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Consumer Preferences for Farmed Seafood: An Italian Case Study

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ABSTRACT

European consumers prefer wild over farmed aquatic food and consider it healthier and tastier. Consumers are increasingly paying attention to sustainability and welfare of farmed fish. Such expectations might be met by organic certification, but this represents a cost for the producer. It is crucial to know consumer habits about farmed aquatic food consumption and willingness to pay for certification. Data about Italian consumers' preferences regarding farmed organic aquatic food were collected by an online questionnaire. A total of 8,657 answers were analyzed, patterns associated with demographics were investigated, and the degree of correlation among answers was calculated. The majority (75%) of family units buy less than 2 kg of farmed aquatic food per month, spending on average 20–50 €. About 40% never consume organic aquaculture products because of lack of knowledge, unavailability, and high price. Slightly over half (55%) of consumers, regardless of age, sex, and area, were willing to pay a premium price for organic-certified aquatic food, seen as antibiotic free, traceable, and sustainable. Organic food in general is well known, and distrust is the main reason that consumers avoid it, while organic aquatic food is still in its infancy, and lack of knowledge is associated with low consumption.

KEYWORDS

Aquaculture; consumer habits; crustaceans; aquatic food consumption; seafood consumption; fish; molluscs; organic

Introduction

World per capita fish consumption grew in recent decades from 9.0 kg in 1961 to 20.2 kg in 2016 (FAO 2018) and should continue to increase in the future due to human population growth. Conversely, fisheries production is stagnating (FAO 2018) and may not support future food requirements. Aquaculture is one of the fastest growing sectors in animal-production: it has grown rapidly since 1990 and is expected to reach 109 million tonnes in 2030 (FAO 2018). Aquaculture is projected to sustain 60% of aquatic food requirements in 2030, compared to the current 52% (FAO 2018). The rise of aquaculture production could lead to impacts on the environment, such as water pollution, habitat destruction, negative interactions with wild aquatic populations, and overfishing of wild stocks used as feed sources for farmed fish (Klinger and Naylor 2012). Accordingly, sustainable solutions for the aquaculture industry should be suggested and promoted.

Currently, organic aquaculture represents a step in that direction. Organic aquaculture is regulated by Reg. (CE) No. 834/2007¹ and successive implementing rules. The new organic regulation (Reg. EU No. 2018/848)² will come into force in 2021. The founding principles of organic aquatic food production are conservation of biodiversity, reduction of the negative impacts on the environment and wild resources, high animal welfare standards (i.e., reduced stocking densities, improved water quality, compliance with species-specific physiological and behavioral needs), and high quality

of products. These characteristics have been shown to add an economic value to organic aquatic food. Consumers are willing to pay a premium price for sustainable, environmental-friendly, and “antibiotic-free” aquaculture products (Disegna et al. 2009; Mauracher et al. 2013; Olesen et al. 2010).

In addition to sustainability issues, concerns about animal welfare in animal husbandry have recently gained importance in public opinion and also in consumers’ food demand (Broom 2010; Eurobarometer, 2016; Evans and Miele 2008; Harper and Henson 2001; Harper and Makatouni 2002; Heid and Hamm 2012; Weible et al. 2016).

However, a large number of studies have pointed out that consumers are still biased against farmed fish, instead preferring wild fish, which are considered tastier and healthier (Cardoso et al. 2013; Claret et al. 2014, 2016; Kole 2003; Rickertsen and Alfnes 2016; Verbeke et al. 2007a). This prejudice does not seem to be based on the sensory properties of farmed fish with respect to wild (Claret et al. 2016) but on the image of aquaculture products, perceived as artificial, and on lack of information on sustainable farming practices (Altintzoglou et al. 2010; Claret et al. 2014; Roheim et al. 2012; Salladarrè et al. 2010; Vanhonacker et al. 2011). Several studies attempting to assess which attributes of aquatic food guide consumer choice have highlighted environmental concerns (Brécard et al. 2009). Moreover, several studies have demonstrated that consumers, in particular those paying attention to the ethical aspects of animal production, are concerned about sustainability of fish farming methods and fish welfare (Bergleiter and Meisch 2015; Brécard et al. 2009; Broom 2010; Carlucci et al. 2015; Jaffry et al. 2004; Mauracher et al. 2013; Olesen et al. 2010; Verbeke et al. 2007b; Weible et al. 2016; Whitmarsh and Palmieri 2011; Zander et al. 2018). When information is clearly available, consumers are willing to pay extra costs for healthy and environmentally friendly attributes of aquatic food products (Kole et al. 2010).

The food industry is increasingly ruled by consumers’ perceptions and market orientation. Therefore, to be successful, the aquaculture sector should evolve to meet consumer expectations by differentiating in terms of species, farming methods, and the development of added values (i.e. sustainability, organic certification, and reduced environmental impact) (Barazi-Yeroulanos 2010). For instance, the perception of farmed fish as functional food, enriched with supplements by fish feed during farming, such as anti-oxidants and omega-3 fatty acids, could be a way to improve farmed fish acceptance (Ramalho Ribeiro et al. 2019).

Because organic certification represents a cost to the producer, it is crucial to know in advance the consumer’s willingness to pay for some characteristics of the food, such as sustainability, certification, traceability, and security. Consumer habits regarding other aquatic food attributes, such as product presentation, production mode, and price, are also important. In general, there is evidence that consumers are open to paying higher price premiums for wild fish over farmed fish, preferring sustainably harvested wild fish over sustainably farmed fish. This is the case, for instance, of turbot in Germany (Bronnmann and Hoffmann 2018). But consumer habits and attitudes vary among countries and within each country among individuals, as related to species, tradition, knowledge, and socioeconomic status (Johnston et al. 2001). A recent study carried out in Germany showed that ASC certified farmed salmon is perceived as sustainable by consumers and could manage the same price as wild-caught labelled salmon (Bronnmann and Asche 2017). This case demonstrates that the major issue for aquatic food consumers is the environment and not product quality. The same applies to Norwegian consumers, who are willing to pay a €2/kg price premium for organic salmon (Olesen et al. 2010).

