

Consumer attitudes and acceptance of new fish products: the case of meagre

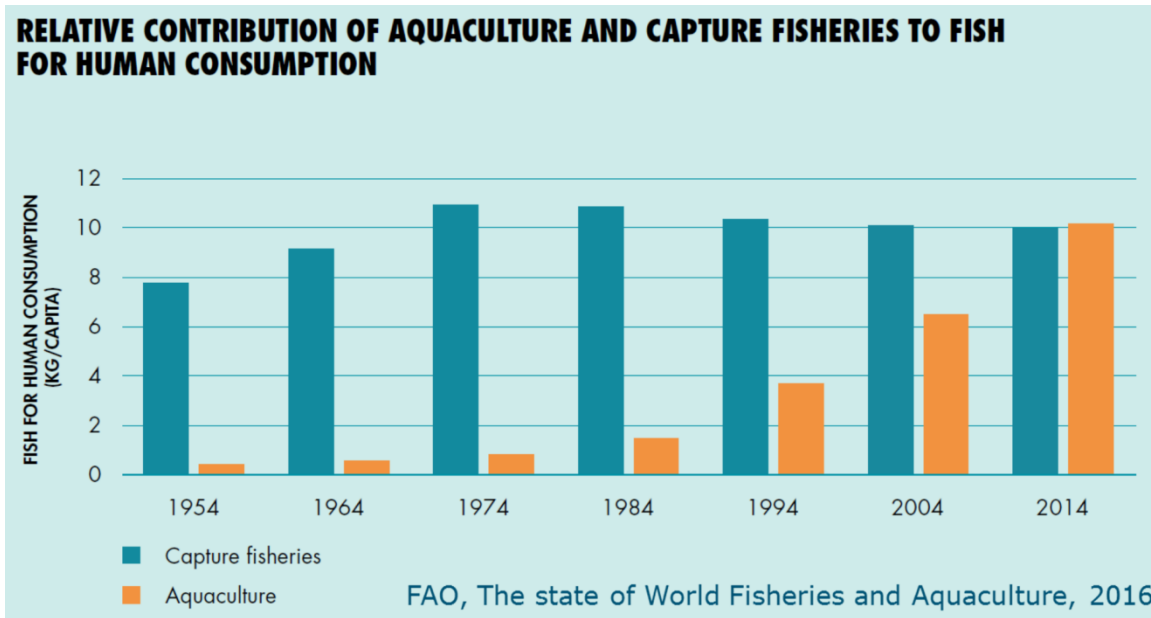


Co-funded by the Seventh
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of the European Union



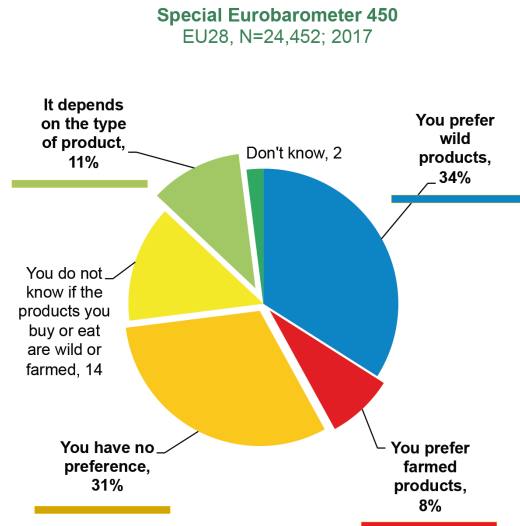
What we know...

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



What we know...

- 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



Attributes	Levels	Utilities	Relative importance (%)
Country of origin	Spain	1.7396	42.96
	Norway	-0.7122	
	Morocco	-1.0275	
Storage conditions	Fresh fish	0.6765	20.58
	Frozen fish	-0.6765	
Purchasing price	6 €/kg	0.4264	19.31
	12 €/kg	0.4168	
	18 €/kg	-0.8432	
Obtaining method	Wild fish	0.5918	18.01
	Farmed fish	-0.5918	

Intercept 4.9707, higher utility values correspond to higher consumer preference.

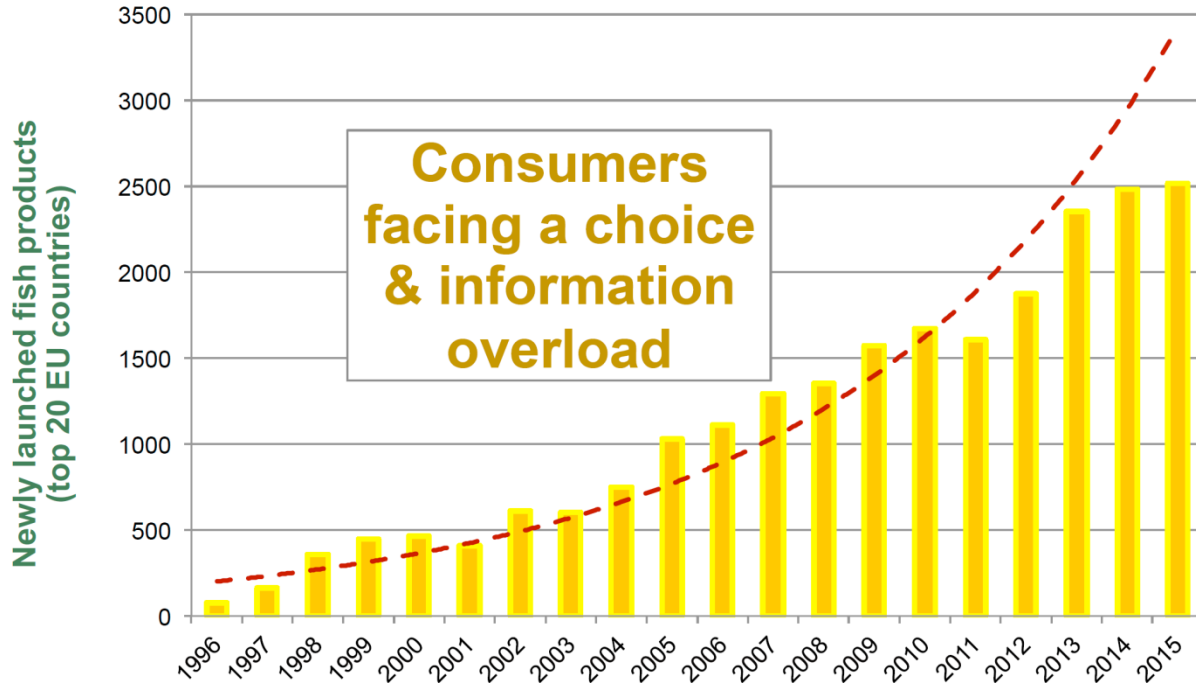
Only one segment of consumers (19.6%) preferred farmed sea fish instead of wild sea fish.

SOURCE: Claret et al. Food Quality and Preference 26 (2012) 259–266

What we know...

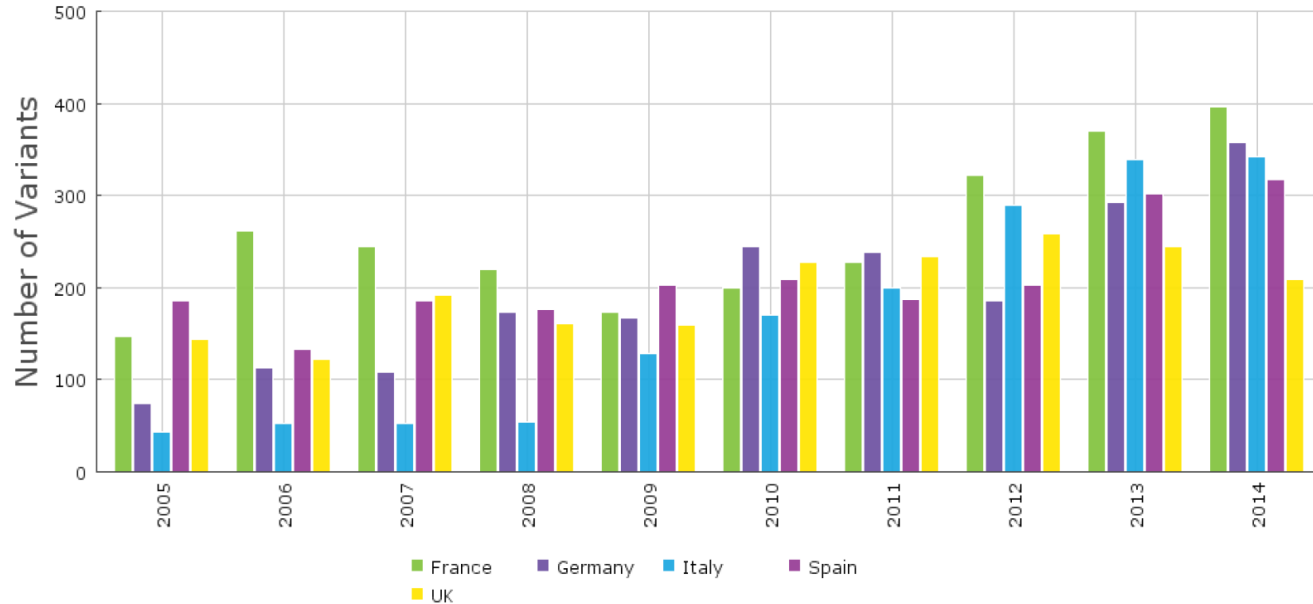
- The relative low market share of aquaculture can also be a direct consequence of the poor variety of aquaculture products in the market, and in particular because of the lack of processed aquaculture foodstuffs
- Variety has been identified as a relevant factor in order to stimulate consumers' purchase, thus avoiding boredom and satisfying individual curiosity
- Diversification: new species and new products, DIVERSIFY

