

Cross-cultural consumer perception of new fish products



What we know...

Aquaculture supply approximately 50% of global food fish production compared with just 9% in 1980s

Aquaculture is still far from its full potential development since European aquaculture production represent about 20% of the total fish production

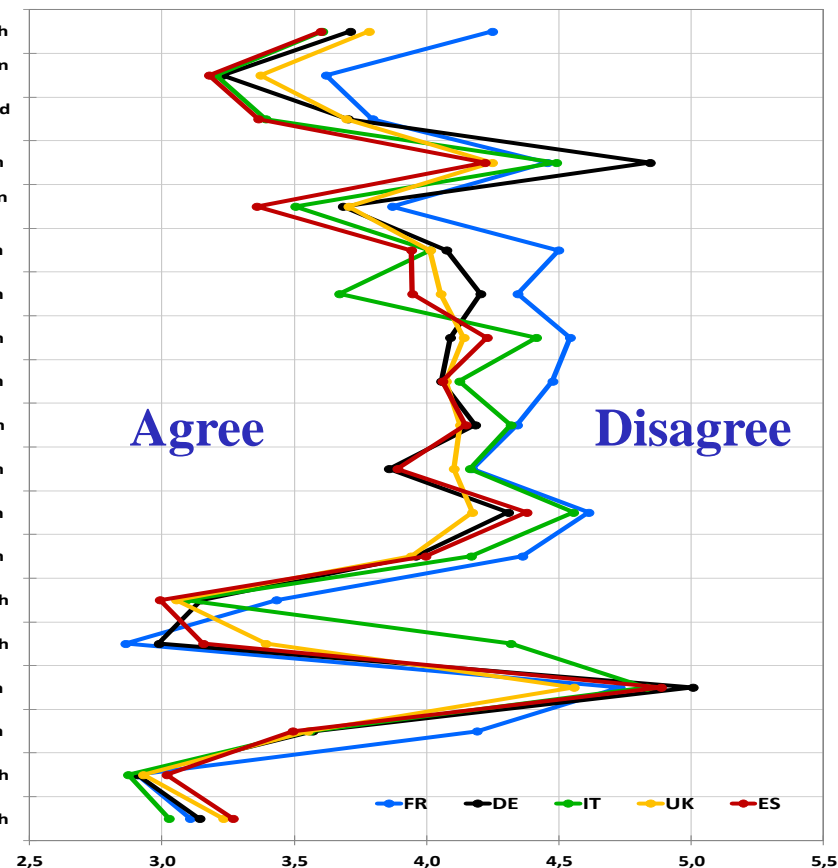
European consumers perceive farmed fish as being of lower general quality than wild fish

Efforts should be more oriented towards an improvement of the image of farmed fish than towards an enhancement of the sensory properties

What we know...

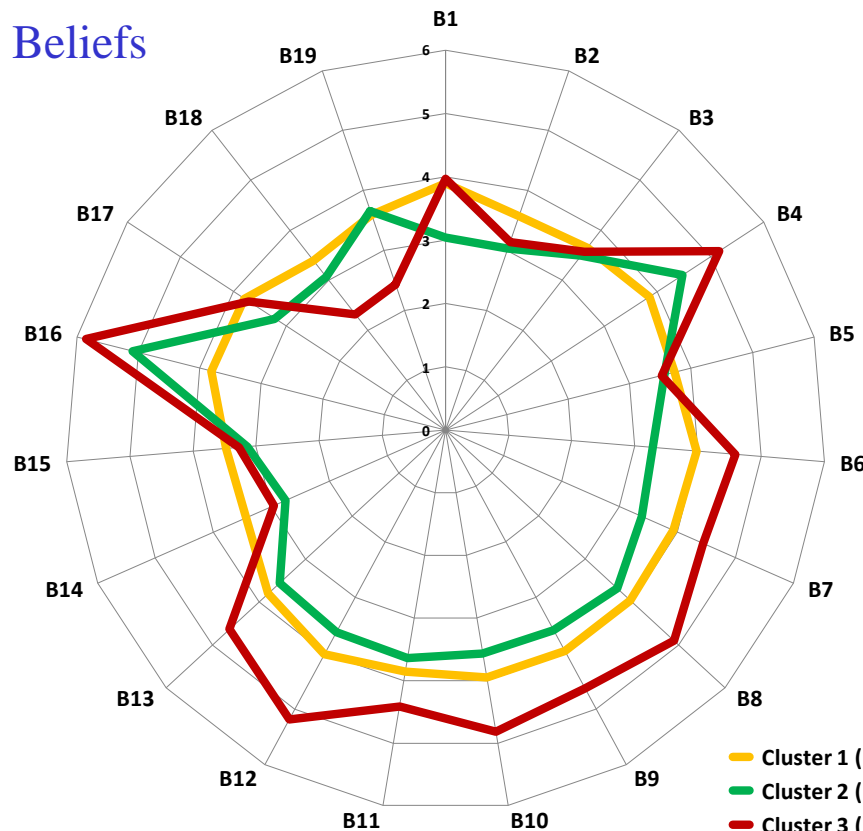
Beliefs

- B1. Farmed fish is safer than wild fish
- B2. Wild fish is more affected by marine pollution (spillages) than farmed fish
- B3. Wild fish contains more heavy metals than farmed fish
- B4. Wild fish contains more antibiotics than farmed fish
- B5. Wild fish is more affected by parasites (anisakis) than farmed fish
- B6. Farmed fish has a healthier diet than wild fish
- B7. Farmed fish is healthier than wild fish
- B8. Farmed fish is of better quality than wild fish
- B9. Farmed fish is fresher than wild fish
- B10. Farmed fish is more nutritious than wild fish
- B11. Wild fish is more fatty than farmed fish
- B12. Farmed fish tastes better than wild fish
- B13. Farmed fish is firmer than wild fish
- B14. Farmed fish is more controlled than wild fish
- B15. Farmed fish is more handled than wild fish
- B16. Wild fish is more artificial than farmed fish
- B17. Farmed fish provides more guarantees than wild fish
- B18. Farmed fish is easier to find than wild fish
- B19. Farmed fish is cheaper than wild fish



What we know...