The present research was carried out in Italy, where aquaculture is a well-differentiated activity, with more than 30 aquatic species farmed (although only three species of molluscs, i.e. Mediterranean mussel, Japanese carpet shell, cupped oyster, and three species of Teleosts, i.e. rainbow trout, gilthead seabream, and seabass, are widespread on the market) and diversity of rearing systems (intensive and extensive systems, in both fresh, brackish, and marine waters, inshore, and offshore)³. Seafood consumption in Italy reached about 26 kg per capita in 2016, remaining above the EU (22.5 kg) and world (20.3 kg) averages (FAO 2018). In 2017, Italian families spent 1.5% of the average monthly expenditure on aquatic

food (Istituto di Servizi per il Mercato Agricolo Alimentare – ISMEA 2017). This percentage was higher in southern regions (2.2%) and islands (2.1%). In the first quarter of 2018, expenditure for frozen aquatic food increased by 6%, while less than 1% growth was recorded for fresh and smoked fish (ISMEA 2018). Italy was rated sixth among 10 countries based on organic aquaculture production, with about 6,000 tons in 2016 (Willer and Lernoud 2018). Considering organic aquaculture production from 2012 to 2015, Italy experienced a very high increase between 2012 and 2013 (166%), followed by a decrease of 44% in 2013–2014 and a decrease of 4% in 2014–2015 (Sicuro 2019; SINAB 2018). Data about Italian consumer habits regarding farmed aquatic food consumption are missing or patchy. The present study was aimed at providing: 1) a national picture of consumer habits, preferences, and perceptions regarding aquaculture products; 2) information about consumer willingness to pay for some added values of aquatic food, such as sustainability, certification, traceability, and security; 3) recommendations for stakeholders interested in promoting certified aquaculture products on the Italian market.

In order to provide a comprehensive picture of the Italian situation, the methodological approach chosen was an online questionnaire covering the entire country. Patterns emerging from demographic characteristics of respondents, such as sex, age, and geographic distribution, were reported and discussed and consumption habits of farmed aquatic food correlated with consumers' reasons and beliefs. In conclusion, this study identifies highly emotive topics guiding different consumer segments towards sustainable and organic aquaculture products that could enhance their acceptance and marketability.

Materials and methods

Data were collected by means of an online questionnaire, developed during specific joint discussion meetings with the main stakeholders of the aquaculture value chain: farmers, small and large retailers, consumer associations, and researchers. Socio-demographic characteristics of the whole sample, such as gender, age, and geographical distribution were collected, as previous studies demonstrated that these variables are strongly related to aquatic food consumption (Murray et al. 2017; Thong and Solgaard 2017). Additional socio-demographics were collected for a subsample of 834 people: income, education, number of family members, and employment (Table 1).

Italian regions were aggregated, according to a latitudinal cline, as follows: North (Valle d'Aosta, Piemonte, Liguria, Lombardia, Emilia-Romagna, Trentino-Alto Adige, Veneto, Friuli-Venezia Giulia); Centre (Toscana, Marche, Umbria, Lazio, Abruzzo, Molise); South (Campania, Puglia, Basilicata, Calabria); Island (Sicilia, Sardegna) (Figure 1).

The questionnaire was divided into two main sections: (1) habits regarding aquatic food consumption and purchase, with particular emphasis on farmed aquatic food; (2) knowledge and awareness about organic aquatic food, purchase habits, perceived added value, reasons for non-purchase, and willingness to pay. An insight into consumer habits toward organic foodstuffs in general was included (type of products bought, frequency of purchase, and reasons for non-purchase). A total of 21 multiple-choice questions (Table 2), with a set of predefined answers, were submitted to consumers from October 2017 to February 2019.

As consumers might not be familiar with some of the terms used in the questionnaire, a brief explanatory section was added. The questionnaire was released by social-media, websites, and mailing lists of large and small retailers and consumer associations. No economic incentives were given to the respondents. No preliminary selection of respondents was conducted in order to interview only aquatic food consumers, but a specific question in the questionnaire allowed the procurement of a clean dataset that only includes consumers of aquatic food.

A total of 8,657 valid answers were collected. The pre-screening process, aimed at selecting only aquatic food consumers, allowed the removal of 862 respondents (10%), as non-aquatic food consumers. This sample was mainly comprised of females (69%) and residents from North and Centre Italy (88% and 12%, respectively).

Table 1. Additional socio-demographic characteristics collected on a subsample (N = 834).

Item	Answer	%
Annual income	<20,000.00 €	21.0
	20,000.00–40,000.00 €	50.0
	40,000.00–60,000.00 €	18.6
	60,000.00–100,000.00 €	7.7
	>100,000.00	2.7
Number of family members	1	15.7
	2	34.7
	3	22.2
	4	22.5
	>4	4.9
Educational level	None	0.0
	Elementary school	0.0
	Secondary school	1.9
	Graduation	29.9
	Degree/Master	58.3
Employment	PhD	9.7
	Independent contractor	31.9
	Entrepreneur	3.5
	Executive	3.7
	Employee	38.4
	Student	4.6
	Unemployed	9.3
Retiree	8.6	

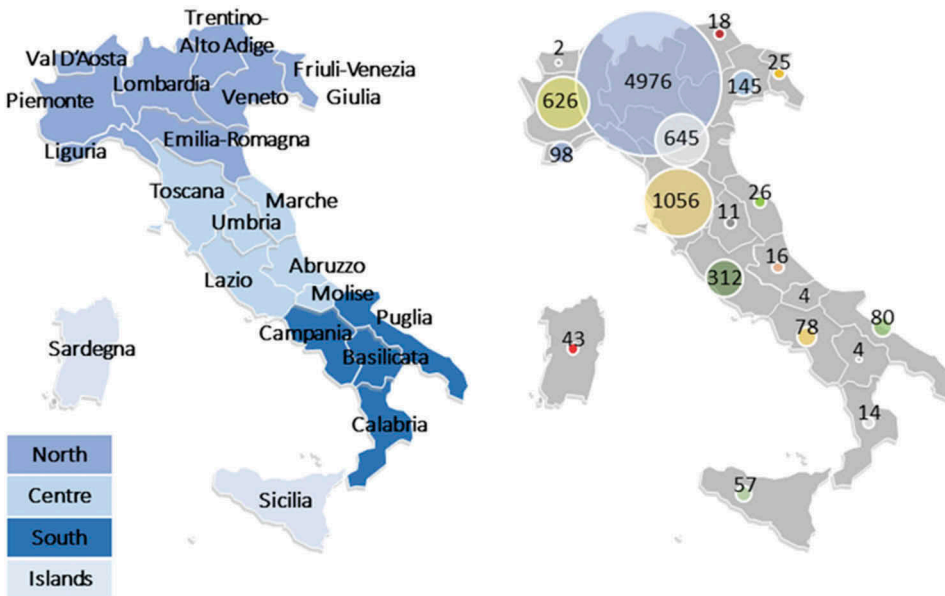


Figure 1. Aggregation of Italian regions according to latitudinal cline and number of collected questionnaires for each geographical district.

Data were stored in an Excel spreadsheet and analyzed in R. To investigate the possible relationship between demographic variables (sex, age, geographical distribution) and each answer, chi-square tests with pairwise post hoc comparisons were performed. Bonferroni correction was applied to pairwise tests. Only findings directly relevant to farmed aquatic food consumption, both conventional and organic, are described in detail in the text.

Table 2. Multiple-choice questions of the questionnaire.

