 2021).

The socio-demographic characteristics of the respondents per country are summarized in Table 1.

### 3.2. Measures

#### 3.2.1. Segmentation basis

The Core dimensions of the food-related lifestyle scale (Brunso et al., 2021), namely *food involvement*, *food innovativeness* and *food responsibility*, were used as segmentation basis. Each of the dimensions was measured by five items rated on a 7-point agreement scale ranging from "strongly disagree" (1) to "strongly agree" (7) (see Table 2). The exact phrasing of each item, the corresponding descriptive statistics and scale

**Table 1**  
Sample characteristics per country.

	SPAIN (N = 500)	GERMANY (N = 500)	FRANCE (N = 500)	TOTAL (N = 1500)
Age (Mean (SD)) (18 to 75 years old)	43.2 (14.5)	43.5 (14.8)	43.4 (15.1)	43.4 (14.8)
Household size (Mean (SD)) (excluding respondent; 0 to 7 or more)	2.1 (1.2)	1.6 (1.3)	1.8 (1.4)	1.8 (1.3)
Gender (%)				
Male	40	40	40	40
Female	60	60	60	60
Education (%)				
Secondary or lower	43.2	71	51	55.1
University	56.8	29	49	44.9
Location of residence (%)				
City	56.2	31.8	26.6	38.2
Larger provincial town (>50.000 inhabitants)	14.4	17	10.4	13.9
Large provincial town (10.000–50.000 inhabitants)	15.6	21	16.6	17.7
Town (5.000–10.000 inhabitants)	7	10.8	16.8	11.5
Smaller town (<5.000 inhabitants) or outside of towns/the countryside	6.8	19.4	29.6	18.6
Social class (%)				
Upper Middle Class (comfortable) or higher	15.2	17.6	12.8	15.2
Middle Class	53.6	59	54.6	55.7
Lower Middle Class (working) or Lower	31.2	23.4	32.6	29.1

reliabilities can be seen in Table 2. The dimensions showed very high reliability scores (Table 2) and were used as composite variables (computed as the average of the items).

### 3.2.2. Profiling factors

In order to profile the segments, several psychographics were used. The scales used, the corresponding descriptive statistics and scale reliabilities can be seen in Table 2.

*General attitude towards fish or fish products* was assessed with four items adapted from previous literature (Pieniak et al., 2010). The scale showed high reliability and was used as composite variable.

*Category involvement* with fish and fish products was assessed with three items adapted from previous literature and rated on a 7-point agreement scale ranging from “strongly disagree” (1) to “strongly agree” (7) (Beatty, Kahle, & Homer, 1988; Reinders et al., 2016). The scale showed high reliability and was used as composite variable (computed as the average of the items). This construct refers to consumers’ involvement with the fish category in particular, thereby can provide important insights as profiling factor.

*Health involvement* was assessed with four items adapted from previous literature and rated on a 7-point agreement scale ranging from “strongly disagree” (1) to “strongly agree” (7) (Pieniak et al., 2010). A composite variable was used for the scale as it had high reliability.

*Motives to eat aquaculture fish or fish products* (e.g. “Eating fish or fish products from aquaculture is nutritious”) were measured with four items related to healthiness, nutrition, tastiness and safety adapted from Vanhonacker et al. (2010) and rated on a 7-point agreement scale ranging from “strongly disagree” (1) to “strongly agree” (7). The items were used separately in the data analysis.

*Domain innovativeness* was measured with a scale consisting of six items adapted from previous literature and rated on a 7-point agreement scale ranging from “strongly disagree” (1) to “strongly agree” (7) (Goldsmith & Hofacker, 1991; Reinders et al., 2016). In exploratory

**Table 2**  
Questionnaire description, descriptive statistics and scale reliabilities.

Items	Rating scale	Mean	Standard deviation	Cronbach's alpha
<b>Segmentation bases</b>				
<i>Food Involvement</i>	“Strongly disagree” (1) – “Strongly agree” (7)	5.68	1.029	0.895
Food and drink is an important part of my life (Q10_2)		5.71	1.193	
I just love good food (Q10_9)		6.10	1.073	
Eating and drinking are a continuous source of joy for me (Q10_10)		5.69	1.228	
Decisions on what to eat and drink are very important for me (Q10_11)		5.58	1.233	
Eating and food is an important part of my social life (Q10_12)		5.31	1.384	
<i>Food Innovativeness</i>	“Strongly disagree” (1)– “Strongly agree” (7)	5.19	1.289	0.906
I look for ways to prepare unusual meals (Q10_3)		5.08	1.486	
Recipes and articles on food from other culinary traditions encourage me to experiment in the kitchen (Q10_6)		4.86	1.593	
I like to try out new recipes (Q10_8)		5.48	1.428	
I like to try new foods that I have never tasted before (Q10_13)		5.22	1.515	
I love to try recipes from different countries (Q10_15)		5.29	1.533	
<i>Food Responsibility</i>	“Strongly disagree” (1) – “Strongly agree” (7)	5.06	1.288	0.912
I try to choose food that is produced in a sustainable way (Q10_1)		5.17	1.411	
I try to buy organically produced foods if possible (Q10_4)		4.64	1.630	
		5.14	1.493	

(continued on next page)

Table 2 (continued)

Items	Rating scale	Mean	Standard deviation	Cronbach's alpha
I am concerned about the conditions under which the food I buy is produced (Q10.5)		4.99	1.488	
I try to choose food produced with minimal impact on the environment (Q10.7)		5.34	1.461	
It is important to understand the environmental impact of our eating habits (Q10.14)				
<b>Profiling constructs</b>				
<i>General attitude to fish</i>		5.81	1.261	0.905
In my opinion, eating fish or fish products is...				
Bad (1) – Good (7) (Q28.1)	Bad (1) – Good (7)	6.12	1.238	
Unsatisfying (1) – Satisfying (7) (Q28.2)	Unsatisfying (1) – Satisfying (7)	5.81	1.430	
Unpleasant (1) – Pleasant (7) (Q28.3)	Unpleasant (1) – Pleasant (7)	5.79	1.510	
Dull (1) – Exciting (7) (Q28.4)	Dull (1) – Exciting (7)	5.53	1.522	
<i>Category involvement</i>	"Strongly disagree" (1) – "Strongly agree" (7)	5.54	1.258	0.926
I am very concerned about what fish or fish products I purchase (Q11.1)		5.44	1.402	
I care a lot about what fish or fish products I consume (Q11.2)		5.54	1.340	
Generally, choosing the right fish or fish products is important to me (Q11.3)		5.65	1.300	
<i>Health involvement</i>	"Strongly disagree" (1) – "Strongly agree" (7)	5.99	1.011	0.926
Health is very important to me (Q13.1)		6.22	1.013	
I care a lot about health (Q13.2)		5.81	1.192	
Health means a lot to me (Q13.3)		6.05	1.082	
I appreciate healthy food very much (Q13.4)		5.88	1.175	
	"Strongly disagree" (1) –			

Table 2 (continued)