Number of new fish products launched in the EU market



Source: Mintel GNPD-database, 2016

Fish product launches per year for 5 EU countries



10,245 products

Source: Mintel GNPD-database, 2014

Meat products vs. Fish products



What we know... In favour of the new farmed species

THE BLUE REVOLUTION

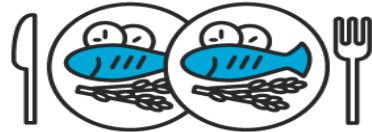
DEMAND

OUR GLOBAL POPULATION WILL GROW AN ADDITIONAL **2.7 BILLION** IN THE NEXT 50 YEARS



WE WILL NEED **70% MORE PROTEIN** BY 2050

2X MORE FISH IS CONSUMED GLOBALLY THAN BEEF



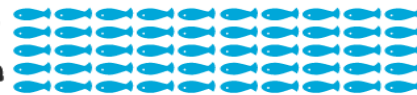
OCEANS ARE OUR BIGGEST SOURCE OF PROTEIN FEEDING **2.6 BILLION**

SUSTAINABILITY



OUR FISHERIES ARE **2.5X LARGER** THAN WHAT OUR OCEAN CAN SUPPORT

VARIETY



+500 SPECIES OF FARMED FISH
 = 10 fish

FEED CONVERSION FOR 1 LB OF MEAT



• 8/9 LB OF FEED • 1 LB OF FEED
 • 8K LITERS OF WATER

TRACEABILITY

WILD FISH

DON'T KNOW WHAT THEY'VE EATEN

NO IDEA WHAT KIND OF WATER THEY CAME FROM

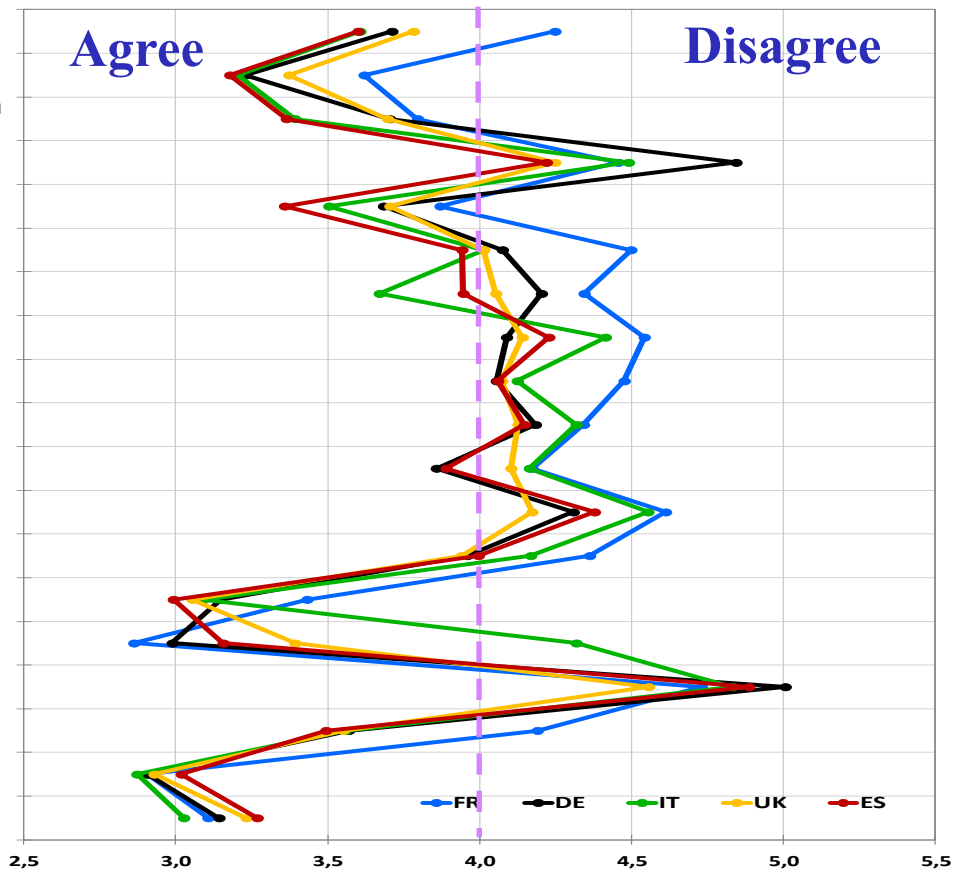


Objectives

- (a) to explore consumers beliefs about farmed and wild fish
- (b) to identify segment of consumers with different attitudes towards new products from new species
- (c) to elicit and assess ideas for new products
- (d) to develop new products based on selected ideas/concepts
- (e) 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)
- f) To define the most appropriate extrinsic properties for the new products

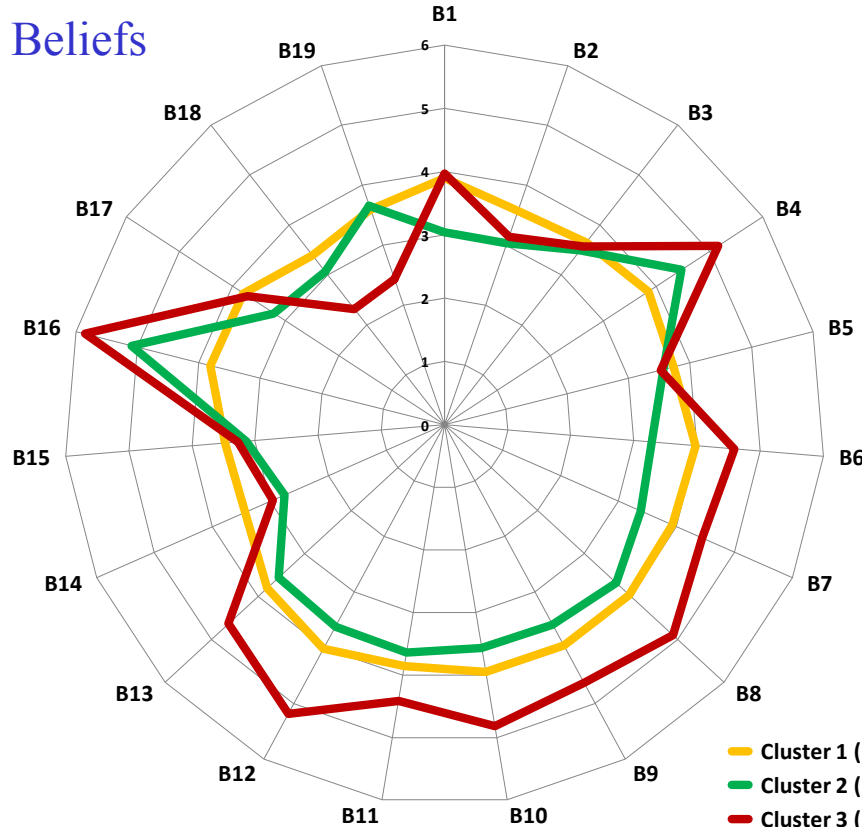
What consumers think about farmed fish

- 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 consumers think about farmed fish

Beliefs



■ Cluster 1 (N=1151)
■ Cluster 2 (N=391)
■ Cluster 3 (N=969)



Cluster 1 "Neutral":



< 40 years ♂



Cluster 2 "Pro -farmed fish"



15.6%



Cluster 3 "Pro -wild fish"

> 50 years ♀

Should we worry?