Question	Choice
Place of consumption	Canteen (1); Home (2); Restaurant (3)
Out of home consumption frequency	Never (4); Less than once a month (5); Once a month (6); Bimonthly (7); Weekly (8)
Type of restaurant	Seafood restaurants (9); Tavern (10); Take away/street food (11); Sushi places (12)
Seafood products consumed out of home	Marine fish (13); Bivalve molluscs (14); Cephalopod molluscs (15); Crustaceans (16); Freshwater fish (17)
Responsible of groceries	Me (18); My partner (19); Both (20); My sons (21); My parents (22); Domestic worker (23)
Farmed seafood purchasing frequency	Less than once a month (24); Once a month (25); Bimonthly (26); Weekly (27); Twice a week (28)
Farmed seafood purchasing place	Supermarket (29); Fish market (30); Street market (31); Buying groups (32); Online (33)
Monthly amount of farmed seafood purchased	Doesn't know (34); < 2 kg (35); 2–5 kg (36); 5–10 kg (37); > 10 kg (38)
Average monthly expenditure for farmed seafood	Doesn't know (39); < 20 € (40); 20–50 € (41); 50–100 € (42); > 100 € (43)
Aquaculture products mostly consumed	Marine fish (44); Bivalve molluscs (45); Crustaceans (46); Freshwater fish (47)
Preferred preservation status of aquaculture products	Fresh (48); Fresh ready to cook (49); Frozen (50); Canned (51); Thawed (52)
Reasons to prefer fresh seafood	Availability (53); Seasonality (54); Taste and flavor (55); Wholesomeness (56)
Reasons to prefer frozen seafood	Convenience (57); Easy to cook (58); Easy to store (59); Food security (60); Hard to evaluate fish freshness (61); Labelling (62); Lower price (63)
Meaning of the term “organic”	Doesn't know (64); Healthy (65); Natural (66); Safe (67); Sustainable (68)
Frequency of organic food consumption	Never (69); Rarely (70); Sometimes (71); Often (72); Exclusively (73)
Organic products generally consumed	Baby food (74); Cereals/Pasta/Bread (75); Eggs (76); Fruit and vegetables (77); Legumes (78); Meat substitutes (79); Meat/Fish (80); Milk/Milk products (81); Oil (82)
Reasons to avoid organic food	Distrust (83); High price (84); Lack of knowledge (85); Unavailability (86); Worse taste (87)
Frequency of organic seafood consumption	Never (88); Often (89); Rarely (90); Sometimes (91)
Reasons to avoid organic seafood	Distrust (92); High price (93); Lack of knowledge (94); Limited choice of products (95); Preference for wild seafood (96); No difference with conventional (97); Unavailability (98); Worse taste (99)
Added values of organic seafood	Doesn't know (100); Traceability (101); Natural taste (102); Sustainability (103); Antibiotic free (104)
Willingness to pay extra-costs for sustainable and certified farmed seafood	Yes (105); No (106)

Numbers in brackets refer to numbers in the dendrogram of Figure 8.

In order to test for correlations between the questionnaire's answers, a tetrachoric correlation coefficient (r) was computed. It is analogous to the Pearson correlation coefficient but can handle binary data. Tetrachoric correlation coefficient (r) values ranges from -1 to 1 for negative or positive correlations, respectively.

Results and discussion

Structure of the sample

The final sample ($N = 7,795$) was structured as follows: 2,502 male (29%) and 6,155 (71%) female respondents; the age distribution was below 30 years old (3%), 31–49 years old (37%), 50–59 years old (30%), 60–69 years old (19%), over 70 years old (11%); the between regions distribution was not homogeneous (North 78%, Centre 18%, South 3%, Islands 2%) (Figure 1), which must be considered when interpreting the results. Gender data were biased with respect to the 2018 Italian population census (ISTAT, 2018): males 48%, females 52%. The skewed gender distribution, often found in this kind of surveys (e.g., Birch and Lawley 2012), could be explained by the traditionally greater involvement of women in food purchasing. Age distribution approximately fits the Italian population (below 30 years old 13%, 31–49 years old 35%, 50–59 years old 19%, 60–69 years old 14%), with

some deviation due to the different structure of the census compared to the present survey. Additional demographic characteristics (annual income, number of family members, educational level, and employment) that can be related to aquatic food consumption habits were available only for a subsample (11%) of the total sample and thus were not used in statistical analysis but could be helpful in making general inferences. As reported in [Table 1](#), families mainly consisted of pairs of people (35%) or couples with one or two children (45%). The average annual income was between 20,000 and 40,000 € for 50% of respondents. The subsample had, in general, a high degree of education (30% graduated, 58% with a degree or a master).

Aquatic food consumption and purchase

To determine social habits of Italian people regarding aquatic food consumption, questions relative to the typical place of consumption (home, restaurant, or canteen), the frequency of out of home consumption, the typology of restaurant, and the aquatic food products consumed out of home were included in the questionnaire. In general, Italians prefer to eat aquatic food at home (73%), while 24% tend to consume aquatic food outside ([Figure 2a](#)), even if mainly less than once a month (43%) or once a month (21%) ([Figure 2b](#)). Traditional aquatic food restaurants (46%) and taverns (32%) were preferred ([Figure 2c](#)), and all the products, except for freshwater fish (3%), were likewise appreciated (marine fish 28%, crustaceans 25%, bivalve and cephalopod molluscs 22% – [Figure 2d](#)).

Women were mainly responsible for grocery purchases (64% – [Figure 3a](#)). The purchase of aquatic food was made mainly at the supermarket (66%) or at the fish market (25%) ([Figure 3c](#)), according to ISMEA data (ISMEA 2018). Concerning aquaculture product purchases, few respondents bought more than 10 kg of farmed aquatic food per month (0.2%) ([Figure 4a](#)). Geographic distribution and sex did not significantly affect the average monthly quantity of farmed aquatic food purchased. Southern regions and islands were similar in the quantity of farmed aquatic food purchased, while relatively minor differences, even if not significant, were found when compared to northern and central regions. A very high percentage of respondents was not able to quantify the monthly amount of aquatic food purchased (27%), in particular in North and Centre Italian regions (North: 68%; Centre: 61%; South: 44%; Islands: 49%). Most (75%) of the people interviewed purchased less than 2 kg of aquaculture products each month, ranging from 72% in northern regions to 79% in southern regions. Age significantly affected the average monthly quantity of farmed aquatic food purchased ($\chi^2 = 29.01$, $p < .01$). Among age groups, significant differences were found between older respondents (>70 years old), buying less farmed aquatic food, and all other age groups. Positive relationships between age and aquatic food consumption have been frequently detected in the literature: older consumers are generally more likely to purchase wild and fresh fish than younger ones (Birch and Lawley 2012; Myrland et al. 2000; Olsen 2003; Trondsen et al. 2003; Verbeke and Vackier 2005).