Items	Rating scale	Mean	Standard deviation	Cronbach's alpha
<i>Motives to eat aquaculture fish or fish products</i>	"Strongly agree" (7)			
Eating fish or fish products from aquaculture...				
Is healthy (Q27.1)		5.14	1.281	
Is nutritious (Q27.2)		5.23	1.232	
Is tasty (Q27.3)		5.19	1.302	
Is safe (Q27.4)		4.98	1.344	
<i>Domain innovativeness</i>	"Strongly disagree" (1) – "Strongly agree" (7)			
<i>Domain innovativeness – openness</i>		4.44	1.252	0.740
If I heard that new fish products were available through a local store, I would be interested enough to buy it (Q12.2)		4.83	1.498	
I would be ready to buy/consider buying new fish products, even if I hadn't heard of it yet (Q12.4)		4.65	1.495	
I know more about new fish products than other people do (Q12.6)		3.84	1.634	
<i>Domain innovativeness – reluctance</i>		3.71	1.319	0.732
In general, I am among the last in my circle of friends to purchase new fish product (Q12.1)		3.64	1.624	
Compared to my friends, I do little shopping for new fish products (Q12.3)		3.82	1.634	
In general, I am the last in my circle of friends to know the latest trends of fish products (Q12.5)		3.67	1.646	
<i>Perceived difficulties in preparing fish</i>	"Strongly disagree" (1) – "Strongly agree" (7)	3.81	1.590	0.826
It is a problem for me to prepare fish for cooking (Q14.1)		3.40	1.882	
It is a problem for me to evaluate the		3.78	1.773	

(continued on next page)

Table 2 (continued)

Items	Rating scale	Mean	Standard deviation	Cronbach's alpha
quality of fish (Q14.2)		4.23	1.880	
I find it difficult to remove all bones out of fish (Q14.3)				
Habitual fish consumption	"Strongly disagree" (1) – "Strongly agree" (7)	4.91	1.427	0.929
Eating fish or fish products is something ... that belongs to my weekly routine (Q15.1)		4.98	1.739	
I learned from my parents (Q15.2)		4.75	1.847	
I have been doing for a long time (Q15.3)		5.01	1.747	
I do without thinking about it (Q15.4)		4.85	1.676	
we often did at my home (Q15.5)		4.97	1.749	
I have no need to think about doing (Q15.6)		4.64	1.740	
I am used to from my childhood (Q15.7)		4.90	1.800	
that belongs to my monthly routine (Q15.8)		5.21	1.657	
Objective knowledge	True (1); False (2); Do not know (3) Recoded to Correct (1), Incorrect or Do not know (0)	2.23	1.049	
Sea bass is a lean fish (Q16.1)		62.9% Correct		
Sea bream is a fish that comes only from farming/aquaculture (Q16.2)		51.7% Correct		
Fish is a source of omega-3 fatty acids (Q16.3)		90.2% Correct		
More than half of the fish we can buy in [country where survey is sent] is farmed/aquaculture fish (Q16.4)		18.3% Correct		
Outcomes				
Intention to buy new fish products	"Would not consider" (1); "Might not consider" (2); "Neutral" (3); "Might consider" (4);			

Table 2 (continued)

Items	Rating scale	Mean	Standard deviation	Cronbach's alpha
Salty fish snacks: fish fingers minimally processed to eat on the go or to dip (Q24.1)	"Definitely consider" (5)	3.27	1.269	
Fish brochettes for barbecue moments (Q24.2)		3.63	1.159	
Fish hamburgers and meatballs (meat style) (Q24.3)		3.26	1.284	
Sushi-style fish (Q24.4)		3.17	1.459	
Fish ceviches or fish carpaccios (Q24.5)		3.04	1.342	
Fish kit for different recipes and cooking options (Q24.6)		3.05	1.236	
Ready to bake/grill fish preparations (Q24.7)		3.55	1.179	
High-quality homemade fish soups (Q24.8)		3.29	1.346	
Frequency buy fish or fish products				
How often do you buy fish or fish products (e.g. fish burgers, surimi)?	"daily or almost every day" (1), "3–4 times a week" (2), "2 times a week" (3), "once a week" (4), "2–3 times a month" (5), "once a month" (6), "1–5 times every 6 months" (7), "less frequently" (8), "never" (9) Recoded to represent frequency per week ((9 = 0) (8 = 0.0625) (7 = 0.125) (6 = 0.25) (5 = 0.625) (4 = 1) (3 = 2) (2 = 3.5) (1 = 6.5))	1.48	1.292	
Frequency eat fish or fish products				
How often do you eat fish or fish products (e.g. fish burgers, surimi)?	"daily or almost every day" (1), "3–4 times a week" (2), "2 times a week" (3), "once a week" (4), "2–3 times a month" (5), "once a	1.79	1.374	

(continued on next page)

Table 2 (continued)

Items	Rating scale	Mean	Standard deviation	Cronbach's alpha
	month" (6), "1–5 times every 6 months" (7), "less frequently" (8), "never" (9)			
	Recoded to represent frequency per week ((9 = 0) (8 = 0.0625) (7 = 0.125) (6 = 0.25) (5 = 0.625) (4 = 1) (3 = 2) (2 = 3.5) (1 = 6.5)			

factor analysis, the items loaded on two separate factors. One factor consisted of the positively framed items and was labelled *Domain innovativeness – openness*, whereas the second consisted of the negatively framed items and was labelled *Domain innovativeness – reluctance*. Two composite variables were computed accordingly as the average of the items that loaded on each factor.

*Perceived difficulties in preparing fish and evaluating its quality* was measured by three items adapted from previous literature and rated on a 7-point agreement scale ranging from "strongly disagree" (1) to "strongly agree" (7) (Vanhonacker et al., 2010). A composite variable was used for the scale as it had good reliability.

*Habitual fish consumption* was measured with eight items adapted from previous literature and rated on a 7-point agreement scale ranging from "strongly disagree" (1) to "strongly agree" (7) (Vanhonacker et al., 2010; Verplanken & Orbell, 2003). The scale had high reliability and was used as composite variable.

*Objective knowledge* of fish was measured by asking people to report whether they thought four statements were true or false, while the scale included "do not know" as well. Two of the items were objectively true (i.e. "Sea bass is a lean fish", "Fish is a source of omega-3 fatty acids") and the other two were false (i.e. "Sea bream is a fish that comes only from farming/aquaculture", "More than half of the fish we can buy in [country where survey is sent] is farmed/aquaculture fish"). The items were adapted from previous literature (Claret et al., 2014; Pieniak et al., 2010). An index was computed by summing the recoded scores on the four items (items were recoded so that the correct answer had the value 1, whereas the incorrect answer or "do not know" had the value 0), thus, the measure has values from 0 – no correct answer to 4 – four correct answers.

### 3.2.3. Outcome measures

Self-reported *behavioural measures* in terms of intention to buy new aquaculture fish products and frequency of buying and eating fish or fish products were used to explore differences between segments (see Table 2 for items and descriptive statistics).

