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Deliverable D4.7

Choice modelling report on innovative features and the consumers' willingness to pay

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Executive Summary

The **objective of this study** was to investigate consumer demand and choice behaviour for fresh fish at the retail market. In particular, we examined consumer preferences for different fish alternative species, as well as different attributes, using a labelled **choice experiment** (LCE). The outcomes allow to elicit consumers' preferences and **willingness to pay (WTP)** for the salient attributes of a variety of fresh fish species in the retail market.

Data for this study were collected in June 2017 through a nationwide online survey administered in the five countries (Italy, France, Spain, UK and Germany) by a third-party contractor using its consumer panel database. The sample in each country consisted of approximately 500 fish consumers (2,509 in total), representative of the national populations. The final **experimental design** consisted in five attributes, defined for the seven fish alternatives (trout, herring, salmon, sea bass, sea bream, cod and pangasius): price (average market price +/-30%), production method (wild-caught, farm-raised), format (whole/round cut, fillet, ready-to-cook), sustainability certification, nutrition and health claim. The questionnaire included questions regarding socio-demographics, fish frequency of consumption, past consumption, level of responsibility in fish purchasing and cooking, fish choice motives, attitude towards environmental concerns, attitude towards health concerns, self-efficacy, trust, and attitude towards ready-to-cook fish.

The part-worth, i.e. the marginal utility associated with the single attribute/level, and the price premium (WTP) have been estimated applying two different logit models:

- the first one with fish species-specific effects (FSSE); this is needed for obtaining WTP specific for the seven species;
- the second one with random price effect (RPE) models; this is needed for segmentation.

Based on the questions of the survey about the **fish choice motives**, value for money, price and general appearance are the most important aspects considered by consumers in their fish selection. However, in Italy wild-caught and days since catch/harvest are relevant aspects, in France, Germany and in the UK the easy-to-cook products are more important, and the sustainability certification is relatively more quoted in Germany.

Regarding **attitudinal** beliefs, consumers are more worried about the negative consequences of fishing on marine resources, than those of fish farming on the environment, and believe that fish consumption has more benefits than risks. Consumers' trust in information provided about the sustainable fish production is higher for independent organizations and public authorities,

than for industries and retailers. Trust for farmers and fishermen is higher than trust for industry and retailers in every country. In general, consumers show a rather negative perception about ready-to-cook products, in terms of risk of losing the original fish characteristics.

The choice experiment has shown that, in general, the fish species with the highest **choice probability** is salmon in France, Germany, Spain and in the UK, and seabream in Italy. As Figure *i* shows, the choice probability varies across countries, therefore justifying the application of a model where the attribute part-worth are estimated separately for every species.

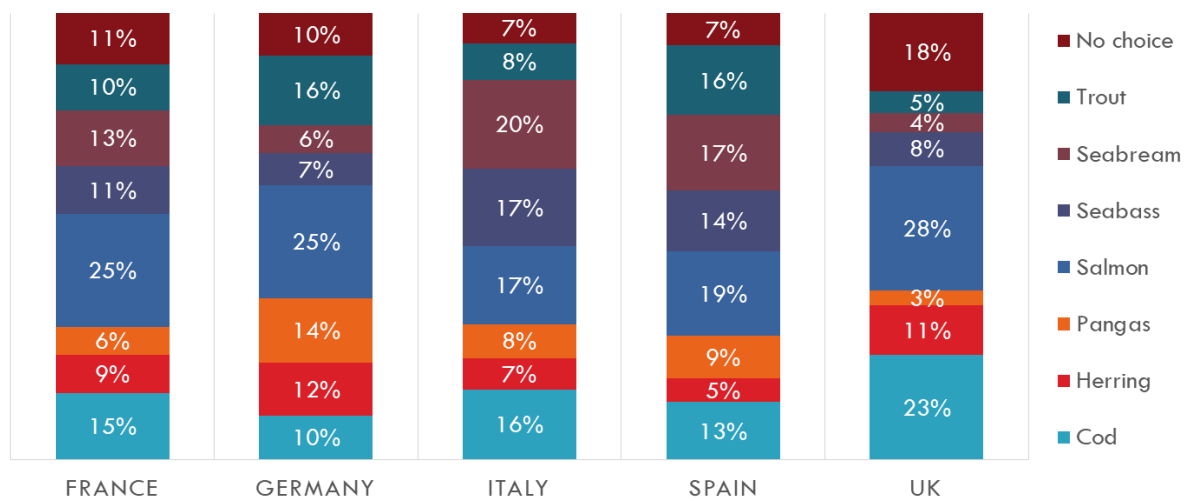


Figure *i*: Choice probability for fish species (mean value) estimated with FSSE model.

The results show that, in general, **wild-caught** fish is more appreciated than farm-raised. However, the WTP estimates varies between countries and species, with highest premiums found in France for salmon (+58%), and for seabass in Germany (+51%); Spanish consumers exhibited the lowest premiums for wild-caught fishes.

Ready-to-cook products are generally preferred to whole (or round cut) fish in all countries, except with round-cut salmon, with higher premiums found in Germany, UK and France, in particular for pangasius, herring and cod. **Fish fillets** preference is more species-specific: salmon, cod and seabream fillet are generally preferred to ready-to-cook alternatives, while ready-to-cook trout and pangasius are more appreciated than fillets.

The results show positive premiums for a **sustainability label**, with high heterogeneity across species and countries. The highest premiums have been found in the UK for herring (above 60%), in Germany for seabream, seabass and pangasius (above 40%), in Spain for trout and pangasius (above 30%), in Italy for cod, herring and pangasius (above 20%), and in France for salmon (above 20%).

The WTP for **nutritional and health claims** varied among countries too, with higher premium found for pangasius and salmon. Price premiums above 20% were found in Spain for pangasius (68%), trout (37%) and salmon (20%), in Germany for pangasius (44%), seabream (30%) and salmon (24%), in Italy for seabream (27%) and salmon (21%), in the UK for pangasius (26%). The relatively low willingness to pay of French consumers for both sustainability label and nutritional and health claim can be partially explained by their weak belief strength in the benefits of sustainability certification to the environment and society, and in the nutrition and health claim.

The clusters resulting from the **segmentation**, based on the choice probabilities, exhibited a **higher willingness to pay** for fish species and attributes as follows:

- In Italy, the first cluster is the largest (36% of the sample), and exhibits a higher WTP in general for all fish species and attributes. It is indeed one of the least sensitive to price changes. Mostly composed of females, middle aged, highly educated and with high income level, living in a medium-large family.
- In France, the first two segments (overall 45%) have the largest WTP scores for all fish species and attributes, including a higher WTP for ready-to-cook products. Consumers in these two segments are less sensitive to price changes. The first one is mostly made up of younger males, highly educated and with high income level, living in two-three people families. The second segment is mostly composed of older females, highly educated and with high income level, living in larger-sized families (four members).
- In Germany, the segment one (28% of the sample), is the one with the highest estimated WTP for all species and attributes. It is almost equally composed of young males and females, with medium-to-high educational level, and high incomes, mostly living with small family units (one or two members).
- In the UK, segment four (19%) is the one with the highest estimated WTP; middle-aged and older females are more represented, as well as middle educated and income levels, and mostly living in families with two members.
- In Spain, segment two (18% of the sample), showing the highest WTPs, is composed of young males, with high income, living in large family units (four people or more). Segment three (19%), showing medium-high WTP estimates, is relatively more represented by older females, with low income level, living in small family units.

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1. Introduction

The average apparent fish consumption per capita in the EU is the second highest in the world (at around 22 kg/capita/year), and some individual EU Member States are among the highest fish consuming countries in the world (EEA, 2016). The EU is the largest market in the world for fish; with a value of €55 billion and a volume of 12 million tons (FAO, 2016). While EU fish and seafood consumption has risen over the past 10 years with stable or declining supply from the fisheries sector, most of this increase has come from imports rather than from EU aquaculture. In 2014, around 75% of fisheries and aquaculture products consumed in the EU came from marine capture fisheries, which remains consistent with trends over the last decade (EUMOFA, 2015). Today 25% of all EU seafood consumption comes from EU fisheries, 10% from EU aquaculture and 65% from imports from third countries, both fisheries and aquaculture products. European aquaculture growth has stagnated since the turn of the century partly because its products have not been competitive compared with imports. In a market driven by the demand a better understanding of consumer purchasing behaviour towards fish products is paramount to developing more effective marketing and policy strategies (Carlucci et al., 2015). Therefore, understanding the consumers' preferences across the EU countries for fish species and fish product attributes is crucial to sustain the fisheries and aquaculture sectors.

The objective of this study was to investigate consumer demand and choice behaviour for fresh fish at the retail market. In particular, we examined consumer preferences for different fish alternative species, as well as different attributes. The outcomes allowed us to elicit consumers' preferences and willingness to pay (WTP) for the salient attributes of a variety of fresh fish species in the retail market.

We applied a discrete choice experiment (DCE) to accomplish this objective; this method is strongly consistent with the economic demand theory and in particular with the multi-attribute demand studies based on the Lancasterian consumer theory (Lancaster, 1966). This theory assumes that consumer's utility stems from product properties rather than the products themselves. Thus, multi-attribute demand models can elicit the intrinsic value of the product attributes and have been applied widely in marketing research. Moreover, this method is highly flexible with respect to data collection and model specifications. DCE is based on random utility theory about individual decision making, and seems realistic in imitating real shopping behaviour (Louviere et al., 2000).

Choice modelling techniques are multi-attribute valuation techniques that elicit values for multiple attributes by asking respondents to rate, rank or choose a set of attributes (levels). In particular, choice experiments are valuation techniques where respondents have to make trade-offs and indicate their preferred option out of a set of alternatives. We developed a

choice-based on-line experiment, on a number of 500 respondents per country (Italy, France, Spain, UK and Germany). The profile attributes and levels analysed are derived from previous qualitative tasks (i.e., qualitative analysis by in-person interviews), and include product innovation features such as health claims, sustainability certification, etc.

To accommodate the evaluation of choice alternatives through both attribute judgment and alternative comparison, we applied a labelled choice experiment (LCE), where choice alternatives were labelled by the respective names of the seafood (e.g., salmon, cod, herring, etc.) (Nguyen et al., 2015). We set our model specification in such a way that the constant terms, which represent intrinsic value of the alternatives, and attribute parameters were varied both over fish alternatives and across countries. The WTP associated with each attribute, by species and country, was also estimated.

2. Methods

We applied a labelled choice experiment (LCE) to investigate consumer demand and choice behaviour for fresh fish in a retail market hypothetical situation in five European countries: Italy, France, Spain, UK and Germany. The LCE was conducted for seven fish alternatives (i.e., cod, herring, seabass, seabream, salmon, trout and pangasius) labelled by the respective fish names.

Consumer heterogeneity in preference was expressed by estimating a labelled latent class model with alternative-specific effects, which varies choice probability and model parameters over seafood alternatives and across classes. The WTP for extrinsic attributes (i.e., product format, production method, health claim, and sustainability certification), and the rank ordered-intrinsic value are estimated for each seafood alternative within classes and the entire market. The WTP estimate in our study is expected to be more accurate than those derived from studies based on single product alternatives because the LCE allows respondents to evaluate choice alternatives through both attribute judgment and alternative comparison. Exploring a variety of product alternatives is also meaningful to firms with multiple products (e.g., fresh fish retailers) or firms with many direct competitors.

2.1 The choice experiment

The choice experiment was preceded by a cheap talk aiming at explaining the rationale behind the experiment and the need to respond carefully to the questions: *“In this part of the questionnaire you will be asked to choose your preferred product from a set of 7 alternative products. Options A to G represent 7 different descriptions of a fish product. Please mark the option that you are most likely to purchase. Please pay attention to all the attributes that are displayed. Experience from previous similar surveys suggests that people often respond in one way but act in another. For instance, people sometimes state they would pay a higher price for a product than they actually would in reality. Therefore, please do consider thoroughly how the price would affect your budget, so that you are able to give as accurate an answer as possible. Similarly to the price, pay attentions to all fish alternatives and attributes“.*

At the end of the choice experiment, each consumer had to respond to the following questions in order to *quantify the potential purchase*: “What quantity would you purchase of the above product?” Then, we have also asked consumers about their beliefs of health benefit claims and of the benefits of the sustainable certification to the environment and society, by answering the following questions: “In the marketplace, some producers provide health benefit information from consuming their products. On a scale of 0-100, to what extent do you believe

such health benefit claims? (e.g., 0 = completely unbelievable; 50 = neutral; 100 = completely believable).“ “We assume you have read the definition of sustainability certification above. On a scale of 0-100, to what extent do you believe in the benefits of such certification to the environment and society? (e.g., 0 = completely unbelievable; 50 = neutral; 100 = completely believable).“

2.2 Attributes and levels

A previous qualitative study was performed with 30 individual in-depth interviews conducted in five countries identifying the positive or negative motives, perceptions, associations, attitudes towards fish/seafood consumption, with a focus on the chosen species: salmon, trout, seabass/seabream, herring and cod (Task 4.2). The findings of this qualitative work were collected considering the main attributes, barriers and format used by consumers for fish in general and for the selected fish species. These findings were summarized in Table A1 (see Appendix). This table¹ has been used to identify the main attributes that were mentioned quite uniformly across all fish species. Therefore, the following attributes were evaluated for all the different fish species:

- production method (farmed / wild caught)
- origin (specific countries to be agreed specie by specie)
- nutritional and health claims (high in omega-3, source of omega-3, etc.)
- date of catch / harvest (as a proxy of freshness)

Other attributes were instead relevant for specific fish species:

- format (fillet, whole, frozen, etc.)
- preparation (processed, “ovenable tray”, etc.)
- sustainability (MSC, organic, etc.)
- traceability

This preliminary set of attributes was represented in Table A2² (see Appendix), including: price, origin, production method, format, preparation, sustainability, health / nutrition claim and freshness. This list was discussed in the WP4 meeting in Paris (January 2017). From the

¹ This table has been sent by email to the WP4 partners on September 5th, 2016.

² This table has been sent by email to the WP4 partners on October 4th, 2016.

discussion, we agreed to simplify the design, suggesting to concentrate the experiment on a more limited, and manageable, set of attributes and levels.

Therefore, the final experimental design consisted in **five attributes**, defined for the seven fish alternatives: price, production method, format, sustainability certification, nutrition and health claim (Table 1). Table 2 provides the complete list specific for each fish species.

Table 1. Attributes and levels for the choice experiment in the five countries and for the seven fish species (trout, herring, salmon, sea bass, sea bream, cod and pangasius).

Attributes	Levels
Price	<ul style="list-style-type: none"> • Average market price • -30% • +30%
Production method	<ul style="list-style-type: none"> • Wild-caught fish • Farm-raised fish
Format (picture)	<ul style="list-style-type: none"> • Whole fish/round cut* • Fillet • Easy to cook
Sustainability certification	<ul style="list-style-type: none"> • No • Yes
Nutrition and Health claim	<ul style="list-style-type: none"> • No • Yes

* Round cut for salmon and pangasius.

Table 2: Final list of attributes and levels by fish species, common in the five countries.

Attributes	Trout	Herring	Salmon	Sea bass	Sea bream	Cod	Pangasius
Price	<ul style="list-style-type: none"> • Average market price • -30% • +30% 	<ul style="list-style-type: none"> • Average market price • -30% • +30% 	<ul style="list-style-type: none"> • Average market price • -30% • +30% 	<ul style="list-style-type: none"> • Average market price • -30% • +30% 	<ul style="list-style-type: none"> • Average market price • -30% • +30% 	<ul style="list-style-type: none"> • Average market price • -30% • +30% 	<ul style="list-style-type: none"> • Average market price • -30% • +30%
Production method	Farm-raised fish	Wild-caught fish	<ul style="list-style-type: none"> • Wild-caught fish • Farm-raised fish 	<ul style="list-style-type: none"> • Wild-caught fish • Farm-raised fish 	<ul style="list-style-type: none"> • Wild-caught fish • Farm-raised fish 	<ul style="list-style-type: none"> • Wild-caught fish • Farm-raised fish 	Farm-raised fish
Format (picture)	<ul style="list-style-type: none"> • Whole fish • Fillet • Ready to cook 	<ul style="list-style-type: none"> • Whole fish • Fillet • Ready to cook 	<ul style="list-style-type: none"> • Round cut • Fillet • Ready to cook 	<ul style="list-style-type: none"> • Whole fish • Fillet • Ready to cook 	<ul style="list-style-type: none"> • Whole fish • Fillet • Ready to cook 	<ul style="list-style-type: none"> • Whole fish • Fillet • Ready to cook 	<ul style="list-style-type: none"> • Round cut • Fillet • Ready to cook
Sustainability certification	<ul style="list-style-type: none"> • No • Yes 	<ul style="list-style-type: none"> • No • Yes 	<ul style="list-style-type: none"> • No • Yes 	<ul style="list-style-type: none"> • No • Yes 	<ul style="list-style-type: none"> • No • Yes 	<ul style="list-style-type: none"> • No • Yes 	<ul style="list-style-type: none"> • No • Yes
Nutritional and Health claim	<ul style="list-style-type: none"> • No • Yes* 	<ul style="list-style-type: none"> • No • Yes* 	<ul style="list-style-type: none"> • No • Yes* 	<ul style="list-style-type: none"> • No • Yes* 	<ul style="list-style-type: none"> • No • Yes* 	<ul style="list-style-type: none"> • No • Yes* 	<ul style="list-style-type: none"> • No • Yes*

* **Product high of omega 3 fatty acids which contributes to maintenance of normal function of the heart and normal blood pressure** (the beneficial effect is obtained with a daily intake of 250 mg of omega 3 fatty acids. Such amount can be consumed as part of a balanced diet).



For the definition of the attribute **price**, we have provided some indication by email³ to the reference project partners for each country, suggesting to have, as much as possible, an yearly average market price level (at the retail stage) from an official data source (e.g., governmental/Ministry agencies, like ISMEA in Italy, etc.), possibly for year 2016. The price was indicated in €/kg potentially paid by consumers (£/kg in the UK), more detailed as possible (also with decimals), and considered for the average product/format (fresh product). If the data was not retrieved from official source, we suggested to search it from other renowned sources (e.g., producers associations or syndicates, or the industry reference group), or from other sources (e.g., grey literature). The last possibility suggested was to perform a shop check to get the missing price(s); in this case, we have suggested to visit multiple shops of different format (large retailers, fishmongers, etc.), and calculate an average price. We have also suggested, if possible, to get the data also from different geographical locations. For practical purposes, we have provided a table with some price levels downloaded by <http://www.eumofa.eu/>. The average prices, with corresponding levels +/- 30%, are reported in Table 3.

The **production method** attribute (wild / farmed) is usually considered relevant in purchasing decision, where wild fish is generally perceived as being superior to farmed fish by the majority of consumers in terms of taste, safety, healthiness and nutritional value (Carlucci et al., 2015). However, consumers' perception of farmed fish is also positive for popular cultivated species, such as seabass, seabream, trout and salmon. Considering these patterns, we have decided to include the production method in the experimental design.

The **format** attribute was presented as a picture to consumers. The pictures have been done by a professional agency based on our suggestions. The first shots have been commented by the partners, and several modifications have been suggested, in particular for the ready-to-cook level. The final set of pictures, specific by fish species and country, is reported in Table A3 (see Appendix).