More than half of the respondents (52%) spent on average 20–50 € per month for farmed aquatic food purchase, 23% spent less than 20 € per month, 20% between 50 and 100 €, and only 4% more than 100 €. Age ($\chi^2 = 42.87$, $p < .01$) and geographical distribution ($\chi^2 = 18.41$, $p < .05$) significantly affected average monthly expenditure ([Figure 4b](#)). Significant differences in response rates were found between North and South and Centre and South. A higher percentage of respondents in southern regions spent between 50 and 100 € (23%) and more than 100 € (8%) per month for seafood purchase when compared to other regions of the country. Younger respondents spent less on aquatic food purchase (35% spend less than 20 € per month) than other age classes. The 50–59- and 60–69-year-old respondents, in particular, spent more on aquatic food.

Among farmed aquatic food products, marine fish were the best selling (40%), followed by bivalve molluscs (25%). Marine fish was mainly consumed fresh (high tetrachoric correlation, $r = 0.66$). Different from the out of home consumption, 16% of the respondents purchased freshwater fish, while crustaceans were chosen by 19% of the respondents ([Figure 4c](#)). The choice of farmed aquatic food products was significantly related to demographic variables (geographical distribution: $\chi^2 = 30.03$; sex: $p < .01$; $\chi^2 = 12.75$, $p < .01$; age: $\chi^2 = 30.69$, $p < .01$). In particular, pairwise

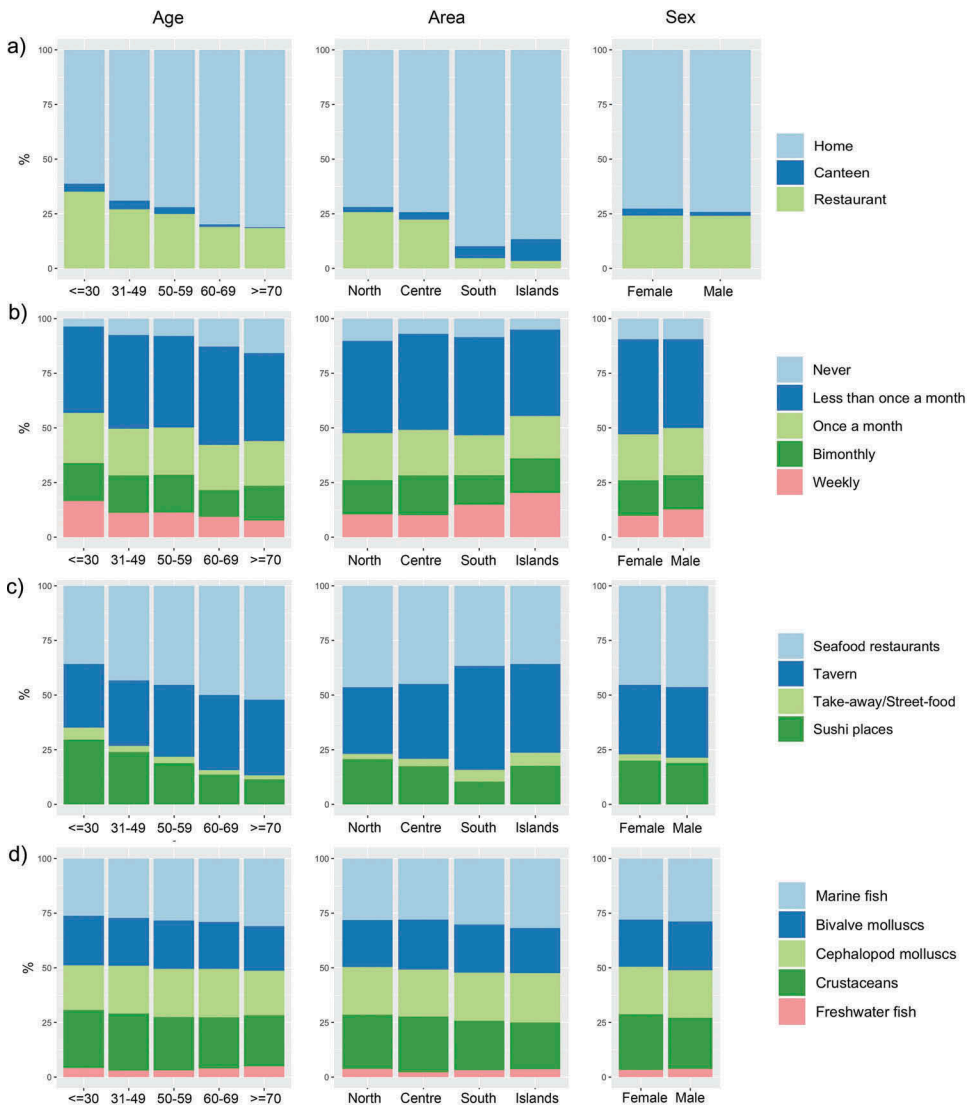


Figure 2. Response rates (grouped according to age, area, and sex): (a) place of consumption; (b) out of home consumption frequency; (c) type of restaurant; (d) aquatic food products consumed out of home.

comparisons revealed significant differences between North and Centre ($\chi^2 = 25.81, p < .01$), with northern inhabitants consuming more freshwater fish (17%) and less marine fish (39%) than Centre ones (13% and 15%, respectively). This difference was probably related to the structure of the Italian aquaculture industry, where freshwater fish farms (producing mainly salmonids, sturgeon, catfish, and other cyprinids) are clustered in the north of the country; thus, freshwater fish species are most known and are part of the northern culinary tradition. Younger respondents differed from all other age groups in their choice of farmed aquatic food products and exhibited a significantly higher ratio of consumption of freshwater to marine fish (0.62 vs 0.40). Freshwater fish species are cheaper than marine fish and crustaceans. According to aquaculture data collection (Reg. EC No. 762/2008), in 2017 the average unit price⁴ for freshwater fish was 5,715.06 €, while for marine fish, it was 8,885.06 €. It is reasonable that younger age classes, who spend less on aquatic food, select freshwater species more than other age groups.