*Intention to buy new aquaculture fish products* was measured by asking people the extent to which they would consider buying each one of eight new aquaculture fish product concepts (i.e. Salty fish snacks: fish fingers minimally processed to eat on the go or to dip, Fish brochettes for barbecue moments, Fish hamburgers and meatballs (meat style), Sushi-style fish, Fish ceviches or fish carpaccios, Fish kit for different recipes and cooking options, Ready to bake/grill fish preparations, High-quality homemade fish soups) on a 5-point scale labeled on each point ("would not consider" (1), "might not consider" (2), "neutral" (3), "might consider" (4), "definitely consider" (5)). The items were used separately in the data analysis. The new aquaculture fish products were elicited in a co-creation activity developed within the MedAID project (<http://www.medaid-h2020.eu/>).

Four main challenges for idea generation were identified in the co-creation activity – new formats for new consumption moments; new formats to create more occasions to eat fish; education: discover and experiment fish; and make fish easier and simple (Deliverable 5.1 in MedAID Project – Gartzia et al., 2018). For each of the concepts or challenges, two representative new fish product ideas were selected for inclusion in the present study as it was impossible to include all elicited ideas in the questionnaire.

*Frequencies of buying and consuming fish or fish products* were asked on a 9-point scale labeled on each point ("daily or almost every day" (1), "3–4 times a week" (2), "2 times a week" (3), "once a week" (4), "2–3 times a month" (5), "once a month" (6), "1–5 times every 6 months" (7), "less frequently" (8), "never" (9)), adapted from (Pieniak et al., 2010). The variables were recoded as shown in Table 2. The two items were used separately in the data analysis.

The measures reported here (see also Table 2) were part of a larger survey on consumer perceptions and behaviours related to fish and fish products. The socio-demographic measures are reported in Table 1.

### 3.3. Data analysis

The shortest survey time for our respondents was 10 min, which was seen as reasonable timing, thus, no respondent was excluded from the dataset prior to the data analysis.

#### 3.3.1. Measurement invariance of core dimensions of food-related lifestyle

The cross-cultural validity of the core dimensions of food-related lifestyle instrument was assessed using multi-group confirmatory factor analysis with structured means in AMOS25. Five models were estimated for food involvement, food innovativeness and food responsibility, namely configural invariance (same basic structure across countries), metric invariance (as before plus factor loadings are assumed equal across countries), scalar invariance (as before plus intercepts are assumed equal), factor covariance and variance invariance (as before plus factor co-variances and variances are assumed equal), and error variance invariance (as before plus error variances are assumed equal). All models were tested in accordance with Steenkamp and Baumgartner (1998). The goodness-of-fit indicators of the models for the different levels of measurement invariance were assessed to establish cross-cultural validity. The models showed acceptable-to-high goodness of fit (Table 3), suggesting a good degree of measurement invariance across the three countries. The scalar invariance models showed slightly worse fit indicators, compared to the other models, which is not uncommon (Thøgersen, 2017) in relation to past segmentation studies that have used the original food-related lifestyle (FRL) instrument (Brunso et al., 2004).

Composite variables were computed for each of the *three core dimensions of food-related lifestyle* by averaging the items measuring them.

#### 3.3.2. Multilevel latent class cluster analysis

Multilevel latent class cluster analysis was conducted in Latent Gold 5.1 (Vermunt & Magidson, 2016; Vermunt, 2003, 2008) using the three core dimensions of food-related lifestyle to segment the consumers across the three countries, Spain, France, Germany.

This type of analysis allows taking into account that the respondents are nested within countries. The model then allows to identify the latent classes or segments at the individual level (level 1, food-related lifestyles), while at the same time identifying the optimal number of latent group classes (level 2, countries) (Vermunt, 2003). The segments resulting from such an approach are seen as highly relevant for international marketing management due to the link between country and consumer segmentation (Bijmolt, Paas, & Vermunt, 2004). The method was recently applied to validate the core dimensions of food-related lifestyle (Brunso et al., 2021) and to study the impact of country and food-related lifestyle on sustainable food consumption (Thøgersen, 2017).

**Table 3**  
Goodness of fit statistics (estimates based on Spanish, German and French samples).

Model	Chi square	df	Chi square/df	p-value	RMSEA	CFI	TLI	SRMR
<b>Food Involvement</b>								
Configural invariance	94	15	6.3	<0.001	0.059	0.982	0.964	0.027
Metric invariance	105	23	4.6	<0.001	0.049	0.982	0.975	0.028
Scalar invariance	174	33	5.3	<0.001	0.053	0.968	0.971	0.028
Factor co- and variance invariance	179	35	5.1	<0.001	0.052	0.967	0.972	0.040
Error variance invariance	244	45	5.4	<0.001	0.054	0.954	0.969	0.037
<b>Food Innovation</b>								
Configural invariance	114	15	7.6	<0.001	0.066	0.979	0.958	0.035
Metric invariance	137	23	5.7	<0.001	0.056	0.977	0.970	0.038
Scalar invariance	471	33	14.2	<0.001	0.094	0.908	0.917	0.056
Factor co- and variance invariance	221	34	6.5	<0.001	0.061	0.961	0.965	0.055
Error variance invariance	328	44	7.5	<0.001	0.066	0.940	0.959	0.051
<b>Food Responsibility</b>								
Configural invariance	61	15	4.1	<0.001	0.041	0.991	0.981	0.021
Metric invariance	97	23	4.2	<0.001	0.046	0.985	0.980	0.024
Scalar invariance	211	29	6.8	<0.001	0.062	0.963	0.964	0.025
Factor co- and variance invariance	159	31	5.1	<0.001	0.053	0.974	0.975	0.038
Error variance invariance	232	41	5.6	<0.001	0.056	0.961	0.972	0.028

The segmentation variables, level 1, used in the present study were the core dimensions of food-related lifestyle – *food involvement*, *food innovativeness* and *food responsibility*. The level 2 variable was the country, consisting of Spain, France and Germany. The identified class membership was exported to SPSS for further profiling.

### 3.3.3. Profiling of segments

To profile the identified segments, two-way ANOVA analyses (i.e. segment and country group as fixed factors) with Bonferroni adjustment were conducted in SPSS26&27. When Levene's test for homogeneity of variances was significant, one-way ANOVAs were used to confirm the differences between segments with Games-Howell adjustment post hoc tests.

Cross-tabs (chi-square test) were used to investigate differences between segments in terms of categorical variables (e.g. gender, education, social class) using Bonferroni adjustment at  $p < 0.05$ .

## 4. Results

### 4.1. Core dimensions of food-related lifestyle

There was a high level of food involvement, innovativeness and responsibility reported by the respondents across countries (Table 4). Only in Germany, the scores on innovativeness and responsibility were a bit lower than in the other countries. Moreover, respondents in Spain showed higher food involvement compared to Germany and France.