The Spanish case:

- 2008 vs. 2014 vs. 2016
- Low effectiveness

ACUICULTURA ESPAÑOLA: GARANTÍA Y FRESCURA TODO EL AÑO



alimentacion.es
Saber más para comer mejor

QUÉ

¿QUÉ ES LA ACUICULTURA?

La acuicultura es el cultivo de organismos acuáticos, abarcando peces, moluscos, crustáceos, plantas acuáticas y algas.



¿DÓNDE SE REALIZA EL CULTIVO DE LAS ESPECIES?

CULTIVOS EN AGUAS SALOBRES



• Cultivos de marisco (moluscos y crustáceos)
• Cultivos de peces (carpa, salmón y tilapia)

CULTIVOS EN MAR



• Cultivos de marisco (moluscos)
• Cultivos de peces (carpa, salmón y tilapia)

CULTIVOS EN TIERRA



• Cultivos de marisco (moluscos)
• Cultivos de peces (carpa, salmón y tilapia)

¿POR QUÉ ES ACCESIBLE EL PRODUCTO DE ACUICULTURA?

La disponibilidad durante todo el año de los productos de acuicultura y su calidad homogénea hacen que los precios sean más accesibles para el consumidor.

¿CÓMO DIFERENCIO LAS ESPECIES DE ACUICULTURA EN MI PESCADERÍA?

Por su etiqueta. Todo producto piscícola debe estar acompañado por una etiqueta. En ella aparecen un apartado en el que se indica el método de producción y debe estar marcado. Acuicultura.

¿TODAS LAS ESPECIES DE ACUICULTURA QUE ENCUENTRO EN MI PESCADERÍA SON PRODUCCIONES EN ESPAÑA?

No siempre. Puedes conocer su procedencia u origen marcando la etiqueta que lo acompaña, en ella debe aparecer dicha información.

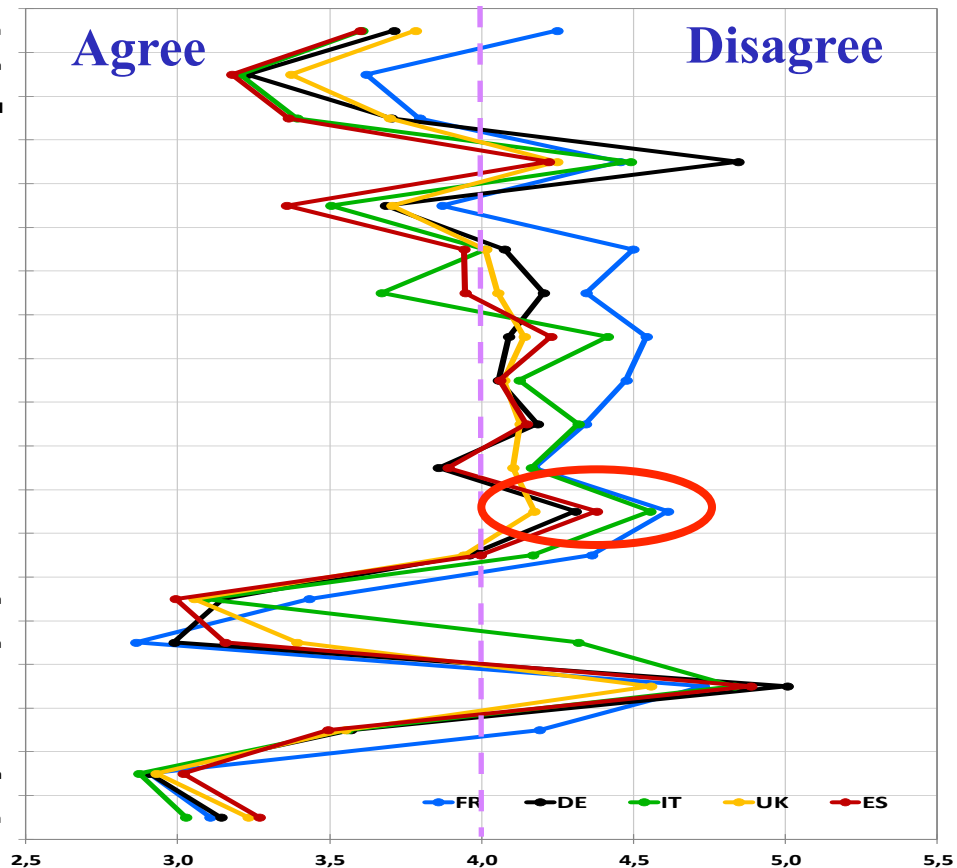


ACUICULTURA



apenas mediamos unos milímetros,

- 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
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Contents lists available at ScienceDirect

Aquaculture

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



Does information affect consumer liking of farmed and wild fish?



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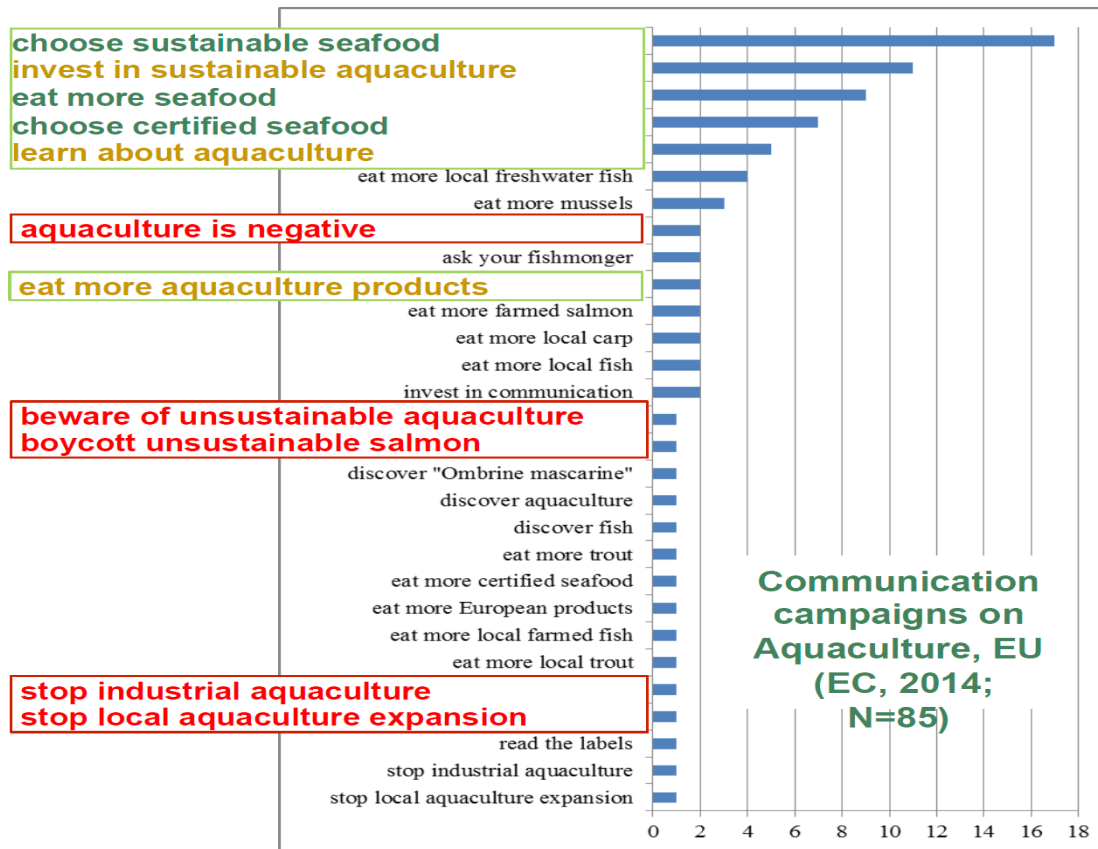
^c ULPGC-Instituto Universitario de Sanidad Animal y Seguridad Alimentaria, Dept. Acuicultura y Genética Marina, Trasmontaña s/n, E-35413 Arucas, Las Palmas, Spain