Beliefs



Cluster 1 “Neutral”:



40 years



Cluster 2 “Pro-farmed fish”



Cluster 3 “Pro-wild fish”

> 50 years



Cluster 1 (N=1151)

Cluster 2 (N=391)

Cluster 3 (N=969)

What we know...

Wild or farmed taste??

Aquaculture 454 (2016) 157–162



Contents lists available at ScienceDirect

Aquaculture

journal homepage: www.elsevier.com/locate/aquaculture



Does information affect consumer liking of farmed and wild fish?



Anna Claret ^a, Luis Guerrero ^{a,*}, Irene Gartzia ^b, Maruxa Garcia-Quiroga ^b, Rafael Ginés ^c

^a IRTA-Food Technology, XaRTA, Finca Camps i Amet s/n, E-17121 Monells, Girona, Spain

^b AZTI-Tecnalia, Astondo Bidea, Edificio 609, Parque Tecnológico de Bizkaia, E-48160 Derio, Bizkaia, Spain

^c ULPGC-Instituto Universitario de Sanidad Animal y Seguridad Alimentaria, Dept. Acuicultura y Genética Marina, Trasmontaña s/n, E-35413 Arucas, Las Palmas, Spain

Overall liking of wild and farmed fish in the blind and informed conditions.

	Overall liking			
	Wild fish	Farmed fish	RMSE	p Value
Informed condition	7.4	6.7	1.803	<0.0001
Blind condition	6.3	6.7	2.095	<0.0001
RMSE	2.003	1.950		
p Value	<0.0001	0.957		

What we know...

The relative low market share of aquaculture can also be a direct consequence of the poor variety of aquaculture products in the market, and in particular because of the lack of processed aquaculture foodstuffs

Variety has been identified as a relevant factor in order to stimulate consumers' purchase, thus avoiding boredom and satisfying individual curiosity

Diversification: new species and new products: DIVERSIFY

Objective: to assess consumer perception of new products from new farmed species in the five countries investigated (i.e., Germany, France, United Kingdom, Italy and Spain)

Methodology

- Selection of the new products to test



MEAGRE	<p>Idea 1*: Frozen fish fillets with different recipes</p> <p>Idea 6: Fish burgers shaped as fish (H)</p> <p>Idea 4: Ready to eat meal: salad with fish (L)</p>
PIKEPERCH	<p>Idea 21: Fresh fish fillet with different “healthy” seasoning and marinades</p> <p>Idea 30: Ready-made fish tartar with additional soy sauce</p> <p>Idea 9: Fish spreads/pate (H)</p>
GREY MULLET	<p>Idea 2: Thin smoked fillets (M)</p> <p>Idea 33: Ready-made fish fillets in olive oil (M)</p> <p>Idea 21: Fresh fish fillet with different “healthy” seasoning and marinades</p>
GREATER AMBERJACK	<p>Idea 13: Frozen fish fillet that is seasoned or marinated</p> <p>Idea 30: Ready-made fish tartar with additional soy sauce</p> <p>Idea 34: Fresh fish steak for grilling in the pan (L)</p>

L: low processing; M: mid processing; H: high processing.



Methodology

Recruitment of participants

100 consumers



- 50% of the individuals per country "Involved innovators" and "Involved traditional"
- Balanced fish consumption (farmed and wild), age, gender, income and marital status, trying to fit the average frequencies in their respective segments per country

Methodology

Preparation of the samples



Methodology

Test design and execution

- Ten tasting sessions (1-1.5h) in each location in two consecutive days (10-12 participants)
- Each tasting session was divided in four main parts:
 - 1) Participants were informed about the aim of the test and how to use the computers for inserting their answers
 - 2) Overall liking expectation for each of the 10 different ideas
 - 3) Blind tasting: liking and Check-all-that-apply or CATA (28 sensory descriptors) of the six selected products
 - 4) Overall expectation in informed condition: overall acceptability, purchase intention and personal perception of each product by means of a semantic differential scale (made up of 11 adjectives)

Methodology

Please, try to imagine how much you think you would like the following fish product:

Product: 246

Frozen fish fillets with different recipes

Please answer by ticking in the relevant box on the left hand side.

- 9 ☐ I think I would like it extremely
- 8 ☐ I think I would like it very much
- 7 ☐ I think I would like it moderately
- 6 ☐ I think I would like it slightly
- 5 ☐ I do not think I would like it nor dislike it
- 4 ☐ I think I would dislike it slightly
- 3 ☐ I think I would dislike it moderately
- 2 ☐ I think I would dislike it very much
- 1 ☐ I think I would dislike it extremely

NEXT

Methodology

Product: 246

Frozen fish fillets with different recipes

In your opinion, this product....