### 4.2. Identifying consumer segments based on the core dimensions of food-related lifestyle

In order to identify the best fitting model in the process described before, 18 models were estimated with the number of clusters ranging

**Table 4**  
Descriptive statistics of the core dimensions of food-related lifestyle.

	Overall (N = 1500)		Spain (N = 500)		Germany (N = 500)		France (N = 500)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Food Involvement	5.7	1.0	5.8 <sup>a</sup>	1.0	5.6 <sup>b</sup>	1.1	5.6 <sup>b</sup>	1.0
Food Innovativeness	5.2	1.3	5.5 <sup>a</sup>	1.2	4.8 <sup>b</sup>	1.4	5.3 <sup>a</sup>	1.2
Food Responsibility	5.1	1.3	5.3 <sup>a</sup>	1.2	4.7 <sup>b</sup>	1.4	5.2 <sup>a</sup>	1.2

Scale end-points: 1 = “strongly disagree”, 7 = “strongly agree”. One-way ANOVAs for differences between countries in terms of core dimensions of food-related lifestyle; means with different letters per dimension are significantly different using Bonferroni or Games-Howell adjustment at  $p < 0.05$  (since Levene's test for homogeneity of variances was significant, post hoc tests with Games-Howell adjustment were used as well, though there was no difference between the two adjustments across analyses).

from 1 to 6 and the number of country groups ranging from 1 to 3. The Bayesian Information Criterion that is based on the log-likelihood (BICLL) was used to compare the models and identify the best-fitting one (see the various indicators in Appendix A). Although the model with the lowest BICLL value (“minimal BICLL”) is commonly selected as the best-fitting one, in large datasets the BICLL and other information criteria tend to decrease continuously as the number of clusters increases (Thøgersen, 2017). Therefore, we follow the rule of thumb proposed by Thøgersen (2017), where the “minimal decrease in BICLL” (operationalized as <1% decrease in BICLL) is used as criterion, together with the “minimal BICLL”. As it is presented in Table 5, the decrease in BICLL from the models with 4 clusters to the models with 5 clusters is higher than 1% for two out of three country groups, whereas the decrease in BICLL from the five clusters to the six clusters models is <1% for two of the three country groups. Accordingly, using the “minimal decrease in BICLL” criterion, the 5 clusters model was selected as best-fitting. Looking at the models with five clusters, the BICLL is lowest for the two-country groups model (i.e. where the three countries are divided into two groups). Thus, the five clusters and two country groups model was chosen as most suitable (BICLL = 12018, classification error = 0.14). In the following, we use this model with five consumer segments (i.e. five clusters) and two-country groups (i.e. where the three countries under study were divided into two groups).

The profile of the five segments in terms of *food involvement*, *food innovativeness* and *food responsibility*, as well as the distribution of the segments across countries, are displayed in Table 6. The first country group consists of Spain and France, whereas the second country group consists of Germany. The two country groups differ in the distribution of the five food-related lifestyle segments. Therefore, the analysis shows that there are international segments, but their prevalence varies by country group, whereby Spain and France form one group and Germany another. Segment 1 is almost equal in the two country groups. Segments



**Table 5**

Bayesian Information Criterion (BICLL) for models varying in the number of clusters from 1 to 6 and country groups from 1 to 3.

Clusters	1 Country Group (CG)	2 Country Groups (CG)	3 Country Groups (CG)	Decrease in BICLL 1 CG	Decrease in BICLL 2 CG	Decrease in BICLL 3CG
1	14,419	14,427	14,434			
2	13,026	12,993	13,007	-9.66%	-9.93%	-9.88%
3	12,458	12,424	12,445	-4.36%	-4.38%	-4.32%
4	12,221	12,170	12,198	-1.91%	-2.04%	-1.99%
5	12,077	<b>12,018</b>	12,086	-1.17%	-1.25%	-0.91%
6	11,988	11,910	11,948	-0.74%	-0.90%	-1.14%

**Table 6**

Country group sizes, food-related lifestyle segment sizes by country group and overall, core food-related lifestyle dimensions means per segment in the model with five segments and two country groups.

	Country group size	Segment 1 "Moderate"	Segment 2 "Adventurous responsible"	Segment 3 "Conservative"	Segment 4 "Foodies"	Segment 5 "Uninvolved"	Overall
Country group 1	63%	39%	33%	11%	10%	8%	100%
Country group 2	37%	35%	21%	36%	4%	4%	100%
Segment sizes overall		38%	28%	20%	8%	6%	
Mean per segment							
Food Involvement		5.5 <sup>c</sup>	6.3 <sup>b</sup>	5.0 <sup>d</sup>	7.0 <sup>a</sup>	4.1 <sup>e</sup>	5.7
Food Innovativeness		5.0 <sup>c</sup>	6.2 <sup>b</sup>	3.7 <sup>e</sup>	6.9 <sup>a</sup>	4.1 <sup>d</sup>	5.2
Food Responsibility		5.1 <sup>c</sup>	5.8 <sup>b</sup>	3.6 <sup>e</sup>	6.7 <sup>a</sup>	4.0 <sup>d</sup>	5.0

Country group 1 = Spain & France; Country group 2 = Germany.

Scale end-points: 1 = "strongly disagree", 7 = "strongly agree."

Means with different letters are significantly different according to the paired comparisons parameters for the model with five clusters and two country groups.

2, 4 and 5 have a higher prevalence in country group 1, whereas Segment 3 has a much higher prevalence in country group 2. Overall, the first segment is the largest, whereas the last two segments are the smallest in each country group. Segment 1 has average values on all three core food-related lifestyle dimensions, thus, was labelled as "Moderate". Segment 2 has higher mean values on all dimensions, in particular *food innovativeness* but also in *food responsibility* and was labelled the "Adventurous responsible". Segment 3 had low values on all core food-related lifestyle dimensions, however, it had higher values on *food involvement* than the other dimensions where it had the lowest values, thus, was labelled as "Conservative". Segment 4 had very high values on all three dimensions and was labelled as "Foodies". Finally, Segment 5 scored lowest on *food involvement* and second lowest on the other two dimensions and was labelled as the "Uninvolved".

**4.3. Profiling the food-related lifestyle consumer segments**

The identified segments did not differ in terms of age or social class

**Table 7**

Socio-demographics by segment.

	"Moderate"	"Adventurous responsible"	"Conservative"	"Foodies"	"Uninvolved"	Sig.
Age	43.9	42.7	44.0	42.8	42.3	0.466
Household size	1.8 <sup>a, c</sup>	2.0 <sup>b, c</sup>	1.5 <sup>a</sup>	2.3 <sup>b</sup>	1.7 <sup>a, c</sup>	0.001
Gender						<0.01
Male	41% <sup>a, b</sup>	35% <sup>b</sup>	48% <sup>a</sup>	33% <sup>a, b</sup>	47% <sup>a, b</sup>	
Female	59% <sup>a, b</sup>	65% <sup>b</sup>	52% <sup>a</sup>	68% <sup>a, b</sup>	53% <sup>a, b</sup>	
Education						<0.001
Secondary or lower	55% <sup>a</sup>	50% <sup>a</sup>	69% <sup>b</sup>	48% <sup>a</sup>	56% <sup>a, b</sup>	
University	45% <sup>a</sup>	50% <sup>a</sup>	31% <sup>b</sup>	52% <sup>a</sup>	44% <sup>a, b</sup>	
Social class						0.275
Upper Middle Class or higher	14%	17%	15%	16%	11%	
Middle Class	58%	55%	51%	59%	51%	
Lower Middle Class or Lower	28%	28%	34%	25%	38%	

Two way ANOVAs (segment & country group as fixed factors) for differences between segments in terms of age and household size with Bonferroni adjustment. For Age, country group did not have a significant effect (p = .50) and the interaction between segment and country group was not significant (p = .78). For Household size, country group had a significant effect (p = .04; M<sub>France& Spain</sub> = 1.97; M<sub>Germany</sub> = 1.60) and the interaction between segment and country group was not significant (p = .48). Cross-tabs for differences between segments in terms of gender, education and social class; means with different letters are significantly different using Bonferroni adjustment at p < 0.05.

