



## Research report

Consumer beliefs regarding farmed *versus* wild fish <sup>☆</sup>

Anna Claret <sup>a</sup>, Luis Guerrero <sup>a,\*</sup>, Rafael Ginés <sup>b</sup>, Amàlia Grau <sup>c</sup>, M. Dolores Hernández <sup>d</sup>, Enaitz Aguirre <sup>e</sup>, José Benito Peleteiro <sup>f</sup>, Carlos Fernández-Pato <sup>g</sup>, Carmen Rodríguez-Rodríguez <sup>h</sup>

<sup>a</sup> IRTA-Food Technology, XaRTA. Finca Camps i Armet, E-17121 Monells, Spain.

<sup>b</sup> ULPGC-Universidad de las Palmas de Gran Canaria, Instituto Universitario de Sanidad Animal y Seguridad Alimentaria, Dept. Acuicultura y Genética Marina. Trasmontaña s/n, E-35413 Arucas, Las Palmas, Spain.

<sup>c</sup> LIMIA-Laboratorio de Investigaciones Marinas y Acuicultura. Govern de les Illes Balears. Av. Eng. Gabriel Roca 69, E-07158 Port d'Andratx, Mallorca, Spain.

<sup>d</sup> IMIDA-Acuicultura. Ctra. del Puerto s/n, P.O. Box 65, E-30740 San Pedro de Pinatar, Murcia, Spain.

<sup>e</sup> AGAPA-Agencia de Gestión Agraria y Pesquera de Andalucía. C/ Bergantín 39, E-41012 Sevilla, Spain.

<sup>f</sup> IEO Vigo-Instituto Español de Oceanografía, Centro Oceanográfico de Vigo. Cabo Estai-Canido. P.O. Box 1552, E-36280 Vigo, Pontevedra, Spain.

<sup>g</sup> IEO Santander-Instituto Español de Oceanografía, Centro Oceanográfico de Santander. P.O. Box 240, E-39080 Santander, Santander, Spain.

<sup>h</sup> CEP Asturias-Centro de Experimentación Pesquera, El Muelle, E-33760 Castropol, Asturias, Spain.

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## ABSTRACT

Aquaculture is a food-producing activity, alternative to traditional extractive fishing, which still acts as a reference for most consumers. The main objective of the present paper was to study which consumer beliefs, regarding farmed *versus* wild fish, hinder the potential development of the aquaculture sector. To achieve this purpose the study was organized into two complementary steps: a qualitative approach (focus groups) aimed at assessing consumer perception about wild and farmed fish and to identify the salient beliefs that differentiate them; and a quantitative approach (survey by means of a questionnaire) to validate the results obtained in the focus group discussions over a representative sample of participants (n = 919). Results showed that participants perceive clear differences between farmed and wild fish. Although no significant differences between both kinds of fish were detected on safety, in general farmed fish was perceived to be less affected by marine pollution, heavy metals and parasites. In the contrary, wild fish was considered to have healthier feeding, to contain fewer antibiotics and to be fresher, healthier, less handled and more natural. Beliefs related to quality were in favour of wild fish, while those related to availability and price were in favour of farmed fish. Significant differences were observed in the perception of both kinds of fish depending on the consumers' objective knowledge about fish, on the level of education, age and gender and on the three segments of consumers identified: "Traditional/Conservative", "Connoisseur", "Open to aquaculture". The results provided could play an important role when planning and designing efficient marketing strategies for promoting farmed fish by adapting the information provided to the perception of each segment of consumers identified by the present study

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## Introduction

Global fish and seafood consumption (including finfish, crustaceans, molluscs and others) increased from about 40 million tons in 1970 to around 131 million tons in 2011 as a result of the growth

in population and the increase of individual consumption (from 10.9 kg/year to 18.8 kg/year in the same period) (FAO, 2013) due to its healthy and nutritious characteristics (Verbeke, Sioen, Pieniak, Van Camp, & De Henauw, 2005). Traditional fisheries have been supplying fish to the food market for a long time. However, unsustainable fishing practices have led to the depletion of natural fish stocks and catches. Given these circumstances, aquaculture seems to be the most suitable alternative, complementary to traditional fishing, to gradually satisfy the global consumer demand (Cahu, Salen, & de Lorgeril, 2004) which is expected to increase substantially in the future (FAO, 2013). In fact, aquaculture is the fastest-growing animal-food-producing sector with a global production which has increased from less than 1 million tons per year in the early 1950s

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\* Corresponding author.