	1 Strongly disagree	2 Disagree	3 Moderately disagree	4 Neither disagree nor agree	5 Moderately agree	6 Agree	7 Strongly agree
Is nutritious.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Is healthy.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Makes people feel good.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Is convenient.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Is easily available.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tastes good	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Contains no additives.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Is natural.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Is a good value for money.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Is expensive.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Is hard to digest.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Is familiar/known.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Is a traditional product.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Is produced in an environmental friendly way.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Is authentic.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Has a high quality.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Helps local producers/economy.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Is unsafe.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

NEXT

Methodology

Please, taste the product provided and answer the following questions by ticking in the appropriate box (please, keep some sample for the next questions):

- How much do you like this fish product (overall liking)?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I dislike it extremely	I dislike it very much	I dislike it moderately	I dislike it slightly	I do not like it nor dislike it	I like it slightly	I like it moderately	I like it very much	I like it extremely

- How much do you like the ODOUR of this fish product?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I dislike it extremely	I dislike it very much	I dislike it moderately	I dislike it slightly	I do not like it nor dislike it	I like it slightly	I like it moderately	I like it very much	I like it extremely

- How much do you like the FLAVOUR of this fish product?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I dislike it extremely	I dislike it very much	I dislike it moderately	I dislike it slightly	I do not like it nor dislike it	I like it slightly	I like it moderately	I like it very much	I like it extremely

- How much do you like the TEXTURE of this fish product?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I dislike it extremely	I dislike it very much	I dislike it moderately	I dislike it slightly	I do not like it nor dislike it	I like it slightly	I like it moderately	I like it very much	I like it extremely

NEXT

Methodology

Please, taste the sample again and tick in the following list all the sensory descriptors that you can perceive in this sample:

- | | | | |
|-----------------------------------|---|-------------------------------------|------------------------------------|
| <input type="checkbox"/> Acid | <input type="checkbox"/> Aromatic herbs | <input type="checkbox"/> Bitter | <input type="checkbox"/> Butter |
| <input type="checkbox"/> Earthy | <input type="checkbox"/> Fish | <input type="checkbox"/> Garlic | <input type="checkbox"/> Intense |
| <input type="checkbox"/> Lemon | <input type="checkbox"/> Metallic | <input type="checkbox"/> Milky | <input type="checkbox"/> Oil |
| <input type="checkbox"/> Pungent | <input type="checkbox"/> Salty | <input type="checkbox"/> Sardine | <input type="checkbox"/> Shellfish |
| <input type="checkbox"/> Smoked | <input type="checkbox"/> Sweet | <input type="checkbox"/> Vegetables | <input type="checkbox"/> Vinegar |
| <input type="checkbox"/> Adhesive | <input type="checkbox"/> Crumbly | <input type="checkbox"/> Fibrous | <input type="checkbox"/> Gummy |
| <input type="checkbox"/> Hard | <input type="checkbox"/> Juicy | <input type="checkbox"/> Oily | <input type="checkbox"/> Pasty |

NEXT

Methodology

Product: **Fresh thin smoked fillets** from grey mullet, which can be used as a starter or incorporated within a sandwich/salad. The product is sustainably produced. It is labelled as a premium product and the country of origin is EU. The packaging is a plastic tray where the fillets are laid covered with a transparent plastic, which allows visibility of the fillets and vacuum or modified atmosphere packaging is used for shelf life prolongation. Ideas concerning the different uses of the fillets are included on the product's sleeve.

- How much do you like this fish product (overall liking)?

- | | | | | | | | | |
|---------------------------|---------------------------|----------------------------|--------------------------|------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| I dislike it
extremely | I dislike it
very much | I dislike it
moderately | I dislike it
slightly | I do not like it
nor dislike it | I like it
slightly | I like it
moderately | I like it
very much | I like it
extremely |

- Would you buy this product?

- ☐ No chance, almost no chance (1 in 100)
- ☐ Very slight possibility (1 chance in 10)
- ☐ Slight possibility (2 chances in 10)
- ☐ Some possibility (3 chances in 10)
- ☐ Fair possibility (4 chances in 10)
- ☐ Fairly good possibility (5 chances in 10)
- ☐ Good possibility (6 chances in 10)
- ☐ Probable (7 chances in 10)
- ☐ Very probable (8 chances in 10)
- ☐ Almost sure (9 chances in 10)
- ☐ Certain, practically certain (99 chances in 100)

NEXT

Methodology

Product: **Fresh thin smoked fillets** from grey mullet, which can be used as a starter or incorporated within a sandwich/salad. The product is sustainably produced. It is labelled as a premium product and the country of origin is EU. The packaging is a plastic tray where the fillets are laid covered with a transparent plastic, which allows visibility of the fillets and vacuum or modified atmosphere packaging is used for shelf life prolongation. Ideas concerning the different uses of the fillets are included on the product's sleeve.

In your opinion this product is or have:

	1	2	3	4	5	6	7	
Known	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Unknown
Unique	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Standard
Safe	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Unsafe
Unhealthy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Healthy
Expensive	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Cheap
Bad taste	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Good taste
Low quality	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	High quality
Boring	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Stimulating
Artificial	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Natural
Environment loading	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Environment friendly
Traditional	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Contemporary

NEXT

Results

Liking expectations

Average expected degree of liking of selected product ideas.