**Table 8**  
Psychographics by segment and country group.

	"Moderate"	"Adventurous responsible"	"Conservative"	"Foodies"	"Uninvolved"	Sig. Segment	Country group1 (France & Spain)	Country group2 (Germany)	Sig. Country group	Sig. Segment X Country group
General attitude to fish	5.7 <sup>c</sup>	6.1 <sup>b</sup>	5.6 <sup>c</sup>	6.6 <sup>a</sup>	4.9 <sup>d</sup>	<0.001	5.8	5.8	0.947	0.859
Category Involvement	5.5 <sup>c</sup>	6.2 <sup>b</sup>	4.5 <sup>d</sup>	6.7 <sup>a</sup>	4.3 <sup>d</sup>	<0.001	5.6 <sup>a</sup>	5.4 <sup>b</sup>	0.010	0.289
Health involvement	5.9 <sup>c</sup>	6.5 <sup>b</sup>	5.4 <sup>d</sup>	6.8 <sup>a</sup>	4.8 <sup>e</sup>	<0.001	6.1	5.9	0.891	0.900
Motives to eat aquaculture fish or fish products										
Healthy	5.1 <sup>b, c</sup>	5.3 <sup>b</sup>	4.9 <sup>c</sup>	6.0 <sup>a</sup>	4.4 <sup>d</sup>	<0.001	5.3	4.9	0.055	0.147
Nutritious	5.2 <sup>c</sup>	5.4 <sup>b</sup>	4.9 <sup>d</sup>	6.0 <sup>a</sup>	4.5 <sup>e</sup>	<0.001	5.4 <sup>a</sup>	4.9 <sup>b</sup>	<0.001	0.322
Tasty	5.2 <sup>b</sup>	5.4 <sup>b</sup>	4.9 <sup>c</sup>	6.0 <sup>a</sup>	4.4 <sup>d</sup>	<0.001	5.3	5.1	0.224	0.568
Safe	4.9 <sup>c</sup>	5.2 <sup>b</sup>	4.5 <sup>d</sup>	5.9 <sup>a</sup>	4.4 <sup>d</sup>	<0.001	5.2 <sup>a</sup>	4.7 <sup>b</sup>	<0.001	0.453
Domain Innovativeness – openness	4.3 <sup>c</sup>	5.1 <sup>b</sup>	3.2 <sup>e</sup>	5.8 <sup>a</sup>	3.9 <sup>d</sup>	<0.001	4.6 <sup>a</sup>	4.2 <sup>b</sup>	0.034	0.093
Domain Innovativeness – reluctance*	3.8	3.7	3.6	3.4	3.9	0.007	3.8	3.6	0.035	<b>0.011</b>
Perceived difficulties in preparing fish*	4.0	3.5	4.0	3.1	4.0	<0.001	3.7	4.0	0.630	<b>0.006</b>
Habitual fish consumption	4.9 <sup>c</sup>	5.4 <sup>b</sup>	3.8 <sup>d</sup>	6.1 <sup>a</sup>	4.0 <sup>d</sup>	<0.001	5.2 <sup>a</sup>	4.3 <sup>b</sup>	<0.001	0.377
Objective knowledge**	2.3 <sup>a</sup>	2.4 <sup>a</sup>	1.7 <sup>b</sup>	2.4 <sup>a</sup>	1.9 <sup>b</sup>	<0.001	2.4 <sup>a</sup>	1.9 <sup>b</sup>	<0.001	0.571

Two-way ANOVAs for differences between segments and country groups in terms of psychographics; means with different letters are significantly different in Post Hoc tests (Bonferroni adjustment for differences between segments) at  $p < .05$ ; when Levene's test for homogeneity of variances was significant (for all psychographics except *Objective knowledge*), one-way ANOVAs were used to confirm the differences between segments with Games-Howell adjustment post hoc tests – only in the case of the *Domain innovativeness - reluctance* the differences between segments in multiple comparisons were not significant in the one-way ANOVA.

\*Interaction effects were significant for these constructs. For *Domain innovativeness - reluctance*, one way ANOVAs per country group showed that there were no significant differences between segments in Germany, whereas in France and Spain the "Conservative" scored significantly lower ( $M = 3.4$ ) than the "Moderate" ( $M = 3.8$ ) and "Uninvolved" ( $M = 4.0$ ). For *Perceived difficulties in preparing fish*, one way ANOVAs per country group showed that there were some differences between countries: France & Spain ( $M_{\text{Moderate}} = 4.0^a$ ,  $M_{\text{Adventurous responsible}} = 3.5^b$ ,  $M_{\text{Conservative}} = 3.6^{a,b}$ ,  $M_{\text{Foodies}} = 3.3^b$ ,  $M_{\text{Uninvolved}} = 3.9^a$ ), Germany ( $M_{\text{Moderate}} = 4.0^{a,c}$ ,  $M_{\text{Adventurous responsible}} = 3.6^c$ ,  $M_{\text{Conservative}} = 4.3^a$ ,  $M_{\text{Foodies}} = 2.4^b$ ,  $M_{\text{Uninvolved}} = 4.3^a$ ).

\*\*Scale from 0 to 4 where higher values represent higher knowledge; all other measures have scores from 1 to 7 with higher scores representing higher levels of the construct.

than the other three, with the former being the lowest on *Domain innovativeness - openness* and the latter the lowest in *Health involvement* and *Nutritious motive to eat aquaculture fish or fish products*.

For *Category involvement*, *Habitual fish consumption* and *Safe motive to eat aquaculture fish or fish products*, a similar pattern was identified, except for the fact that there was no difference between the two lowest-scoring segments, i.e. the "Conservative" and the "Uninvolved". The "Foodies" scored highest of all segments and the "Uninvolved" scored lowest in the *Tasty* and *Healthy motives to eat aquaculture fish or fish products*. The "Adventurous responsible" and "Moderate" scored second highest but did not differ from each other in these motives, whereas the "Conservative" had the third lowest scores for the *Tasty* motive but did not differ from the "Moderate" on the *Healthy* motive.

There were fewer differences between the segments in *Objective knowledge* about fish. The "Foodies", "Adventurous responsible" and "Moderate" had higher knowledge than the other segments.

Lastly, in the case of *Perceived difficulties in preparing fish* and *Domain innovativeness - reluctance*, there was a significant interaction between segment and country group. There were only few differences between segments by country, especially in terms of *Domain innovativeness - reluctance*.

#### 4.4. Intention to buy new aquaculture products and frequency of using fish

Lastly, there were differences between the identified segments in relation to their intention to buy new aquaculture fish products and the frequency of buying and eating fish or fish products (Tables 9 and 10).