E-mail address: [lluis.guerrero@irta.es](mailto:lluis.guerrero@irta.es) (L. Guerrero).

to 60 million tons in 2010 (estimated total value of US\$119 billion). Accordingly, aquaculture supplied approximately 50% of global food fish production in 2010, compared with just 9% in 1980 (FAO, 2013). However, while aquaculture production has shown strong growth in developing countries, particularly in Asia, annual growth rates in developed industrialized countries has stagnated as a response to a wide range of factors. In Europe for example, aquaculture production has remained more or less constant at around 1.3 million tons per year since the turn of the century (European Commission, 2009). According to the European Commission (2009), Europe's strengths regarding aquaculture are due to the terms of safety, technology, research, entrepreneurial base and climate. However, aquaculture is still far from its full potential development since European aquaculture production in 2009 represented only 20% of the total fish production. This fact can be attributed to the costs, the competition for space (inland and coastal) with other activities, as well as the less positive image of fish from aquaculture when compared with wild-caught fish among consumers, even if unfounded (European Commission, 2012). Actually, in spite of having a positive overall image of both, fishery and aquaculture products (Ernst & Young, 2008), European consumers perceive farmed fish as being of lower general quality than wild fish (Kole, 2003; Verbeke, Vermeir, & Brunso, 2007).

Consumer perception of a certain food product and its acceptance or rejection is of a multi-factorial nature (Costell, Tárrega, & Bayarri, 2010). The implied factors do not only include sensory characteristics but also preconceived ideas such as attitudes or beliefs about the product, especially in new food stuffs (Pearson, 2002; Shifferstein, 2001; Von Alvensleben, 2001). Indeed, beliefs about the characteristics of a certain product and the way it is produced can have a relevant influence on consumer perception such as in the case of farmed fish (Kole, 2003) thus conditioning its acceptance. In spite of being an ancient practice (Rabanal, 1988), aquaculture is in general regarded as an alternative to the traditional extractive fishing activity, which still acts as a reference for most consumers.

According to Fishbein and Azjen (1975), beliefs represent the information that a consumer possesses about an object and therefore links an object to some attribute. One example of a belief statement would be "fish is healthy" where fish is the object and healthy is the attribute. It is important to mention that as pointed out by Rokeach (1969), beliefs may be true or false, correct or incorrect. Thus, belief statements represent an individual's perception (opinion) of the relationship between the given object and the particular attribute associated with the object (Smith, Walker, & Hamidova, 2012).

Belief formation is a lifelong dynamic process (Castelfranchi, 2004) that can be developed by *direct observation* (descriptive beliefs about products are mainly formed by consumers through their experience with them), by *information* (informational beliefs are formed by accepting information provided by an outside source such as mass media, relatives, friends, doctors, etc.) and by *inference* (inferential beliefs are formed by inferential connections through previously acquired experience and knowledge) (Finn, 1981; Fishbein & Azjen, 1975; Smith et al., 2012). This way, beliefs are loosely encompassed by aspects such as experiences or acquired knowledge and personal characteristics that determine consumer attitudes, buying intention and preferences (Friedler & Bless, 2000; Ivan & Penev, 2011; Tourangeau & Rasinski, 1988). Regarding aquaculture, Fernández-Polanco and Luna (2012) determined that educational level, retail format and advertising credibility were some of the factors affecting consumer beliefs towards the animal-food-production system.

The main objective of the present paper was to study consumer beliefs, regarding farmed *versus* wild fish, which hinder the potential development of the aquaculture sector. To achieve this purpose the study was organized into two complementary steps:

a qualitative approach (focus groups) which was aimed at assessing consumer perception about wild and farmed fish and to identify the salient beliefs that differentiate them; and a quantitative approach (survey by means of a questionnaire) to validate the results obtained in the focus group discussions over a representative sample of participants.