The **sustainability certification** attribute was based on the following definition, provided to respondents before the choice experiment, mostly derived from the Marine Stewardship Council (MSC) and Aquaculture Stewardship Council (ASC) standards: *“When certified according to a sustainability scheme, any fish can be traced back to a fishery or to a fish farm that meets principles reflecting the maintenance and re-establishment of healthy populations of targeted species, the maintenance of the integrity of ecosystems, the use of feed and other inputs that are sourced responsibly, and the social responsibility for workers and communities*

³ The email has been sent to the WP4 partners on January 31st, 2017.

impacted by fishing and fish farming. This standard is intended to be used on a global basis by accredited third party certifiers to undertake the certification of fisheries and fish farmers to the above mentioned principles and criteria."

The **nutrition and health claim** used in the experiment is "*Product high of omega 3 fatty acids which contributes to maintenance of normal function of the heart and normal blood pressure*", with the following condition of use: "*the beneficial effect is obtained with a daily intake of 250 mg of omega 3 fatty acids. Such amount can be consumed as part of a balanced diet*". This claim has already been approved by the EFSA (2009; 2010).

Table 3: Price levels (€/kg, and £/kg for the UK) by fish species for each country.

	Trout	Herring	Salmon	Seabream	Seabass	Cod	Pangasius
France							
Price + 30%	16.64	12.87	19.37	14.95	18.59	19.37	11.05
Avg. price	12.80	9.90	14.90	11.50	14.30	14.90	8.50
Price -30%	8.96	6.93	10.43	8.05	10.01	10.43	5.95
Spain							
Price + 30%	7.76	15.47	16.73	12.83	14.35	15.60	6.80
Avg. price	5.97	11.90	12.87	9.87	11.04	12.00	5.23
Price -30%	4.18	8.33	9.01	6.91	7.73	8.40	3.66
Italy							
Price + 30%	13.66	12.87	19.63	14.07	15.37	15.87	7.28
Avg. price	10.51	9.90	15.10	10.82	11.82	12.21	5.60
Price -30%	7.36	6.93	10.57	7.57	8.27	8.55	3.92
Germany							
Price + 30%	15.05	14.12	21.89	21.71	21.84	21.78	6.83
Avg. price	11.58	10.86	16.84	16.70	16.80	16.75	5.25
Price -30%	8.11	7.60	11.79	11.69	11.76	11.73	3.68
UK (€/kg)							
Price + 30%	21.83	6.81	20.97	28.09	30.73	20.68	13.48
Avg. price	16.79	5.24	16.13	21.61	23.64	15.91	10.37
Price -30%	11.75	3.67	11.29	15.13	16.55	11.14	7.26
UK (£/kg)⁴							
Price + 30%	19.32	6.03	18.56	24.86	27.20	18.30	11.93
Avg. price	14.86	4.64	14.27	19.12	20.92	14.08	9.18
Price -30%	10.40	3.25	9.99	13.39	14.64	9.86	6.42

We have decided to exclude the attribute *origin*; indeed, this attribute has already been deeply studied in the literature (Carlucci et al., 2015). Moreover, a huge effect of the domestic origin

⁴ The figure in €/kg was translated in £/kg in the UK case. The exchange rate used was 1 GB £ = 1.16€.

has been documented: 145% WTP by Stefani et al. (2012), 108% by Mauracher et al. (2013), 100% by McClenachan et al. (2016). We have evaluated that this effect might overwhelm the impact of other attributes on the consumers' choices. Therefore, since other attributes have been studied much less, we have preferred to exclude the origin from the experiment.

2.3 Measures

Apart the choice experiment, the questionnaire included the following items: socio-demographics, frequency of consumption of fish, past consumption, level of responsibility in fish purchasing and cooking, fish choice motives, attitude towards environmental concerns, attitude towards health concerns, self-efficacy, trust, and attitude towards ready-to-cook fish. The survey questionnaire was developed and revised based on input from qualitative analysis and pre-tests. The questionnaire has been submitted online and was approx. 15 minutes long.

The items with the asterisk (*) are common "bridge questions" with the survey performed in Task 5.4. The English version of the questionnaire is reported in the Appendix (see Appendix A4); the partners have translated the English version of the questionnaire in their national language (i.e. Italian, French, German and Spanish). Their versions were checked using a back-translation method to avoid semantic variance between countries.

The *frequency of consumption of fish* was measured by the following item: "Please indicate how often you consume fish (fresh, frozen, canned, smoked, ready to eat, etc.) at home, at restaurants and other food outlets (canteens, bars, etc.): Almost every day; 3-4 times a week; 1 or 2 times a week; 2-3 times a month; Once a month or less; Few times a year; Never" (*). This question has been replicated for every species considered in the experiment (salmon, trout, seabass, seabream, herring, cod, and pangasius). *Past consumption* was assessed by the following 7-point scaled item: "In the past 3 years has your fish consumption: strongly decreased – strongly increased" (*).

We have assessed the *level of responsibility in fish purchasing and cooking* by asking respondents to indicate the level of involvement in their household in fish purchasing, and in preparing and cooking fish (Not at all involved/Somewhat involved/Fairly involved/Completely involved).

Then we asked respondents to indicate the importance of each of the following attributes when purchasing fish: general appearance (*), free of smell (*), value for money (*), sustainability certification (*), easy to cook (*), low in calories (*), not previously frozen, wild caught, domestic origin, days since catch/harvest, organic certification, price (*fish choice motives*).

Attitude towards environmental concerns was assessed with two items (7-point scale, from “strongly disagree” to “strongly agree”): “I believe that fishing has negative consequences on marine resources” (*), “I believe that fish farming has negative consequences on the environment” (*).

We have measured *attitude towards health concerns* with two items (7-point scale, from “strongly disagree” to “strongly agree”): “I believe that eating fish containing omega-3 fatty acids benefits my health” (*), “I believe that eating fish would expose myself to substances (e.g. mercury, antibiotics, etc.) risking negative consequences on my health” (*).

We assessed *self-efficacy* with two items, using a 7-point scale (from “strongly disagree” to “strongly agree”): “I feel confident in evaluating the quality of the fish before buying it” (*), “I feel confident in cooking fish” (*).

Trust was defined by asking respondents the level of agreement (using a 7-point scale, from “strongly disagree” to “strongly agree”) with the following five statements: “I would trust the information provided about the sustainable fish production practices (fishing or farming) if they were certified by a: Public authority (e.g., the national Government or the EU) / Fish farmer or fisherman / Fish processing industry / Retailer / Independent organization (e.g., an NGO)”.

Attitude towards ready-to-cook fish was measured with four items using a 7-point scale (from “strongly disagree” to “strongly agree”): “I believe that ready-to-cook products would alter the original fish characteristics” (*), “I prefer to eat ready-to-cook fish because it allows me to save time” (*), “Preferably, I spend as little time as possible on meal preparation” (*), and “I prefer to eat ready-to-cook fish because it does not smell”.

2.4 Data collection and sample

Data for this study were collected in June 2017 through a nationwide online survey administered in the five countries (Italy, France, Spain, UK and Germany) by a third-party contractor using its consumer panel database.

The sample in each country consisted of approximately 500 fish consumers (2,509 in total), representative of the national populations in at least three of the following criteria: age, gender, educational level and geographical macro-areas (e.g. in Italy: North, Centre, South). The main sample characteristics are reported in Table 4.








Table 4: Sample characteristics.

	France		Germany		Italy		Spain		UK		Total	
Gender	n	%	n	%	n	%	n	%	n	%	n	%
Males	256	51.1%	262	52.2%	250	49.6%	260	51.9%	254	50.7%	1282	51.1%
Females	245	48.9%	240	47.8%	254	50.4%	241	48.1%	247	49.3%	1227	48.9%
Age	n	%	n	%	n	%	n	%	n	%	n	%
18-24	61	12.2%	56	11.2%	51	10.1%	56	11.2%	49	9.8%	273	10.9%
25-34	91	18.2%	101	20.1%	98	19.4%	97	19.4%	121	24.2%	508	20.2%
35-44	113	22.6%	99	19.7%	117	23.2%	132	26.3%	105	21.0%	566	22.6%
45-54	117	23.4%	130	25.9%	127	25.2%	114	22.8%	118	23.6%	606	24.2%
55+	119	23.8%	116	23.1%	111	22.0%	102	20.4%	108	21.6%	556	22.2%
Education	n	%	n	%	n	%	n	%	n	%	n	%
Lower secondary education or below	92	18.4%	86	17.1%	197	39.1%	181	36.1%	79	15.8%	635	25.3%
Upper secondary education	140	27.9%	97	19.3%	156	31.0%	65	13.0%	149	29.7%	607	24.2%
University or college below a degree	97	19.4%	191	38.0%	68	13.5%	75	15.0%	71	14.2%	502	20.0%
Bachelor's or equivalent level	88	17.6%	58	11.6%	41	8.1%	116	23.2%	133	26.5%	436	17.4%
Postgraduate MSc or PhD	84	16.8%	70	13.9%	42	8.3%	64	12.8%	69	13.8%	329	13.1%
Geographical area	n	%	n	%	n	%	n	%	n	%	n	%
Rural area	164	32.7%	100	19.9%	93	18.5%	52	10.4%	113	22.6%	522	20.8%
Small sized urban area	170	33.9%	187	37.3%	208	41.3%	144	28.7%	180	35.9%	889	35.4%
Large urban area	167	33.3%	215	42.8%	203	40.3%	305	60.9%	208	41.5%	1098	43.8%
Coastline	n	%	n	%	n	%	n	%	n	%	n	%
Yes	160	31.9%	91	18.1%	215	42.7%	294	58.7%	184	36.7%	944	37.6%
BMI	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
	25.2	5.6	26.8	6.9	25.2	5.2	25.5	4.8	31.2	15.5	26.8	8.9
Persons in household (n)	2.6	1.3	2.4	1.2	3.0	1.2	3.2	1.2	2.8	1.6	2.8	1.3
< 18 years (n)	0.7	1.0	0.4	0.7	0.6	0.8	0.8	0.9	0.7	1.2	0.6	1.0
> 60 years (n)	0.4	0.7	0.4	0.7	0.5	0.8	0.4	0.7	0.3	0.7	0.4	0.7
Total (n)	501		502		504		501		501		2509	

2.5 The experimental design

The experimental design resulted in 9 blocks of 8 choice sets with 7 product profiles plus the “no choice” option. Figure 1 shows an example of the layout of the choice set.

Please, check the option that you would be most likely to purchase for a normal lunch or dinner.

 <p>Trout Farm-raised fish</p> <ul style="list-style-type: none"> - Product with Sustainability Certification - Product with Nutritional and Health Claim <p>14.86€/kg</p>	 <p>Salmon Wild-caught fish</p> <p>14.27€/kg</p>	 <p>Sea bream Farm-raised fish</p> <ul style="list-style-type: none"> - Product with Sustainability Certification - Product with Nutritional and Health Claim <p>13.39€/kg</p>	 <p>Pangasius Farm-raised fish</p> <ul style="list-style-type: none"> - Product with Nutritional and Health Claim <p>6.42€/kg</p>
 <p>Herring Wild-caught fish</p> <ul style="list-style-type: none"> - Product with Sustainability Certification - Product with Nutritional and Health Claim <p>6.03€/kg</p>	 <p>Sea bass Wild-caught fish</p> <ul style="list-style-type: none"> - Product with Sustainability Certification - Product with Nutritional and Health Claim <p>14.64€/kg</p>	 <p>Cod Farm-raised fish</p> <ul style="list-style-type: none"> - Product with Sustainability Certification <p>9.86€/kg</p>	<p><input type="radio"/> None of these products</p>

What quantity would you purchase of the above product (gr.)?

Figure 1: Example of choice set.

3. Results

3.1 Descriptive analysis

The median values of fish consumption is reported in Table 5. In our samples, fish is more frequently consumed in Italy, France and Spain: “3-4 times a week” as a median value. As a median value, pangasius, herring and trout are the fish species less consumed in every country, whilst cod and salmon are those more consumed. Seabass and seabream are frequently consumed in the Mediterranean countries (Italy and Spain, in particular).

Table 5: Frequency of fish consumption (median values).

	Italy	France	Germany	Spain	UK
Trout	Few times a year	Few times a year	Few times a year	Few times a year	Few times a year
Herring	Few times a year	Few times a year	Few times a year	Few times a year	Never
Salmon	Once a month	Once a month	Once a month	Once a month	Once a month
Seabass	Once a month	Few times a year	Never	Once a month	Few times a year
Seabream	Once a month	Few times a year	Never	Once a month	Never
Cod	2-3 times a month	Once a month	2-3 times a month	2-3 times a month	2-3 times a month
Pangasius	Few times a year	Never	Few times a year	Few times a year	Never
Fish	3-4 times a week	3-4 times a week	2-3 times a month	3-4 times a week	2-3 times a month

Overall, 40% of the respondents increased fish consumption in the past 3 years, 16% decreased fish consumption in the same period, and 44% maintained the same level. The share of those who increased fish consumption is higher in the UK (45%) and Italy (43%), whilst the quota of those who decreased fish consumption is higher in France (20%), Germany (17%) and Spain (17%) (Figure 2).

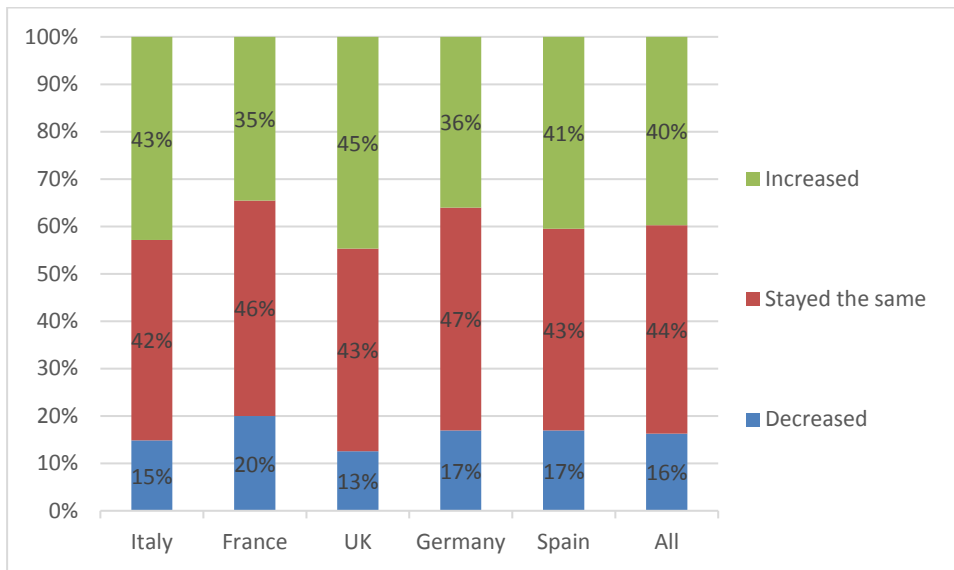


Figure 2: Evolution of fish consumption in the past 3 years.

The level of involvement is high in all countries both for fish purchasing (83% are completely or fairly involved) and for fish preparing and cooking (79%). The level of involvement is higher in the UK, respectively, 86% and 84% (Figure 3).

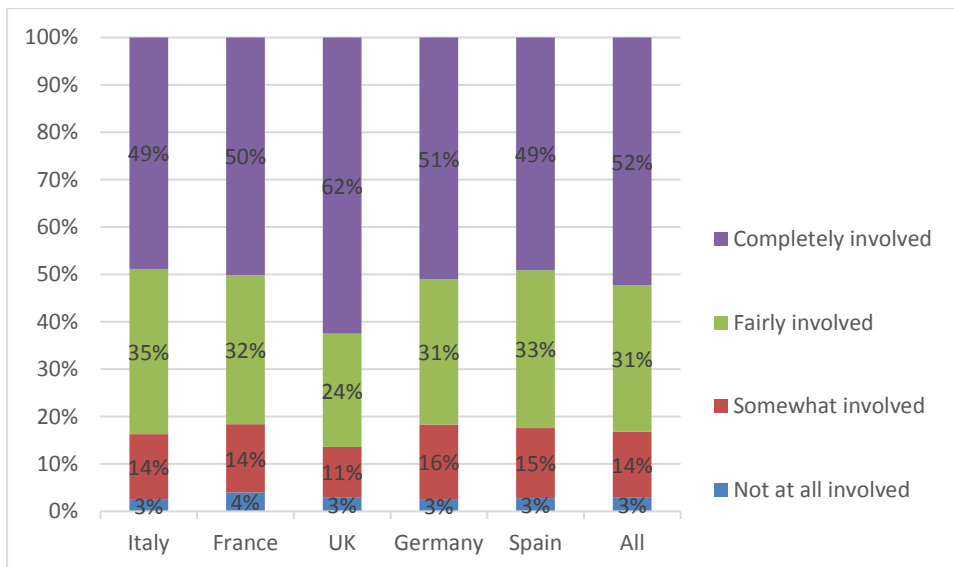


Figure 3: Level of involvement in fish purchasing in your household.

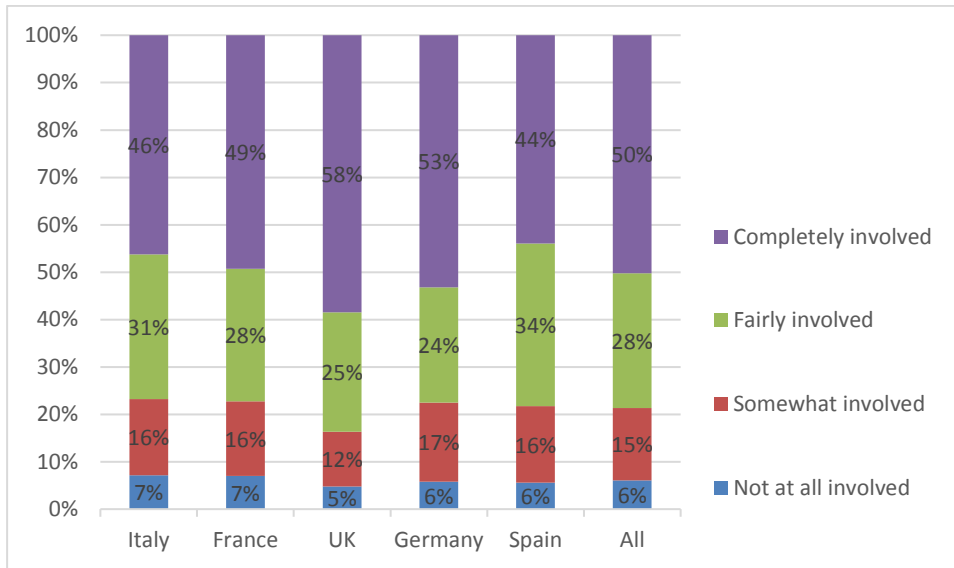


Figure 4: Level of involvement in your household when preparing and cooking fish.

Table 6 shows the fish choice motives expressed by the participants. Value for money, price and general appearance are the most important attributes in every country. However, in Italy wild caught and days since catch/harvest (likely as a proxy of freshness) are more important than price. Easy to cook is ranked as another important attribute in fish selection, in particular in France, UK and Germany. Sustainability certification is ranked as 5th and 6th aspect in fish selection, respectively, in Germany and Spain.

Table 7 shows the level of agreement on the attitudinal beliefs attitude towards environmental concerns (AE), attitude towards health concerns (AH), self-efficacy (SE), trust in information about sustainable production (TI), attitude towards ready-to-cook fish (AR). The results about the attitudinal beliefs are also displayed in Figures 5-9.

Table 6: Relative importance of different aspects in fish selection (1 = Not at all important; 7 = Extremely important).