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

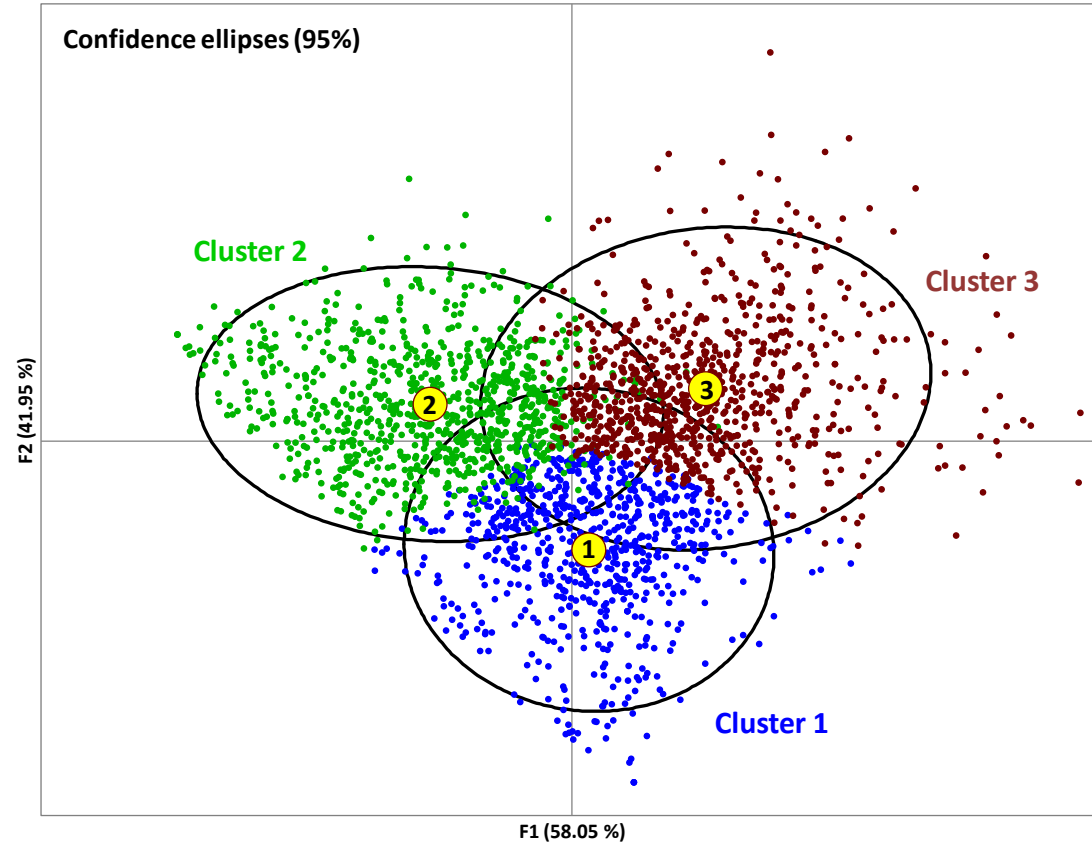
	Overall liking		RMSE	p Value
	Wild fish	Farmed fish		
Informed condition	7.4	6.7	1.803	<0.0001
Blind condition	6.3	6.7	2.095	<0.0001
RMSE	2.003	1.950		
p Value	<0.0001	0.957		

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

Contradictory messages

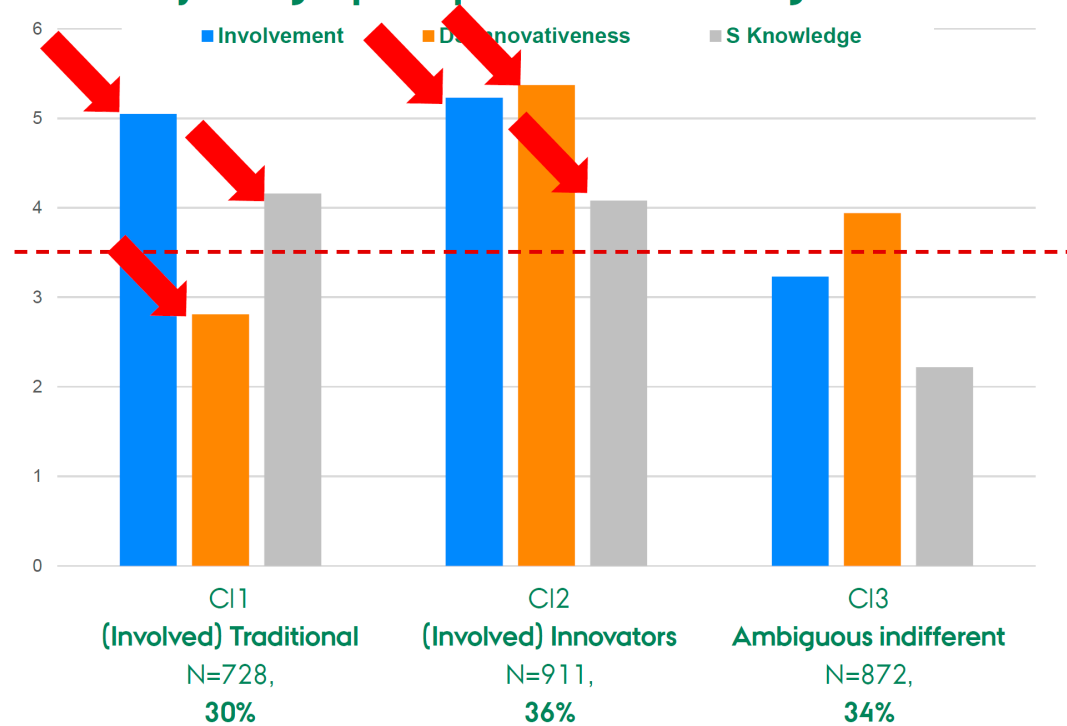


Consumers segments: acceptance of new farmed fish





Two potential segment for new products

Psychographic profile of the segments

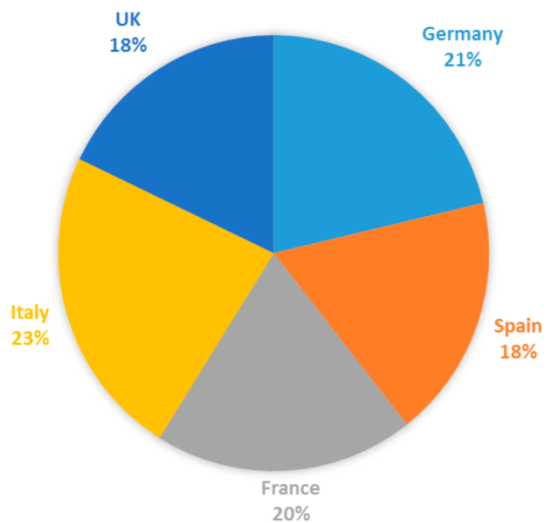


Two potential segment for new products

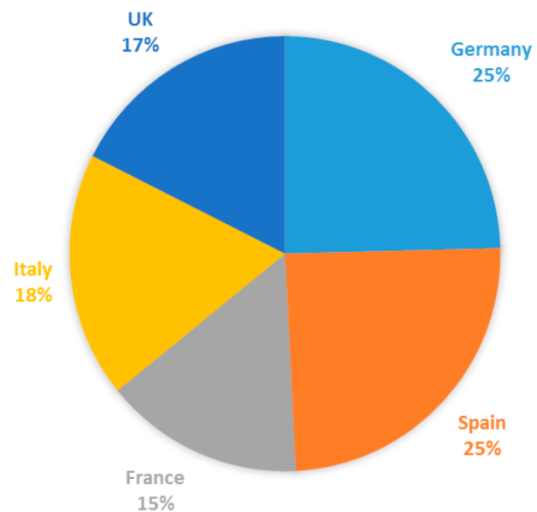
The “traditional” fish eaters (30%)	The “innovators” (36%)	Ambiguous indifferent (34%)
		
<p>PSYCHOGRAPHICS -Involved, knowledgeable</p> <p>BEHAVIOUR -Highest number of regular fish consumers across all fish types (farmed, wild, etc.)</p> <p>PERCEPTIONS OF VALUE & COST -Average perceived value of the new species, highest perceived cost (i.e. price, safety, effort), high WTP and PI</p> <p>BELIEFS -Overall strongest beliefs: farmed fish is handled, guaranteed, safe, tasty; wild fish suffers pollution, heavy metals, parasites</p>	<p>-Involved, knowledgeable, innovative when it comes to new fish</p> <p>-Highest number of regular farmed fish consumers, highest number of occasional wild fish consumers</p> <p>-Highest perceived value (i.e. functional, hedonic, ethical), lowest perceived cost, highest expected outcomes (i.e. satisfaction, trust, WOM), high WTP and PI</p> <p>-Stronger beliefs about farmed fish: easier to find, cheaper, more controlled</p>	<p>-Non-involved, non-knowledgeable</p> <p>-Highest number of occasional of non-consumers of all fish types</p> <p>-Lowest value perceptions and outcomes, average cost perceptions</p> <p>-Neutral, low-strength beliefs</p>