## Methodology

### *Qualitative approach: selection of beliefs comparing farmed and wild fish by means of focus group discussions*

Nine different focus group discussions (Krueger, 1988) were carried out in nine different Spanish regions: eight coastal regions (Andalusia, Asturias, Balearic Islands, Canary Islands, Cantabria, Catalonia, Galicia, and Murcia) and one interior region, Madrid, as a representative of a non-fishing area but with a high fish consumption (MARM, 2010). The number of participants in each focus group ranged from between six and 12. All participants (N = 81) were involved in food purchasing within their household and were recruited taking into account age (between 20 and 75 years) and gender (52% women and 48% men). Frequent (more than twice a week), occasional fish consuming participants (less than twice a week) and non-consumers (almost never) were selected to enrich the discussion and to gain a broader picture of the topic under analysis. Focus group sessions lasted 1.5–2 h and were structured in three main stages: generic discussion on fish consumption, motives/advantages and barriers/disadvantages of fish intake, and perceived differences between farmed and wild fish. All the focus groups were conducted by the same experienced moderator in all geographic locations. An observer was also present to take notes and each session was audio and video recorded for a deeper qualitative analysis. Relevant beliefs when comparing both kinds of fish identified in the third stage of the focus group discussions constituted the basis of the design of the quantitative questionnaire performed in the next step.

### *Quantitative approach: participants and questionnaire*

A sample of 919 consumers was recruited from the same nine Spanish regions as mentioned above (about 100 participants from each one) using a probabilistic sampling by quotas including gender (minimum 25% men) and age (between 20 and 75 years) within each region (according to the distribution of the Spanish population). A filter questionnaire was specifically elaborated to achieve this aim and a marketing agency was subcontracted to perform the recruitment by random phone calls in the different regions. Only those consumers involved in food purchasing and preparation at home who stated that they ate fish at least twice a week were selected. Table 1 shows the socio-demographic characteristics of the consumers involved in the present study. The overall sample included 318 men (34.7%) and 599 women (65.3%). This distribution showed a bias when compared with the Spanish population (50.2% men and 49.8% women) (INE, 2009), which reflects the effect of the recruitment criterion (respondents had to be involved in food purchasing and preparation at home). Age distribution approximately matched the Spanish population (INE, 2009), while the percentage of consumers with a high-intermediate level of education (80.6%) was higher than the national average (51%) (Ministerio de Educación, 2009). This bias was probably due to the higher self-confidence, as well as to the higher willingness to participate that medium-high educated people tend to show (Claret et al., 2012).

Questionnaire data were collected as a part of an extensive survey held in a central location in each Spanish region. This paper focus on 19 items related to consumer beliefs concerning farmed and wild fish (Table 2) which were formulated literally as the consumers had

**Table 1**  
Socio-demographic characteristics of the participants in the quantitative step expressed as a percentage (N = 919).

Socio-demographic characteristic		%	Socio-demographic characteristic		%
Region	Andalucia	11.0	Education	Elementary	19.4
	Asturias	11.0		Medium	54.9
	Balearic Islands	10.7		High	25.7
	Canary Islands	11.0	Children at home	Yes	36.7
	Cantabria	11.2		No	63.3
	Cataluña	11.2	Perceived economic situation	Difficult	27.2
	Galicia	11.3		Intermediate	70.8
	Madrid	11.3		Well-off	2.0
	Gender	Murcia	11.3	Objective knowledge <sup>a</sup>	Low
Men		34.7	Medium		60.7
Age	Women	65.3	Subjective knowledge <sup>b</sup>		High
	≤ 35	37.2		Low	14.4
	36–55	41.4		Medium	64.6
	>55	21.4		High	21.0

<sup>a</sup> Objective knowledge (O.K); Low (0 or 1), Medium (2 or 3), High (4 or 5).

<sup>b</sup> Subjective knowledge (S.K.); Low: S.K. < 3, Medium: 3 ≤ S.K. ≤ 5, High: S.K. > 5.

done in the focus groups (Malhorta, 2006) in order to ensure a proper understanding. Some of the items were reversed to check mechanical answers. Items were assessed by means of a 7-point Likert scale (1 = strongly disagree; 4 = neither agree nor disagree; 7 = strongly agree). Participants filled in the questionnaire in groups of between 10 and 20 and were assisted by two researchers who provided brief indications on the questionnaire structure and the use of the scale at the beginning of the sessions.

Socio-demographic data (gender, age, education, family size, children at home, perceived economic situation) and objective and subjective knowledge about fish (Pieniak, Verbeke, Scholderer, Brunso, & Olsen, 2007) were also recorded (Table 1) as additional variables to better characterize the different participants.