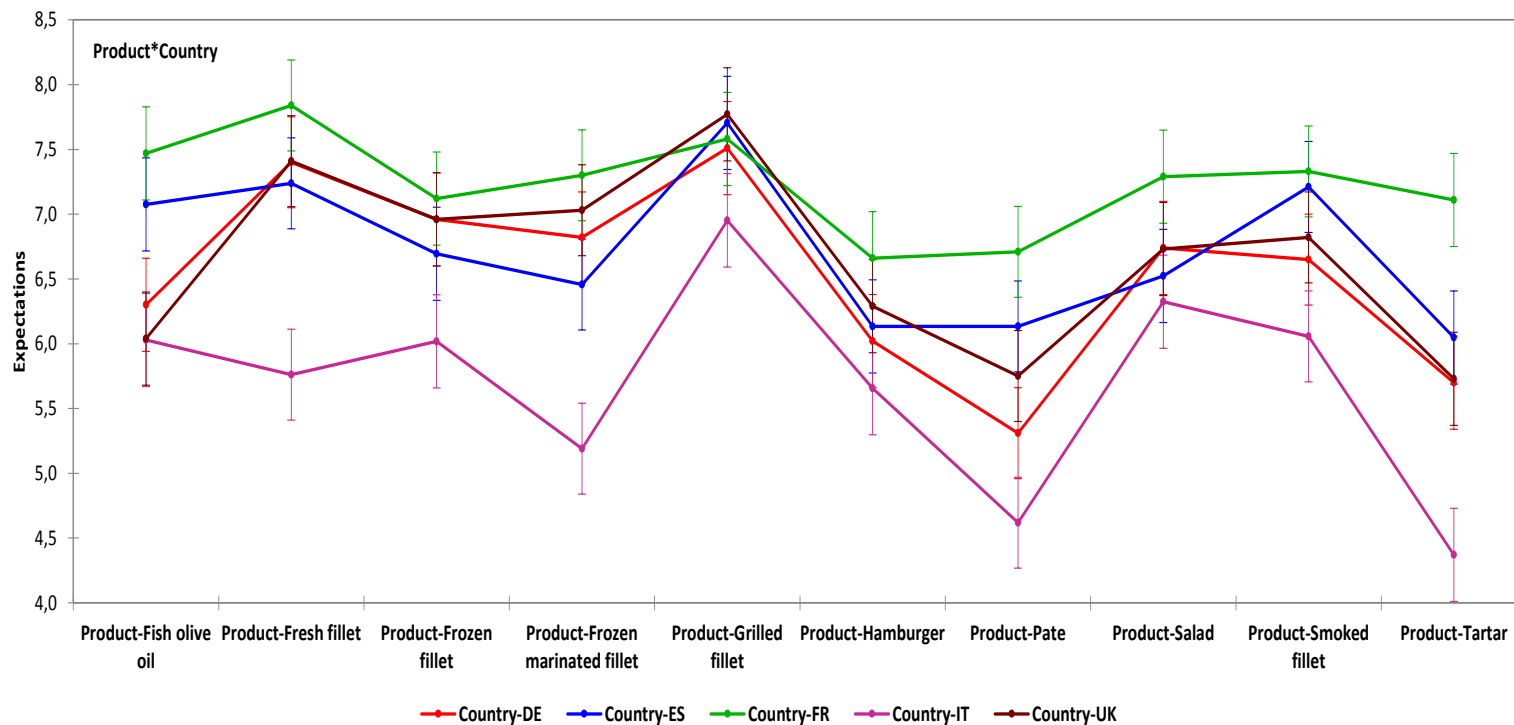
Idea	Mean value	Standard deviation
Grilled fillet (Idea 34)	7.5 ^a	1.672
Fresh fillet (Idea 21)	7.1 ^b	1.843
Smoked fillet (Idea 2)	6.8 ^{bc}	1.862
Frozen fillet (Idea 1)	6.7 ^c	1.716
Salad (Idea 4)	6.7 ^c	1.867
Fish olive oil (Idea 33)	6.6 ^c	1.879
Frozen marinated fillet (Idea 13)	6.6 ^c	1.858
Hamburger (Idea 6)	6.2 ^d	1.929
Tartar (Idea 30)	5.8 ^e	2.273
Pate (Idea 9)	5.8 ^e	2.184

a-e: Mean values with different superscripts differ significantly ($p < 0.05$).

- Higher preference for those products having the genuine sensory properties of fish, without any interference (recruitment criteria)