Country participation

CL.1: INVOLVED TRADITIONAL

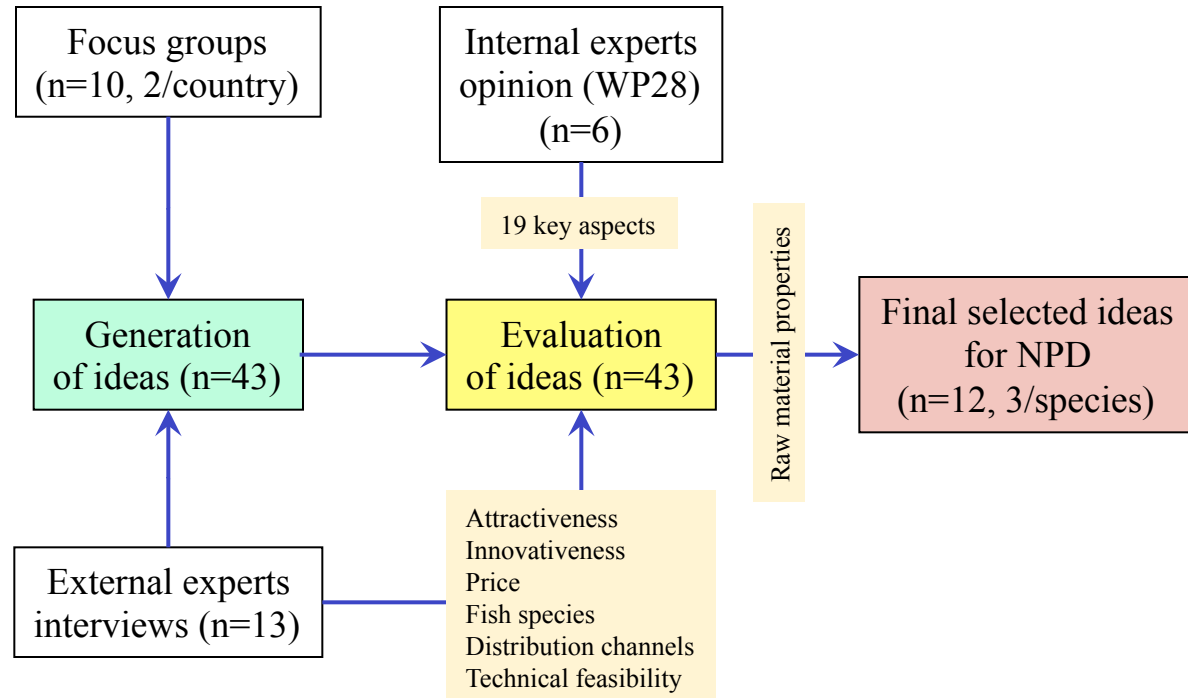


CL.2: INVOLVED INNOVATORS



New product development

- Generation and evaluation of ideas



New product development

- Technical properties:

Meagre is a fast grower. Its usual commercial sizes are between 1-2 kg, while it can reach up to 8 kg. Smaller commercial sizes starting from 600g have been also used recently, but with some issues of inferior texture, darker appearance and higher edible losses. Its large sizes allow flexibility in cutting (cuts, fillets). Small quantities of processed forms, in specific frozen fish, smoked fillets and sushi have been also reported for meagre. Its flesh is characterized as white of medium firmness, mild flavour and has very low fat contents. The muscle fat of farmed meagre ranges, according to the literature, from 0.73-2.93%. Its low muscle fat content may be a limiting factor in processing forms where flesh drying takes place (e.g. smoking, salting).

New product development

Selected ideas for NPD

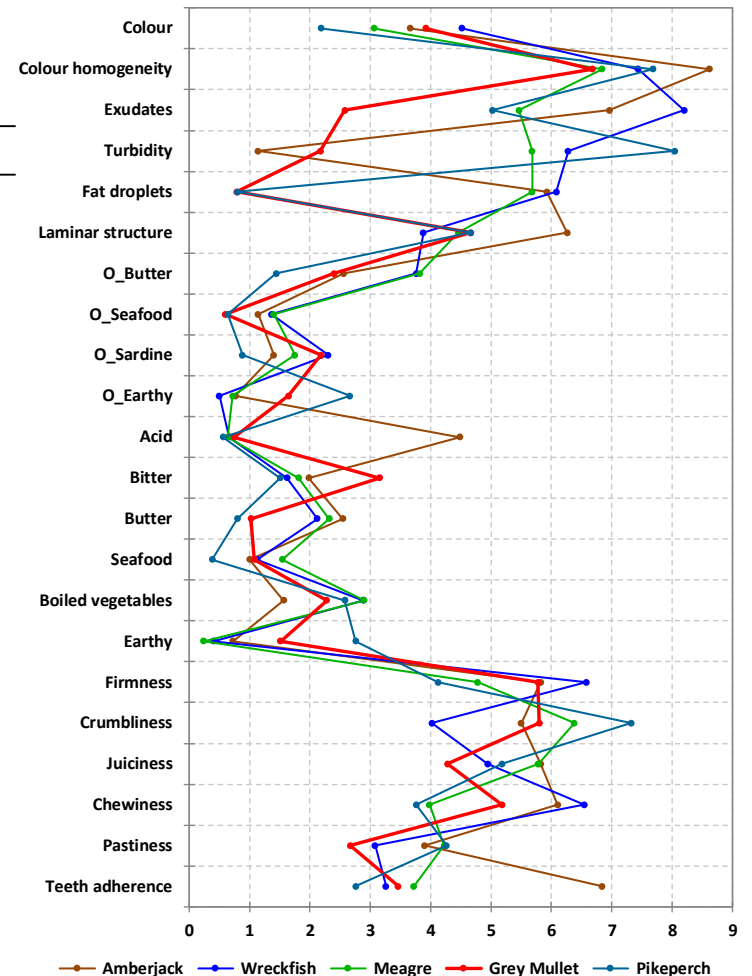
Based on technical feasibility and the opinion of experts (19 factors: Nutritional benefit, Healthiness, Convenience in preparation (easy-to-cook), Convenience in consumption (ready-to-eat), Cost for consumer (price), Technical feasibility (equipment & raw material), Technical feasibility (know-how), Specific consumer targeting, Familiarity, Newness/ innovativeness, Existence of similar/competitive products, Shares characteristics of successful products, Perceived consumer freshness, Safety, Shelf life, Packaging, Added value, Attractiveness (Appearance/ presentation), Recipes)

Species	Growth rate	Fillet Size	Yield	Firmness	Fat content	Flavor
Grey Mullet	Slow	300-500g	Low	High	Medium/high	Bitter
Meagre	Fast	1-2kg	Medium	Medium	Low	Mild
Greater Amberjack	Fast	3-5kg	High	Medium	High	Sour
Wreckfish	Fast	>8kg	High	High	Low	Neutral
Pikeperch	Medium	1-2kg	Medium	Low	Low	Earthy

New product development

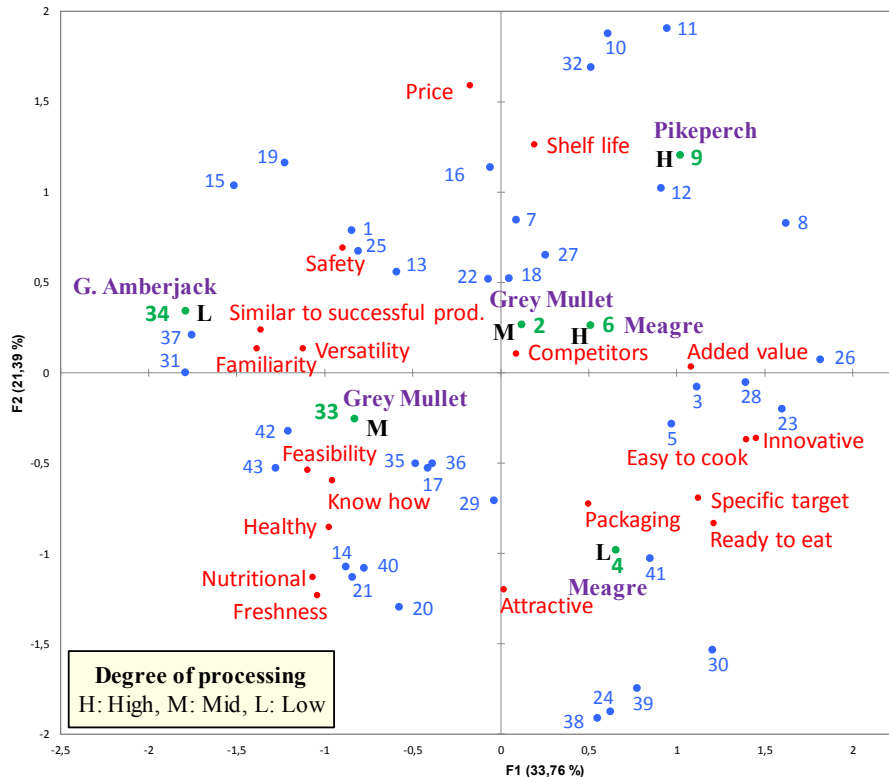
Selected descriptors used for the final descriptive profile along with their description.