The pattern of differences between the five segments in terms of their intentions to buy eight new aquaculture fish products was similar. The "Foodies" reported the highest intentions to buy all new aquaculture fish products, followed by the "Adventurous responsible" and then the "Moderate". The "Conservative" and "Uninvolved" had the lowest intention to buy the new aquaculture fish products and they did not differ from each other, except that for *Sushi-style fish*, *Fish ceviches or fish carpaccios* and *Fish kit for different recipes and cooking options*, there was no difference between the "Moderate" and the "Uninvolved".

A similar pattern was identified for differences in frequency of buying and eating fish or fish products. The "Foodies" buy and eat fish most frequently, followed by the "Adventurous responsible" and then the "Moderate". The "Conservative" and "Uninvolved" reported the lowest frequency of buying and eating fish or fish products and did not differ from each other, whereas the "Uninvolved" did not differ from the "Moderate" in terms of buying frequency.

## 5. Discussion

The present study aimed to understand the behaviour of consumer segments that can be promising for the aquaculture fish products market. The core dimensions of food-related lifestyle were used as segmentation bases, while accounting for the country, an approach applied by Thøgersen (2017) based on a different measure of food-related lifestyles. Our results revealed two country groups, one comprising France and Spain and the other represented by Germany, and five consumer segments varying in food involvement, food innovativeness and food responsibility. The "Foodies" was one of the smallest segments,

**Table 9**  
Intention to buy new aquaculture fish products by segment and country group.

	"Moderate"	"Adventurous responsible"	"Conservative"	"Foodies"	"Uninvolved"	Sig. Segment	Country group1 (France & Spain)	Country group2 (Germany)	Sig. Country group	Sig. Interaction
Intention to buy new fish products										
Salty fish snacks: fish fingers minimally processed to eat on the go or to dip	3.2 <sup>c</sup>	3.5 <sup>b</sup>	2.9 <sup>d</sup>	4.1 <sup>a</sup>	2.8 <sup>d</sup>	<0.001	3.3	3.1	0.803	0.482
Fish brochettes for barbecue moments	3.6 <sup>c</sup>	3.9 <sup>b</sup>	3.0 <sup>d</sup>	4.4 <sup>a</sup>	3.1 <sup>d</sup>	<0.001	3.8 <sup>a</sup>	3.3 <sup>b</sup>	0.003	0.934
Fish hamburgers and meatballs (meat style)	3.2 <sup>c</sup>	3.5 <sup>b</sup>	2.8 <sup>d</sup>	4.1 <sup>a</sup>	2.8 <sup>d</sup>	<0.001	3.4	3.1	0.547	0.781
Sushi-style fish	3.1 <sup>c</sup>	3.5 <sup>b</sup>	2.6 <sup>d</sup>	4.1 <sup>a</sup>	2.9 <sup>c, d</sup>	<0.001	3.3	2.9	0.073	0.305
Fish ceviches or fish carpaccios	3.0 <sup>c</sup>	3.4 <sup>b</sup>	2.3 <sup>d</sup>	4.1 <sup>a</sup>	2.6 <sup>c, d</sup>	<0.001	3.2 <sup>a</sup>	2.7 <sup>b</sup>	0.007	0.703
Fish kit for different recipes and cooking options	3.0 <sup>c</sup>	3.3 <sup>b</sup>	2.4 <sup>d</sup>	4.1 <sup>a</sup>	2.7 <sup>c, d</sup>	<0.001	3.2 <sup>a</sup>	2.7 <sup>b</sup>	0.001	0.811
Ready to bake/grill fish preparations	3.5 <sup>c</sup>	3.8 <sup>b</sup>	3.2 <sup>d</sup>	4.1 <sup>a</sup>	3.1 <sup>d</sup>	<0.001	3.6	3.5	0.366	0.920
High-quality homemade fish soups	3.3 <sup>c</sup>	3.6 <sup>b</sup>	2.5 <sup>d</sup>	4.2 <sup>a</sup>	2.9 <sup>d</sup>	<0.001	3.6 <sup>a</sup>	2.8 <sup>b</sup>	<0.001	0.471

Intention to buy new fish products was scored on a 5-point scale where the higher the score the higher the intention;

Two-way ANOVAs for differences between segments and country groups in terms of intention to buy; means with different letters are significantly different in Post Hoc tests (Bonferroni adjustment for differences between segments) at  $p < .05$ ; because Levene's test for homogeneity of variances was significant, one-way ANOVAs were used to confirm the differences between segments with Games-Howell adjustment post hoc tests – only in the case of the *Fish ceviches or fish carpaccios* the difference between the "Moderate" and "Uninvolved" was significant in the one-way ANOVA.

**Table 10**  
Frequency to buy or eat fish by segment and country group.

	"Moderate"	"Adventurous responsible"	"Conservative"	"Foodies"	"Uninvolved"	Sig. Segment	Country group1 (France & Spain)	Country group2 (Germany)	Sig. Country group	Sig. Interaction
Frequency buy fish or fish products	1.4 <sup>c</sup>	1.7 <sup>b</sup>	0.9 <sup>d</sup>	2.3 <sup>a</sup>	1.1 <sup>c, d</sup>	<0.001	1.7 <sup>a</sup>	1.1 <sup>b</sup>	0.001	0.078
Frequency eat fish or fish products	1.7 <sup>c</sup>	2.1 <sup>b</sup>	1.0 <sup>d</sup>	2.8 <sup>a</sup>	1.4 <sup>d</sup>	<0.001	2.1 <sup>a</sup>	1.2 <sup>b</sup>	<0.001	0.280

Frequency of buying and eating fish or fish products was recoded to represent frequency per week (i.e. daily or almost every day = 6.5, 3–4 times a week = 3.5, 2 times a week = 2, once a week = 1, 2–3 times a month = 0.625, once a month = 0.25, 1–5 times every 6 months = 0.125, less frequently = 0.0625, never = 0)

Two-way ANOVAs for differences between segments and country groups in terms of frequency of buying and eating fish or fish products; means with different letters are significantly different (Bonferroni adjustment for differences between segments) at  $p < .05$ ; because Levene's test for homogeneity of variances was significant, one-way ANOVAs were used to confirm the differences between segments with Games-Howell adjustment post hoc tests.

As the difference between the points of the frequency scale can be seen as not homogenous, we have conducted the nonparametric Kruskal Wallis tests to confirm that there is a significant difference between the segments in terms of frequency to buy and frequency to eat fish or fish products (Frequency buy:  $H(4) = 183,636$ ;  $p < .001$ ; Frequency eat:  $H(4) = 201,965$ ;  $p < .001$ ).

however, consumers in this group were the most involved with food, the most open to innovativeness and the most interested in responsibility in food. They were closely followed by the "Adventurous responsible". The "Moderate" had average involvement in food as well as interest in innovativeness and responsibility in food. Finally, the "Conservative" and "Uninvolved" scored lower on all these dimensions. The segments identified in the current study share similarities with the cross-national segments identified using the original food-related lifestyle instrument (Grunert, Brunsø, Bredahl, & Bech, 2001). The original "Uninvolved" and "Conservative" segments were characterized by low interest in novelty or innovativeness in food, but differed in terms of importance of food. In particular, for the "Uninvolved" food was not central in their lives, whereas food was important for the "Conservative". This is in line

with our results in terms of food involvement and food innovativeness for these two segments. The "Adventurous" were characterized as attaching high importance to food in their everyday life and being interested in novelty (Grunert et al., 2001), which matches their scores on food involvement and innovativeness from the current study. The original instrument consisted of 69 items and did not include an explicit dimension of food responsibility. Our results are largely in line with segmentation based on the revised food-related lifestyle instrument that consists of 15 items and three core constructs, namely food involvement, food innovativeness and food responsibility (Brunso et al., 2021), and that was applied in the present study. The study by Brunsø et al. (2021) further inspired the naming of segments in our study. In our study, the "Moderate" consumers were more involved with food compared to the