Fish choice motives	France		Germany		Italy		Spain		UK		Total	
	Mean	sd	Mean	sd	Mean	sd	Mean	sd	Mean	sd	Mean	sd
Value for money	5.63	1.24	5.15	1.39	5.61	1.17	5.62	1.27	5.33	1.42	5.47	1.31
Price	5.57	1.24	5.10	1.34	5.31	1.25	5.44	1.29	5.29	1.42	5.34	1.32
General appearance	5.43	1.49	5.19	1.48	5.66	1.38	5.38	1.47	5.01	1.65	5.33	1.51
Free of smell	4.81	1.64	4.77	1.64	5.17	1.48	5.34	1.49	4.90	1.76	5.00	1.62
Easy to cook	5.09	1.44	4.87	1.49	4.99	1.35	4.97	1.44	5.00	1.49	4.98	1.44
Days since catch/harvest	5.01	1.51	4.39	1.63	5.36	1.43	5.25	1.46	4.70	1.67	4.94	1.58
Sustainability certification	4.80	1.48	4.81	1.59	5.14	1.36	5.09	1.45	4.65	1.72	4.90	1.54
Domestic origin	5.01	1.47	4.13	1.57	5.26	1.42	4.97	1.49	4.35	1.68	4.74	1.59
Wild caught	4.77	1.44	4.01	1.47	5.39	1.34	4.74	1.49	4.33	1.64	4.65	1.55
Organic certification	4.60	1.45	4.04	1.69	4.94	1.45	5.00	1.47	3.92	1.77	4.50	1.64
Not previously frozen	4.54	1.61	3.88	1.55	5.11	1.54	4.81	1.58	4.16	1.70	4.50	1.66
Low in calories	4.28	1.61	3.89	1.65	4.45	1.61	4.62	1.50	4.16	1.77	4.28	1.65

Table 7: Level of agreement on the following attitudinal beliefs: attitude towards environmental concerns (AE), attitude towards health concerns (AH), self-efficacy (SE), trust in information about sustainable production (TI), attitude towards ready-to-cook fish (AR).

Fish choice motives	Att	France		Germany		Italy		Spain		UK		Total	
		Mean	sd	Mean	sd	Mean	sd	Mean	sd	Mean	sd	Mean	sd
I believe that fishing has negative consequences on marine resources.	AE	4.73	1.43	4.39	1.41	4.02	1.53	4.39	1.52	4.27	1.41	4.36	1.48
I believe that fish farming has negative consequences on the environment.	AE	4.38	1.47	3.79	1.44	3.74	1.51	3.88	1.66	4.14	1.44	3.98	1.52
I believe that eating fish containing omega-3 fatty acids benefits my health.	AH	5.40	1.34	5.41	1.22	5.57	1.27	5.69	1.35	5.42	1.30	5.50	1.30
I believe that eating fish would expose myself to substances (e.g. mercury, antibiotics, etc.) risking negative consequences on my health.	AH	3.99	1.53	3.79	1.42	3.95	1.50	4.19	1.61	3.64	1.56	3.91	1.54
I feel confident in evaluating the quality of the fish before buying it.	SE	4.85	1.25	4.47	1.25	4.85	1.23	5.06	1.38	4.76	1.39	4.80	1.32
I feel confident in cooking fish.	SE	4.97	1.28	4.88	1.33	5.11	1.29	5.38	1.32	5.14	1.48	5.09	1.35
I would trust the information provided about the sustainable fish production practices (fishing or farming) if they were certified by a public authority (e.g., the Government or the EU)	TI	4.49	1.43	4.68	1.39	4.79	1.47	5.00	1.54	4.88	1.46	4.77	1.47
I would trust the information provided about the sustainable fish production practices (fishing or farming) if they were certified by a fish farmer or fisherman	TI	4.71	1.38	4.53	1.35	4.65	1.37	4.85	1.36	4.69	1.39	4.68	1.37
I would trust the information provided about the sustainable fish production practices (fishing or farming) if they were certified by a fish processing industry	TI	3.97	1.51	3.91	1.44	4.43	1.41	4.65	1.47	4.47	1.45	4.29	1.49
I would trust the information provided about the sustainable fish production practices (fishing or farming) if they were certified by a retailer	TI	4.19	1.39	4.16	1.36	4.30	1.42	4.47	1.47	4.48	1.33	4.32	1.40

Table 7: continue.

Fish choice motives	Att	France		Germany		Italy		Spain		UK		Total	
		Mean	sd	Mean	sd	Mean	sd	Mean	sd	Mean	sd	Mean	sd
I would trust the information provided about the sustainable fish production practices (fishing or farming) if they were certified by an independent organization (e.g., an NGO)	TI	4.89	1.34	4.81	1.34	4.91	1.41	4.96	1.52	4.93	1.38	4.90	1.40
I believe that ready-to-cook products would alter the original fish characteristics	AR	4.91	1.32	4.45	1.15	4.47	1.25	4.95	1.39	4.52	1.21	4.66	1.28
I prefer to eat ready-to-cook fish because it allows me to save time	AR	3.89	1.66	4.49	1.34	4.03	1.46	4.03	1.65	4.34	1.58	4.15	1.56
Preferably, I spend as little time as possible on meal preparation	AR	3.74	1.64	4.35	1.45	3.92	1.53	3.82	1.71	4.14	1.56	3.99	1.60
I prefer to eat ready-to-cook fish because it does not smell	AR	3.39	1.60	4.19	1.36	3.62	1.60	3.59	1.68	3.98	1.56	3.75	1.59

Note: all items are scored on the scale: 1 = Strongly disagree; 7 = Strongly agree.

In general consumers are more worried about the negative consequences of fishing on marine resources, than those of fish farming on the environment (Figure 5). The concern is higher in France and lower in Italy.

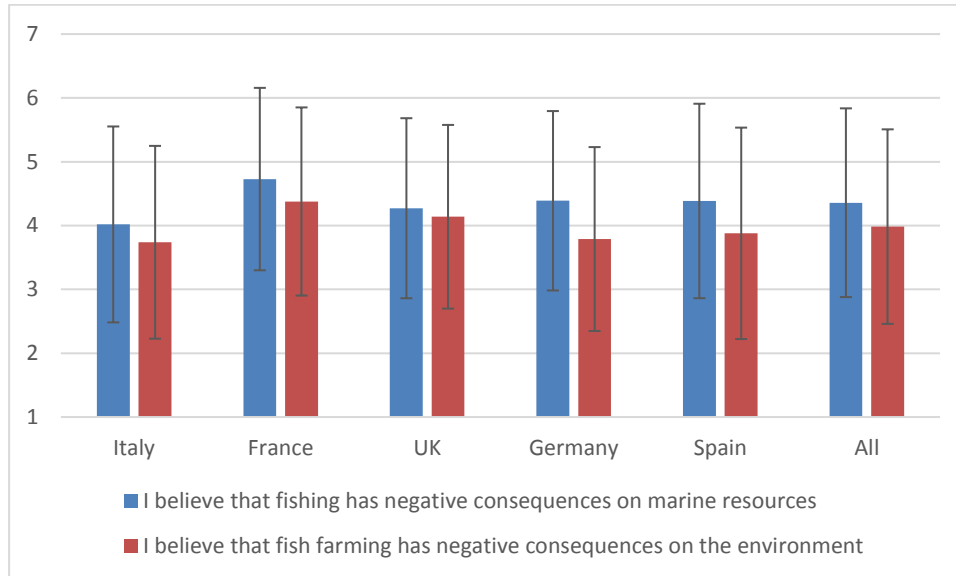


Figure 5: Attitude towards environmental concerns.

In general, respondents believe that fish consumption has more benefits than risks (Figure 6). The benefits are more appreciated in Spain, as well as the risks of negative consequences.

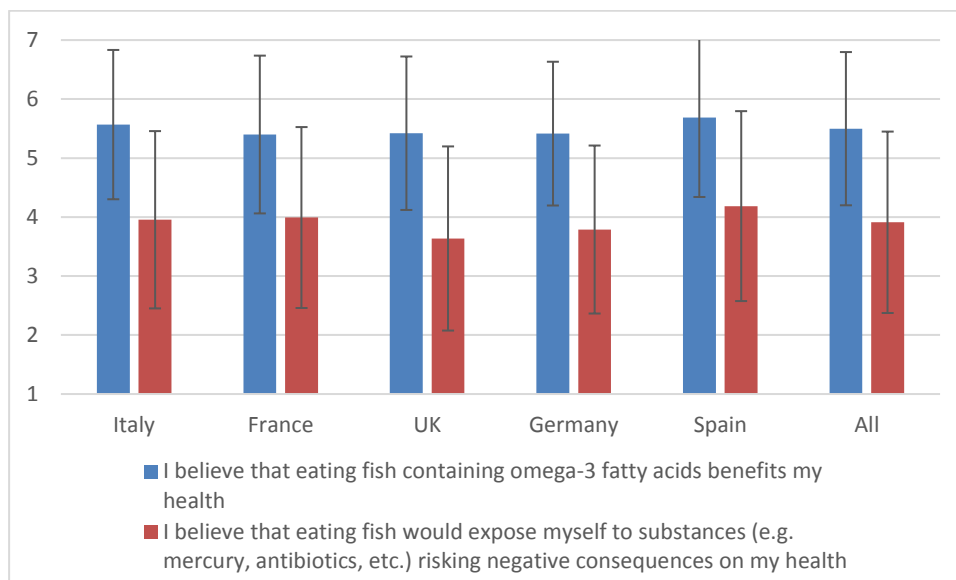


Figure 6: Attitude towards health concerns.

In general consumers are more confident in cooking fish than in evaluating the quality of the fish before buying it (Figure 7).

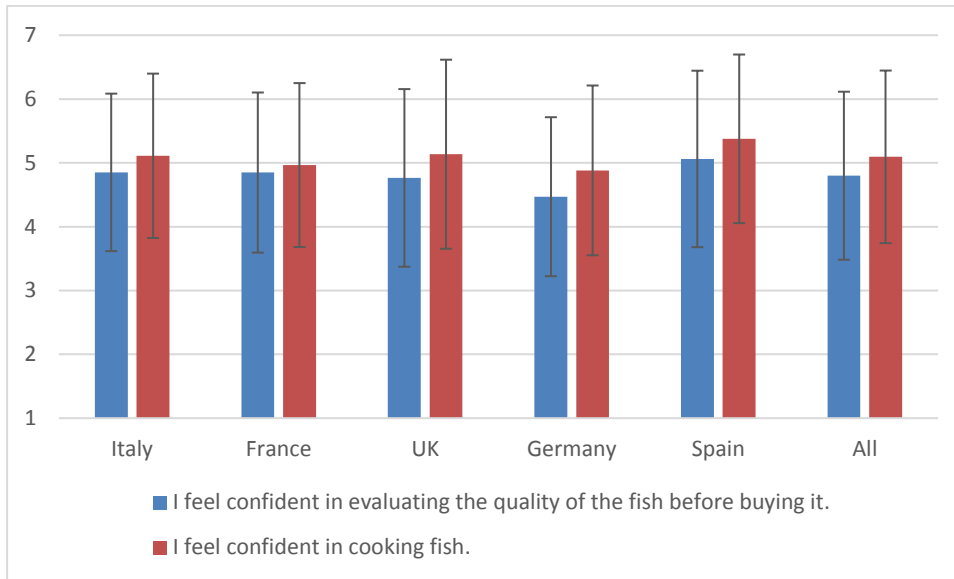


Figure 7: Self-efficacy.

Consumers' trust in information provided about the sustainable fish production is higher for independent organizations and public authorities, than for industries and retailers. Trust for farmers and fishermen is higher than trust for industry and retailers in every country. In France, the trust for fish farmers or fishermen is higher than for the public authority (Figure 8).

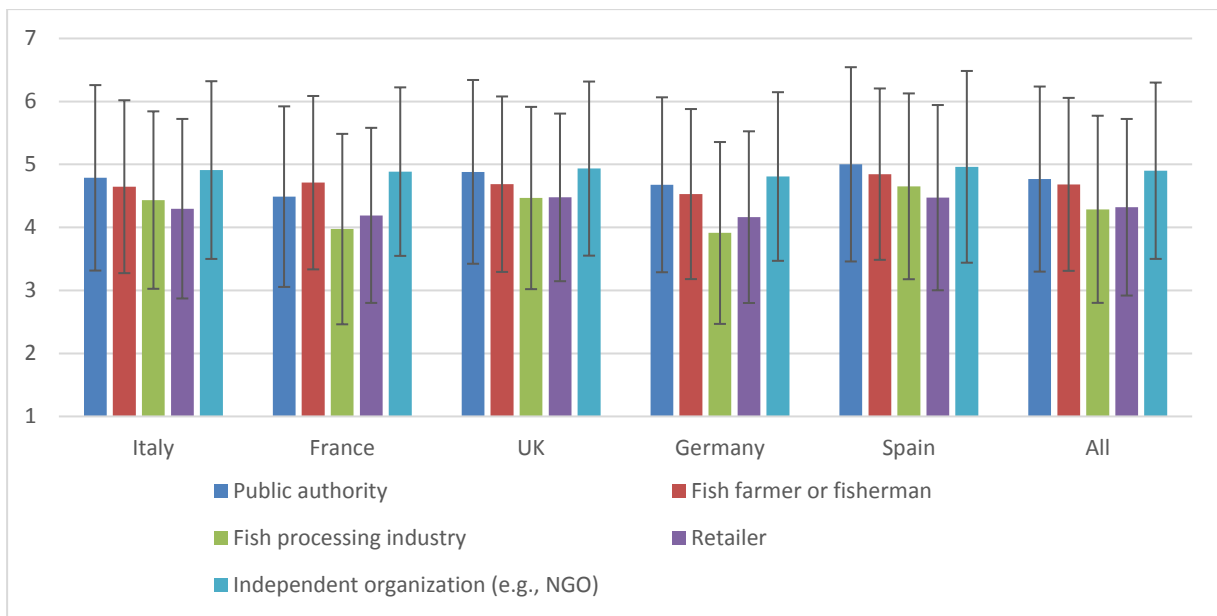


Figure 8: Trust for information about sustainable fish production.

In general, consumers show a rather negative perception about ready-to-cook products, in terms of loss of original characteristics. The preference for ready-to-cook fish products because of saving time is lower than the risk of alter the original fish characteristics (Figure 9). This difference is much larger in France and Spain, while is lower in the UK. Only in Germany

consumers' preference for ready-to-cook fish products is higher than the risk of alter the original fish characteristics.

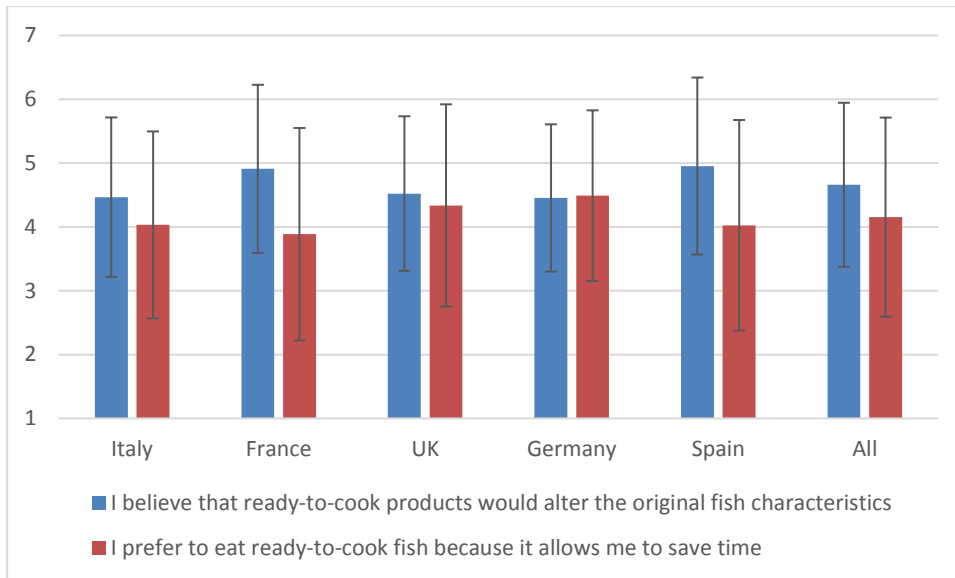


Figure 9: Attitude towards ready-to-cook fish.

Once having performed the choice experiment, the respondents had to state how they believed in the benefits of sustainability certification to the environment and society, and how they believed in the nutrition and health claim. The results are reported in Figure 10 and 11. The belief strength is generally higher for the sustainability certification scheme, while, for both labels, is lower in France compared to Spain, Italy and UK.

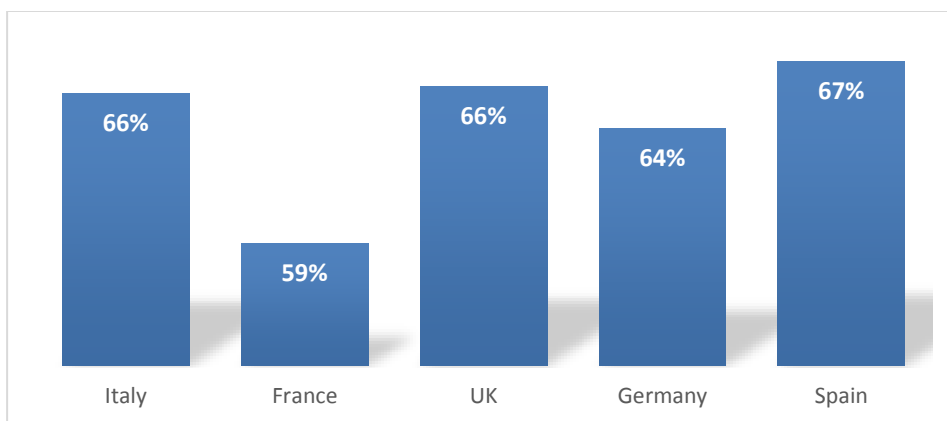


Figure 10: Belief strength about the sustainability label.

Note: "We assume you have read the definition of sustainability certification above. On a scale of 0-100, to what extent do you believe in the benefits of such certification to the environment and society? (e.g., 0 = completely unbelievable; 50 = neutral; 100 = completely believable)

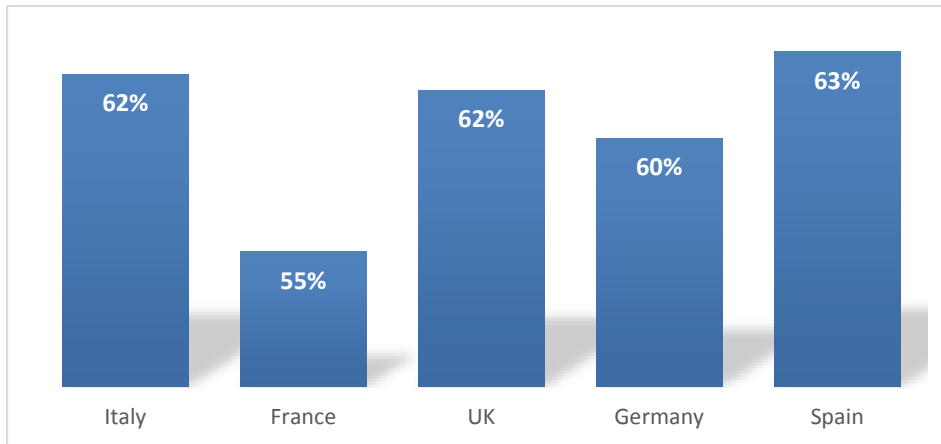


Figure 11: Belief strength about the nutritional and health claim.