Consumer level of objective knowledge about fish was measured with five statements. Three of them were false (“More than half of the fish we buy in Spain is farmed fish”; “Fish is a source of dietary fibre” and “Cod is a fatty fish”) and two were true (“Fish is a source of omega-3 fatty acids” and “Salmon is a fatty fish”). A “true”/“false”/“do not know” scale (Brucks, 1985; Park, Mothersbaugh, & Feick, 1994) was used to assess objective knowledge.

Subjective or perceived level of knowledge was assessed by means of four statements: “I consider that I know more about fish than the average person”, “I think that I know more about fish than my friends”, “I have a lot of knowledge about how to prepare fish” and “I have a lot of knowledge about how to evaluate the quality of fish”. Respondents ranged the statements using a 7-point semi-structured Likert scale (“totally disagree”/“neither agree nor disagree”/“fully agree”).

Socio-demographic questions and evaluation of objective and subjective knowledge about fish were placed at the end of the questionnaire.

#### Data analysis

Focus group discussions were analysed by means of triangulation (Guerrero et al., 2010). Triangulation is often used in qualitative research to check and establish validity by analysing a research question from multiple perspectives (Guion, Diehl, & McDonald, 2002). Accordingly, three different researchers with a minimum of 5 years experience in qualitative techniques analysed the informa-

**Table 2**  
Mean values of the selected beliefs comparing wild versus farmed fish.

Category	Item	Mean value					
		Overall	Cluster 1 (n = 345)	Cluster 2 (n = 313)	Cluster 3 (n = 261)		
Safety	Wild fish is safer than farmed fish	4	NS	4.8a	3.4b	3.5b	
	Wild fish is more affected by marine pollution (spillages) than farmed fish	4.7	***	4.0c	5.6a	4.6b	
	Wild fish contains more heavy metals than farmed fish	4.6	***	4.2b	4.9a	4.8a	
	Wild fish contains more antibiotics than farmed fish	2.9	***	3.0a	2.7b	3.1a	
	Wild fish is more affected by parasites (anisakis) than farmed fish	4.7	***	4.2c	5.2a	4.7b	
	Wild fish has a healthier diet than farmed fish	4.8	***	5.3a	4.9a	3.9b	
	Wild fish is healthier than farmed fish	4.8	***	5.1a	5.0a	4.1b	
	Quality	Wild fish is of better quality than farmed fish	5.2	***	5.6a	5.6a	4.2b
		Wild fish is fresher than farmed fish	4.2	**	5.5a	3.5b	3.4b
Wild fish is more nutritious than farmed fish		4.7	***	5.4a	4.7b	3.8c	
Wild fish is more fatty than farmed fish		3.6	***	3.6	3.6	3.6	
Wild fish tastes better than farmed fish		5.6	***	6.2a	6.1a	4.2b	
Wild fish is firmer than farmed fish		4.5	***	4.6ab	4.7a	4.4b	
Control	Wild fish is more controlled than farmed fish	3.3	***	3.6a	2.9b	3.3a	
	Wild fish is more handled than farmed fish	3.3	***	2.8c	3.1b	4.3a	
	Wild fish is more artificial than farmed fish	2.2	***	2.1b	1.4c	3.3a	
	Wild fish provides more guarantees than farmed fish	4.1	*	4.8a	3.8b	3.6b	
When buying fish	Wild fish is easier to find than farmed fish	3.8	**	4.2a	3.4c	3.8b	
	Wild fish is cheaper than farmed fish	3	***	3.2a	2.4b	3.3a	

Mean values in a 7-point Likert scale. Mean values > 4 indicate agreement and mean values < 4 indicate disagreement.

One-sample t-test significance: \*\*\*p ≤ 0.001; \*\*p ≤ 0.01; \*p ≤ 0.05; NS: >0.05 (for the overall sample).

Different letters in the same row indicate statistically significant differences (p < 0.05) between the mean values of the clusters.

tion obtained and made independent reports. The results presented in the current paper were obtained by a consensus among the three researchers over the three independent reports to balance out the subjective influences of individuals (Denzin, 1978; Guerrero et al., 2009).