“Conservative”, and the “Uninvolved” consumers scored slightly higher on food innovativeness and food responsibility compared to the “Conservative” consumers as opposed to the study by [Brunso et al. \(2021\)](#). Our profiling results are similar to those of [Brunso et al. \(2021\)](#) in terms of consumer behaviour towards fish. Although there were some small differences in the core dimensions of food-related lifestyle between the segments identified in this study and the study by [Brunso et al. \(2021\)](#) between “Moderate” and “Conservative” consumers, we have similar findings in terms of frequency of eating fish for these segments, namely the “Conservative” do this more rarely than the “Moderate”. The present study extends these previous findings by showing that the identified segments differ in their interest to accept innovative fish product concepts.

### 5.1. The “Foodies” and the “Adventurous responsible” segments

The “Foodies”, closely followed by the “Adventurous responsible”, scored higher than other segments in psychographics that drive fish purchase and consumption, such as general attitude towards fish, category involvement, domain innovativeness, health involvement, or habitual fish consumption ([Carlucci et al., 2015](#); [Pieniak et al., 2010](#); [Reinders et al., 2016](#); [Vanhonacker et al., 2010](#); [Verbeke et al., 2007](#)). These two segments had stronger motives to eat aquaculture fish or fish products (e.g. nutritious, safe). The “Foodies”, closely followed by the “Adventurous responsible”, were also the most willing to buy the eight new aquaculture fish products under study and reported the highest frequency of eating and buying fish and fish products. Given that these segments scored high in psychographics that drive fish purchase and consumption, it is to be expected that they are frequent eaters and buyers of fish and fish products. Their profile makes these two segments especially interesting for the aquaculture fish market. They share characteristics with “involved innovators” that have been identified in previous work as relevant target segments for new aquaculture fish products ([Reinders et al., 2016](#)).

### 5.2. The “Moderate” segment

The “Moderate” consumers scored somewhat lower on many psychographics than the “Adventurous responsible”, namely they had moderate scores on the psychographics. The “Moderate” were somewhat willing to buy the new aquaculture fish products, but to a lower extent than the “Foodies” or the “Adventurous responsible”, and were less frequent eaters of fish compared to these segments.

### 5.3. The “Conservative” and the “Uninvolved” segments

In some psychographic respects, the “Conservative” did not differ from the “Moderate” segment, such as general attitude towards fish or the healthiness motive to eat aquaculture fish or fish products. The “Conservative” and the “Uninvolved” were the least willing to buy new aquaculture fish or fish products and reported lower frequency of buying and eating fish or fish products compared to the other segments. In addition, their psychographic profile matches these behavioural responses. These segments share some similarities with the “Ambiguous indifferent” segment identified in previous cross-country segmentation research ([Reinders et al., 2016](#)).

The segments identified based on the core dimensions of food-related lifestyle varied in terms of their intention to buy several new aquaculture fish products, supporting the important role of lifestyle in consumer responses to fish products ([Budhathoki et al., 2022](#); [Carlucci et al., 2015](#)). The identified segments did not differ to a large extent by demographics, similar to previous segmentation studies ([Vanhonacker et al., 2010](#)) and the study that developed the core dimensions of food-related lifestyle used as segmentation bases in the present study ([Brunso et al., 2021](#)). However, there were several differences between segments in terms of psychographics, implying that making decisions about

targeting and positioning of fish products based on demographics may not be the best strategy. The core dimensions of food-related lifestyle proved useful in deriving consumer segments and showed satisfactory psychometric properties, which supports their usefulness for segmentation studies ([Grunert, 2019](#)). The present study extends the usefulness of the core dimensions of food-related lifestyle for segmentation to three additional countries to the ones covered by [Brunso et al. \(2021\)](#). The method employed for segmentation allowed to account for the nested nature of the data, where respondents belonged to one of three countries. Previous literature shows that country is important in the segmentation of consumers with relevance for the fish market ([Pieniak et al., 2010](#)), but that similar consumer segments exist in various EU countries ([Reinders et al., 2016](#)). Our results support these previous findings and, in addition, show that when taking into account country in the segmentation, the same segments exist across countries but their prevalence can differ between countries.

### 5.4. Implications

The findings show that food-related lifestyles are useful in identifying consumer segments that vary in their willingness to accept new aquaculture fish products and that are thus promising target groups for the aquaculture market in its aim to improve its competitiveness by incorporating a more consumer-centric approach in new product development for international markets. Although the food-related lifestyles are important in consumer behaviour towards food in general, the core dimensions of food-related lifestyle proved useful in segmenting the market for fish products in particular as well. The usefulness of the core dimensions of food-related lifestyle is supported by the results of the measures specific to fish (e.g. category involvement, domain specific innovativeness) which showed similar differences between segments as the dimensions of food-related lifestyle.

The identified profiles of the segments and the differences in their willingness to buy new aquaculture fish products provide important insights for the aquaculture market in order to target those promising segments that can contribute to increase the competitiveness of this market, especially in regions where this is needed like the Mediterranean region.

The “Foodies” represent the most promising segment, they are highly interested in innovativeness in food in general and in the fish domain in particular; thus, they could be good targets for new aquaculture fish products. Although this segment is one of the smallest segments identified, they were also the most willing to buy several new fish products from aquaculture. “Foodies” are also most interested in responsibility in food and such ethical beliefs are highly important for purchase intentions of aquaculture fish from environmentally friendly “blue” production ([Banovic et al., 2019b](#)).

The “Adventurous responsible” consumers can also be seen as a promising target group for the aquaculture market, as they are willing to buy new fish products from aquaculture and have a psychographic profile that supports consumption and purchase of fish products. This segment is larger than the “Foodies”, and together these two segments account for 36% of the respondents. Therefore, the two particularly promising segments, the “Foodies” and the “Adventurous responsible”, represent a sizable target for the aquaculture market. Communication about new fish products targeted at these two segments could benefit from emphasizing the innovativeness of the products, any sustainability-related benefits as well as health-related benefits. This would be in line with the segments’ interest in innovativeness in food, their health involvement and the fact that health and nutrition are important motives for consumption of aquaculture fish for these consumers. For example, these consumers may be interested in products certified sustainable (e.g. ASC label), products carrying a nutrition or health claim or products with novel ingredients. Thus, to approach these two consumer segments, it will be important to develop communication strategies using labels or emphasizing new innovative attributes of the products,

and implementing this communication where the consumers make their product choices, e.g., in the supermarket or at the fishmonger, as they are already interested in consuming fish.