Note: "In the marketplace, some producers provide health benefit information from consuming their products. On a scale of 0-100, to what extent do you believe such health benefit claims? (e.g., 0 = completely unbelievable; 50 = neutral; 100 = completely believable)

3.2 The choice experiment results

Two different models were estimated:

- the first one with fish species-specific effects (FSSE); this is needed for obtaining WTP specific for the 7 species;
- the second one with random price effect (RPE) models; this is needed for segmentation.

3.2.1 Model specification and estimation

According to Lancaster's consumer theory (1966), consumer utility stems from product attributes, not the products themselves. In other words, consumer utility can be separated into part-worth utilities. The part-worth utilities equal consumers' preference for corresponding attributes. In marketing research, the product attributes are classified into extrinsic and intrinsic attributes (Zeithaml, 1988; Olsen et al., 2008). Regardless of whether consumers are exposed to these attributes, they may be important signals of product quality and determinants of consumer preference.

The overall utility that a consumer obtains from consuming a seafood species j (U_j) can be expressed as:

$$u_{ij} = x'_{ij}\beta + \varepsilon_{ij} \quad (1)$$

where:

- $i=1, \dots, N$: Individual consumer i ,
- $j=1, \dots, J$: product j among J products,
- u_{ij} : utility obtained by individual i from product j ,
- x'_{ij} : product attributes,
- β : vector of part-worth utility,
- ε_{ij} : random effect.

It is generally assumed that an individual would choose a product alternative if the utility derived from this alternative is maximized compared to the other alternatives:

$$y_{ij} = \begin{cases} 1, & \text{if } u_{ij} \geq \max(u_i) \\ 0 & \text{otherwise} \end{cases} \quad (2)$$

When facing a “basket” of seafood products, consumers assign a random utility to each product alternatives and select the one with the highest derived utility. Assuming that the stochastic components ε_j have independent and identical distributed (*iid*) forms, the probability of a consumer i choosing a fish product j ($P(y_{ij} = 1)$) given by the multinomial logit (MNL) model (McFadden, 1974), is expressed in the following equation:

$$P(y_{ij} = 1) = \frac{\exp(x'_{ij}\beta)}{\sum_{k=1}^J \exp(x'_{ik}\beta)} \quad (3)$$

The MNL model presented in equation (3) is the basic choice model and has been approved to have several disadvantages such as assuming *iid* of the error and assuming the homogeneity of consumers' preference. To overcome the limitations of MNL, there many advanced discrete choice models suggested such as the mixed logit models (random coefficient, scaled-multinomial logit, and generalized-multinomial logit) and the latent class model (LCM) (see Fiebig et al., 2010; Greene & Hensher, 2003).

We estimated two types of models in this report to elicit the consumers' WTP for fish attributes that are specific to particular fish species and for individual consumers, named as fish species-specific effect model (FSSE) and random (i.e price) parameter effect model.

The fish species-specific effect (FSSE) model (fish j), is expressed as:

$$u_{ij} = \alpha_j + \beta_{1j}Method_{ij} + \beta_{2j}Format_{ij} + \beta_{3j}Health_{ij} + \beta_{4j}Sustain_{ij} + \beta_{5j}Price_{ij} + \varepsilon_{ij} \quad (4)$$

where β parameters are estimated for the j -th fish species and for the attributes production method (i.e. Method, as wild caught vs. farmed fish), product format (i.e. Format, as whole fish/round cut, fillet or ready-to-cook), nutritional and health claim (i.e. Health, as with/without nutritional and health claim), and sustainability label (i.e. Sustain, as with/without sustainability certification).

The Random price effect (RPE) model is specified so that the price coefficients includes two components, such as the average effect of price and the individual variance of price effects, expressed as:

$$u_{ij} = \alpha_j + \beta_1Method_{ij} + \beta_2Format_{ij} + \beta_3Health_{ij} + \beta_4Sustain_{ij} + \beta_5Price_{ij} + \gamma_{3i}Price_{ij} + \varepsilon_{ij} \quad (5)$$

where α_j , β_k are fixed-effect coefficients, γ_3 is random coefficient of price estimated for individual i .

The specification of FSSE allows us to calculate the willingness to pay (WTP) for each of seven fish species in the choice experiment, while random price effect model allows us to elicit the WTP of each fish attributes at individual consumers' level. The WTP for a non-monetary attribute is the price premium that consumers are willing to pay for obtaining a desired attribute level. The WTP for an attribute level A (e.g. health) from FSSE model in equation (4) is calculated as:

$$WTP_{Aj} = -\frac{\beta_{Aj}}{\beta_{5j}} \quad (6)$$

where WTP_{Aj} is the price premium paid for obtaining a desired level of attribute A (i.e., product with health claim) of the fish j , and β_{Aj} and β_{5j} are the estimated coefficients of attribute A and price attributes of fish j .

Similarly, the WTP for attribute A (not specific to fish species) at consumers' individual level (WTP_{Ai}) is calculated from model in equation (5) is:

$$WTP_{Ai} = \frac{\beta_A}{\beta_{5i}} \quad (7)$$

We estimate the WTP specific to fish species with expectation that consumers' preference for fish quality attributes depends in specific species (Thong et al., 2015). For instance, consumers may prefer filleted cod to the whole fish cod, but they may prefer whole fish herring to the filleted herring. The WTP for fish quality attributes are calculated at individual consumers because the nature of heterogeneity of preference. The random price effect model also allows us to obtain choice probability for fish species at the individual consumer's level. The individual consumers' choice probability thus will be used for segmentations that are actionable for marketing strategy and developing the decision support system (DSS). The segments are derived in every country using SAS macros, and three parameter criterion: cubic clustering criterion (Sarle, 1983), Pseudo-F statistics (Calinski and Harabasz, 1974), and Pseudo-t squared statistics (Duda and Hart, 1973).

3.2.2 Italy

Table 8 reports the coefficients estimates for models with fish species-specific effect (FSSE) in the Italian sample.

The higher coefficient reported for seabass indicate that this species is the most preferred by the Italian consumers, followed by cod and seabream, while the least preferred is herring. Wild caught alternative is the most preferred compared to the farm-raised fish for all species, with higher incidence for cod and seabass. Ready-to-cook products are preferred compared to whole or round cut in the case of cod, herring and pangasius, while is less preferred for salmon and seabream. Fish fillet is preferred than ready-to-cook products for salmon, seabream and cod, while is less preferred for trout and seabass. The sustainability label is generally appreciated for all species, where the effect is higher for cod, seabream, pangasius and trout. The nutritional and health claim is also generally appreciated, where higher scores are found for seabream, pangasius and cod.

The willingness to pay is directly derived from these results, applying the formula (6). The results are shown in Table 9, where the price premium (in €/kg) and the marginal WTP (in % above or below the average price in Table 3) are reported. Considering the production method, the higher relative WTP has been found in the case of wild salmon, compared to the farm-raised alternative (+48%). Again the higher marginal WTP for format attribute is found for salmon fillet and round cut compared to the ready-to-cook alternative (respectively, +70% and +38%). The higher WTP for the sustainability scheme was found for cod (+27%), while the WTP for nutritional and health claim is higher for seabream (+27%).

Table 8: Fish Species-Specific Effect (FSSE) Model, β (mean and standard deviation) - Italy.

β parameter (effects)	Mean	Std dev
Species		
Cod	2.558	0.249
Herring	0.660	0.295
Pangasius	1.006	0.278
Salmon	1.765	0.239
Seabass	2.831	0.243
Seabream	2.367	0.227
Trout	1.543	0.267
Price		
Cod	-0.101	0.015
Herring	-0.071	0.026
Pangasius	-0.188	0.045
Salmon	-0.046	0.012
Seabass	-0.111	0.015
Seabream	-0.125	0.016
Trout	-0.135	0.023
Production method (baseline Farmed)		
Cod (wild caught)	0.482	0.091
Salmon (wild caught)	0.340	0.083
Seabass (wild caught)	0.449	0.084
Seabream (wild caught)	0.272	0.081
Product format (baseline Ready-to-cook)		
Cod (Round cut)	-0.372	0.112
Cod (Fillet)	0.118	0.103
Herring (Whole)	-0.119	0.159
Herring (Fillet)	-0.037	0.155
Pangasius (Round cut)	-0.228	0.154
Pangasius (Fillet)	-0.037	0.144
Salmon (Round cut)	0.266	0.109
Salmon (Fillet)	0.496	0.105
Seabass (Whole)	-0.041	0.103
Seabass (Fillet)	-0.171	0.105
Seabream (Whole)	0.179	0.101
Seabream (Fillet)	0.192	0.103
Trout (Whole)	-0.066	0.136
Trout (Fillet)	-0.393	0.148
Sustainability label (baseline None)		
Cod	0.336	0.092
Herring	0.144	0.126
Pangasius	0.221	0.121
Salmon	0.066	0.088
Seabass	0.095	0.085
Seabream	0.222	0.081
Trout	0.200	0.119
Nutritional and Health claim (baseline None)		
Cod	0.173	0.088
Herring	0.081	0.125
Pangasius	0.180	0.120
Salmon	0.148	0.084
Seabass	0.153	0.087
Seabream	0.363	0.082
Trout	0.105	0.120
<i>Mean of Log-likelihood</i>	-7666.7	
<i>Accepted Rate</i>	0.626	
<i>Hit probability</i>	0.165	
<i>Average Efficiency</i>	0.71	

Table 9: Italian consumers' WTP a price premium (in €/kg and % above or below the average market price) for specific fish attributes, based on the estimates of the FSSE model.

Attribute / level	€/kg	%
<i>Production method (baseline Farmed)</i>		
Cod (wild caught)	4.775	39.1%
Salmon (wild caught)	7.330	48.5%
Seabass (wild caught)	4.031	34.1%
Seabream (wild caught)	2.186	20.2%
<i>Product format (baseline Ready-to-cook)</i>		
Cod (Round cut)	-3.679	-30.1%
Cod (Fillet)	1.166	9.6%
Herring (Whole)	-1.660	-16.8%
Herring (Fillet)	-0.515	-5.2%
Pangasius (Round cut)	-1.215	-21.7%
Pangasius (Fillet)	-0.195	-3.5%
Salmon (Round cut)	5.722	37.9%
Salmon (Fillet)	10.694	70.8%
Seabass (Whole)	-0.365	-3.1%
Seabass (Fillet)	-1.531	-12.9%
Seabream (Whole)	1.436	13.3%
Seabream (Fillet)	1.539	14.2%
Trout (Whole)	-0.490	-4.7%
Trout (Fillet)	-2.922	-27.8%
<i>Sustainability label (baseline None)</i>		
Cod	3.322	27.2%
Herring	2.022	20.4%
Pangasius	1.181	21.1%
Salmon	1.420	9.4%
Seabass	0.855	7.2%
Seabream	1.784	16.5%
Trout	1.485	14.1%
<i>Nutritional and Health claim (baseline None)</i>		
Cod	1.711	14.0%
Herring	1.137	11.5%
Pangasius	0.962	17.2%
Salmon	3.194	21.2%
Seabass	1.375	11.6%
Seabream	2.910	26.9%
Trout	0.778	7.4%

The random price effect (RPE) model, able to estimate the price coefficient for every single consumer, resulted in the mean effects (and standard deviation) reported in Table 10. The attribute effects, in this case, are computed without the interaction with the species (i.e. on average for all species). The higher utility score was found for wild caught fishes compared to the farm-raised ones, and for the sustainability label and nutritional and health claims. The WTP estimates, based on these effects, are reported in Table 11. These estimates are the mean values estimated for each consumer in the sample.

Table 10: Random Price Effect (RPE) model, β (mean and standard deviation) - Italy.

β parameter (effects)	Mean	Std dev
Cod	3.223	0.143
Herring	1.963	0.145
Pangasius	1.643	0.118
Salmon	3.491	0.152
Seabass	3.290	0.142
Seabream	3.332	0.138
Trout	2.598	0.139
Wild vs Farmed	0.386	0.044
Whole (round cut) vs. Ready-to-cook	-0.033	0.046
Fillet vs. Ready-to-cook	0.074	0.046
Sustainability label	0.198	0.038
Nutritional and health claim	0.189	0.037
Price (mean)	-0.137	0.012
Price (variance)	0.044	0.004
<i>Mean of Log-likelihood</i>	<i>-7011.89</i>	
<i>Accepted Rate</i>	<i>0.908</i>	
<i>Hit probability</i>	<i>0.216</i>	
<i>Average Efficiency</i>	<i>0.563</i>	

Table 11: Italian consumers' WTP (in €/kg) for fish species and attributes, based on the estimates of the RPE model.

Species and Attribute/levels	Mean	Std dev
Cod	23.453	12.042
Herring	14.285	12.160
Pangasius	11.958	9.933
Salmon	25.408	12.782
Seabass	23.943	11.899
Seabream	24.248	11.571
Trout	18.908	11.647
Wild vs Farmed	2.812	3.697
Whole (round cut) vs. Ready-to-cook	-0.238	3.899
Fillet vs. Ready-to-cook	0.535	3.824
Sustainability label	1.438	3.160
Nutritional and health claim	1.372	3.101

The choice probability for fish species is reported in Table 12. This probability is very similar using both models, indicating the robustness of the effects across the models. Seabream, seabass and salmon exhibit the higher choice probability, while herring and pangasius and trout the lowest.

Table 12: Choice probability for fish species (mean value, standard deviation, minimum and maximum) with Fish Species-Specific Effect (FSSE) and Random Price Effect (RPE) models - Italy.

Species	Mean	Std Dev.	Min	Max
<i>FSSE model</i>				
Cod	0.158	0.065	0.043	0.328
Herring	0.070	0.017	0.039	0.114
Pangasius	0.076	0.024	0.032	0.135
Salmon	0.174	0.051	0.072	0.310
Seabass	0.174	0.061	0.071	0.319
Seabream	0.198	0.071	0.087	0.424
Trout	0.082	0.032	0.029	0.161
No choice	0.067	0.010	0.049	0.094
<i>RPE model</i>				
Cod	0.158	0.080	0.000	0.604
Herring	0.070	0.036	0.001	0.230
Pangasius	0.075	0.060	0.001	0.443
Salmon	0.174	0.109	0.000	0.767
Seabass	0.174	0.081	0.000	0.506
Seabream	0.198	0.089	0.001	0.533
Trout	0.083	0.041	0.001	0.274
No choice	0.068	0.115	0.000	0.902

We have derived five different segments, based on choice probabilities, shown in Table 13. The first cluster is the largest (36% of the sample), and exhibits a higher WTP in general for all fish species and attributes. It is indeed one of the least sensitive to price changes. Mostly composed by females, middle aged, high educated and with high income level, living in a medium-large family. The second segment (12% of the sample) exhibits a low WTP, compared to the other segments, and a high sensitivity to price changes. It is made of females (61%), with lower education level, mostly living in two people families. The third segment is the second large one (30%), and expressed a medium WTP for all species, and a medium-high WTP for sustainability label and wild-caught fishes. It shows a low sensitivity with price changes. It is mostly composed by men (53%), middle-high aged, both low and high educated, with medium income and large family units (> three people). The fourth segment, representing 20% of the sample, shows slightly higher WTP values compared to the third one, only with a higher sensitivity with price changes. It is mostly composed by men (58%), younger, with lower educational level, and lower income (even if the higher income level is well represented), and

living in larger family units. The fifth sample is the smallest (3%), and exhibits a low WTP for all species and attributes, and high price sensitivity.

Table 13: Segmentation of the Italian market, based on individuals' choice probabilities.

	CL 1	CL 2	CL 3	CL 4	CL5
Size of segment (%)	36.31	11.69	29.54	19.69	2.77
WTP for cod (€/kg)	19.06	8.37	10.82	11.19	4.78
WTP for herring (€/kg)	11.60	5.09	6.68	6.81	2.91
WTP for pangasius (€/kg)	9.78	4.26	5.43	5.74	2.44
WTP for salmon (€/kg)	20.63	9.06	11.72	12.11	5.18
WTP for seabass (€/kg)	19.47	8.54	11.02	11.43	4.88
WTP for seabream (€/kg)	19.70	8.65	11.00	11.57	4.94
WTP for trout (€/kg)	15.38	6.74	8.89	9.01	3.85
WTP for health claim (€/kg)	1.10	0.49	0.52	0.65	0.28
WTP for sustainability label (€/kg)	1.18	0.51	0.70	0.69	0.29
WTP for whole vs. ready-to-cook (€/kg)	-0.19	-0.09	-0.11	-0.11	-0.05
WTP for fillet vs. ready-to-cook (€/kg)	0.41	0.19	0.22	0.24	0.11
WTP for fillet vs. whole (€/kg)	0.60	0.28	0.33	0.36	0.16
WTP for wild vs. Farmed fish (€/kg)	2.30	1.00	1.36	1.34	0.57
<i>Price sensitivity (estimated coefficient)</i>	<i>-0.18</i>	<i>-0.41</i>	<i>-0.07</i>	<i>-0.30</i>	<i>-0.69</i>
Gender (%)					
Male	44.92	39.47	53.13	57.81	33.33
Female	55.08	60.53	46.88	42.19	66.67
Age group (%)					
Age < 30	12.71	18.42	18.75	20.31	22.22
Age 30-40	22.03	26.32	20.83	23.44	33.33
Age 41-50	33.05	23.68	29.17	21.88	22.22
Age 51-60	21.19	15.79	21.88	23.44	22.22
Age >60	11.02	15.79	9.38	10.94	0.00
Education (%)					
Secondary or lower	39.83	42.11	40.63	42.19	33.33
Secondary school	29.66	34.21	28.13	39.06	33.33
College/University/Postgraduate	30.51	23.68	31.25	18.75	33.33
Income (%)					
Level 1 (lowest)	8.47	7.89	9.38	15.63	22.22
Level 2	31.36	31.58	29.17	31.25	22.22
Level 3	29.66	31.58	38.54	17.19	22.22
Level 4 (highest)	30.51	28.95	22.92	35.94	33.33
Family size (%)					
Family with One person	9.32	7.89	11.46	10.94	11.11
Family with two people	29.66	34.21	20.83	25	44.44
Family with three people	28.81	28.95	31.25	26.56	44.44
Family with four people	27.12	23.68	31.25	20.31	0.00
Family with five or more people	5.08	5.26	5.21	17.19	0.00

3.2.3 France

Table 14 reports the coefficients estimates in the French sample for models with fish species-specific effect (FSSE).

The higher β coefficient reported for seabream, cod and seabass indicate that these species are the most preferred by the French consumers, while the least preferred are herring and pangasius. Wild caught alternative is preferred compared to the farm-raised fish for all species, with higher incidence for seabream. Ready-to-cook products are preferred compared to whole or round cut for all species, except with salmon. Fish fillet is preferred than ready-to-cook products for salmon and cod, while is less preferred for pangasius. The sustainability label is generally appreciated by consumers, with higher effects for seabass and pangasius. The nutritional and health claim is appreciated for seabass, whilst the other effects are less significant.

The willingness to pay results, applying the formula (8), are shown in Table 15 where the price premium (in €/kg) and the marginal WTP (in % above or below the average price in Table 3) are reported. Considering the production method, the higher relative WTP has been found in the case of wild salmon, compared to the farm-raised alternative (+58% compared to average market price); high premiums have been also estimated for wild seabream (+34%) and wild cod (+33%). The higher marginal WTP for format attribute is found for salmon fillet and round cut compared to the ready-to-cook alternative (respectively, +58% and +48%). Round cut pangasius is the least accepted, with a WTP for ready-to-cook alternative of 72%. Significant price premiums are also estimated for ready-to-cook cod (35%) and herring (33%), compared to, respectively, round cut and whole alternatives. The higher price premium for the sustainability scheme was found for salmon (+23%), seabass (+20%) and pangasius (+17%); the WTP for nutritional and health claim is higher for seabass (+13%).