Regarding the questionnaire, a descriptive analysis was carried out aimed at describing the sample of participants recruited. In order to determine the significance of each item or belief assessed (wild fish versus farmed fish) a one-sample t-test ( $H_0: \mu = 4$ , since 4 was the neutral point of the scale) was performed.

An ascendant hierarchical cluster analysis (“Ward” method and Euclidian distance) was performed in order to identify the existence of different segments of consumers showing different belief profiles concerning farmed and wild fish. The final number of clusters to be retained was based on the parsimony rule: this is the simplest possible structure (low number of clusters) that still represents homogenous groups (assessed by the number of beliefs that differed significantly between clusters). An analysis of variance (ANOVA, Tukey *post hoc* test) was carried out to determine the existence of statistical differences between the clusters obtained regarding the belief patterns. In order to characterize the different clusters a multinomial logistic regression (“Logit” model) was performed including the cluster as dependent variable and the information on socio-demographics and objective and subjective knowledge about fish as explanatory variables.

The objective knowledge (O.K.) of each consumer was measured by the addition of right answers (coded as 1) and fail answers or “do not know” (coded as 0) thus obtaining three different groups of consumers: Low (0 or 1), Medium (2 or 3) and High objective knowledge (4 or 5). Concerning the subjective knowledge, firstly the unidimensionality of the four items was assessed by means of a PCA analysis and the reliability was verified on the basis of Cronbach’s alpha coefficient alpha (Cronback, 1951) (Cronbach’s alpha = 0.68). Secondly the individuals’ subjective knowledge (S.K.) was estimated by means of the average of the five items and three different categories of consumers were created: Low (S.K. < 3), Medium ( $3 \leq \text{S.K.} \leq 5$ ), High subjective knowledge (S.K. > 5).

All the analyses were carried out by means of XLSTAT 2011 software (Addinsoft, France).

## Results

### Focus group (qualitative approach)

Generally speaking, similar results were obtained from the nine different Spanish regions where the focus groups were carried out. In all cases, participants started to talk spontaneously about farmed fish before the topic was introduced into the discussion by the moderator. A certain lack of knowledge of ever having tasted farmed fish was observed. However, when the participants were asked about the species of fish they usually consumed, they mainly mentioned some of the most produced and commercialized farmed sea fish species in Spain such as gilthead bream and sea bass (APROMAR, 2012). Participants not only stated that they perceived tangible differences between both kinds of fish as a result of their own experience but also because of unfounded subjective reasoning (opinions and beliefs). In this sense, consumers draw parallelisms between wild and intensive terrestrial animal farming (notably with poultry) when describing the differences between both kinds of fish. Overall, 19 consumer beliefs about farmed and wild fish mainly related to their quality, safety and control issues arose. As shown in Table 2, seven items were included in the safety category: safety in general, marine pollution, heavy metals, antibiotics, parasites, healthy animal feeding and healthiness. Six items mentioned by participants were grouped in the quality category: quality in general, freshness, nutritional value, fat, flavour and firmness. The items related to control

in general, handling, artificial character and guarantees were included in the control category. Participants also asserted to perceive differences between both kinds of fish at the moment of buying it in terms of availability (ease of finding the product in the market) and price.

An overall preference for wild fish was detected markedly due to its quality characteristics. In this sense, it is worth mentioning that participants frequently used terms such as “fresh fish” or “fish from the sea” when referring to wild fish. Sensory characteristics of farmed fish, taste and texture particularly, were elicited as the main limiting factors for its complete acceptance. Participants recognized their poor knowledge on aquaculture methods and animal feeding; nevertheless, they considered farmed fish to be safer than wild fish especially because of its major control as far as diseases and balanced feeding are concerned. In spite of all this, fish selection seems to depend more on quality and/or price attributes than on safety related aspects since safety is already assumed by consumers. Additionally, the price of farmed fish acts as a balancing factor for consumers and compensates for the better sensory characteristics of wild fish.

Finally, it should be noted that there was an absolute agreement among the participants on the fact that aquaculture is the only realistic alternative available to preserve marine resources and satisfy the global demand of seafood in the future.

### Survey (quantitative approach)

Overall results of the questionnaire confirmed those of the focus group discussions (Table 2).