Attributes	Description
Appearance	
Color intensity	Color intensity from white to light brown inside the flesh of the fish
Color uniformity	Color homogeneity inside the flesh of the fish without black veins or spots
Exudate quantity	Quantity of liquid released after cooking the sample
Fat droplets	Fat released in fish exudate in the form of oil droplets
Laminar structure	Visual distinction of muscular structures when removing the skin of the fish
Turbidity of exudate	Suspended particles in exudate that block transparency
Odor	
Butter	Intensity of odor like butanedione
Earthy	Intensity of odor like humid earth
Sardine	Intensity of odor like fish oil
Sea food	Intensity of characteristic odor
Flavor	
Sour	Flavor like citric acid
Boiled vegetable	Flavor like cooked vegetable
Butter	Flavor intensity like butanedione
Bitter	Flavor like quinine
Earthy	Flavor like humid earth
Sea food	Flavor like seafood
Texture	
Chewiness	Number of chews before swallowing
Crumbliness	Degree of fish disintegration in the first bite
Firmness	Force required to deform the fillet between the tongue and palate
Juiciness	Liquid released when chewing the fish sample
Pastiness	Degree in which fish turns in to a paste after chewing
Teeth adherence	Degree in which fish sticks between molars



New product development

Selected ideas for NPD



Selected Ideas

1. Frozen fish fillets with different recipes
2. Thin smoked fillets
3. Ready to eat meal: fish soup
4. Ready to eat meal: salad with fish
5. Ready to eat meal: fish risotto
6. Fish burgers shaped as fish
7. Fish balls
8. Dried fish sticks with accompanying dip
9. Fish pate/spreads
10. Fish broth in cubes
11. Fish powder/ seasoning
12. Fish sauces
13. Frozen fish fillet that is seasoned or marinated
14. Fresh fish fillet with herbs and spices
15. Whole deep frozen fish
16. Frozen whole fish filled with spices and with organic vegetables
17. Fresh whole fish filled with spices and with organic vegetables
18. Frozen fish fillet with potatoes and vegetables
19. Deep frozen white fish fillet in the transparent packaging with additional information
20. Fresh back fish fillet
21. Fresh fish fillet with different 'healthy' seasoning and marinades
22. Frozen fish and seafood salad
23. Varied meal with fish fillet, burgers sausages
24. Fresh fish Carpaccio
25. Frozen back fish fillet in transparent packaging and accompanying marinades
26. Fresh ready to eat meal with fish fillet with different cheese and fine herbs
27. Fish sausages and fish hamburgers
28. Liquid fish to make soups or drink.
29. Fresh fish fillet medallions with garnish and sauce, separately packed.
30. Ready-made fish tartar with additional soy sauce
31. Whole fresh fish with information how to be prepared
32. Bread crusted crispy frozen fish product with a topping
33. Ready-made fish fillets in olive oil
34. Fresh fish steak for grilling in the pan
35. Steamed fish fillets
36. Ready-made larger pieces of fish without bones
37. Fresh fish fillet in a simple package
38. Fresh fish Carpaccio 2
39. Bottarga sliced as medallions
40. Fresh fish fillet sliced presented in the shape imitating of fish scales
41. Ready-made fish fillet / fish dices accompanied with cereals and vegetables
42. Fresh fish roast
43. Fresh fish fillet that comes with 3-day plan

New product development

- Selection of the new products to test



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

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



Consumer test

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

Consumer test

Preparation of the samples



Consumer test

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 and image for each of the 10 different ideas
 - 3) Blind tasting: liking of the six selected products
 - 4) Overall expectation in informed condition: overall acceptability and personal perception of each product by means of a semantic differential scale (made up of 11 adjectives)