Table 14: Fish Species-Specific Effect (FSSE) Model, β (mean and std. deviation) - France.

β parameter (effects)	Mean	Std dev
Species		
Cod	2.176	0.244
Herring	0.600	0.273
Pangasius	0.814	0.296
Salmon	1.823	0.214
Seabass	2.040	0.297
Seabream	2.279	0.273
Trout	1.406	0.249
Price		
Cod	-0.088	0.013
Herring	-0.082	0.025
Pangasius	-0.150	0.033
Salmon	-0.050	0.011
Seabass	-0.139	0.016
Seabream	-0.132	0.019
Trout	-0.123	0.018
Production method (baseline Farmed)		
Cod (wild caught)	0.436	0.095
Salmon (wild caught)	0.436	0.075
Seabass (wild caught)	0.379	0.105
Seabream (wild caught)	0.520	0.101
Product format (baseline Ready-to-cook)		
Cod (Round cut)	-0.468	0.119
Cod (Fillet)	0.243	0.104
Herring (Whole)	-0.265	0.151
Herring (Fillet)	0.040	0.137
Pangasius (Round cut)	-0.914	0.187
Pangasius (Fillet)	-0.205	0.149
Salmon (Round cut)	0.362	0.094
Salmon (Fillet)	0.434	0.092
Seabass (Whole)	-0.078	0.134
Seabass (Fillet)	0.063	0.129
Seabream (Whole)	-0.127	0.124
Seabream (Fillet)	0.083	0.120
Trout (Whole)	-0.262	0.132
Trout (Fillet)	-0.011	0.127
Sustainability label (baseline None)		
Cod	0.017	0.094
Herring	-0.068	0.119
Pangasius	0.220	0.136
Salmon	0.171	0.077
Seabass	0.389	0.105
Seabream	0.059	0.099
Trout	0.162	0.108
Nutritional and Health claim (baseline None)		
Cod	0.095	0.093
Herring	0.014	0.116
Pangasius	-0.009	0.132
Salmon	-0.010	0.074
Seabass	0.258	0.107
Seabream	0.036	0.098
Trout	0.027	0.110
<i>Mean of Log-likelihood</i>	<i>-7509.23</i>	
<i>Accepted Rate</i>	<i>0.602</i>	
<i>Hit probability</i>	<i>0.167</i>	
<i>Average Efficiency</i>	<i>0.647</i>	

Table 15: French consumers' WTP a price premium (in €/kg and % above or below the average market price) for specific fish attributes, based on the estimates of the FSSE model.

Attribute / level	€/kg	%
<i>Production method (baseline Farmed)</i>		
Cod (wild caught)	4.928	33.1%
Salmon (wild caught)	8.685	58.3%
Seabass (wild caught)	2.725	19.1%
Seabream (wild caught)	3.939	34.3%
<i>Product format (baseline Ready-to-cook)</i>		
Cod (Round cut)	-5.293	-35.5%
Cod (Fillet)	2.752	18.5%
Herring (Whole)	-3.214	-32.5%
Herring (Fillet)	0.481	4.9%
Pangasius (Round cut)	-6.106	-71.8%
Pangasius (Fillet)	-1.370	-16.1%
Salmon (Round cut)	7.211	48.4%
Salmon (Fillet)	8.649	58.0%
Seabass (Whole)	-0.564	-3.9%
Seabass (Fillet)	0.455	3.2%
Seabream (Whole)	-0.961	-8.4%
Seabream (Fillet)	0.630	5.5%
Trout (Whole)	-2.128	-16.6%
Trout (Fillet)	-0.087	-0.7%
<i>Sustainability label (baseline None)</i>		
Cod	0.189	1.3%
Herring	-0.820	-8.3%
Pangasius	1.472	17.3%
Salmon	3.400	22.8%
Seabass	2.798	19.6%
Seabream	0.444	3.9%
Trout	1.314	10.3%
<i>Nutritional and Health claim (baseline None)</i>		
Cod	1.074	7.2%
Herring	0.164	1.7%
Pangasius	-0.058	-0.7%
Salmon	-0.199	-1.3%
Seabass	1.860	13.0%
Seabream	0.273	2.4%
Trout	0.218	1.7%

The random price effects (RPE) model results (mean and standard deviation) are reported in Table 16 where the β coefficients are shown. The higher utility score was found for salmon and cod, and for wild caught fishes compared to the farm-raised ones. To a lesser extent the β coefficients are also positive for the fillets compared to the ready-to-cook alternatives, and for the sustainability label.

The WTP estimates, based on these effects, are reported in Table 17; the higher premiums are associated with salmon and cod (respectively, 24.6 and 20.6 €/kg), and with wild-caught fishes (3.2 €/kg). The relatively low willingness to pay of French consumers for both

sustainability label and nutritional and health claim can be partially explained by their weak belief strength in the benefits of sustainability certification to the environment and society, and in the nutrition and health claim.

Table 16: Random Price Effect (RPE) model, β (mean and standard deviation) - France.

β parameter (effects)	Mean	Std dev
Cod	2.897	0.140
Herring	1.582	0.131
Pangasius	1.477	0.125
Salmon	3.458	0.138
Seabass	2.505	0.142
Seabream	2.400	0.129
Trout	2.586	0.132
Wild vs Farmed	0.455	0.047
Whole (round cut) vs. Ready-to-cook	-0.131	0.049
Fillet vs. Ready-to-cook	0.167	0.047
Sustainability label	0.138	0.039
Nutritional and health claim	0.067	0.038
Price (mean)	-0.140	0.011
Price (variance)	0.039	0.003
<i>Mean of Log-likelihood</i>	<i>-6808.12</i>	
<i>Accepted Rate</i>	<i>0.888</i>	
<i>Hit probability</i>	<i>0.231</i>	
<i>Average Efficiency</i>	<i>0.558</i>	

Table 17: French consumers' WTP (in €/kg) for fish species and attributes, based on the estimates of the RPE model.

Species and Attribute/levels	Mean	Std dev
Cod	20.633	12.372
Herring	11.269	11.602
Pangasius	10.517	11.044
Salmon	24.630	12.248
Seabass	17.839	12.558
Seabream	17.091	11.434
Trout	18.416	11.673
Wild vs Farmed	3.239	4.168
Whole (round cut) vs. Ready-to-cook	-0.932	4.319
Fillet vs. Ready-to-cook	1.188	4.133
Sustainability label	0.984	3.451
Nutritional and health claim	0.479	3.381

The choice probability for fish species is reported in Table 18. This probability is very similar using both models, indicating the robustness of the effects across the models. Salmon, cod and seabream exhibit the higher choice probability, while pangasius and herring the lowest.

Table 18: Choice probability for fish species (mean value, standard deviation, minimum and maximum) with Fish Species-Specific Effect (FSSE) and Random Price Effect (RPE) models - France.

Species	Mean	Std Dev.	Min	Max
<i>FSSE model</i>				
Cod	0.150	0.016	0.102	0.211
Herring	0.086	0.012	0.053	0.131
Pangasius	0.062	0.010	0.036	0.103
Salmon	0.252	0.020	0.189	0.327
Seabass	0.107	0.013	0.068	0.162
Seabream	0.125	0.015	0.082	0.182
Trout	0.104	0.013	0.067	0.155
No choice	0.114	0.007	0.091	0.140
<i>RPE model</i>				
Cod	0.150	0.038	0.044	0.287
Herring	0.086	0.020	0.025	0.145
Pangasius	0.062	0.017	0.016	0.117
Salmon	0.253	0.056	0.082	0.436
Seabass	0.107	0.026	0.032	0.202
Seabream	0.125	0.026	0.040	0.200
Trout	0.104	0.023	0.032	0.177
No choice	0.114	0.057	0.014	0.424

Finally, we have derived six different segments, based on choice probabilities, shown in Table 19. The first two segments (CL1 and CL2), representing overall 45% of the sample, have the largest WTP scores for all fish species and attributes, including a higher WTP for ready-to-cook fishes compared to whole alternatives. These two clusters are less sensitive to price changes. The first segment is mostly composed by younger males, highly educated and with higher income level, living in two-three people families. The second segment is mostly composed by older females, highly educated and with higher income level, living in larger-sized families (four people). The third segment (29% of the sample) exhibits an average WTP, compared to the other segments. It is mostly made of males (53%), middle-high aged, less educated and with lower income, mostly living alone. The fourth and the fifth segments, representing 9% and 5% of the sample, show low price premiums compared to the other ones, exhibiting a higher sensitivity with price changes. Segment four is mostly composed by young females (64%), with lower education and income, living either alone or in larger families (four people or more). Segment six, representing 13% of the sample, exhibits a medium-low willingness to pay premium for all species, but with low sensitivity with price change. It is mostly

composed by young males with medium educational level, and high income, living in larger family units (three and more components).

Table 19: Segmentation of the French market, based on individuals' choice probabilities.

	CL 1	CL 2	CL 3	CL 4	CL5	CL 6
Size of segment (%)	14.61	30.19	28.57	9.09	4.55	12.99
WTP for cod (€/kg)	19.63	18.86	12.35	7.52	4.93	9.96
WTP for herring (€/kg)	10.59	10.30	6.73	4.10	2.69	5.51
WTP for pangasius (€/kg)	9.93	9.58	6.29	3.83	2.51	4.86
WTP for salmon (€/kg)	23.46	22.49	14.75	8.97	5.89	12.01
WTP for seabass (€/kg)	16.88	16.32	10.68	6.50	4.26	8.65
WTP for seabream (€/kg)	16.21	15.60	10.23	6.22	4.08	8.56
WTP for trout (€/kg)	17.45	16.85	11.03	6.71	4.40	8.67
WTP for health claim (€/kg)	0.41	0.44	0.29	0.17	0.11	0.17
WTP for sustainability label (€/kg)	0.90	0.90	0.59	0.36	0.24	0.50
WTP for whole vs. ready-to-cook (€/kg)	-0.83	-0.86	-0.55	-0.34	-0.22	-0.42
WTP for fillet vs. ready-to-cook (€/kg)	1.14	1.07	0.72	0.43	0.28	0.59
WTP for fillet vs. whole (€/kg)	1.98	1.92	1.27	0.77	0.51	1.01
WTP for wild vs. Farmed fish (€/kg)	3.09	2.97	1.95	1.18	0.77	1.50
<i>Price sensitivity (estimated coefficient)</i>	-0.12	-0.19	-0.27	-0.40	-0.60	-0.04
Gender (%)						
Male	51.11	46.24	52.27	35.71	50	55
Female	48.89	53.76	47.73	64.29	50	45
Age group (%)						
Age < 30	15.56	13.98	15.91	32.14	14.29	25
Age 30-40	28.89	25.81	15.91	21.43	28.57	22.5
Age 41-50	24.44	17.20	34.09	28.57	35.71	27.5
Age 51-60	13.33	19.35	21.59	14.29	14.29	12.5
Age >60	17.78	23.66	12.5	3.57	7.14	12.5
Education (%)						
Secondary or lower	20	17.2	22.73	32.14	21.43	12.5
Secondary school	26.67	22.58	32.95	21.43	28.57	37.5
College/University/Postgraduate	53.33	60.22	44.32	46.43	50	50
Income (%)						
Level 1 (lowest)	6.67	7.53	14.77	14.29	21.43	10
Level 2	15.56	15.05	21.59	17.86	7.14	15
Level 3	15.56	15.05	14.77	10.71	21.43	10
Level 4 (highest)	62.22	62.37	48.86	57.14	50	65
Family size (%)						
Family with One person	17.78	20.43	29.55	35.71	21.43	17.5
Family with two people	37.78	36.56	32.95	14.29	42.86	27.5
Family with three people	28.89	13.98	18.18	25	0	22.5
Family with four people	13.33	25.81	9.09	14.29	28.57	22.5
Family with five or more people	2.22	3.23	10.23	10.71	7.14	10

3.2.4 Germany

Table 20 reports the coefficients estimates in the German sample for models with fish species-specific effect (FSSE), with and without beliefs.

Cod, salmon, trout and seabass reported the higher β coefficients, indicating that these species are the most preferred by German consumers. Wild caught alternative is the most preferred compared to the farm-raised fish for all species, with higher β coefficient for seabass. Ready-to-cook products are generally preferred compared to whole (or round cut) fishes and fillets, except for salmon, where fillet is preferred than ready-to-cook product. The sustainability label is generally appreciated for all species, with more significant effects where found for seabass and seabream. The nutritional and health claim reported higher coefficients for seabream and herring.

The willingness to pay results, applying the formula (8), are shown in Table 21. Wild-caught seabass exhibits the highest premium compared to the farm-raised alternative (+51% above the average market price), followed by wild-caught salmon (+35%) and seabream (+32%). As said before, the ready-to-cook products are generally preferred, with highest premiums found for pangasius, cod and seabass, compared to the whole or round cut fish. Consumers are willing to pay 38% price premium for salmon fillets compared to ready-to-cook products. The higher marginal WTP for the sustainability label was found for seabream (+53%), pangasius (49%) and seabass (42%). The WTP for nutritional and health claim is higher for pangasius (+44%) and seabream (+30%).

Table 20: Fish Species-Specific Effect (FSSE) Model, β (mean and std. deviation) - Germany.

β parameter (effects)	Mean	Std dev
Species		
Cod	1.919	0.286
Herring	1.396	0.237
Pangasius	0.812	0.215
Salmon	1.761	0.215
Seabass	1.576	0.360
Seabream	0.473	0.378
Trout	1.613	0.209
Price		
Cod	-0.095	0.013
Herring	-0.123	0.020
Pangasius	-0.068	0.036
Salmon	-0.040	0.009
Seabass	-0.067	0.016
Seabream	-0.051	0.017
Trout	-0.098	0.016
Production method (baseline Farmed)		
Cod (wild caught)	0.205	0.111
Salmon (wild caught)	0.237	0.075
Seabass (wild caught)	0.569	0.127
Seabream (wild caught)	0.269	0.134
Product format (baseline Ready-to-cook)		
Cod (Round cut)	-0.796	0.147
Cod (Fillet)	-0.015	0.122
Herring (Whole)	-0.379	0.127
Herring (Fillet)	-0.063	0.118
Pangasius (Round cut)	-0.664	0.120
Pangasius (Fillet)	-0.071	0.103
Salmon (Round cut)	0.031	0.091
Salmon (Fillet)	0.253	0.090
Seabass (Whole)	-0.506	0.163
Seabass (Fillet)	-0.102	0.145
Seabream (Whole)	-0.213	0.169
Seabream (Fillet)	-0.040	0.162
Trout (Whole)	-0.190	0.110
Trout (Fillet)	-0.178	0.111
Sustainability label (baseline None)		
Cod	0.153	0.111
Herring	0.223	0.105
Pangasius	0.173	0.094
Salmon	0.105	0.077
Seabass	0.473	0.130
Seabream	0.447	0.138
Trout	0.106	0.092
Nutritional and Health claim (baseline None)		
Cod	0.180	0.109
Herring	0.242	0.102
Pangasius	0.157	0.091
Salmon	0.165	0.073
Seabass	-0.052	0.123
Seabream	0.255	0.136
Trout	0.105	0.091
<i>Mean of Log-likelihood</i>	<i>-7529.17</i>	
<i>Accepted Rate</i>	<i>0.575</i>	
<i>Hit probability</i>	<i>0.164</i>	
<i>Average Efficiency</i>	<i>0.598</i>	

Table 21: German consumers' WTP a price premium (in €/kg and % above or below the average market price) for specific fish attributes, based on the estimates of the FSSE model.

Attribute / level	€/kg	%
<i>Production method (baseline Farmed)</i>		
Cod (wild caught)	2.150	12.8%
Salmon (wild caught)	5.908	35.1%
Seabass (wild caught)	8.505	50.6%
Seabream (wild caught)	5.289	31.7%
<i>Product format (baseline Ready-to-cook)</i>		
Cod (Round cut)	-8.358	-49.9%
Cod (Fillet)	-0.154	-0.9%
Herring (Whole)	-3.081	-28.4%
Herring (Fillet)	-0.512	-4.7%
Pangasius (Round cut)	-9.775	-186.2%
Pangasius (Fillet)	-1.040	-19.8%
Salmon (Round cut)	0.771	4.6%
Salmon (Fillet)	6.314	37.5%
Seabass (Whole)	-7.556	-45.0%
Seabass (Fillet)	-1.531	-9.1%
Seabream (Whole)	-4.201	-25.2%
Seabream (Fillet)	-0.793	-4.8%
Trout (Whole)	-1.932	-16.7%
Trout (Fillet)	-1.814	-15.7%
<i>Sustainability label (baseline None)</i>		
Cod	1.606	9.6%
Herring	1.810	16.7%
Pangasius	2.552	48.6%
Salmon	2.613	15.5%
Seabass	7.064	42.0%
Seabream	8.799	52.7%
Trout	1.078	9.3%
<i>Nutritional and Health claim (baseline None)</i>		
Cod	1.895	11.3%
Herring	1.965	18.1%
Pangasius	2.306	43.9%
Salmon	4.102	24.4%
Seabass	-0.782	-4.7%
Seabream	5.020	30.1%
Trout	1.064	9.2%

The RPE model effects (β coefficients mean and standard deviation) are reported in Table 22. The higher utility score was found for salmon, trout and cod, and for wild-caught fishes compared to the farm-raised ones and for ready-to-cook products compared to whole or round cut fishes. The β coefficients are also significant for the sustainability label and nutritional and health claim. The WTP estimates, based on these effects, are reported in Table 23; the higher premiums are associated with salmon and trout (respectively, 28.5 and 22.6 €/kg), and with ready-to-cook (2.7 €/kg compared to the whole alternative) and wild-caught fishes (2.4 €/kg).

Table 22: Random Price Effect (RPE) model, β (mean and standard deviation) - Germany.

β parameter (effects)	Mean	Std dev
Cod	2.641	0.151
Herring	2.207	0.133
Pangasius	1.791	0.099
Salmon	3.626	0.147
Seabass	2.306	0.155
Seabream	2.140	0.156
Trout	2.877	0.126
Wild vs Farmed	0.299	0.053
Whole (round cut) vs. Ready-to-cook	-0.346	0.048
Fillet vs. Ready-to-cook	-0.006	0.047
Sustainability label	0.221	0.039
Nutritional and health claim	0.162	0.038
Price (mean)	-0.127	0.011
Price (variance)	0.036	0.003
<i>Mean of Log-likelihood</i>	<i>-6704.31</i>	
<i>Accepted Rate</i>	<i>0.915</i>	
<i>Hit probability</i>	<i>0.235</i>	
<i>Average Efficiency</i>	<i>0.55</i>	

Table 23: German consumers' WTP (in €/kg) for fish species and attributes, based on the estimates of the RPE model.

Species and Attribute/levels	Mean	Std dev
Cod	20.749	13.700
Herring	17.335	12.109
Pangasius	14.072	9.009
Salmon	28.487	13.345
Seabass	18.117	14.082
Seabream	16.809	14.164
Trout	22.603	11.418
Wild vs Farmed	2.350	4.845
Whole (round cut) vs. Ready-to-cook	-2.721	4.391
Fillet vs. Ready-to-cook	-0.046	4.227
Sustainability label	1.737	3.545
Nutritional and health claim	1.274	3.473

Table 24 shows the choice probability for fish species. This probability is higher for salmon, trout and pangasius, while is lower for seabream and seabass.