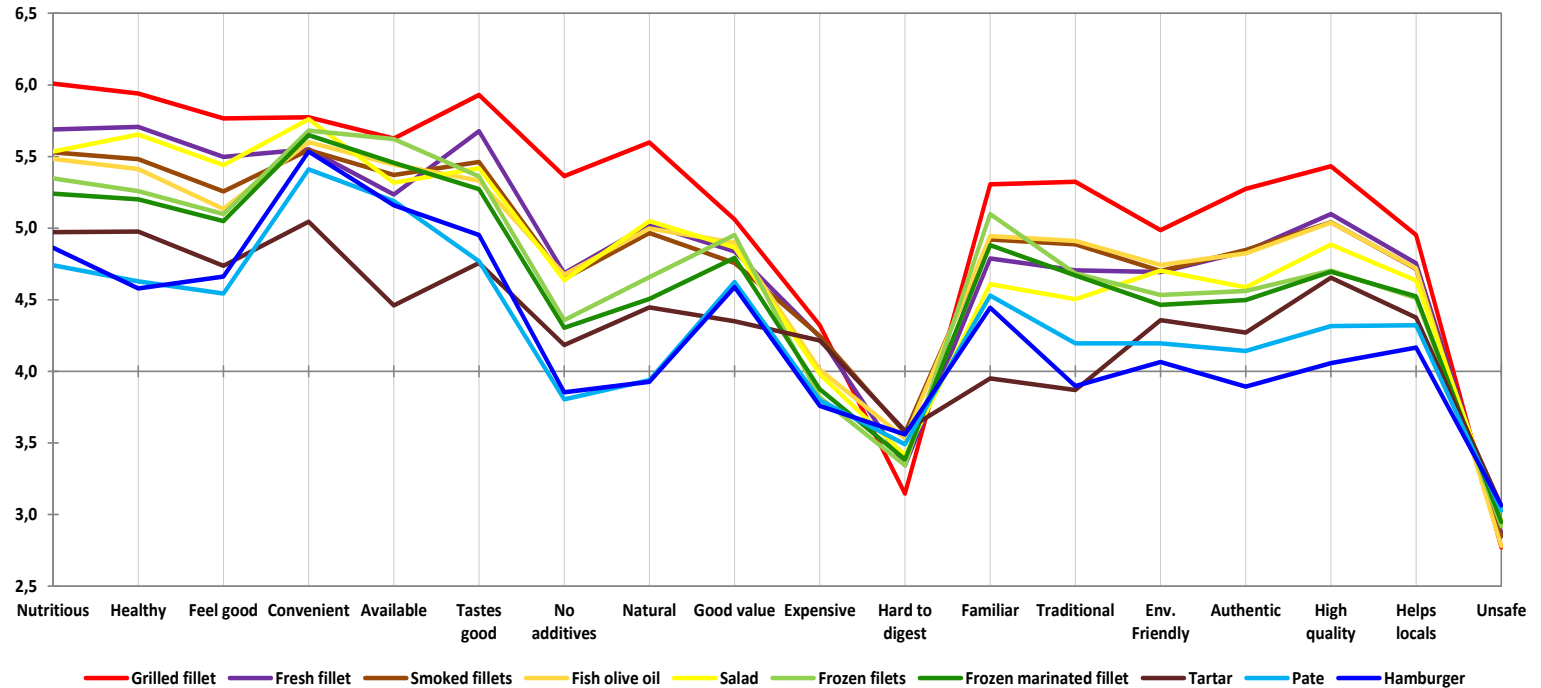
Results

Liking expectations



Results

Image/perception of the different products or ideas



- All the products were perceived quite positively

Results

Blind tasting (6 products)

Mean acceptability values for the different products per country.

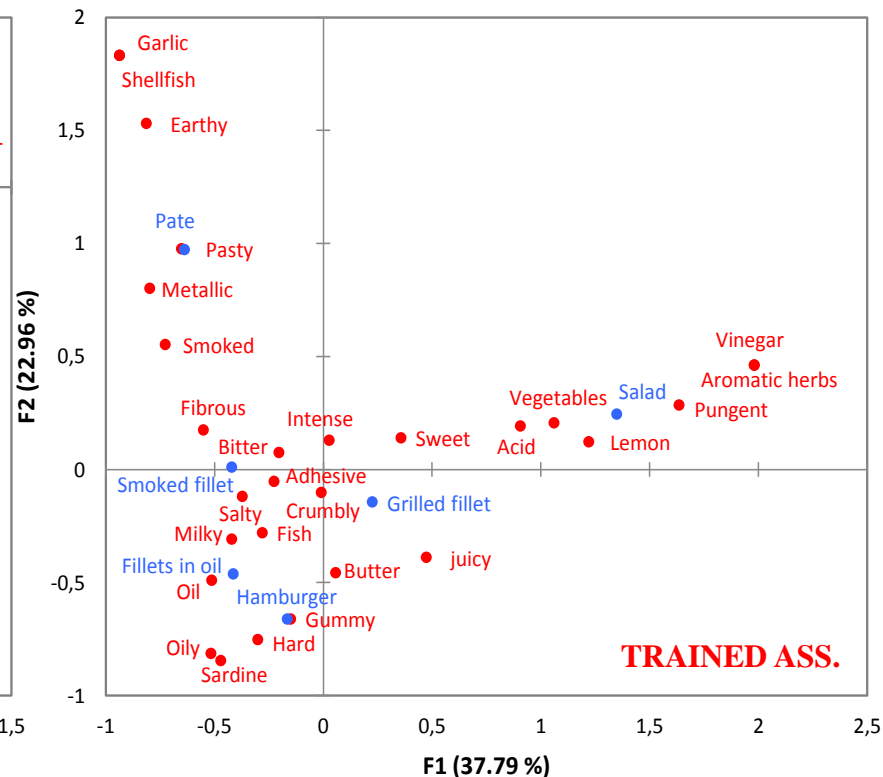
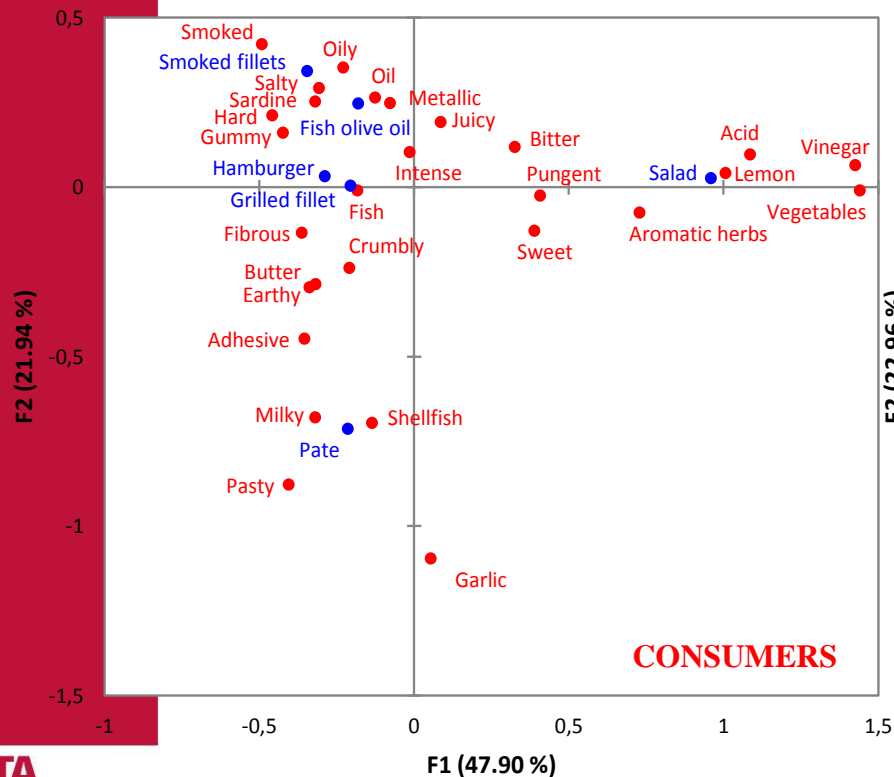
Product	Overall	DE	ES	FR	IT	UK
Fish olive oil	6.3 ^b	6.0 ^b	6.7 ^{ab}	7.2 ^{abc}	6.0 ^{bc}	5.7 ^{bc}
Grilled fillet	7.1 ^a	6.9 ^a	7.0 ^a	7.5 ^a	6.8 ^a	7.3 ^a
Hamburger	6.5 ^b	6.2 ^{ab}	6.9 ^{ab}	7.1 ^{abc}	6.4 ^{ab}	6.0 ^{bc}
Pate	5.8 ^c	5.2 ^c	6.4 ^{ab}	6.6 ^c	5.3 ^c	5.3 ^c
Salad	6.3 ^b	6.0 ^b	6.2 ^b	7.4 ^{ab}	5.5 ^c	6.4 ^b
Smoked fillet	6.2 ^b	6.3 ^{ab}	6.7 ^{ab}	6.7 ^{bc}	5.6 ^c	5.9 ^{bc}
Std. Error	0.088	0.200	0.192	0.166	0.186	0.228