Consumer test

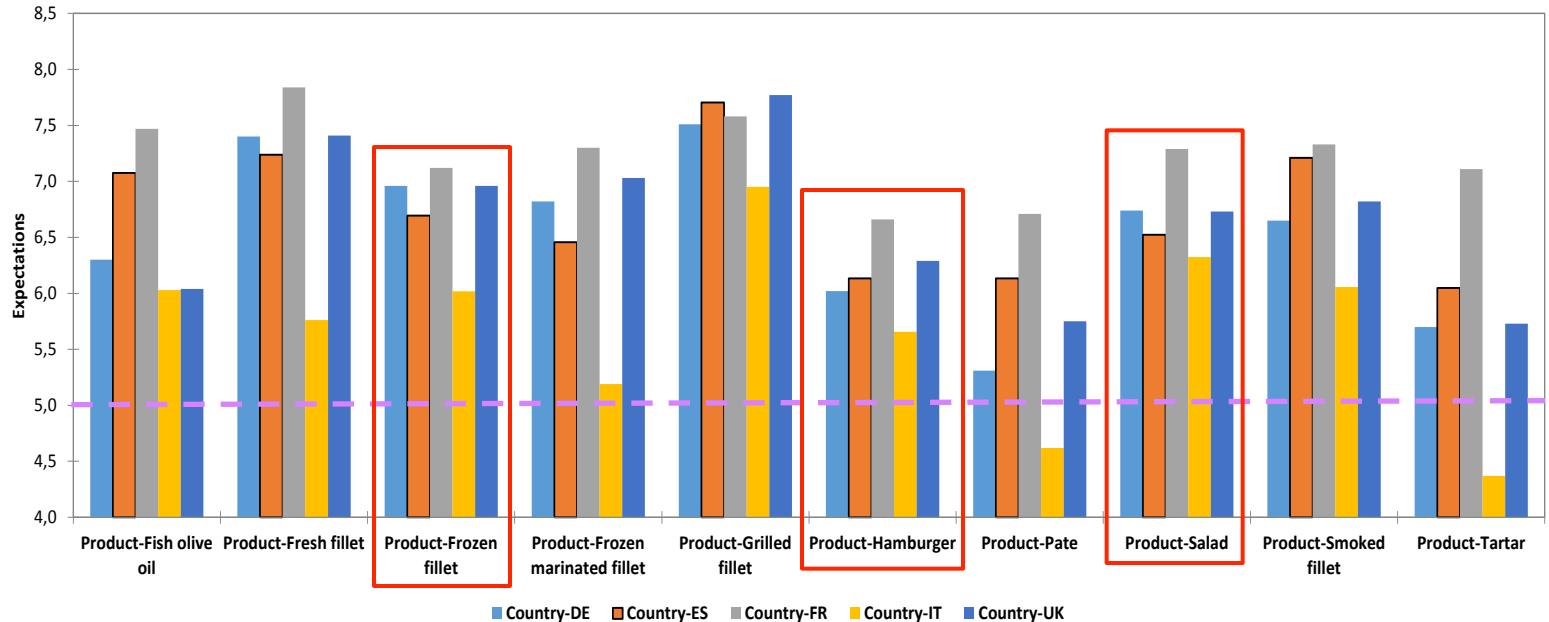
Liking expectations

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

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

Consumer test

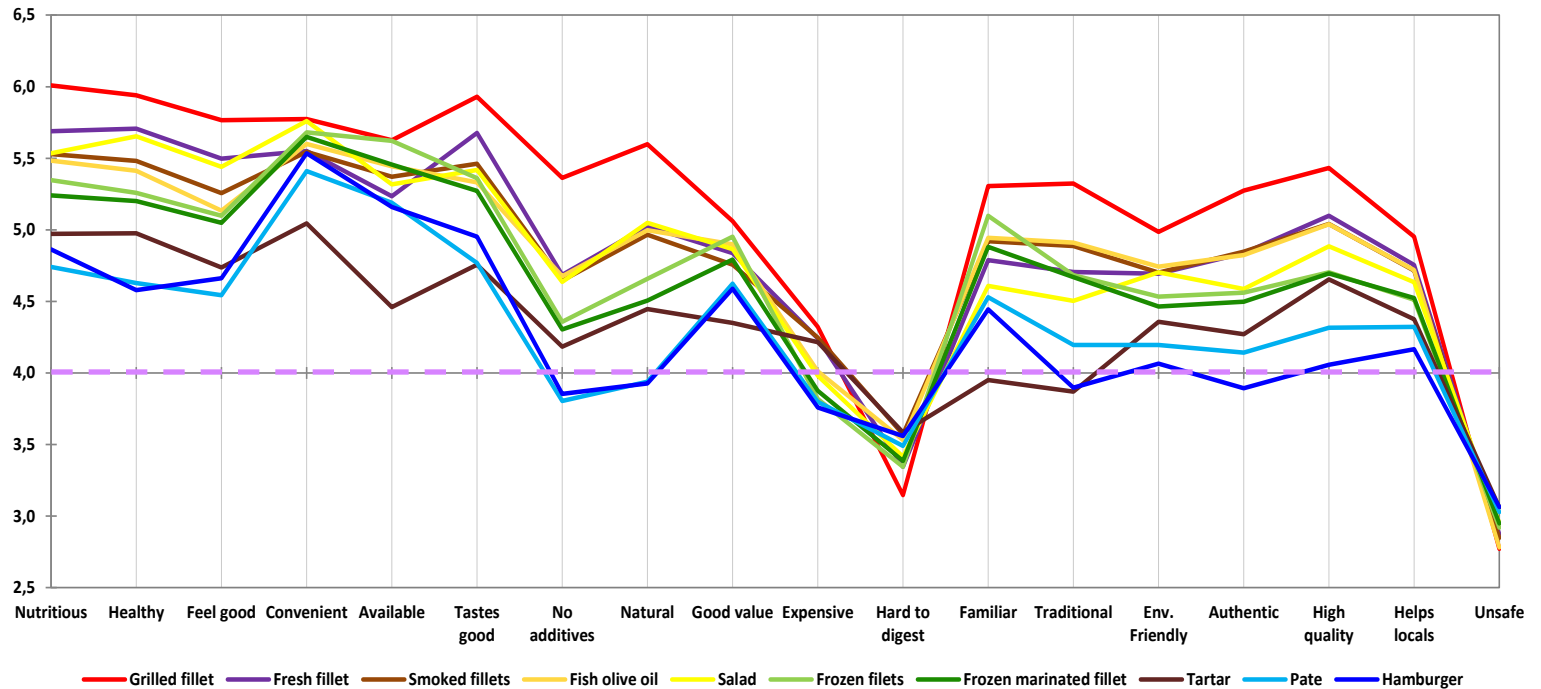
Liking expectations



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

Consumer test

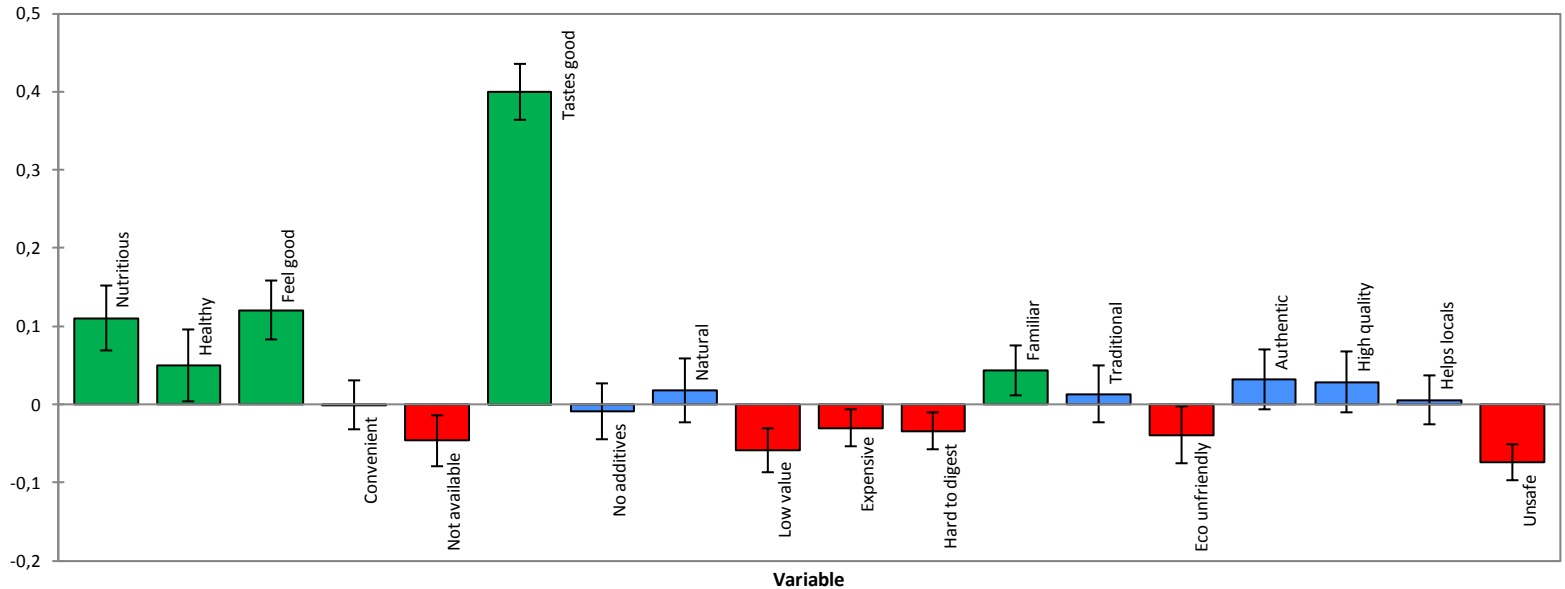
Image/perception of the different products or ideas



- All the products were perceived quite positively

Consumer test

Effect of image/perception on expectations (all countries)



Consumer test

Blind tasting (6 products)

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

- Agreement with the previously reported expected liking

Consumer test

Overall liking in the full informed condition

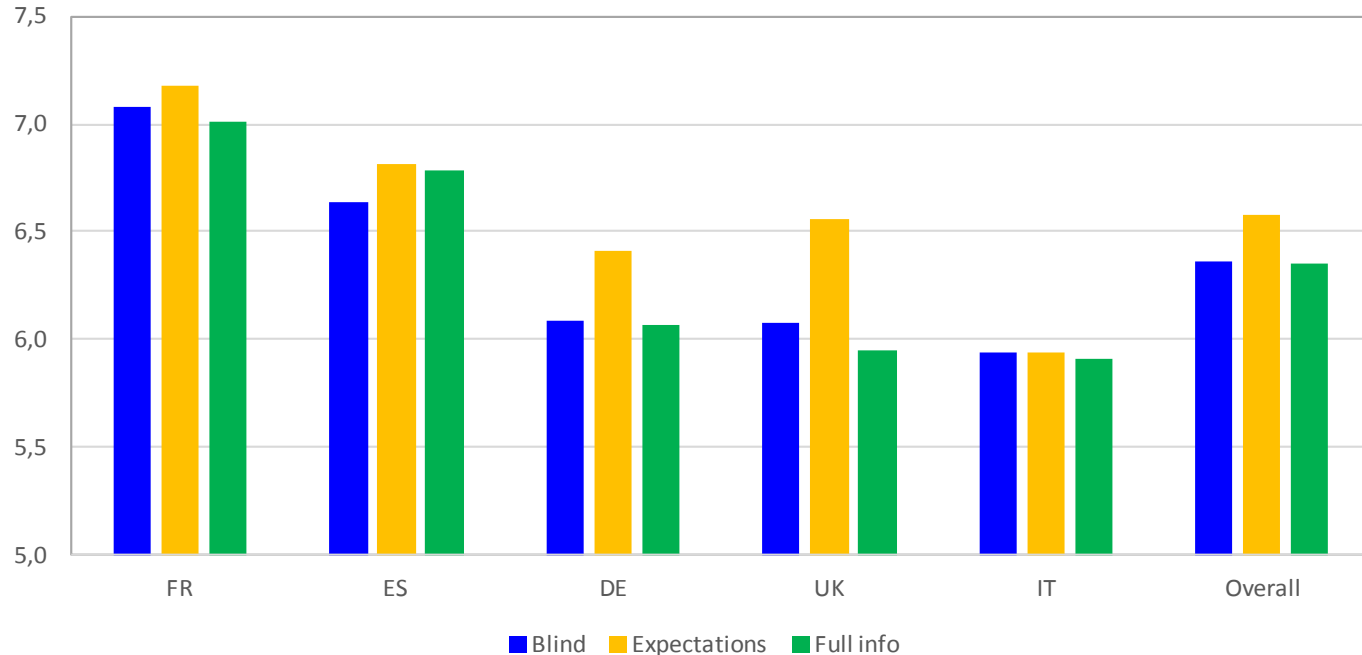
Product: **Frozen fish (meagre) burgers shaped as fish**. The burgers are ready to cook and prepared with a mild seasoning and can be incorporated in a sandwich or prepared as a part of a meal. The product is produced in an environmentally sustainable way. It is labelled as a premium product, the country of origin is EU. The product is included in a transparent vacuum-packed bag or in a plastic tray with transparent plastic on the top. Information on fish for educative purposes (children) and playful gifts (e.g. sticker) are included in the packaging.