As can be observed, significant differences were detected in 18 of the 19 beliefs included in the questionnaire. It is also important to remark that in contrast to what had been observed in the focus group discussions, safety was the only item in which no significant difference between the two kinds of fish was detected. Farmed fish was perceived as less affected by marine pollution, heavy metals and parasites. To the contrary, wild fish was considered to have a healthier diet, to contain fewer antibiotics and to be fresher, healthier, less handled and more natural. Overall quality was one of the items in which noticeable differences were detected, and wild fish was perceived as having a better overall quality than farmed fish. Concretely, 60% of the participants in the current study affirmed that wild fish was of better overall quality than farmed fish while those assuming that farmed fish was of better quality represented only 26%. It is worth mentioning that in contrast to the case of food safety, all the scores of the items included in the questionnaire dealing with quality (sensory characteristics – better taste and firmer, nutritional value – more nutritious and less fatty and freshness) were in favour of wild fish.

In agreement with the results from the focus group discussions, taste was one of the items in which differences between both kinds of fish were more significant. It is worth mentioning the importance that the artificial character associated to farmed fish had for most of the participants in this study. In fact, the belief concerning artificiality was the strongest one when comparing farmed versus wild fish. In the present study wild fish was perceived as more natural, more nutritious, and healthier than farmed fish as well as being of better quality. Regarding the items related to the moment of buying fish, i.e. availability and price, both items were in favour of farmed fish.

Generally the participants showed a moderate-high level of both objective (73% of the participants) and subjective knowledge (85%) about fish.

Cluster analysis allowed the identification of three clusters of consumers differing in their perception about farmed and wild fish (Table 2). It is important to mention that the clusters obtained differed significantly for all the items assessed except for the one related

to the fatty character of the two kinds of fish where it was agreed that farmed fish is fatter than wild fish. These results reinforce the right selection of the final number of clusters retained according to the parsimony rule. The three clusters were named as “Traditional/conservative”, “Connoisseur” and “Open to aquaculture” based on the mean values obtained for each of the items in each one. Results of the multivariate logistic regression carried out to characterize them showed that in general, significant information was provided by the variables included in the model ( $-2 \text{ Log (Likelihood)} = 0.003$ ) although a low goodness of fit ( $R^2 \text{ (McFadden)} = 0.021$ ) was obtained. The age, gender and the objective knowledge had a significant ( $p \leq 0.05$ ) effect on consumer membership to one cluster or another. In particular, middle aged consumers (36–55 years old) ( $p = 0.001$ ; odds ratio = 1.986) and indeed, consumers with a moderate-high level of objective knowledge ( $p = 0.014$ ; odds ratio = 2.021, respectively) were more likely to be grouped in the “Connoisseur” cluster. Furthermore, according to the model, women were more likely ( $p = 0.020$ ; odds ratio = 1.522) to be included in the cluster named “Open to aquaculture” than in the cluster labelled “Traditional/Conservative”.

## Discussion

### *Focus group (qualitative approach)*

The focus group discussions provided valuable insights into perception of farmed and wild fish and how these perceptions might influence preference and buying intention. Spanish participants seemed to perceive aquaculture as a well-known and usual practice since farmed fish appeared spontaneously during all the focus groups discussions. This result contrasts with that observed by Verbeke, Sioen, Brunso, De Henauw, and Van Camp (2007) who carried out several focus groups with Belgian participants to a similar purpose. These differences could be explained by the dissimilarities in food culture between the two countries, which is strongly linked to food habits and consumption (Guerrero et al., 2012). Fish consumption in Belgium represented only 10% of the total amount (kg/capita/year) consumed in Spain (European Commission, 2012). In addition, the particular geographical characteristics, situation and extension of Spain in comparison with Belgium, explains its higher aquaculture activity. Spain is the EU member state with the highest aquaculture production while Belgium is the second lowest one (production 268,565 t versus 576 t in 2009, respectively) (European Commission, 2012).

The deficiency of fresh fish labelling in Spanish fish retail shops (Asensio & Montero, 2008) could justify the lack of knowledge observed regarding ever having tasted fish from aquaculture, which agrees with the moderate relative importance that the obtaining method (extractive fishing/aquaculture) has for most Spanish consumers (Claret et al., 2012).