a-c: Mean values with different superscripts differ significantly ($p < 0.05$).

- Agreement with the previously reported expected liking

Results

Sensory perception (made by consumers and trained assessors, CATA)



Results

Overall liking in the full informed condition

Mean acceptability values for the different products per country.

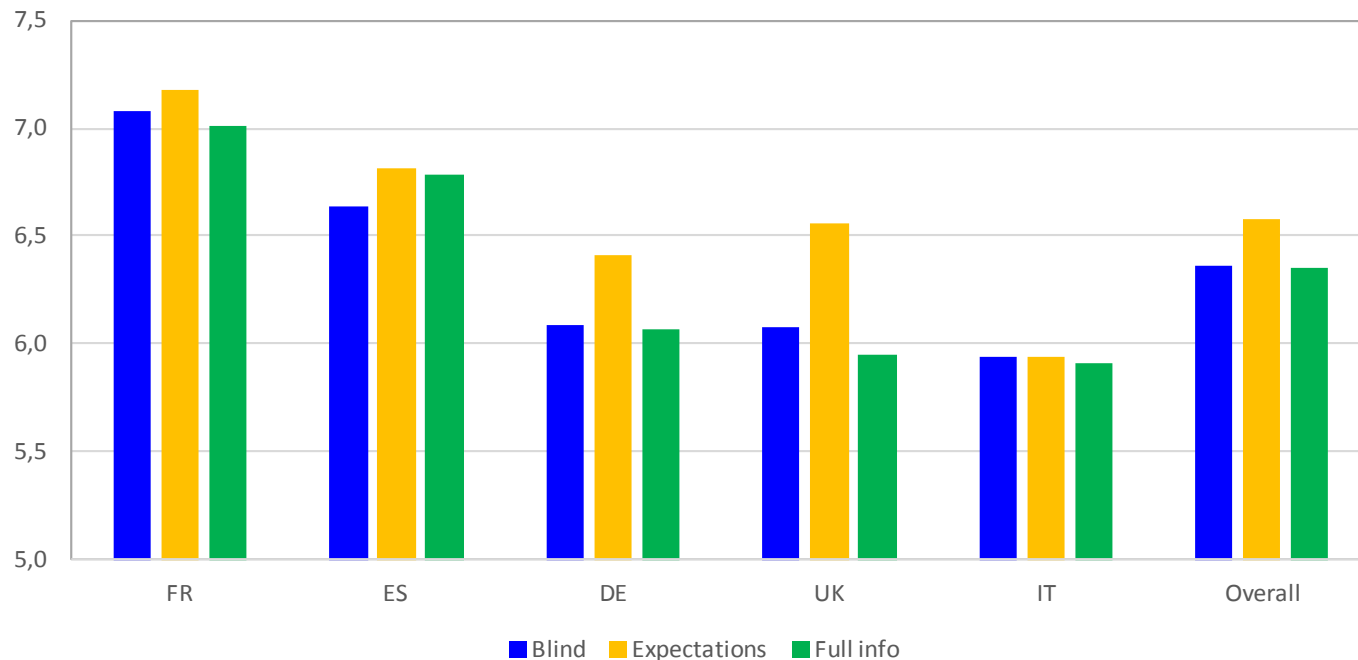
Product	Overall	DE	ES	FR	IT	UK
Fish olive oil	6.4 ^{bc}	6.0 ^{bc}	7.0 ^{ab}	6.9 ^{ab}	6.0 ^b	5.8 ^b
Grilled fillet	7.1 ^a	7.0 ^a	7.3 ^a	7.5 ^a	6.8 ^a	7.1 ^a
Hamburger	6.2 ^c	5.7 ^{bc}	6.5 ^b	6.8 ^{ab}	6.0 ^b	5.7 ^{bc}
Pate	5.6 ^d	5.2 ^c	6.5 ^b	6.5 ^b	4.9 ^c	4.8 ^c
Salad	6.3 ^{bc}	5.9 ^{bc}	6.4 ^b	7.5 ^a	5.5 ^{bc}	6.2 ^{ab}
Smoked fillet	6.5 ^b	6.5 ^{ab}	7.1 ^{ab}	6.9 ^{ab}	6.2 ^{ab}	6.1 ^b