Table 24: Choice probability for fish species (mean value, standard deviation, minimum and maximum) with Fish Species-Specific Effect (FSSE) and Random Price Effect (RPE) models - Germany.

Species	Mean	Std Dev.	Min	Max
<i>FSSE model</i>				
Cod	0.099	0.013	0.062	0.150
Herring	0.118	0.013	0.079	0.170
Pangasius	0.145	0.015	0.101	0.202
Salmon	0.253	0.020	0.189	0.326
Seabass	0.072	0.011	0.041	0.120
Seabream	0.061	0.011	0.034	0.107
Trout	0.156	0.015	0.110	0.215
No choice	0.095	0.006	0.076	0.118
<i>RPE model</i>				
Cod	0.099	0.028	0.026	0.207
Herring	0.118	0.025	0.036	0.188
Pangasius	0.144	0.043	0.033	0.297
Salmon	0.253	0.061	0.075	0.451
Seabass	0.072	0.021	0.019	0.156
Seabream	0.061	0.018	0.016	0.134
Trout	0.157	0.032	0.050	0.241
No choice	0.095	0.045	0.012	0.322

We have derived four different segments, based on choice probabilities, shown in Table 25. The first cluster, representing 28% of the sample, is the one with the highest willingness to pay for all species and attributes, including the ready-to-cook alternatives. It is almost equally composed by young males and females, with medium-to-high educational level, and high incomes, mostly living with small family units (one or two members). Segment two is the smallest one (13.5%). It reports a low willingness to pay for all species and attributes, compared to the other segments. This segment is made by young and old people (middle aged less represented), with medium educational level, and high income, living in large family units (three people or more). The third segment is the largest (32%); it exhibits a medium willingness to pay for species and attributes. It is mostly composed by males, middle-old aged, average education, high income, and living in families with two people. Finally, the fourth segment (26%), reports a low willingness to pay for all species and attributes. It is made by middle-age females (59%), with low educational level, middle income and living in small family units.

Table 25: Segmentation of the German market, based on individuals' choice probabilities.

	CL 1	CL 2	CL 3	CL 4
Size of segment (%)	28.38	13.51	31.76	26.35
WTP for cod (€/kg)	20.41	9.00	14.04	7.64
WTP for herring (€/kg)	17.07	7.51	11.73	6.38
WTP for pangasius (€/kg)	13.83	6.10	9.54	5.18
WTP for salmon (€/kg)	28.02	12.30	19.32	10.49
WTP for seabass (€/kg)	17.83	7.71	12.24	6.67
WTP for seabream (€/kg)	16.50	7.21	11.36	6.18
WTP for trout (€/kg)	22.22	9.65	15.32	8.32
WTP for health claim (€/kg)	1.26	0.61	0.89	0.47
WTP for sustainability label (€/kg)	1.65	0.77	1.18	0.64
WTP for whole vs. ready-to-cook (€/kg)	-2.71	-1.17	-1.86	-1.00
WTP for fillet vs. ready-to-cook (€/kg)	-0.05	-0.07	-0.02	-0.02
WTP for fillet vs. whole (€/kg)	2.66	1.10	1.84	0.99
WTP for wild vs. Farmed fish (€/kg)	2.26	1.21	1.61	0.87
<i>Price sensitivity (estimated coefficient)</i>	<i>-0.12</i>	<i>-0.04</i>	<i>-0.22</i>	<i>-0.38</i>
Gender (%)				
Male	48.81	47.5	59.57	41.03
Female	51.19	52.5	40.43	58.97
Age group (%)				
Age < 30	17.86	17.5	13.83	12.82
Age 30-40	22.62	27.5	20.21	16.67
Age 41-50	22.62	12.5	25.53	23.08
Age 51-60	21.43	20	18.09	29.49
Age >60	15.48	22.5	22.34	17.95
Education (%)				
Secondary or lower	13.1	15	15.96	25.64
Secondary school	21.43	22.5	21.28	10.26
College/University/Postgraduate	65.48	62.5	62.77	64.10
Income (%)				
Level 1 (lowest)	11.9	12.5	10.64	10.26
Level 2	9.52	5	10.64	19.23
Level 3	30.95	27.5	32.98	39.74
Level 4 (highest)	47.62	55	45.74	30.77
Family size (%)				
Family with One person	35.71	10	18.09	32.05
Family with two people	40.48	27.5	45.74	32.05
Family with three people	13.1	27.5	15.96	25.64
Family with four people	5.95	25	17.02	8.97
Family with five or more people	4.76	10	3.19	1.28

3.2.5 UK

Table 26 reports the coefficients estimates in the UK sample for models with fish species-specific effect (FSSE).

The high coefficients reported for salmon and cod indicate that these species are the most preferred by the UK consumers, while the least preferred are pangasius and seabass, exhibiting a negative β coefficient which denotes that these species decrease the consumers' utility. Wild caught alternative are generally preferred, in particular seabass and salmon. Ready-to-cook products are preferred compared to while or round cut for all fish species, except for salmon. Fish fillet is preferred than ready-to-cook products for salmon and seabream, while it is less preferred for trout and pangasius. The sustainability label is mostly appreciated for herring and seabream, whilst it is detrimental for consumers' utility in the case of pangasius. The nutritional and health claim is mostly appreciated for pangasius, salmon and trout.

Table 10 shows the WTP estimates, in £/kg and as a % of the average price, applying the formula (8). The results show a +48% price premium consumers are willing to pay for wild-caught seabass compared to farmed alternative. The higher marginal WTP for format attribute have been found for ready-to-cook products, compared to whole/round cut fish, in the case of herring (81%), seabass (49%), cod (37%), trout (33%) and seabream (30%). Salmon fillet is preferred compared to the ready-to-cook alternative (+44%). The higher WTP for the sustainability scheme was found for herring (+62%), while the WTP for nutritional and health claim is higher for pangasius (+26%).

Table 26: Fish Species-Specific Effect (FSSE) Model, β (mean and standard deviation) – UK.

β parameter (effects)	Mean	Std dev
Species		
Cod	1.469	0.216
Herring	-0.064	0.244
Pangasius	-0.938	0.411
Salmon	1.569	0.209
Seabass	0.751	0.359
Seabream	-0.316	0.433
Trout	0.245	0.346
Price		
Cod	-0.076	0.011
Herring	-0.086	0.045
Pangasius	-0.073	0.042
Salmon	-0.077	0.011
Seabass	-0.043	0.012
Seabream	-0.055	0.018
Trout	-0.099	0.022
Production method (baseline Farmed)		
Cod (wild caught)	0.084	0.082
Salmon (wild caught)	0.284	0.075
Seabass (wild caught)	0.431	0.127
Seabream (wild caught)	0.111	0.160
Product format (baseline Ready-to-cook)		
Cod (Round cut)	-0.402	0.099
Cod (Fillet)	0.091	0.090
Herring (Whole)	-0.322	0.129
Herring (Fillet)	-0.087	0.121
Pangasius (Round cut)	-0.231	0.228
Pangasius (Fillet)	-0.142	0.218
Salmon (Round cut)	0.331	0.090
Salmon (Fillet)	0.479	0.089
Seabass (Whole)	-0.434	0.157
Seabass (Fillet)	-0.027	0.141
Seabream (Whole)	-0.313	0.215
Seabream (Fillet)	0.149	0.193
Trout (Whole)	-0.489	0.194
Trout (Fillet)	-0.165	0.173
Sustainability label (baseline None)		
Cod	0.124	0.080
Herring	0.249	0.108
Pangasius	-0.204	0.186
Salmon	0.073	0.076
Seabass	0.032	0.120
Seabream	0.165	0.162
Trout	-0.018	0.152
Nutritional and Health claim (baseline None)		
Cod	0.054	0.079
Herring	0.003	0.108
Pangasius	0.176	0.181
Salmon	0.178	0.071
Seabass	0.034	0.122
Seabream	0.027	0.166
Trout	0.139	0.155
<i>Mean of Log-likelihood</i>	<i>-6818.34</i>	
<i>Accepted Rate</i>	<i>0.437</i>	
<i>Hit probability</i>	<i>0.201</i>	
<i>Average Efficiency</i>	<i>0.372</i>	

Table 27: UK consumers' WTP a price premium (in £/kg, €/kg⁵ and % of the average market price) for specific fish attributes, based on the estimates of the FSSE model.

Attribute / level	£/kg	€/kg	%
<i>Production method (baseline Farmed)</i>			
Cod (wild caught)	1.100	1.276	7.8%
Salmon (wild caught)	3.691	4.281	25.9%
Seabass (wild caught)	10.087	11.701	48.2%
Seabream (wild caught)	2.025	2.350	10.6%
<i>Product format (baseline Ready-to-cook)</i>			
Cod (Round cut)	-5.262	-6.104	-37.4%
Cod (Fillet)	1.191	1.382	8.5%
Herring (Whole)	-3.749	-4.349	-80.8%
Herring (Fillet)	-1.012	-1.173	-21.8%
Pangasius (Round cut)	-3.153	-3.658	-34.4%
Pangasius (Fillet)	-1.944	-2.255	-21.2%
Salmon (Round cut)	4.300	4.988	30.1%
Salmon (Fillet)	6.218	7.213	43.6%
Seabass (Whole)	-10.157	-11.782	-48.6%
Seabass (Fillet)	-0.630	-0.731	-3.0%
Seabream (Whole)	-5.698	-6.610	-29.8%
Seabream (Fillet)	2.716	3.151	14.2%
Trout (Whole)	-4.943	-5.734	-33.3%
Trout (Fillet)	-1.665	-1.932	-11.2%
<i>Sustainability label (baseline None)</i>			
Cod	1.621	1.881	11.5%
Herring	2.894	3.357	62.4%
Pangasius	-2.791	-3.237	-30.4%
Salmon	0.949	1.101	6.7%
Seabass	0.749	0.869	3.6%
Seabream	2.996	3.476	15.7%
Trout	-0.185	-0.215	-1.2%
<i>Nutritional and Health claim (baseline None)</i>			
Cod	0.704	0.816	5.0%
Herring	0.036	0.042	0.8%
Pangasius	2.410	2.796	26.3%
Salmon	2.306	2.676	16.2%
Seabass	0.799	0.926	3.8%
Seabream	0.485	0.563	2.5%
Trout	1.402	1.627	9.4%

⁵ The exchange rate used is 1 GB £ = 1.16 €.

The RPE model results are reported in Table 28, where the β coefficients (mean and standard deviation) are shown.

Table 28: Random Price Effect (RPE) model, β (mean and standard deviation) - UK.

β parameter (effects)	Mean	Std dev
Cod	2.774	0.134
Herring	0.524	0.102
Pangasius	0.285	0.139
Salmon	2.979	0.133
Seabass	1.892	0.167
Seabream	1.259	0.169
Trout	1.322	0.148
Wild vs Farmed	0.226	0.050
Whole (round cut) vs. Ready-to-cook	-0.174	0.053
Fillet vs. Ready-to-cook	0.145	0.051
Sustainability label	0.112	0.042
Nutritional and health claim	0.097	0.042
Price (mean)	-0.148	0.012
Price (variance)	0.039	0.003
<i>Mean of Log-likelihood</i>	-5863.98	
<i>Accepted Rate</i>	0.887	
<i>Hit probability</i>	0.298	
<i>Average Efficiency</i>	0.488	

Table 29: UK consumers' WTP (in £/kg and €/kg⁶) for fish species and attributes, based on the estimates of the RPE model.

Species and Attribute/levels	Mean (£/kg)	Std dev (£/kg)	Mean (€/kg)	Std dev (€/kg)
Cod	18.781	11.617	21.786	13.476
Herring	3.545	8.896	4.112	10.319
Pangasius	1.926	12.052	2.234	13.981
Salmon	20.170	11.557	23.397	13.406
Seabass	12.810	14.548	14.859	16.875
Seabream	8.526	14.661	9.890	17.007
Trout	8.953	12.878	10.385	14.939
Wild vs Farmed	1.529	4.313	1.774	5.003
Whole (round cut) vs. Ready-to-cook	-1.180	4.583	-1.369	5.316
Fillet vs. Ready-to-cook	0.983	4.409	1.140	5.114
Sustainability label	0.758	3.643	0.879	4.226
Nutritional and health claim	0.657	3.626	0.763	4.206

The higher utility score was found for salmon and cod, and for wild caught fishes compared to the farm-raised ones. Ready-to-cook products are generally preferred compared to the

⁶ The exchange rate used is 1 GB £ = 1.16 €.

whole/round cut alternatives. To a lesser extent the β coefficients are also positive for the fillets compared to the ready-to-cook alternatives, and for the sustainability label.

The WTP estimates, based on these effects, are reported in Table 29; the higher premiums for fish species are associated with salmon and cod (respectively, 23.4 and 21.8 €/kg). For the attributes, wild-caught fishes carry the higher premiums (1.8 €/kg), followed by ready-to-cook products compared to whole alternative (1.4 €/kg), and by fish fillets compared to ready-to-cook ones (1.1 €/kg).

The choice probability, reported in Table 30, indicate that salmon and cod are the most chosen alternatives, while pangasius, seabream and trout are the least preferred ones.

Table 30: Choice probability for fish species (mean value, standard deviation, minimum and maximum) with Fish Species-Specific Effect (FSSE) and Random Price Effect (RPE) models - UK.

Species	Mean	Std Dev.	Min	Max
<i>FSSE model</i>				
Cod	0.235	0.048	0.072	0.370
Herring	0.112	0.034	0.025	0.228
Pangasius	0.032	0.008	0.009	0.061
Salmon	0.280	0.055	0.090	0.431
Seabass	0.075	0.032	0.014	0.237
Seabream	0.042	0.016	0.009	0.120
Trout	0.048	0.012	0.013	0.093
No choice	0.176	0.065	0.033	0.460
<i>RPE model</i>				
Cod	0.235	0.048	0.072	0.369
Herring	0.112	0.034	0.026	0.228
Pangasius	0.032	0.008	0.009	0.061
Salmon	0.280	0.055	0.090	0.431
Seabass	0.075	0.032	0.014	0.237
Seabream	0.042	0.016	0.009	0.120
Trout	0.048	0.012	0.013	0.093
No choice	0.176	0.065	0.033	0.464

We have derived four different segments for the UK market, based on choice probabilities (Table 31). The first segment (13%) is the one with the lowest WTP for all species and attributes, and the one more sensitive with price changes. It shows, compared to the other segments, a higher incidence of middle-aged females, with low education and low income, living in larger family units. Segment 2 is the largest one (41% of the sample), showing, compared to the other segment a medium-high WTP. Younger males are more represented, with higher educational level and income, and living in families with three or four members. The third segment (27%) shows low estimates of premium prices; it is mostly composed by

females, with medium income level and education, living in small family units. Segment 4 (19%) is the one with the highest estimated WTP; middle-aged and older females are more represented, as well as middle educated and income levels, and mostly living in families with two members.

Table 31: Segmentation of the UK market, based on individuals' choice probabilities.

	CL 1	CL 2	CL 3	CL 4
Size of segment (%)	13.07	41.34	26.75	18.84
WTP for cod (£/kg)	5.81	14.07	10.54	18.13
WTP for herring (£/kg)	1.10	2.69	1.99	3.41
WTP for pangasius (£/kg)	0.59	1.40	1.08	1.83
WTP for salmon (£/kg)	6.24	15.00	11.32	19.47
WTP for seabass (£/kg)	3.96	9.88	7.19	12.32
WTP for seabream (£/kg)	2.63	6.37	4.77	8.18
WTP for trout (£/kg)	2.77	6.71	5.02	8.61
WTP for health claim (£/kg)	0.20	0.49	0.37	0.64
WTP for sustainability label (£/kg)	0.23	0.51	0.43	0.73
WTP for whole vs. ready-to-cook (£/kg)	-0.37	-0.75	-0.66	-1.14
WTP for fillet vs. ready-to-cook (£/kg)	0.30	0.76	0.55	0.94
WTP for fillet vs. whole (£/kg)	0.67	1.51	1.21	2.09
WTP for wild vs. Farmed fish (£/kg)	0.47	1.10	0.86	1.49
<i>Price sensitivity (estimated coefficient)</i>	-0.50	-0.08	-0.28	-0.18
Gender (%)				
Male	44.19	55.15	45.45	41.94
Female	55.81	44.85	54.55	58.06
Age group (%)				
Age < 30	9.3	18.38	21.59	16.13
Age 30-40	23.26	35.29	20.45	14.52
Age 41-50	39.53	18.38	21.59	29.03
Age 51-60	23.26	21.32	22.73	27.42
Age >60	4.65	6.62	13.64	12.9
Education (%)				
Secondary or lower	20.93	16.18	18.18	9.68
Secondary school	23.26	22.79	32.95	35.48
College/University/Postgraduate	55.81	61.03	48.86	54.84
Income (%)				
Level 1 (lowest)	23.26	8.09	11.36	12.9
Level 2	18.6	27.21	23.86	27.42
Level 3	6.98	10.29	23.86	17.74
Level 4 (highest)	51.16	54.41	40.91	41.94
Family size (%)				
Family with One person	16.28	16.91	23.86	16.13
Family with two people	32.56	27.94	29.55	40.32
Family with three people	16.28	24.26	14.77	19.35
Family with four people	20.93	21.32	20.45	16.13
Family with five or more people	13.95	9.56	11.36	8.06

3.2.6 Spain

Table 32 reports the coefficients estimates in the Spanish sample for models with fish species-specific effect (FSSE), with and without beliefs.

Seabass, seabream and cod are the species with the highest β coefficients in the FSSE model, indicating a stronger preference of Spanish consumers for these products, while pangasius is the least preferred one. Wild-caught alternative are generally appreciated, while wild-caught seabass carrying the highest utility. Ready-to-cook products are preferred compared to while or round cut in the case of cod, pangasius and herring, while it is less preferred for salmon and seabream. This result is very similar to the Italian case. Fish fillets are generally preferred than ready-to-cook products apart from trout and pangasius. The sustainability label coefficient carrying the higher utility for consumers was found for trout, herring and seabream. The nutritional and health claim is generally appreciated, where higher scores are found for pangasius.

The price premiums (in €/kg and % of the average price) that Spanish consumers are willing to pay for species and attributes, estimated with formula (8), are shown in Table 33. The higher relative WTP has been found in the case of wild-caught seabass, compared to the farm-raised alternative (+19%). Salmon fillet carries the higher premium compared to ready-to-cook alternative (+53%), whilst ready-to-cook trout is preferred than the fillet alternative, showing a 47% WTP. Consumers are willing to pay a premium for ready-to-cook pangasius compared to round cut and fillets, respectively, +36% and 32% premium. The higher WTP for the sustainability label and nutritional and health claim was found for trout (respectively, +33% and +37%) and pangasius (respectively, +30% and +68%).

Table 32: Fish Species-Specific Effect (FSSE) Model, β (mean and standard deviation) - Spain.