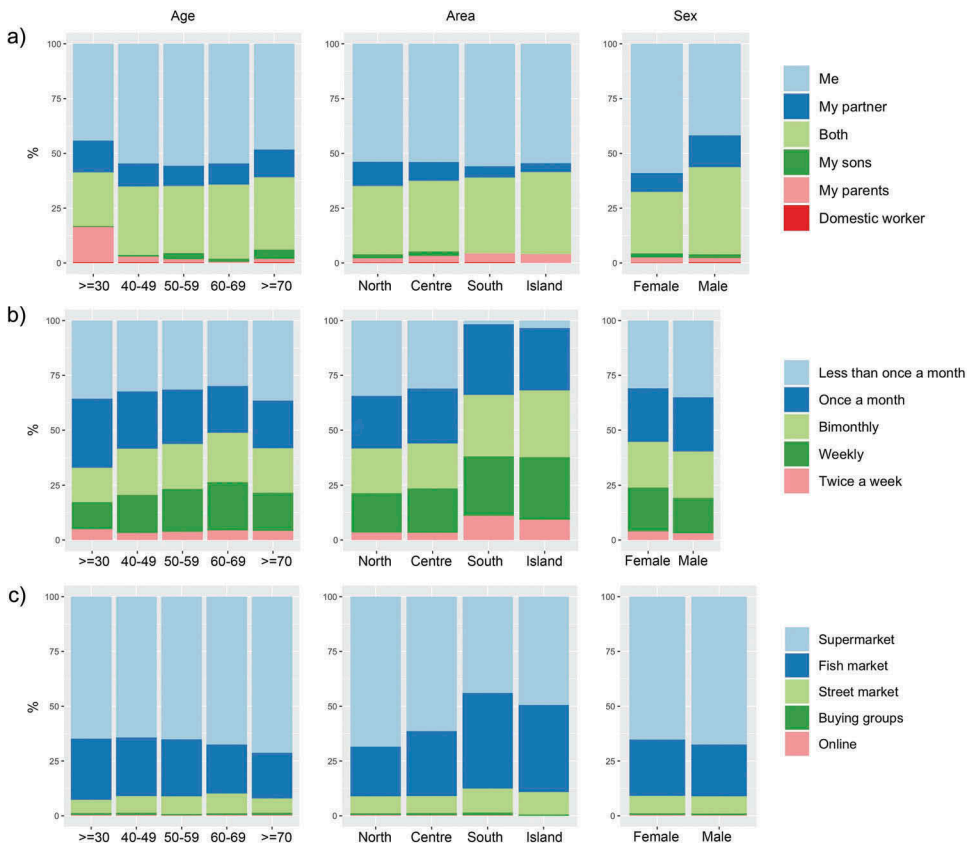


Figure 3. Response rates (grouped according to age, area, and sex): (a) responsible for groceries; (b) farmed aquatic food purchasing frequency; (c) farmed aquatic food purchasing place.

According to Cardoso et al. (2013), the choice of farmed aquatic food products was significantly affected by gender. In particular, men consume more bivalve molluscs (26% vs 24%) and marine fish (41% vs 40%) than women, while women purchase more freshwater fish than men (17% vs 15%).

Regarding farmed aquatic food presentations, 46% of the respondents preferred fresh, 22% frozen, about 23% preferred canned and thawed products, and only 9% preferred “ready to cook” fresh aquatic food (Figure 4d). This result was in agreement with previous investigations carried out in Portugal (Cardoso et al. 2013) and Spain (Claret et al. 2012), where fresh marine fish were preferred over frozen fish. However, previous studies associated habits of fresh aquatic food consumption to the preference for wild aquatic food (Mitterer-Daltoé et al. 2013; Tomić et al. 2017; Verbeke and Vackier 2004), while, in the present study, freshness is an attribute recognized in farmed fish as well. Such preference for fresh fish, even if frozen aquatic food is increasingly available and diversified, has been ascribed to consumers yearning for products with a low level of processing (Claret et al. 2012; Cleveland et al. 2001). Demographic variables had a significant effect on preferences of presentations of aquatic food (geographic distribution: $\chi^2 = 40.99$, $p < .01$; sex: $\chi^2 = 10.36$, $p < .05$; age: $\chi^2 = 53.12$, $p < .01$). Concerning regional distribution, all pairwise comparisons were significant, except for that between Centre and Islands, in particular for higher consumption of frozen products and lower consumption of canned products. Frozen products were also chosen more by women (22% vs 20%), who, however, tended to buy less canned products (16% vs 17%) than men. Older age classes (60–69 and >70 years old) were significantly different from younger in their clearer preference for fresh aquatic food.

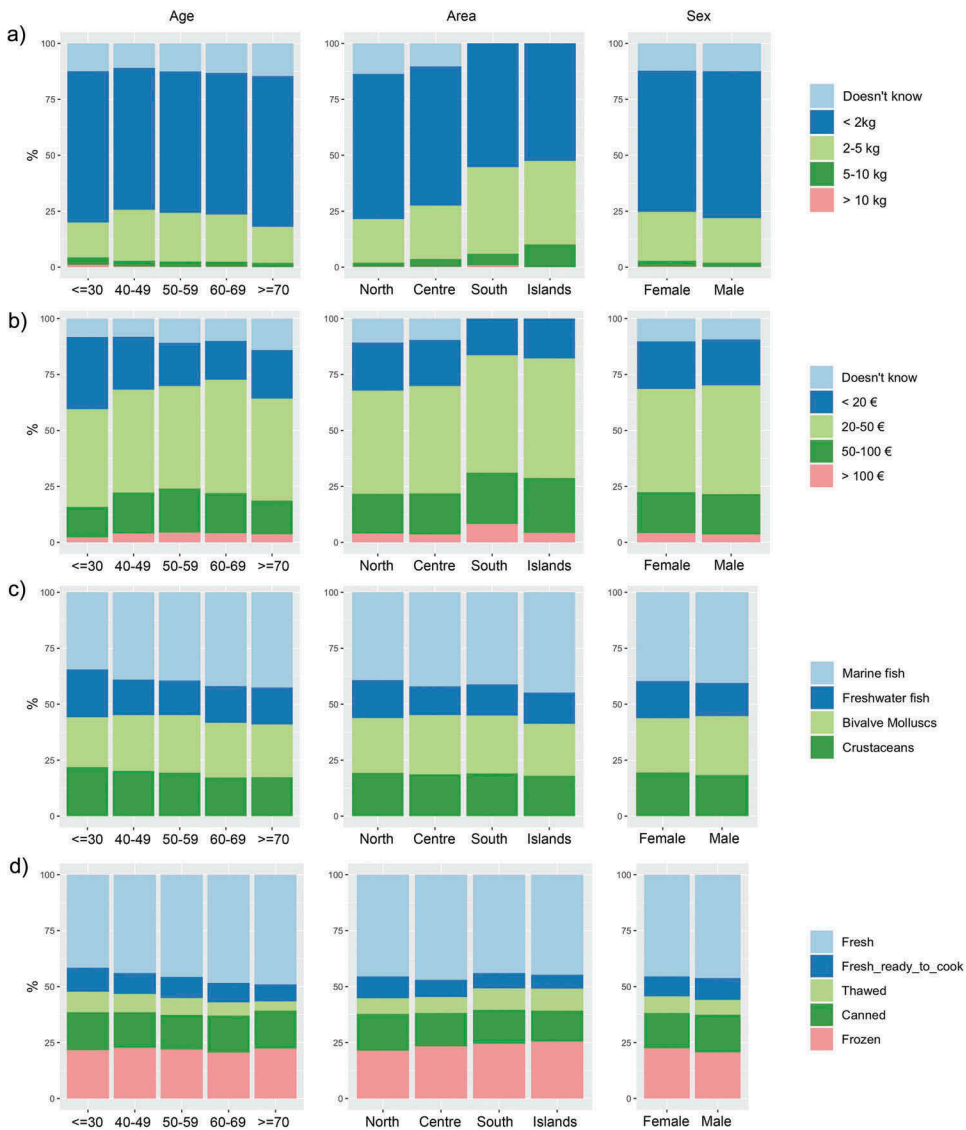


Figure 4. Response rates (grouped according to age, area, and sex): (a) monthly amount of farmed aquatic food purchased; (b) average monthly expenditure for farmed aquatic food; (c) aquaculture products consumed; (d) preferred preservation status of aquaculture products.