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

- Similar to what was observed in the blind tasting (low impact of the species)

Consumer test

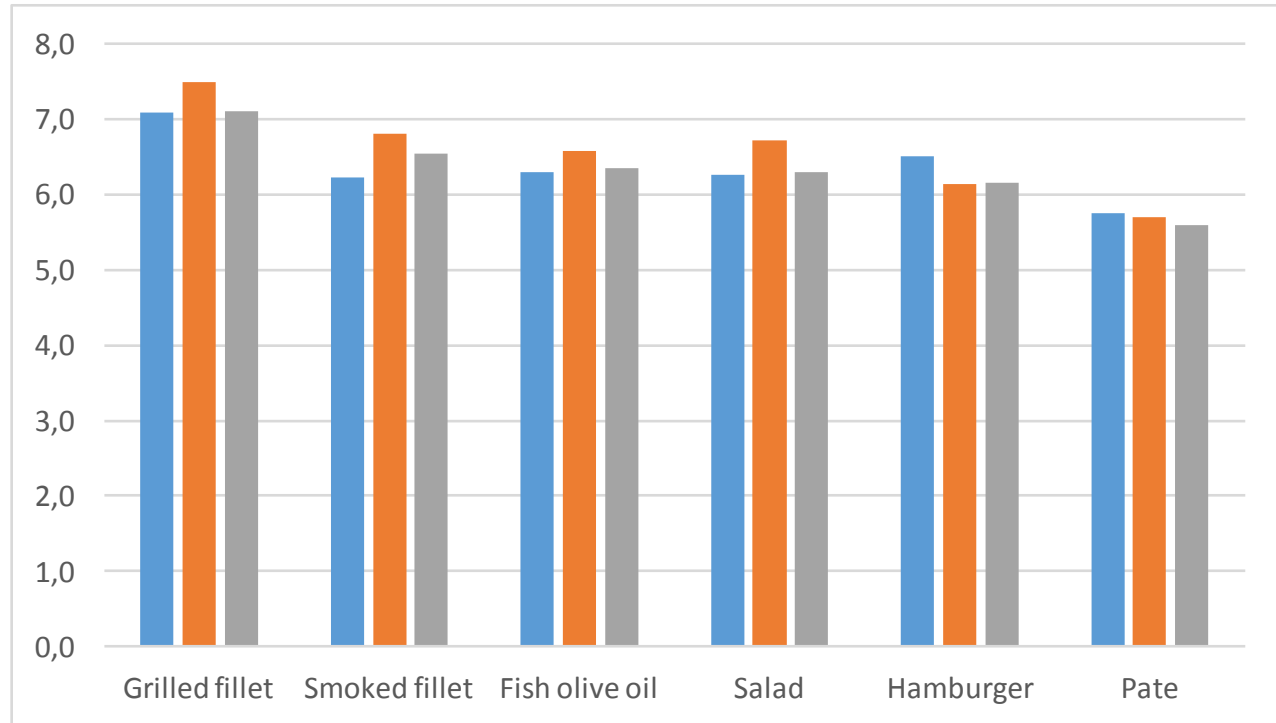
Confirmation/disconfirmation of expectations



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

Consumer test

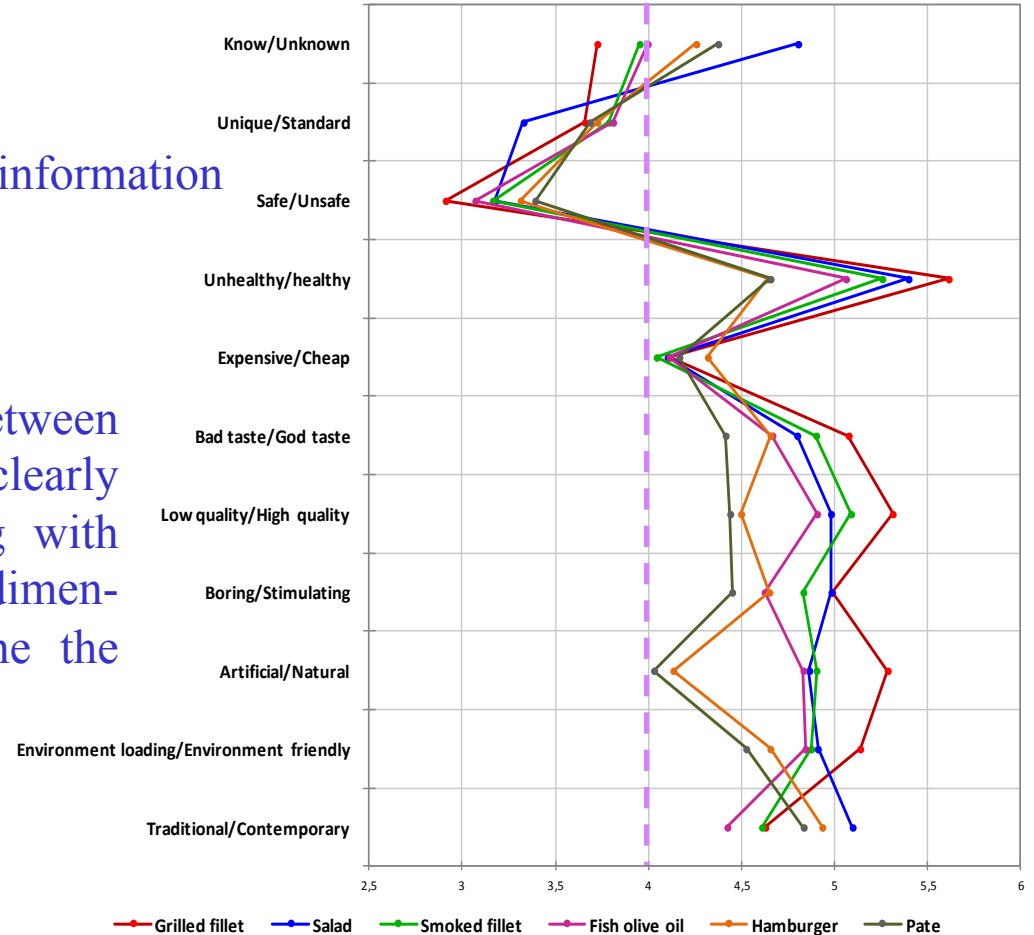
Confirmation/disconfirmation of expectations (all countries)



Consumer test

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



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 environmental friendly character of the products did not affect the preference in an important way (it was included in the description of the different products)

The team

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DIVERSIFY



New species for EU aquaculture



DIVERSIFY



New species for EU aquaculture

What we know...

- Percentage of income spend on food has declined in most countries due to the crisis, but this will (partly) recover
- Tuna, cod, salmon and shrimps are most consumed across the EU. The fish market for flatfish and small pelagics is saturated but market needs for shrimps, groundfish, salmonids and tuna are not satisfied with local production/catches. Good filets and hardly any or easy bones
- Northern EU countries eat more processed fish than southern EU countries, but this changes rapidly. Market shares of supermarkets are growing for fresh products in the southern EU
- Minorities grow faster than locals in most countries, so ethnic developments change the eating habits and assortments in supermarkets

What we know...

- Personal well-being and (health) impact are growing motives for food choices
- Value for money have become a leading buying motive due to the crisis
- Increase of fresh fish assortment in supermarkets
- Concentration in sea food consumption areas is fading out to other areas due to increasing high quality availability in supermarkets and hypermarkets all-over the countries
- Increasing demand for value added products like marinated fish
- Saturation of the protein market in the EU. Growth can only be reached by defeating the competition

What we know... in favour of the new farmed species

- Government programmes support fish intake, since fish is perceived as more healthy than meat, or higher fish consumption is stimulated from a more varied protein consumption perspective
- Aquaculture is perceived as more sustainable than wild catch
- Aquaculture of these new species can bring employment in regions with high unemployment
- Increasing world wide demand for proteins, which might increase the price for fish products
- Consumers decrease meat and meat product consumption for health reasons (WHO advice)