β parameter (effects)	Mean	Std dev
Species		
Cod	2.144	0.262
Herring	1.099	0.337
Pangasius	0.615	0.256
Salmon	1.597	0.237
Seabass	2.325	0.268
Seabream	2.249	0.241
Trout	1.192	0.209
Price		
Cod	-0.129	0.017
Herring	-0.137	0.026
Pangasius	-0.099	0.043
Salmon	-0.070	0.013
Seabass	-0.129	0.018
Seabream	-0.164	0.019
Trout	-0.090	0.030
Production method (baseline Farmed)		
Cod (wild caught)	0.132	0.096
Salmon (wild caught)	0.105	0.081
Seabass (wild caught)	0.267	0.093
Seabream (wild caught)	0.113	0.086
Product format (baseline Ready-to-cook)		
Cod (Round cut)	-0.143	0.118
Cod (Fillet)	0.120	0.114
Herring (Whole)	-0.061	0.185
Herring (Fillet)	0.136	0.178
Pangasius (Round cut)	-0.185	0.135
Pangasius (Fillet)	-0.164	0.132
Salmon (Round cut)	0.299	0.104
Salmon (Fillet)	0.472	0.104
Seabass (Whole)	0.011	0.115
Seabass (Fillet)	0.030	0.114
Seabream (Whole)	0.238	0.108
Seabream (Fillet)	0.222	0.110
Trout (Whole)	-0.046	0.104
Trout (Fillet)	-0.253	0.112
Sustainability label (baseline None)		
Cod	0.153	0.097
Herring	0.174	0.148
Pangasius	0.156	0.108
Salmon	0.064	0.086
Seabass	-0.069	0.093
Seabream	0.162	0.086
Trout	0.176	0.091
Nutritional and Health claim (baseline None)		
Cod	0.096	0.096
Herring	0.023	0.142
Pangasius	0.349	0.109
Salmon	0.181	0.080
Seabass	0.189	0.095
Seabream	0.174	0.086
Trout	0.198	0.091
<i>Mean of Log-likelihood</i>	<i>-7820.090</i>	
<i>Accepted Rate</i>	<i>0.621</i>	
<i>Hit probability</i>	<i>0.154</i>	
<i>Average Efficiency</i>	<i>0.696</i>	

Table 33: Spanish consumers' WTP a price premium (in €/kg and % above or below the average market price) for specific fish attributes, based on the estimates of the FSSE model.

Attribute / level	€/kg	%
<i>Production method (baseline Farmed)</i>		
Cod (wild caught)	1.027	8.6%
Salmon (wild caught)	1.503	11.7%
Seabass (wild caught)	2.061	18.7%
Seabream (wild caught)	0.686	7.0%
<i>Product format (baseline Ready-to-cook)</i>		
Cod (Round cut)	-1.110	-9.3%
Cod (Fillet)	0.927	7.7%
Herring (Whole)	-0.447	-3.8%
Herring (Fillet)	0.992	8.3%
Pangasius (Round cut)	-1.873	-35.8%
Pangasius (Fillet)	-1.661	-31.8%
Salmon (Round cut)	4.296	33.4%
Salmon (Fillet)	6.777	52.7%
Seabass (Whole)	0.087	0.8%
Seabass (Fillet)	0.230	2.1%
Seabream (Whole)	1.450	14.7%
Seabream (Fillet)	1.351	13.7%
Trout (Whole)	-0.512	-8.6%
Trout (Fillet)	-2.815	-47.2%
<i>Sustainability label (baseline None)</i>		
Cod	1.183	9.9%
Herring	1.273	10.7%
Pangasius	1.578	30.2%
Salmon	0.914	7.1%
Seabass	-0.532	-4.8%
Seabream	0.987	10.0%
Trout	1.959	32.8%
<i>Nutritional and Health claim (baseline None)</i>		
Cod	0.745	6.2%
Herring	0.168	1.4%
Pangasius	3.534	67.6%
Salmon	2.595	20.2%
Seabass	1.460	13.2%
Seabream	1.062	10.8%
Trout	2.203	36.9%

The RPE model effects (β coefficients mean and standard deviation) are reported in Table 34. The higher utility score was found for salmon, seabream, seabass and cod, and for wild-caught fishes compared to the farm-raised ones. The β coefficients are also significant for the sustainability label and nutritional and health claim. The WTP estimates, based on these effects, are reported in Table 35; the higher premiums for species are associated with salmon (mean premium 20.7 €/kg), seabream (18.4 €/kg) and cod (18.1 €/kg). The nutritional and health claim carries the highest premium among the attributes, with 1.1 €/kg.

Table 34: Random Price Effect (RPE) model, β (mean and standard deviation) - Spain.

β parameter (effects)	Mean	Std dev
Cod	3.197	0.144
Herring	2.192	0.154
Pangasius	1.841	0.113
Salmon	3.653	0.146
Seabass	3.153	0.140
Seabream	3.239	0.133
Trout	2.552	0.113
Wild vs Farmed	0.157	0.046
Whole (round cut) vs. Ready-to-cook	0.052	0.046
Fillet vs. Ready-to-cook	0.108	0.046
Sustainability label	0.121	0.037
Nutritional and health claim	0.186	0.036
Price (mean)	-0.176	0.013
Price (variance)	0.049	0.004
<i>Mean of Log-likelihood</i>	<i>-7121.84</i>	
<i>Accepted Rate</i>	<i>0.931</i>	
<i>Hit probability</i>	<i>0.205</i>	
<i>Average Efficiency</i>	<i>0.573</i>	

Table 35: Spanish consumers' WTP (in €/kg) for fish species and attributes, based on the estimates of the RPE model.

Species and Attribute/levels	Mean	Std dev
Cod	18.144	11.171
Herring	12.438	11.961
Pangasius	10.451	8.791
Salmon	20.734	11.318
Seabass	17.896	10.845
Seabream	18.385	10.341
Trout	14.481	8.744
Wild vs Farmed	0.889	3.527
Whole (round cut) vs. Ready-to-cook	0.296	3.581
Fillet vs. Ready-to-cook	0.610	3.535
Sustainability label	0.689	2.876
Nutritional and health claim	1.054	2.822

Table 36 shows the choice probability for fish species. This probability is higher for salmon, seabream and trout, while is lower for herring and pangasius.

Table 36: Choice probability for fish species (mean value, standard deviation, minimum and maximum) with Fish Species-Specific Effect (FSSE) and Random Price Effect (RPE) models - Spain.

Species	Mean	Std Dev.	Min	Max
<i>FSSE model</i>				
Cod	0.130	0.015	0.086	0.187
Herring	0.053	0.009	0.029	0.090
Pangasius	0.095	0.012	0.060	0.141
Salmon	0.189	0.018	0.135	0.256
Seabass	0.136	0.015	0.091	0.196
Seabream	0.169	0.017	0.116	0.231
Trout	0.156	0.015	0.110	0.215
No choice	0.073	0.005	0.057	0.092
<i>RPE model</i>				
Cod	0.130	0.033	0.038	0.249
Herring	0.053	0.014	0.014	0.110
Pangasius	0.094	0.027	0.022	0.185
Salmon	0.189	0.051	0.054	0.380
Seabass	0.136	0.030	0.043	0.234
Seabream	0.169	0.032	0.057	0.259
Trout	0.156	0.039	0.042	0.274
No choice	0.073	0.039	0.007	0.297

We have derived seven different segments, based on choice probabilities, shown in Table 37. The first cluster, which is the larger one (21%), shows medium price premiums, compared to the other clusters, for species and attributes. It is mostly made by young females, highly educated, with high income and relatively medium-large family units (four people). Segment 2 (18% of the sample), showing the highest WTPs, is composed by young males, with high income, living in large family units (four people or more). Segment 3 shows medium-high WTP estimates too (19% of the sample), is relatively more representative of older females, with lower income level, living in smaller family units. The fourth segment (19% of the sample) shows an average WTP for species and attributes. It is mostly composed by middle-aged males, less educated and with lower income. Segments 5, 6 and 7 are all exhibiting lower premiums estimates for species and attributes.

Table 37: Segmentation of the Spanish market, based on individuals' choice probabilities.

	CL 1	CL 2	CL 3	CL 4	CL5	CL 6	CL 7
Size of segment (%)	20.61	17.88	18.79	18.79	10.61	7.27	6.06
WTP for cod (€/kg)	11.98	18.53	13.98	10.27	0.82	7.83	5.12
WTP for herring (€/kg)	8.26	12.73	9.60	7.02	0.81	5.37	3.51
WTP for pangasius (€/kg)	6.87	10.68	8.07	5.93	0.47	4.51	2.95
WTP for salmon (€/kg)	13.62	21.19	15.99	11.73	1.17	8.95	5.85
WTP for seabass (€/kg)	11.82	18.32	13.79	10.13	0.96	7.72	5.05
WTP for seabream (€/kg)	12.11	18.81	14.17	10.40	1.00	7.94	5.19
WTP for trout (€/kg)	9.45	14.85	11.17	8.20	0.67	6.25	4.09
WTP for health claim (€/kg)	0.63	1.07	0.81	0.59	0.10	0.46	0.30
WTP for sustainability label (€/kg)	0.48	0.70	0.53	0.38	0.04	0.30	0.19
WTP for whole vs. ready-to-cook (€/kg)	0.21	0.30	0.23	0.16	-0.06	0.13	0.08
WTP for fillet vs. ready-to-cook (€/kg)	0.35	0.61	0.46	0.35	-0.03	0.26	0.17
WTP for fillet vs. whole (€/kg)	0.14	0.31	0.23	0.19	0.03	0.14	0.09
WTP for wild vs. Farmed fish (€/kg)	0.57	0.91	0.68	0.51	-0.20	0.38	0.25
<i>Price sensitivity (estimated coefficient)</i>	-0.13	-0.20	-0.28	-0.36	-0.03	-0.43	-0.65
Gender (%)							
Male	44.12	55.93	46.77	56.45	42.86	62.5	50.00
Female	55.88	44.07	53.23	43.55	57.14	37.5	50.00
Age group (%)							
Age < 30	16.18	25.42	19.35	25.81	20.00	12.5	20.00
Age 30-40	35.29	27.12	24.19	20.97	28.57	16.67	20.00
Age 41-50	23.53	18.64	16.13	29.03	25.71	33.33	40.00
Age 51-60	20.59	18.64	24.19	20.97	14.29	33.33	15.00
Age >60	4.41	10.17	16.13	3.23	11.43	4.17	5.00
Education (%)							
Secondary or lower	26.47	38.98	35.48	43.55	34.29	45.83	55.00
Secondary school	17.65	11.86	14.52	11.29	11.43	12.5	10.00
College/University/Postgraduate	55.88	49.15	50	45.16	54.29	41.67	35.00
Income (%)							
Level 1 (lowest)	1.47	5.08	19.35	14.52	5.71	16.67	15.00
Level 2	11.76	16.95	14.52	24.19	17.14	20.83	20.00
Level 3	23.53	20.34	16.13	16.13	22.86	25	15.00
Level 4 (highest)	63.24	57.63	50.00	45.16	54.29	37.5	50.00
Family size (%)							
Family with One person	2.94	6.78	14.52	4.84	5.71	8.33	25.00
Family with two people	23.53	13.56	25.81	19.35	31.43	25	35.00
Family with three people	23.53	20.34	27.42	33.87	34.29	41.67	20.00
Family with four people	41.18	44.07	25.81	25.81	28.57	16.67	20.00
Family with five or more people	8.82	15.25	6.45	16.13	0.00	8.33	0.00

4. Conclusions

The activity performed in Task 4.4, resulting in this Deliverable (D4.7), investigated consumer demand and choice behaviour for fresh fish using an online choice experiment. In particular, we examined consumer preferences in five countries for different fish alternative species and attributes, using a labelled choice experiment (LCE). The results in terms of part-worth associated with the single attributes allowed to estimate consumers' willingness to pay (WTP) for the salient product characteristics. The heterogeneous choices and preferences across countries and species suggested the application of a model where the attribute part-worth were estimated separately for every species in every country (fish species-specific effects model – FSSE). Using a random price effect (RPE) model we estimated the effects and WTP for attributes at consumers' individual level; the individual consumers' choice probability so estimated thus was used for segmentations in every country.

These results are actionable for marketing strategy and useful input in the developing of the decision support system (PrimeDSS). In particular, using the WTP results of the FSSE model it will be possible to estimate, in the five countries, the consumers' willingness to pay a premium for specific species-related attributes cumulated in a product profile with certain characteristics. In other words, the DSS user, by selecting the preferred characteristics of the given species in a specific country, will retrieve the estimated consumers' willingness to pay for that product, based on the estimated model on the data collected. Given the representativeness of the sample in every country, this result will provide stakeholder with a clear guidance about the (hypothetical) consumers' preferences for each product profile.

Similarly, the segmentation performed using the RPE model will provide DSS users with more details about the characteristics of the market segment more attracted by the given product profile. In addition, RPE model effects will enable us to estimate price elasticities, in which cross price elasticities among fish species are not constant. With these outcome it will be possible to develop competitiveness clouds and vulnerability index.

Finally, the present activity have been implemented in parallel with the survey in Task 5.4, with a number of common questions (the “bridge questions”) leaving the possibly to combine the results of both surveys in a more powerful tool to be implemented in the PrimeDSS.

The results of WTP and price elasticity for markets and segments across the five surveyed countries, as well as the possibility to combine the survey in Tasks 4.4 and 5.4, will be further investigated in Tasks 5.4 and 5.5, and eventually used as an input for the PrimeDSS development in WP6 of the project.



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Appendix

Synthesis of the qualitative phase

Table A1: Familiarity, attributes, barriers, and format for fish species and countries, as retrieved from the qualitative phase (Task 4.1)

Country	General fish	Trout	Herring	Salmon	Sea bass	Sea bream	Cod
Italy	<p><u>Attributes:</u> freshness, certified origin, brand for processed / frozen, healthy / omega3, trust in producer / salesman, promotion, wild / farmed</p> <p><u>Barriers:</u> price, fish bones, cooking difficult, farming concerns</p> <p><u>Format:</u> fresh, frozen, canned, salted, smoked</p>	<p><u>Familiarity:</u> high</p> <p><u>Attributes:</u> wild / farmed, freshness, origin</p> <p><u>Barriers:</u> dislike taste, not sustainable farming</p> <p><u>Format:</u> fresh whole fish</p>	<p><u>Familiarity:</u> low</p> <p><u>Attributes:</u> none, taste/healthy</p> <p><u>Barriers:</u> limited consumption, difficult to find it</p> <p><u>Format:</u> smoked, salted, dried</p>	<p><u>Familiarity:</u> high</p> <p><u>Attributes:</u> origin Norway / Scotland (smoked), colour, freshness (fresh), versatility in preparation</p> <p><u>Barriers:</u> farmed, bones</p> <p><u>Format:</u> fresh (raw, sliced), smoked (vacuum), less frequent frozen</p>	<p><u>Familiarity:</u> high</p> <p><u>Attributes:</u> freshness, eco-farming, health (light), taste</p> <p><u>Barriers:</u> taste, fish bones, farming feed and pollution</p> <p><u>Format:</u> fresh, fillets (also frozen)</p>	<p><u>Familiarity:</u> high</p> <p><u>Attributes:</u> freshness, eco-farming, health (light), taste</p> <p><u>Barriers:</u> taste, fish bones, farming feed and pollution</p> <p><u>Format:</u> fresh, fillets (also frozen)</p>	<p><u>Familiarity:</u> high</p> <p><u>Attributes:</u> easy to cook, healthy fats, processed</p> <p><u>Barriers:</u> bad smell, difficult to cook</p> <p><u>Format:</u> fresh fillet, frozen, box, salted, smoked, squared/blocks</p>
France	<p><u>Attributes:</u> format fresh (fillet, whole), freshness, origin, wild / farmed, organic farmed, colour, healthy (fats, weight control)</p> <p><u>Barriers:</u> price, bones, smell, short storage, origin Norway for farmed, complicated traceability, labels not known, animal welfare critics (overcrowded, antibiotics)</p> <p><u>Format:</u> fresh (fillet, whole), smoked, canned, frozen, cello-wrapped</p>	<p><u>Familiarity:</u> medium/low</p> <p><u>Attributes:</u> local origin, fresh appearance</p> <p><u>Barriers:</u> industrial / farmed, bones, see head</p> <p><u>Format:</u> smoked fillets, whole raw, fillet raw</p>	<p><u>Familiarity:</u> low</p> <p><u>Attributes:</u> none, good for health</p> <p><u>Barriers:</u> low familiarity, low presence in restaurant</p> <p><u>Format:</u> smoked, salted, fillets</p>	<p><u>Familiarity:</u> medium/high</p> <p><u>Attributes:</u> origin (Norway), wild / farmed, healthy (omega3)</p> <p><u>Barriers:</u> farmed, too fat, too dry</p> <p><u>Format:</u> raw fresh fillets, smoked, whole</p>	<p><u>Familiarity:</u> medium/low</p> <p><u>Attributes:</u> none, wild / farmed, fine taste, texture</p> <p><u>Barriers:</u> price</p> <p><u>Format:</u> whole, fillets</p>	<p><u>Familiarity:</u> medium</p> <p><u>Attributes:</u> none, taste</p> <p><u>Barriers:</u> fish bones</p> <p><u>Format:</u> whole, fillets</p>	<p><u>Familiarity:</u> medium/low</p> <p><u>Attributes:</u> wild / farmed, taste, origin (Portugal)</p> <p><u>Barriers:</u> smell, bones</p> <p><u>Format:</u> raw fillet, frozen</p>

Table A1: continue.

Country	General fish	Trout	Herring	Salmon	Sea bass	Sea bream	Cod
UK	<p><u>Attributes:</u> health (natural, no additives, low calories, omega3), environment / ethics, price/promotion, brand, organic and Fairtrade certification, wild/farmed, freshness (day of catch, used before..), eco-certification (tuna fish)</p> <p><u>Barriers:</u> price, smell, bones, farmed, unavailability</p> <p><u>Format:</u> fresh whole, fresh fillets, frozen, smoked</p>	<p><u>Familiarity:</u> low</p> <p><u>Attributes:</u> appearance / freshness, colour, price, omega3</p> <p><u>Barriers:</u> bones, farmed</p> <p><u>Format:</u> whole fish, smoked fillets</p>	<p><u>Familiarity:</u> low</p> <p><u>Attributes:</u> none, omega3</p> <p><u>Barriers:</u> strong taste, bones</p> <p><u>Format:</u> smoked</p>	<p><u>Familiarity:</u> high</p> <p><u>Attributes:</u> taste, texture, easy to cook, wild / farmed, healthy (omega3)</p> <p><u>Barriers:</u> farmed, price</p> <p><u>Format:</u> fresh fillets, smoked</p>	<p><u>Familiarity:</u> low</p> <p><u>Attributes:</u> taste</p> <p><u>Barriers:</u> price</p> <p><u>Format:</u> fillets or whole fish</p>	<p><u>Familiarity:</u> low</p> <p><u>Attributes:</u> taste, texture</p> <p><u>Barriers:</u> fillets or whole fish</p>	<p><u>Familiarity:</u> high</p> <p><u>Attributes:</u> taste, texture, freshness</p> <p><u>Barriers:</u> weak taste, overfishing</p> <p><u>Format:</u> fresh or frozen fillets</p>
Germany	<p><u>Attributes:</u> freshness, taste, appearance / colour, price, certificate / label (MSC), origin / traceability, organic, no additives, wild / farmed, health benefit (low fat, omega3, proteins), convenience (easy to prepare), brand (packed, processed)</p> <p><u>Barriers:</u> overfishing, farming conditions (additives, pollution), processed fish, availability, price, bones</p> <p><u>Format:</u> smoked, fresh fillets, frozen fillets, canned fish, salted</p>	<p><u>Familiarity:</u> medium/high</p> <p><u>Attributes:</u> taste, freshness, appearance</p> <p><u>Barriers:</u> bones, appearance</p> <p><u>Format:</u> whole fish, smoked fillets, fresh fillets, frozen fillets, smoked as a whole</p>	<p><u>Familiarity:</u> medium/high</p> <p><u>Attributes:</u> taste, no additives, brand name, freshness, appearance, label (MSC)</p> <p><u>Barriers:</u> smell bones</p> <p><u>Format:</u> jar fillets, canned, processed (rolled) fillets, fresh fillets / whole</p>	<p><u>Familiarity:</u> high</p> <p><u>Attributes:</u> freshness, appearance / colour, healthy (omega3), taste, texture, wild / farmed, certificate, origin, organic</p> <p><u>Barriers:</u> farmed (additives, diseases, pollution), overfishing, dry flesh</p> <p><u>Format:</u> frozen fillets, fresh fillets, vacuum packed fillets, smoked</p>	<p><u>Familiarity:</u> low</p> <p><u>Attributes:</u> taste, freshness, instore promotions</p> <p><u>Barriers:</u> low availability</p> <p><u>Format:</u> fresh fillets, fresh whole</p>	<p><u>Familiarity:</u> medium/low</p> <p><u>Attributes:</u> taste/texture, freshness, appearance, instore promotions, origin</p> <p><u>Barriers:</u> bones, low availability</p> <p><u>Format:</u> fresh fillets, fresh whole, frozen fillets</p>	<p><u>Familiarity:</u> medium/high</p> <p><u>Attributes:</u> freshness, appearance, certificates MSC, origin, no additives, versatility in preparation</p> <p><u>Barriers:</u> bones, pollution Baltic sea, additives (processed sticks), overfishing</p> <p><u>Format:</u> fresh fillets, fresh whole, frozen fillets</p>

Table A1: continue.