Reasons for choosing fresh aquatic food are mainly hedonistic (41%): organoleptic characteristics of fresh products, such as taste and flavor, are finer ($r = 0.63$). Fresh aquatic food is perceived as healthier (28%) and therefore preferred. Seasonality of fresh aquatic food is also one of the attributes guiding consumer choice (17%) (Figure 5a). Consumers preferring frozen products invoked handiness as the main reason (67%): frozen aquatic food is, foremost, easier to store (33%, $r = 0.80$). Lower price is another important asset of frozen products (14%; $r = 0.62$), while traceability and more detailed labelling are not perceived as pivotal by respondents (6%), even if the answers “frozen” and “labelling” are positively correlated ($r = 0.61$) (Figure 5b).

Several studies revealed that less regular fish consumers face difficulties when choosing and cooking aquatic food. This latter statement is confirmed by this study, as a strong positive correlation exists between the consumption of frozen products and their ease of preparation ($r = 0.60$). The

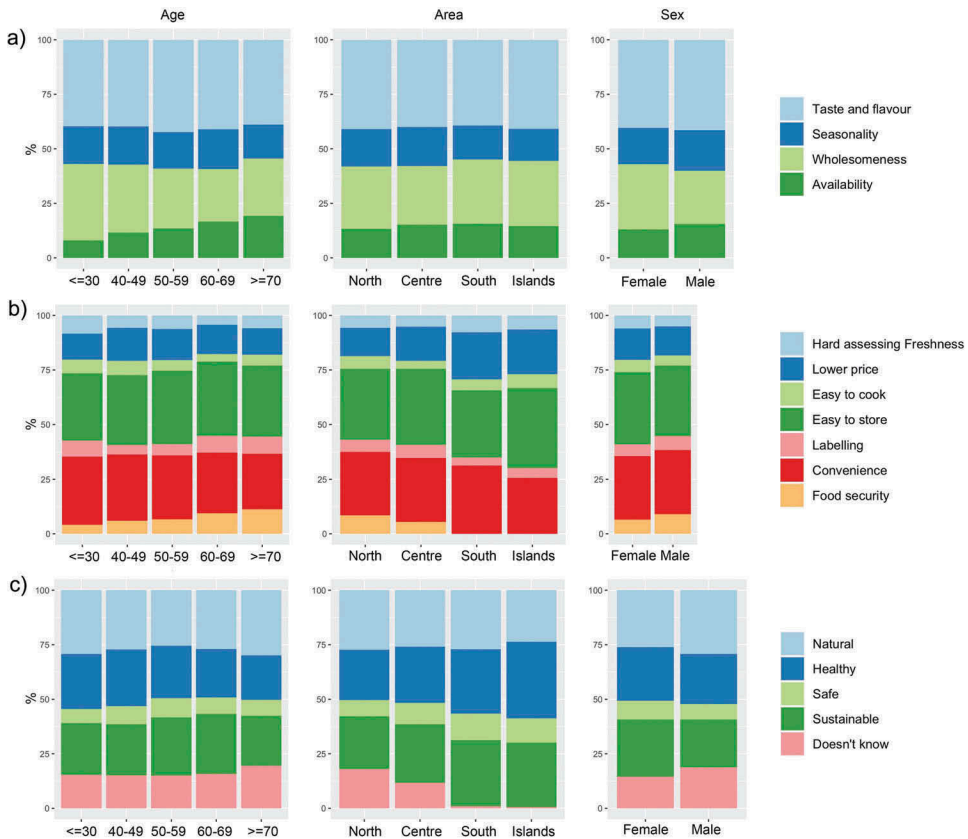


Figure 5. Response rates (grouped according to age, area, and sex): (a) reasons to prefer fresh aquatic food; (b) reasons to prefer frozen aquatic food; (c) meaning of the term “organic”.

difficulty of determining whether aquatic food is fresh represents a barrier to consumption (Olsen 2004; Verbeke et al. 2005; Verbeke and Vackier 2005), varying according to age and sex. In the present study, younger respondents and females were less familiar with fresh aquatic food and less able to recognize it, similar to the findings of Birch and Lawley (2012) for Australian consumers.

Habits of consumption and purchase of organic products, with a focus on organic aquatic food

Respondents were classified as “non-organic food consumers” (7%), “light or occasional consumers” of organic food (57%), “habitual consumers” of organic food (34%), and “organic-food addicted” (2%). A very high percentage of respondents (16%) were not able to define the meaning of the term “organic,” while the 76% provided definitions consistent with organic principles (natural 27%, sustainable 25%, and healthy 24% – Figure 5c). Organic products most appreciated were fruit and vegetables (23%), eggs (18%), cereals (14%), legumes (11%), and oil (11%). Organic meat and fish were selected by 8% of the respondents (Figure 6b). Among the reasons to avoid organic food, high price (43%) and distrust in the organic labels (33%) were most commonly chosen by consumers (Figure 6c). High tetrachoric correlation coefficient, in fact, existed between the answers “I never purchase organic products” and “Reason: Distrust” ($r = 0.67$). The majority of the respondents are light or occasional consumers of organic aquatic food (54%), and as much as 40% never consume organic aquaculture products (Figure 6d). Why is this? Different from