Regarding the main beliefs elicited, it should be noted that the quality, safety and control categories in which most of these beliefs were grouped are basic requirements for consumers (Aumaitre, 1999; Henson, Loader, & Traill, 1995) playing a key role in consumer confidence and trust in the food they consume, especially in those of animal origin. Interestingly, items related to food safety, quality and control mentioned in the focus group discussions are consistent with the scientific definitions of the three characteristics found in the literature (FAO, 1999; FAO and WHO, 2003; Rohr, Luddecke, Drusch, Muller, & von Alvensleben, 2005; Van Rijswijk & Frewer, 2008; Whitehead, 1995). For this reason they were grouped into these three categories. It should be noted that although item freshness has been grouped in the quality category it could also have been included in the safety category because of its bidimensional character (Becker, 2000).

### *Survey (quantitative approach)*

Most of the beliefs assessed differed significantly between both obtaining methods, with the sole exception of the safety item, showing that Spanish consumers perceived them as clearly different. These results agree in part with results obtained by Verbeke and Brunso (2005) who reported that Belgian, Dutch and Polish consumers perceived farmed fish as being as safe as wild fish; but contrast with them in that they asserted that Spanish and Danish consumers perceived farmed fish as less safe. Previous studies performed in Spain from 2003 to 2007 (MARM, 2009a) also indicated that Spaniards perceived farmed fish species as less safe than their respective wild equivalents. However, a tendency to reduce the differences between the safety scores of the two kinds of fish was also observed over time thus leading to the situation observed in the current study. This can probably be explained by the fact that consumer confidence in regulatory institutions, public authorities and actors in the food supply chain has gradually increased despite the food scares which have occurred in the last decades (Rohr, Luddecke, Drusch, Muller, & von Alvensleben, 2005). In fact, most consumers already assume the safety of fish which they find on the market and consume (Van Rijswijk & Frewer, 2008) regardless of its obtaining method (wild/farmed fish). Considering that Spanish consumers especially emphasize “controls” and “guarantees” when defining food safety (Van Rijswijk & Frewer, 2008) it can be concluded that the perception of farmed fish safety is closely linked to its major control whereas the safety aspects of wild fish seem to be determined by the higher guarantees that are provided to consumers. These are probably the main factors that make both kinds of fish equivalent in terms of safety although other aspects can also contribute to this similarity.

The multi factorial character that the food safety concept has for consumers as described by Henson and Traill (1993), Smith and Riethmuller (1999) and Wilcock, Pun, Khanona, and Aung (2004) was highlighted in the present study according to the differences observed between farmed and wild fish in terms of marine pollution, heavy metals, antibiotics, parasites, healthy animal feeding and healthiness.

The important differences found in terms of overall product quality differ from the results shown in a monographic study carried out by the Spanish Ministry for Environment, Marine and Rural Affairs (MARM, 2009b); according to this study, the percentage of consumers believing that quality was in favour of one kind of fish or another was similar. As stated before, in general, all the items included in the quality category were in favour of wild fish, especially those related to taste. Nevertheless, it is probable that similar to the case of poultry, over time consumers will get used to the sensory characteristics of farmed fish and value it in a more positive light. Indeed, other sensory studies have concluded that most consumers are not able to perceive differences between the two kinds of fish (Cahu et al., 2004; Luten et al., 2002; Pohar, 2011) and have even preferred aquaculture fish in a blind test (Claret, 2011). It is also remarkable that the observed consumer beliefs related to nutritional value and freshness about both kinds of fish differed from scientific evidence. According to EFSA (2005) the nutritional content of farmed fish cannot be differentiated from that of wild fish. Cahu et al. (2004) went further and concluded that if raised under appropriate conditions, farmed fish can be at least as beneficial as wild fish in terms of nutritional value as well as providing advantages in terms of freshness. Indeed, the freshness of fish can be affected by the time spent during transportation from the capture place to the selling point and the temperature “history” (Abbas, Mohamed, Jamilah, & Ebrahimian, 2008). Therefore, advances in fish farming and the development of new and more efficient techniques which reduce the time between slaughtering and sale to the market under controlled conditions, would contribute to the advantageous position that farmed fish seems to be in.