The “Moderate” consumers hold some potential as well as they are interested to some extent in new aquaculture products and their psychographic profile is supportive, to some extent, of purchase and consumption of fish from aquaculture. This segment is sizable on its own, thus, together with the previous two very promising segments, would give an even more significant target for aquaculture products. These consumers may find attractive any communication related to benefits of aquaculture for health and nutrition and to some extent also benefits related to sustainability. Communication strategies could attempt to convince these consumers about the safety of eating aquaculture fish and the nutritional properties of these products, as in these aspects the “Moderate” score slightly lower than the “Adventurous responsible”. For example, information about the disease control in relation to aquaculture and information about the content of omega 3 or other such properties of the products could be of interest for these consumers. The “Moderate” did not differ from the “Uninvolved” in their willingness to buy certain fish products like sushi-style fish, fish ceviche or fish carpaccio or fish kit for different recipes and cooking options, which implies that they could be a better target for new fish products that resemble familiar products compared to more innovative new products.

Communication strategies that emphasize the benefits of aquaculture fish consumption in terms of healthiness, tastiness and safety could contribute to the success of new fish products from aquaculture, especially among the segments that are not highly convinced of these benefits (i.e. “Moderate”, “Conservative”, and “Uninvolved”). In this case the communication strategy approach should be at a more generic level as the “Moderate” segment is not looking for new fish products in particular, and thus needs to be approached by attitude-changing convincing arguments before they will choose to look at the fish shelves in the supermarket or to enter a fishmonger.

An important benefit of the identification of international segments is that the communication strategies described so far can be used across the countries. This can make communication efforts much more efficient compared to developing customized strategies for each country. It is though relevant to keep in mind that we identify two country groups, meaning that the prevalence of the segments varies by country group where Spain and France belong to one group and Germany to another.

An important contribution of the study is therefore that the positioning and marketing of new aquaculture products would benefit from targeting consumers from the “Foodies”, the “Adventurous responsible” and even the “Moderate” segments, while not targeting the “Conservative” and the “Uninvolved” consumers as they are not particularly interested in new innovative aquaculture products.

### 5.5. Limitations

The study used self-reported measures that may be a biased estimate of real behaviour, however, this approach is common in previous literature and the focus on the new product development stage of the present study made it impossible to work with real products.

The sample varied in how frequently fish or fish products were bought or eaten. We did not limit the sample to frequent buyers and consumers of fish as that allowed us to explore consumer responses to new fish product concepts in a way that better reflects the real world

## Appendix A

Indicators for models with segments ranging from 1 to 6 and country classes ranging from 1 to 3

market for fish and fish products as not all potential consumers would already be frequent users of such products.

We had two interaction effects between segment and country group when profiling the segments by psychographics, however, the sample size of some of the compared groups in order to interpret the interaction effects were small (e.g.  $N = 20$ ). We did not use attention checks in our questionnaire, which can be seen as limitation, however, the data was collected in collaboration with an international market research agency, Adimen, and the shortest response time measured was 10 min. This is a reasonable time to answer the questionnaire taking into account the length of the questionnaire as well as the fact that items were about everyday opinions and behavioural intentions in relation to food and aquaculture.

Intention to buy new aquaculture fish products was measured in relation to product concepts described as textual name of product. Whereas this helped assess the openness of the different segments towards such product concepts, it would be highly relevant for future research to investigate the differences between segments in terms of the importance they place on different product attributes including price. This could provide further input for the marketing of new aquaculture fish products.

### 5.6. Conclusion

We identified five European consumer segments based on the core dimensions of food-related lifestyle that vary in their willingness to buy new aquaculture fish products. The “Foodies”, closely followed by the “Adventurous responsible”, were the most involved in food, the most innovative in food and the most interested in food responsibility. These two groups scored the highest in many psychographics with high relevance for the purchase and consumption of fish or fish products, such as general attitudes towards fish, involvement with the fish category, health concern. These two segments were the most willing to buy new aquaculture fish products and were frequent users and buyers of fish. Therefore, these two segments can be seen as most promising as target groups for the aquaculture fish market. In addition, the “Moderate” consumers can be seen to hold some promise as target consumers for new aquaculture fish or fish products. The “Conservative” and the “Uninvolved” segments hold little, if any, promise for the aquaculture fish market. The main implications in terms of strategies to target the most promising target segments (i.e. “Foodies” and “Adventurous responsible”) relate to placing emphasis on the innovativeness of the new products, as well as on sustainability and health-related benefits of the products.

### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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		LL	BIC(LL)	AIC(LL)	AIC3(LL)	CAIC(LL)	Npar	Max. BVR	Class.Err.	Entropy R <sup>2</sup>
Model1	1-Cluster 1-GClass	-7187,69	14419,25	14387,37	14393,37	14425,25	6	593,3376	0	1
Model2	2-Cluster 1-GClass	-6465,68	13026,43	12957,36	12970,36	13039,43	13	155,188	0,0698	0,7564
Model3	3-Cluster 1-GClass	-6156,03	12458,32	12352,06	12372,06	12478,32	20	62,8341	0,0832	0,7821
Model4	4-Cluster 1-GClass	-6011,61	12220,68	12077,22	12104,22	12247,68	27	24,134	0,1456	0,7203
Model5	5-Cluster 1-GClass	-5914,27	12077,19	11896,54	11930,54	12111,19	34	17,1909	0,1428	0,7422
Model6	6-Cluster 1-GClass	-5844,25	11988,34	11770,49	11811,49	12029,34	41	7,0378	0,143	0,7627
Model7	1-Cluster 2-GClass	-7187,69	14426,56	14389,37	14396,37	14433,56	7	593,3376	0	1
Model8	2-Cluster 2-GClass	-6441,86	12993,42	12913,72	12928,72	13008,42	15	163,5189	0,0702	0,7575
Model9	3-Cluster 2-GClass	-6127,81	12423,82	12301,62	12324,62	12446,82	23	67,0769	0,0827	0,7842
Model10	4-Cluster 2-GClass	-5971,87	12170,45	12005,74	12036,74	12201,45	31	27,9457	0,1288	0,7418
Model11	5-Cluster 2-GClass	-5866,38	12017,97	11810,76	11849,76	12056,97	39	18,8512	0,1424	0,7474
Model12	6-Cluster 2-GClass	-5783,19	11910,1	11660,38	11707,38	11957,1	47	7,7119	0,1363	0,7773
Model13	1-Cluster 3-GClass	-7187,69	14433,88	14391,37	14399,37	14441,88	8	593,3376	0	1
Model14	2-Cluster 3-GClass	-6441,57	13007,46	12917,14	12934,14	13024,46	17	163,1142	0,0703	0,7576
Model15	3-Cluster 3-GClass	-6127,38	12444,9	12306,75	12332,75	12470,9	26	66,8222	0,0828	0,7852
Model16	4-Cluster 3-GClass	-5970,78	12197,52	12011,56	12046,56	12232,52	35	26,998	0,1298	0,7406
Model17	5-Cluster 3-GClass	-5882,07	12085,93	11852,14	11896,14	12129,93	44	16,7786	0,1353	0,7584
Model18	6-Cluster 3-GClass	-5780,42	11948,44	11666,84	11719,84	12001,44	53	10,0678	0,1342	0,7848

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