Country	General fish	Trout	Herring	Salmon	Sea bass	Sea bream	Cod
Spain	<p><u>Attributes:</u> health (highlighting omega 3 properties), taste, easy to eat/digest, easy to cook</p> <p>+ <u>sensory attributes:</u> Freshness, appearance, Seller / Fishmonger advices and Price / promotion</p> <p>- <u>sensory attributes:</u> Fish forms, reputation and additives</p> <p><u>Barriers:</u> smell when cooking, expensive products in comparison to their substitutes, perishable product (linked to anisakis issues).</p> <p><u>Format:</u> Fresh (whole, stakes, filets), frozen and canned.</p>	<p><u>Familiarity:</u> high</p> <p><u>Attributes:</u> taste, convenience, easy to cook.</p> <p><u>Barriers:</u> bones, "boring" taste (not for an usual/daily consumption)</p> <p><u>Format:</u> fresh and whole fish</p>	<p><u>Familiarity:</u> very low</p> <p><u>Attributes:</u> easy to cook (canned)</p> <p><u>Barriers:</u> Strong taste (salted)</p> <p><u>Format:</u> canned</p>	<p><u>Familiarity:</u> high</p> <p><u>Attributes:</u> taste, healthy properties (omega 3) and convenience</p> <p><u>Barriers:</u> smell and strong taste</p> <p><u>Format:</u> Fresh, whole and sliced as well as smoked fillets</p>	<p><u>Familiarity:</u> high</p> <p><u>Attributes:</u> taste, texture, easy to cook (ideal for a special occasion)</p> <p><u>Barriers:</u> price (specially the wild)</p> <p><u>Format:</u> Fresh and whole</p>	<p><u>Familiarity:</u> high</p> <p><u>Attributes:</u> taste easy to cook (ideal for a special occasion), texture,</p> <p><u>Barriers:</u> smell when cooking and bones</p> <p><u>Format:</u> Fresh, whole</p>	<p><u>Familiarity:</u> high</p> <p><u>Attributes:</u> taste, easy to cook/eat and texture</p> <p><u>Barriers:</u> strong taste (too much salt)</p> <p><u>Format:</u> whole and salted and fresh, filleted and desalted/defrosted</p>

Preliminary list of attributes

Table A2: Preliminary list of attributes and levels by species.

Attributes	Trout	Herring	Salmon	Sea bass	Sea bream	Cod	Pangasius	
Price	<ul style="list-style-type: none"> • Average market price • -25% • +25% 	<ul style="list-style-type: none"> • Average market price • -25% • +25% 	<ul style="list-style-type: none"> • Average market price • -25% • +25% 	<ul style="list-style-type: none"> • Average market price • -25% • +25% 	<ul style="list-style-type: none"> • Average market price • -25% • +25% 	<ul style="list-style-type: none"> • Average market price • -25% • +25% 	<ul style="list-style-type: none"> • Average market price • -25% • +25% 	
Origin	<ul style="list-style-type: none"> • Domestic • Imported from EU country • Imported from other European country • Imported from non-European country 	<ul style="list-style-type: none"> • Domestic • Imported from EU country • Imported from other European country • Imported from non-European country 	<ul style="list-style-type: none"> • Imported from EU country • Imported from other European country • Imported from non-European country 	<ul style="list-style-type: none"> • Domestic • Imported from EU country • Imported from non-European country 	<ul style="list-style-type: none"> • Domestic • Imported from EU country • Imported from non-European country 	<ul style="list-style-type: none"> • Domestic • Imported from EU country • Imported from other European country • Imported from non-European country 	<ul style="list-style-type: none"> • Domestic • Imported from EU country • Imported from other European country • Imported from non-European country 	Imported from non-European country
Production method	Farmed	Wild	<ul style="list-style-type: none"> • Wild • Farmed 	<ul style="list-style-type: none"> • Wild • Farmed 	<ul style="list-style-type: none"> • Wild • Farmed 	<ul style="list-style-type: none"> • Wild • Farmed 	Farmed	
Format	<ul style="list-style-type: none"> • Fresh • Frozen 	<ul style="list-style-type: none"> • Fresh • Frozen 	<ul style="list-style-type: none"> • Fresh • Frozen 	<ul style="list-style-type: none"> • Fresh • Frozen 	<ul style="list-style-type: none"> • Fresh • Frozen 	<ul style="list-style-type: none"> • Fresh • Frozen 	<ul style="list-style-type: none"> • Thawed (previously frozen, refrigerated) • Frozen 	













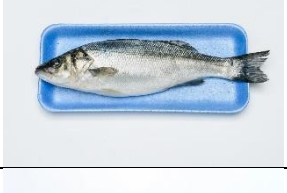








Table A2: Continue.

Attributes	Trout	Herring	Salmon	Sea bass	Sea bream	Cod	Pangasius
Preparation	<ul style="list-style-type: none"> Whole fish Fillet Fillet easy-to-cook Fillet ready-to-eat (microwaveable / ovenable tray) 	<ul style="list-style-type: none"> Fillet Fillet easy-to-cook Fillet ready-to-eat (smoked) 	<ul style="list-style-type: none"> Fillet Fillet easy-to-cook Fillet ready-to-eat (smoked) 	<ul style="list-style-type: none"> Whole fish Fillet Fillet easy-to-cook Fillet ready-to-eat (microwaveable / ovenable tray) 	<ul style="list-style-type: none"> Whole fish Fillet Fillet easy-to-cook Fillet ready-to-eat (microwaveable / ovenable tray) 	<ul style="list-style-type: none"> Fillet Fillet easy-to-cook Fillet ready-to-eat (microwaveable / ovenable tray) 	<ul style="list-style-type: none"> Fillet Fillet easy-to-cook Fillet ready-to-eat (microwaveable / ovenable tray)
Sustainability	<ul style="list-style-type: none"> None Organic certification (for farmed) 	<ul style="list-style-type: none"> None Sustainability certification (for wild) 	<ul style="list-style-type: none"> None Sustainability (for wild) / Organic (for farmed) certification 	<ul style="list-style-type: none"> None Sustainability (for wild) / Organic (for farmed) certification 	<ul style="list-style-type: none"> None Sustainability (for wild) / Organic (for farmed) certification 	<ul style="list-style-type: none"> None Sustainability (for wild) / Organic (for farmed) certification 	<ul style="list-style-type: none"> None Organic certification (for farmed)
Health / Nutrition claim	<ul style="list-style-type: none"> None Source of Omega-3 Low fat content / Easily digestible proteins 	<ul style="list-style-type: none"> None Source of Omega-3 Low fat content / Easily digestible proteins 	<ul style="list-style-type: none"> None Source of Omega-3 Low fat content / Easily digestible proteins 	<ul style="list-style-type: none"> None Source of Omega-3 Low fat content / Easily digestible proteins 	<ul style="list-style-type: none"> None Source of Omega-3 Low fat content / Easily digestible proteins 	<ul style="list-style-type: none"> None Source of Omega-3 Low fat content / Easily digestible proteins 	Not present
Freshness	<ul style="list-style-type: none"> Not indicated Date of harvest (for farmed) Expiry date (for fresh) 	<ul style="list-style-type: none"> Not indicated Date of catch (for wild) Expiry date (for fresh) 	<ul style="list-style-type: none"> Not indicated Date of catch (for wild) or harvest (for farmed) Expiry date (for fresh) 	<ul style="list-style-type: none"> Not indicated Date of catch (for wild) or harvest (for farmed) Expiry date (for fresh) 	<ul style="list-style-type: none"> Not indicated Date of catch (for wild) or harvest (for farmed) Expiry date (for fresh) 	<ul style="list-style-type: none"> Not indicated Date of catch (for wild) or harvest (for farmed) Expiry date (for fresh) 	<ul style="list-style-type: none"> Not indicated Date of harvest (for farmed) Expiry date (for thawed)
















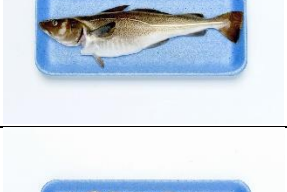





Pictures of the format attribute

Table A3: Set of pictures of the format attribute, by species in each country.






















France

	Whole / round cut	Fillet	Ready-to-cook
Trout			
Herring			
Salmon			
Seabream			
Seabass			
Cod			
Pangasius			















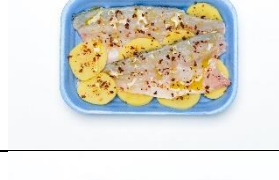
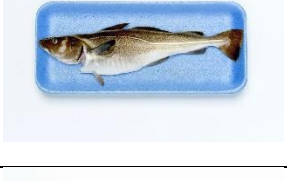

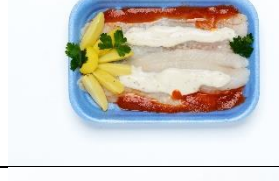



Germany

	Whole / round cut	Fillet	Ready-to-cook
Trout			
Herring			
Salmon			
Seabream			
Seabass			
Cod			
Pangasius			









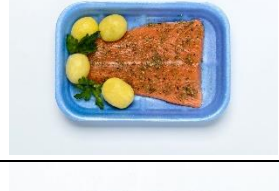












Italy

	Whole / round cut	Fillet	Ready-to-cook
Trout			
Herring			
Salmon			
Seabream			
Seabass			
Cod			
Pangasius			

Spain

	Whole / round cut	Fillet	Ready-to-cook
Trout			
Herring			
Salmon			
Seabream			
Seabass			
Cod			
Pangasius			

UK

	Whole / round cut	Fillet	Ready-to-cook
Trout			
Herring			
Salmon			
Seabream			
Seabass			
Cod			
Pangasius			

The questionnaire

Appendix A4: The questionnaire in the English version.

Dear Participant,

We are a group of researchers from the University of X, and we are conducting a survey on the consumption and purchase of fish in name of the country. This research is non-commercial and funded by the European Union, from the Horizon 2020 research and innovation program (Grant agreement No: 635761).

We are only interested in your opinions regarding eating and shopping for fish. There are no right or wrong answers. It will only take you about 15 minutes to complete this survey. Any information you provide will be kept completely confidential and anonymous.

In most cases, there is a short introduction before the actual question. Please read the introduction and the question thoroughly before answering. Most of the questions make use of scales with 7 points. For example:

Buying fish is important to you:

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7
Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree

If you strongly disagree with the statement, you should mark the number 1. If you strongly agree, you should mark the number 7, and so on. For all questions, you should mark the option which **best describes your opinion**.

Thanks for taking part in this research.

Socio-demographics

(check what is currently available in the panel dataset)

Gender: Male Female

What is your age?:

What is your weight (kg)?.....

What is your height (cm)?....

What is your educational level?

- Lower secondary education or below (e.g. Standard Grade, Intermediates, O Grade, GCSE, NVQ level 1 & 2, no qualifications)
- Upper secondary education (e.g. A-levels, AS level, SCE Higher, NVQ level 3)
- University or college qualification below degree level (e.g. NVQ levels 4 & 5, HND/HNC, Nursing/Teacher Training)
- Bachelor's degree (or NVQ level 6), Master's degree, PGCE, Other Postgraduate, Doctorate

How many persons live in your household, including yourself?

How many of these people are below 18 years old?

How many of these people are above 60 years old?

What is your current employment status?

- Full-time
- Part time/other
- Self employed
- Homemaker
- Retired
- Student
- Unemployed
- Other

In which type of geographical area do you live?

- Rural area (population < 5,000)
- Small sized urban area (< 5,000 population < 50,000)
- Large urban area (population >= 50,000)

Does your council area have a coastline?

- Yes
- No

What is your monthly net household income? (*the income ranges were country-specific*)

- Less than £ 1,000
- £ 1,000 to £ 1,599
- £ 1,600 to £ 2,199
- £ 2,200 to £ 2,999
- £ 3,000 to £ 4,999
- £ 5,000 or more
- I do not know / I do not want to answer

Please indicate how often you consume fish (fresh, frozen, canned, smoked, ready to eat, etc.) at home, at restaurants and other food outlets (canteens, bars, etc.):

- | | | | | | | |
|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Never
(end of the
questionnaire) | Few times
a year | Once a
month | 2-3 times a
month | 1 or 2 times
a week | 3-4 times a
week | Almost
everyday |

Please indicate how often you consume the following fish species (fresh, frozen, canned, smoked, ready to eat, etc.) at home, at restaurants and other food outlets (canteens, bars, etc.):

	Never	Few times a year	Once a month	2-3 times a month	1 or 2 times a week	3-4 times a week	Almost everyday
Salmon	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Trout	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Seabass	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Seabream	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Herring	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cod	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pangasius	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

In the past 3 years has your fish consumption:

- | | | | | | | |
|----------------------------|------------------------------|----------------------------|--------------------------|----------------------------|------------------------------|----------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 1
Strongly
decreased | 2
Moderately
decreased | 3
Slightly
decreased | 4
Stayed the
same | 5
Slightly
increased | 6
Moderately
increased | 7
Strongly
increased |

Please indicate your level of involvement in fish purchasing in your household:

- | | | | |
|--------------------------|--------------------------|--------------------------|-----------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 1
Not at all involved | 2
Somewhat involved | 3
Fairly involved | 4
Completely
involved |

Please indicate your level of involvement in your household when preparing and cooking fish:

- | | | | |
|--------------------------|--------------------------|--------------------------|-----------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 1
Not at all involved | 2
Somewhat involved | 3
Fairly involved | 4
Completely
involved |

Please indicate how important or unimportant each of the following aspects are when selecting your fish:

	1 Not at all important	2 Low importance	3 Slightly important	4 Neutral	5 Moderately important	6 Very important	7 Extremely important
General appearance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Free of smell	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Value for money	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sustainability certification	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Easy to cook	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low in calories	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Not previously frozen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wild caught	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Domestic origin	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Days since catch/harvest	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Organic certification	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Price	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Choice experiment:

In this part of the questionnaire you will be asked to choose your preferred product from a set of 7 alternative products. Options A to G represent 7 different descriptions of a fish product. Please mark the option that you are most likely to purchase.

Please pay attention to all the attributes that are displayed. Experience from previous similar surveys suggests that people often respond in one way but act in another. For instance, people sometimes state they would pay a higher price for a product than they actually would in reality. Therefore, please do consider thoroughly how the price would affect your budget, so that you are able to give as accurate an answer as possible. Similarly to the price, pay attentions to all fish alternatives and attributes.

*Before starting, please consider the following **definition of sustainability certification**:*

When certified according to a sustainability scheme, any fish can be traced back to a fishery or to a fish farm that meets principles reflecting the maintenance and re-establishment of healthy populations of targeted species, the maintenance of the integrity of ecosystems, the use of feed and other inputs that are sourced responsibly, and the social responsibility for workers and communities impacted by fishing and fish farming. This standard is intended to be used on a global basis by accredited third party certifiers to undertake the certification of fisheries and fish farmers to the above mentioned principles and criteria.

Please, check the option that you would be most likely to purchase for a normal lunch or dinner.

Please translate the following table.

#8 CHOICE SETS

What quantity would you purchase of the above product? _____ gr.

In the marketplace, some producers provide health benefit information from consuming their products. On a scale of 0-100, to what extent do you believe such health benefit claims? (e.g., 0 = completely unbelievable; 50 = neutral; 100 = completely believable)

Your belief: _____

We assume you have read the definition of sustainability certification above. On a scale of 0-100, to what extent do you believe in the benefits of such certification to the environment and society? (e.g., 0 = completely unbelievable; 50 = neutral; 100 = completely believable)

Your belief: _____

Now we would like to know your opinion and agreement about the following statements concerning fishing, fish farming and fish consumption.

I believe that fishing has negative consequences on marine resources.

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1 Strongly disagree	2 Disagree	3 Somewhat disagree	4 Neither agree or disagree	5 Somewhat agree	6 Agree	7 Strongly agree

I believe that fish farming has negative consequences on the environment.

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1 Strongly disagree	2 Disagree	3 Somewhat disagree	4 Neither agree or disagree	5 Somewhat agree	6 Agree	7 Strongly agree

I believe that eating fish containing omega-3 fatty acids benefits my health.

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1 Strongly disagree	2 Disagree	3 Somewhat disagree	4 Neither agree or disagree	5 Somewhat agree	6 Agree	7 Strongly agree

I believe that eating fish would expose myself to substances (e.g. mercury, antibiotics, etc.) risking negative consequences on my health.

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1 Strongly disagree	2 Disagree	3 Somewhat disagree	4 Neither agree or disagree	5 Somewhat agree	6 Agree	7 Strongly agree

I feel confident in evaluating the quality of the fish before buying it.

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1 Strongly disagree	2 Disagree	3 Somewhat disagree	4 Neither agree or disagree	5 Somewhat agree	6 Agree	7 Strongly agree

I feel confident in cooking fish.

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1 Strongly disagree	2 Disagree	3 Somewhat disagree	4 Neither agree or disagree	5 Somewhat agree	6 Agree	7 Strongly agree

I believe that ready-to-cook products would alter the original fish characteristics.

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1 Strongly disagree	2 Disagree	3 Somewhat disagree	4 Neither agree or disagree	5 Somewhat agree	6 Agree	7 Strongly agree

I prefer to eat ready-to-cook fish because it allows me to save time.

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1 Strongly disagree	2 Disagree	3 Somewhat disagree	4 Neither agree or disagree	5 Somewhat agree	6 Agree	7 Strongly agree



Preferably, I spend as little time as possible on meal preparation.

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7
Strongly disagree	Disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Agree	Strongly agree

I prefer to eat ready-to-cook fish because it does not smell.

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7
Strongly disagree	Disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Agree	Strongly agree

I would trust the information provided about the sustainable fish production practices (fishing or farming) if they were certified by a:

	1 Strongly disagree	2 Disagree	3 Somewhat disagree	4 Neither agree or disagree	5 Somewhat agree	6 Agree	7 Strongly agree
Public authority (e.g., the national Government or the EU)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fish farmer or fisherman	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fish processing industry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Retailer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Independent organization (e.g., an NGO)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>