The concept of artificial/natural is normally associated with terms such as health and quality (Guerrero et al., 2012) since natural foods are perceived as being nutritious and as having a positive impact on human health (Rozin et al., 2004). The naturalness/artificiality of food is an important driver of food consumption, especially in traditional food products such as fish (Pieniak, Verbeke, Vanhonacker, Guerrero, & Hersleth, 2009). Food manipulation in general but especially of fresh food products seems to be negatively perceived by consumers since it affects the “natural” character (Guerrero et al., 2009; Van Wezemaal, Verbeke, de Barcellos, Scholderer, & Perez-Cueto, 2010). This idea confirms the higher artificialness perceived in farmed fish in the present study.

Participants perceived farmed fish as having a higher availability and lower price in agreement with other European and international studies already published (Amberg & Hall, 2009; Ernst & Young, 2008; Kole, Mennink, & Schelvis-Smit, 2006; Rajani, 2010; Vanhonacker, Pieniak, & Verbeke, 2013; Verbeke et al., 2007). In the case of Spain, price has been identified as the main competitive advantage of farmed fish (Fernández-Polanco & Luna, 2012). However, price is also perceived by consumers as an indicator of the expected quality (Claret et al., 2012) contributing to the fact that consumers could perceive farmed fish as being of a lesser quality than wild fish.

The moderate-high level of both objective and subjective knowledge observed in the present study contrasts with that reported by Pieniak, Verbeke, Perez-Cueto, Brunso, and De Henauw (2008) in Belgium, where a low level of objective knowledge was observed, thus confirming our previous hypothesis regarding food culture differences between both countries concerning knowledge about fish.

Regarding cluster analysis, the first and largest cluster ( $n = 345$ ) showed a predisposition to give more extreme scores for the positive characteristics of wild fish and at the same time to restrain its negative features. Accordingly, this was the only cluster considering wild fish as better than farmed fish in terms of freshness, safety, guarantees and availability. This observed predilection for wild-caught fish could be due to the fact that fish coming from traditional fishing practices still act as a reference for these consumers; as a consequence, this cluster was labelled as “Traditional/Conservative”. The second cluster was named “Connoisseur” since consumers in this group ( $n = 313$ ) seemed to possess a higher level of knowledge about the characteristics of wild and farmed fish than the other two clusters as most of their beliefs were in agreement with scientific evidence. Moreover, this group of consumers held stronger beliefs, both favourable and unfavourable, about fish from aquaculture with respect to the other two clusters. Finally, consumers from the cluster 3 ( $n = 261$ ) were the only ones who considered farmed fish as less handled, having healthier feeding than wild fish and those which minimized the differences in terms of healthiness between both kinds of fish. Furthermore, this cluster also tended to restrain the differences between both kinds of fish in terms of taste, quality, healthiness and artificiality than the rest of clusters. Accordingly this cluster was identified as “Open to aquaculture”.

The “Connoisseur” segment was significantly made up of middle aged consumers, who usually show a higher food involvement than younger consumers (Drichoutis, Lazaridis, & Nayga, 2006) for facts that contribute to make them more interested in looking for information (Beharrel & Denisson, 1995; Verbeke & Vackier, 2004). The cluster showing a higher openness to aquaculture was made up by women. This finding might be explained by the fact that women, as stated above, have always been and still are mainly responsible for food shopping and preparation of food within the household and therefore, more used to aquaculture products and their advantages. It is worth remarking that this last cluster of consumers represents a relevant niche for the development of the aquaculture sector, especially taking into account the role that women have in

the formation and transmission of food habits and culture in the household.

Finally, it is important to bear in mind that other important aspects or beliefs not examined in the present paper, such as environmental issues or the traditional character of extractive fishing, could also play an important role towards a better understanding of consumer responses. The issues not studied in the present paper might influence and help to explain peoples’ perception and beliefs concerning both kinds of fish, therefore additional research would be needed in this sense.

## Conclusions

Overall, farmed and wild fish were perceived to be clearly different regarding the majority of the selected beliefs. In general, consumers with a higher objective knowledge about fish and a higher level of education were more ready to agree with scientific evidence and consequently more likely to make better and reasoned fish choices. In this sense, the design of effective information strategies about farmed fish and its production system might help to increase its image and acceptance. The goal is not to confront both kinds of fish but to provide consumers with information that helps them to value the two kinds of fish based on objective facts and not on preconceived ideas or unfounded beliefs.

The results of this study could play an important role when planning and designing efficient marketing strategies for promoting farmed fish by adapting the information provided to the perception of each of the segments of consumers identified in the present work.

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