a-d: Mean values in the same column with different superscripts differ significantly ($p < 0.05$).

- Similar to what was observed in the blind tasting

Results

Confirmation/disconfirmation of expectations



- In most cases the difference between the blind and the fully informed tasting was not significant

Results

Purchase probability

Purchase probability for each product and country (Juster 11-points scale, 0 to 10).

Product	Overall	DE	ES	FR	IT	UK
Fish olive oil	5.4 ^b	5.3 ^{bc}	5.8 ^{ab}	6.2 ^{abc}	4.9 ^{ab}	4.6 ^{bc}
Grilled fillet	6.6 ^a	6.7 ^a	6.4 ^a	7.4 ^a	5.9 ^a	6.7 ^a
Hamburger	5.1 ^b	4.8 ^{bc}	5.3 ^{ab}	6.2 ^{abc}	4.8 ^b	4.7 ^{bc}
Pate	4.3 ^c	4.1 ^c	4.8 ^b	5.6 ^c	3.4 ^c	3.4 ^c
Salad	5.3 ^b	5.2 ^{bc}	4.9 ^b	7.2 ^{ab}	4.0 ^{bc}	5.3 ^b
Smoked fillet	5.6 ^b	5.9 ^{ab}	5.7 ^{ab}	6.1 ^{bc}	4.9 ^{ab}	5.2 ^b

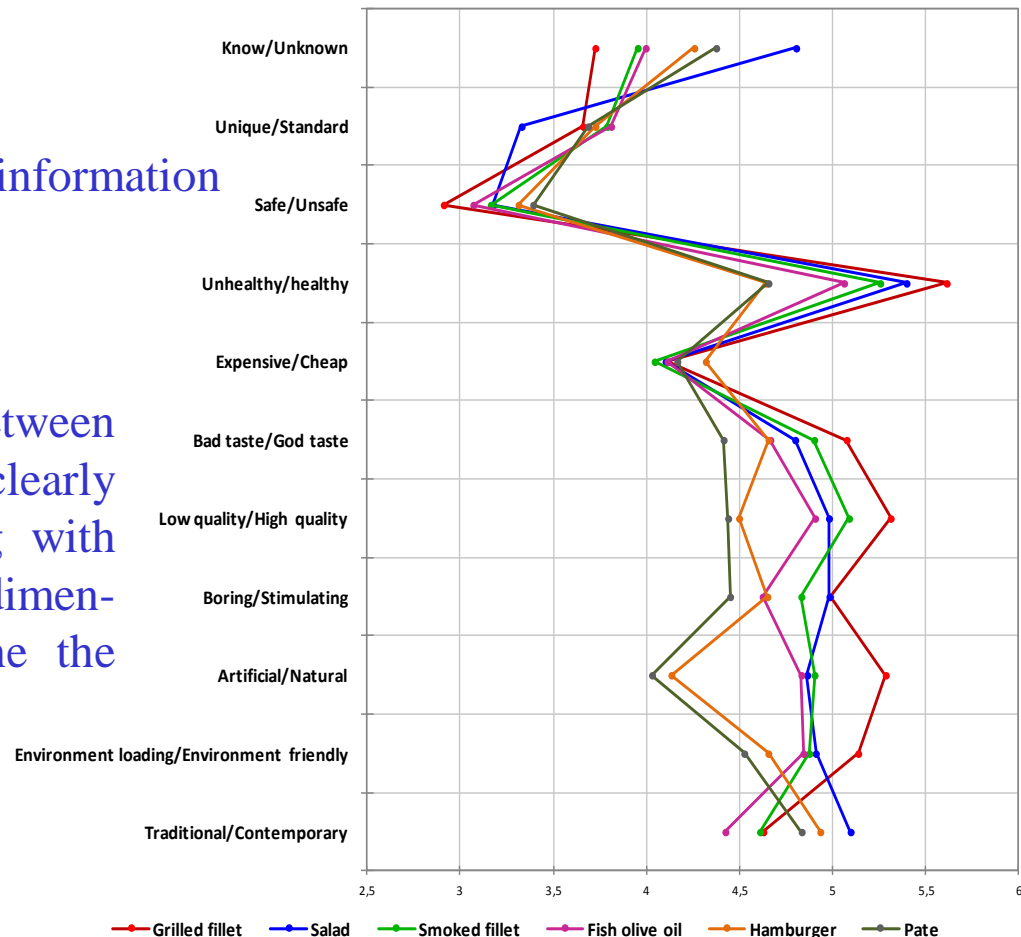
a-c: Mean values with different superscripts differ significantly ($p < 0.05$).