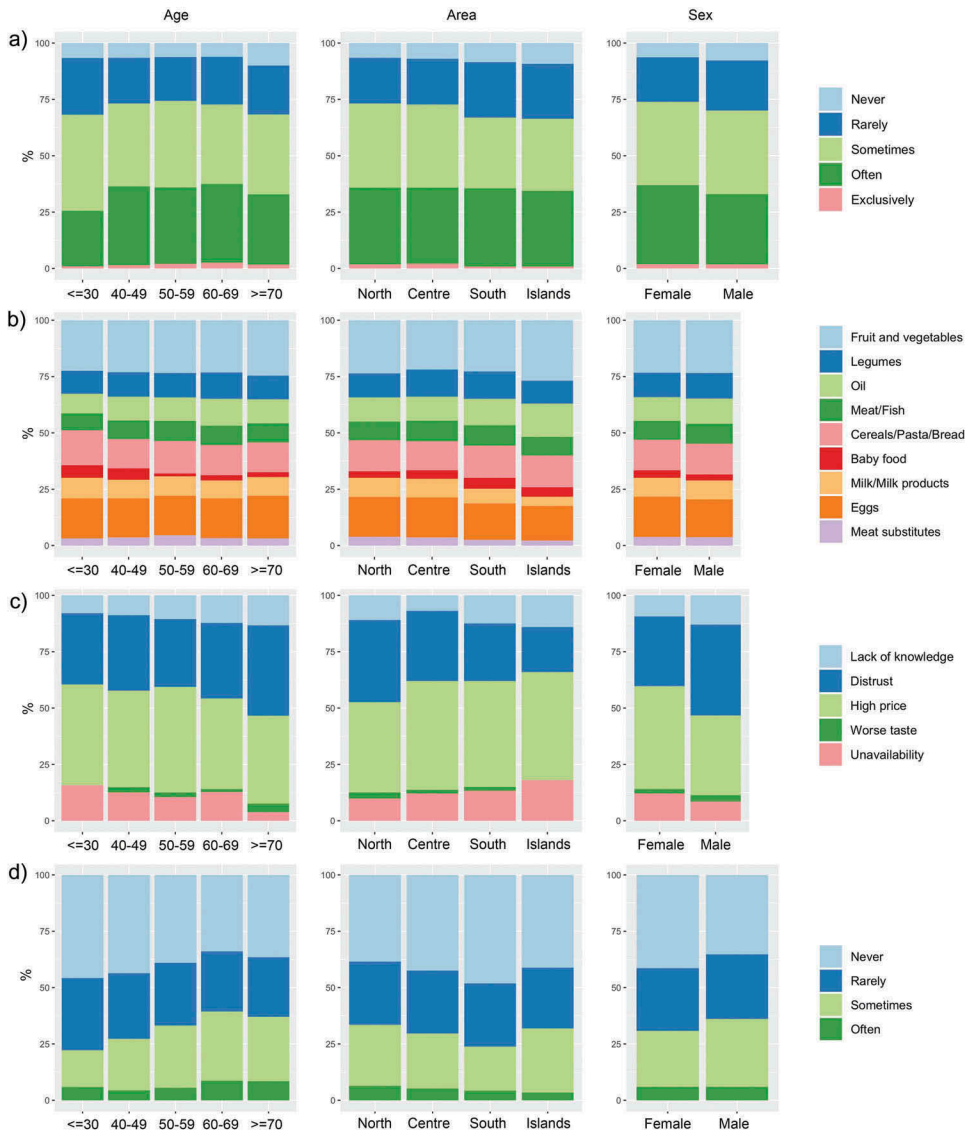


Figure 6. Response rates (grouped according to age, area, and sex): (a) frequency of organic food consumption; (b) organic products consumed; (c) reasons to avoid organic food; (d) frequency of organic aquatic food consumption.

organic food, in general, lack of knowledge about organic aquaculture (27%) and unavailability of organic aquatic food (24%) were indicated as the main reasons that inhibit purchase, followed by high price (16%) (Figure 7a). A positive correlation between the lack of knowledge and the poor consumption of organic aquatic food was indeed obtained ($r = 0.61$). Fifty-five percent of consumers, regardless of age, sex, and geographical position ($p > .05$ in χ^2 tests), declared they were willing to pay price premiums for organic-certified aquatic food (Figure 7c). Organic aquatic food, above all else, should be antibiotic-free (33%), traceable (26%), and sustainable (19%) (Figure 7b). A recent investigation showed that German consumers, previously informed about consequences of organic production on animal welfare, were willing to pay a price premium of 2.4€/kg for organic trout, while no effects were detected when information on the environmental sustainability of production was provided to consumers (Ankamah-Yeboah et al. 2019).

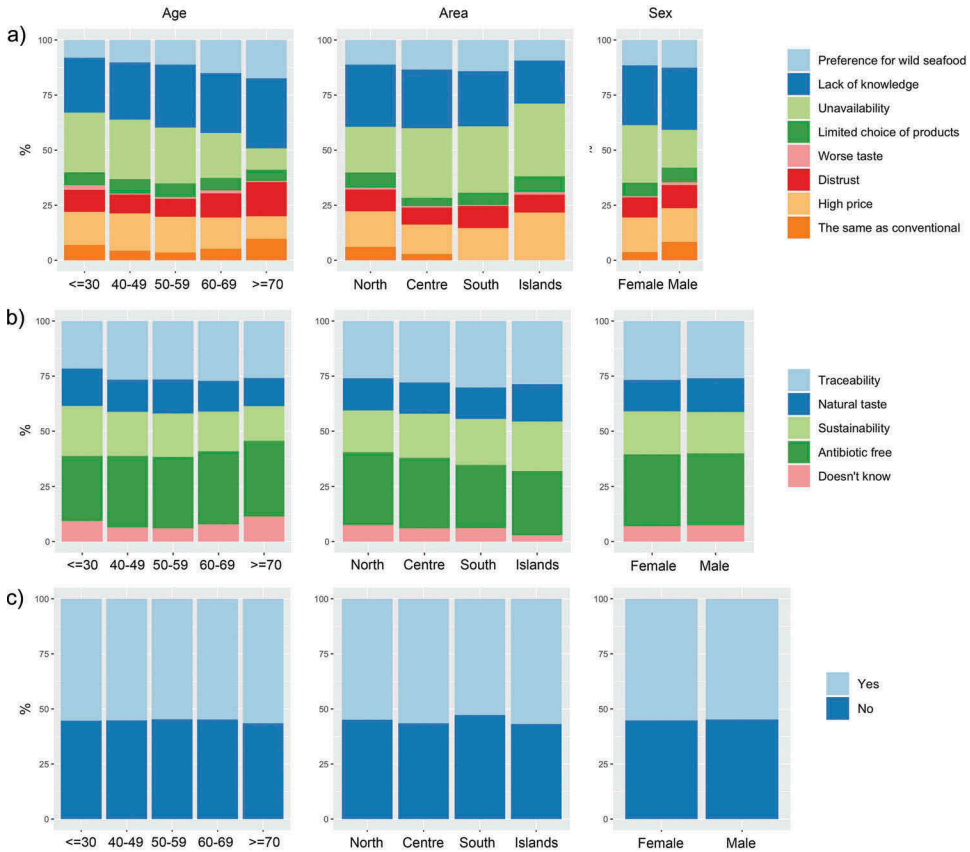


Figure 7. Response rates (grouped according to age, area, and sex): (a) reasons to avoid organic aquatic food; (b) added values of organic aquatic food; (c) willingness to pay extra-costs for sustainable and certified farmed aquatic food.

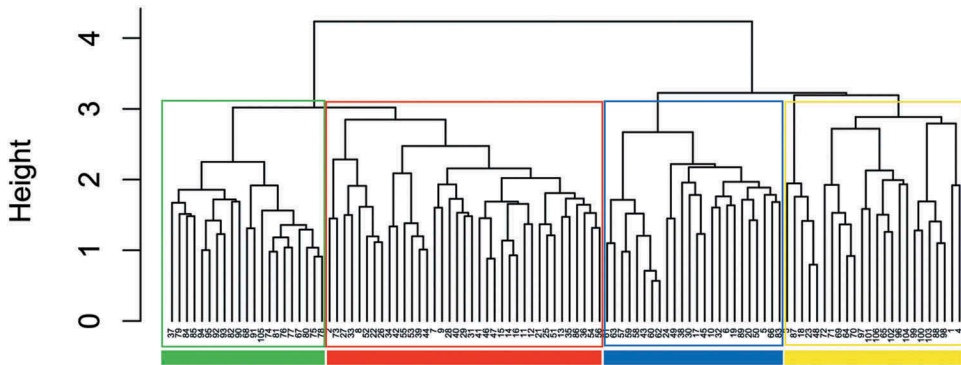


Figure 8. Cluster analysis dendrogram grouping answers according to their tetrachoric coefficients of correlation. Each number corresponds to one of the 106 answers of the questionnaire (see Table 2 for the correspondence). Cluster composition, according to the different colors (green, red, blue, yellow), is described in the text.

Place of residence ($\chi^2 = 27.53, p < .05$) and age ($\chi^2 = 72.08, p < .01$) significantly affected the perception of added values of organic aquatic food, while sex had no effect. This lack of an effect of sex differs from previous studies, where females were significantly more concerned about physical risks (i.e., effects of contamination and treatments with hormones and antibiotics) associated with aquatic food consumption

(Birch and Lawley 2012). In particular, significant differences were found between respondents from North and Centre ($\chi^2 = 11.21, p < .05$) and from North and islands ($\chi^2 = 11.06, p < .05$). Sustainability and traceability were more important for residents in the central regions and islands than for northern region inhabitants, who focused on natural taste and absence of antibiotics. Significant differences were found between extreme age groups (≤ 30 years and ≥ 70 years) and intermediate age groups: both younger and older respondents declared higher rates of unawareness with respect to the question. Sustainability was more important for ≤ 30 -year-old respondents than for other age groups, while the absence of antibiotics was more important for ≥ 70 -year-old respondents. Traceability and natural taste were less important for younger and older respondents, respectively. Such results are consistent with findings of several studies where concerns about the safety of aquatic food (i.e., possible contaminants, use of hormones and antibiotics, inhabitants (22%) and in intermediate age groups (Vanhonacker et al. 2010; Verbeke et al. 2005) were very common among consumers and were responsible for a reduction in consumption (Pieniak et al. 2008; Vanhonacker et al. 2010).

Although fish is frequently perceived as an expensive meal option by consumers (Birch and Lawley 2012; Brunsø et al. 2009; Vanhonacker et al. 2010), the results of this section of the questionnaire showed that only about 15% of the Italian consumers interviewed perceived the higher price of organic aquatic food as a barrier to purchase. Furthermore, this percentage is higher among island inhabitants (22%) and in intermediate age groups (about 16%), while it is very low in older respondents (10%). A small percentage of respondents (8%) stated the preference for wild seafood as a motivation for avoiding organic aquatic food purchase. This answer was common among older respondents (>60 years old) of southern regions.

The output of cluster analysis grouping answers according to their tetrachoric coefficients of correlation is provided in Figure 8. Four main clusters were identified and differently colored, (1) the green cluster included answers that referred to a high frequency of consumption of organic products in general, including organic aquatic food, that were associated with attention to food health and safety and to low environmental impact of food production. The willingness to pay an extra-cost for sustainable certified aquatic food was also part of this cluster. (2) The yellow cluster included answers that indicated scarce consumption of farmed fish, organic products in general, and organic aquatic food in particular. Motivations such as distrust, high prices, and lack of awareness of principles of organic production were associated with poor consumption. (3) In the red cluster, answers referenced the consumption of marine fish and the preference for fresh products due to hedonistic motivations. In this cluster, a high budget was allocated to farmed aquatic food purchase. (4) The blue cluster, in contrast, included answers referencing the preference for frozen products associated with practical reasons. Consumption of freshwater fish was included in this cluster, as was the low-medium budget associated with farmed aquatic food purchase.

Conclusions and recommendations

Results of this survey highlighted that Italians are closely tied to their traditions: they eat aquatic food at home or in traditional restaurants. As confirmed by the high per-capita aquatic food consumption compared to the European average, Italy has a long and rich culinary tradition, covering the full range of aquatic food products, in particular marine ones (i.e., fish, crustaceans, bivalve, and cephalopod molluscs). More than 77% of the respondents also buy farmed aquatic food, even if, in the greatest majority of cases, this is in low amounts and on a tight budget. Fresh aquatic food was largely preferred by Italians as compared to frozen and thawed products, in particular by men and older age classes. Age and geographical distribution significantly affected the average monthly quantity of farmed aquatic food purchase, with older respondents buying significantly less farmed fish than other age groups and inhabitants of southern regions and mid-age respondents spending significantly more for farmed aquatic food.

More than half of the respondents were classified as “light or occasional organic food consumers,” and organic meat and fish were purchased by only about 8% of those interviewed. Concerning

organic aquatic food in particular, lack of awareness about organic aquaculture principles and unavailability of organic-certified aquatic food were the main perceived barriers to purchase, more so than price. From this follows the willingness to pay a price premium for organic aquaculture products, certified as antibiotics free, traceable, and environmentally sustainable. Sustainability of farming practices was perceived as the main added value of organic-certified aquatic food from younger respondents, in particular from central regions and islands, instead of the absence of antibiotics and natural taste, which were perceived as more important for older respondents and inhabitants of northern regions.

Farmed aquatic food is still suffering from some misconceptions of consumers, who perceive fishery products as tastier, with a more balanced fatty acids profile and, thus, healthier. On the contrary, aquaculture products are often chosen because they are cheaper but perceived as less wholesome, treated with antibiotics, and farmed at high densities. Knowledge about farmed aquatic food is scarce and often incorrect, as confirmed by a recent survey carried out among Italian consumers by one of the main national trade associations (AA.VV. 2020). In order to build confidence around aquaculture products, more information and guaranties should be provided by the stakeholders of the value chain. Farmed aquatic food should: (1) be presented as safe because it is traceable; (2) clearly indicate that the use of antibiotics is very limited and responsible; (3) should mention and describe farming practices on the label; and (4) should provide correct information about farmed animals' nutrition and feed quality.

Even more important, sustainability concerns must be stressed for organic-farmed aquatic food production. This is perceived as one of the most important added values of organic fish by young consumers and should be the brand that overcomes the price barrier. If it is still too early to imagine the spread of organic aquaculture products in large distribution, restaurant, and catering distribution channels could be ideal ways to enhance the adoption of such products.

Notes

1. Council Regulation (EC) No 834/2007 of 28 June 2007 on organic production and labelling of organic products and repealing Regulation (EEC) No 2092/91.
2. Regulation (EU) 2018/848 of the European Parliament and of the Council of 30 May 2018 on organic production and labelling of organic products and repealing Council Regulation (EC) No 834/2007.
3. Data collected under Reg. (EC) No. 762/2008.
4. Unit price: Total value of the production/Total volume of the production.

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