- Similar pattern than this observed for the acceptability in the full informed condition ($r=0.81$)

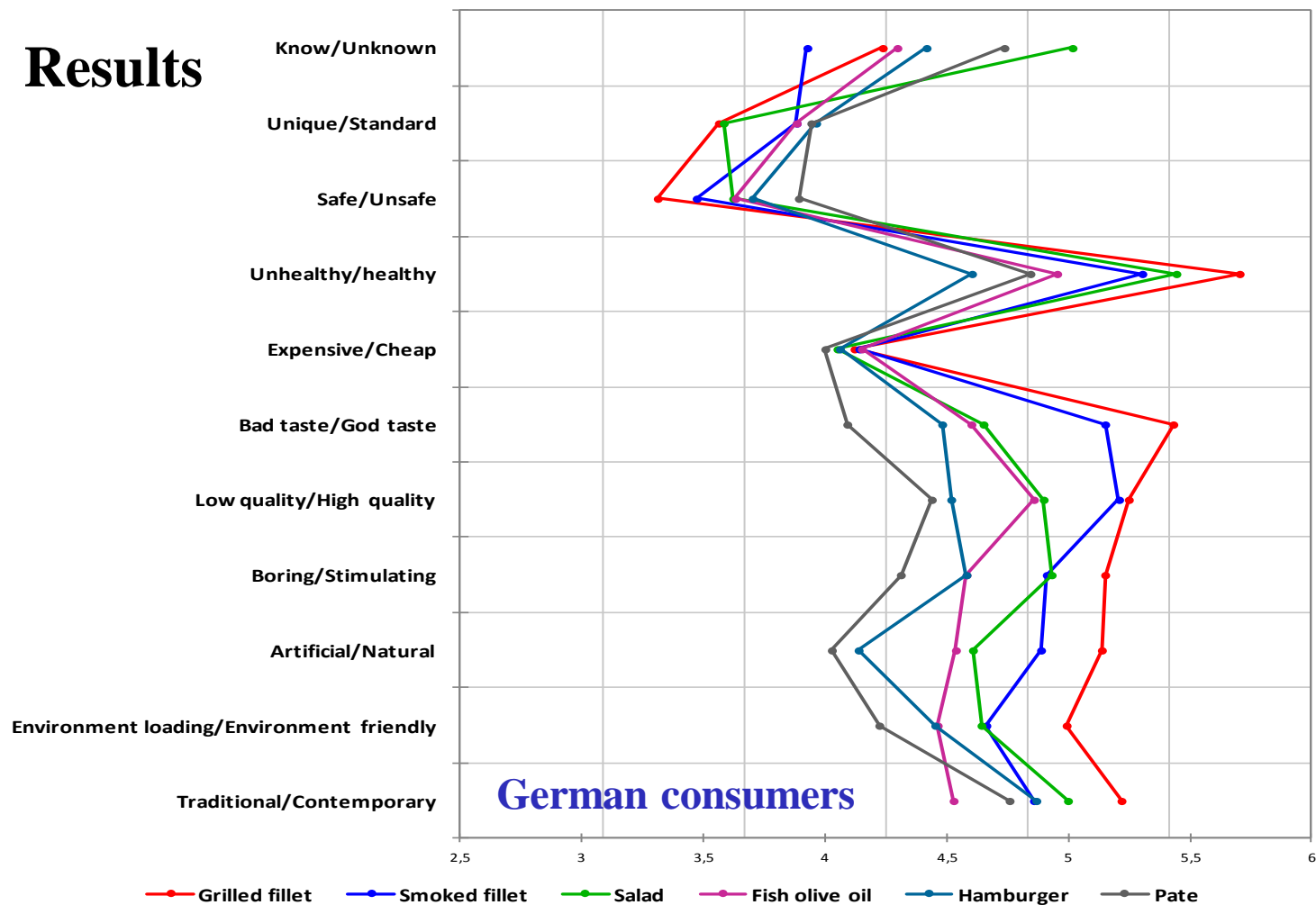
Results

Product image with full information

- Positive perception
- High discrepancies between countries, perception clearly different when dealing with the main intangible dimensions that might define the different products



Results



Take-home messages

- Sensory dimension seems to have an important contribution to the overall acceptance of the product and to its purchase probability
- The products already developed were not able to reach the initial expectations that they produced in the participants
- Products with a lower degree of processing were those who generated higher expected scores and higher acceptability in the blind test (recruitment criteria)
- The stimulating character (vs. boring) of the product also seems to play an important role as a preference driver

Take-home messages

- The environmental friendly character of the products did not affect the preference (it was included in the description of the different products)
- Low impact of the two identified segments (“Involved traditional” and “Involved innovators”) on the results obtained, novelty of the products??
- Effect of the country of origin of the participants was lower than expected
- Image/perception of the different products other than the sensory properties, differed in an important way between countries as well as their impact on the product acceptance and purchase probability



DIVERSIFY



New species for EU aquaculture