

An analysis of consumer attitudes and purchasing behaviour in the fish and seafood market

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Abstract. In the modern conditions of consumer market development, the analysis of factors influencing consumers' decisions to purchase fish and fish products plays a particularly important role. The aim of the article was to identify and analyze the main barriers influencing consumers' decisions to purchase fish and fish products, with subsequent segmentation of buyers according to their consumer priorities. A survey of 1,003 respondents was conducted to explore consumer preferences when purchasing fish. Based on the results, a cluster analysis was carried out using the k-means method, applying the "elbow" criterion to determine the optimal number of consumer groups. Three groups were identified: price-oriented (34%), consumers balancing between price and quality (41%), and quality-oriented (25%). To examine the barriers to purchasing fish and fish products, respondents' answers were analysed concerning the frequency of refusals to follow through with a planned purchase for various reasons. Factors were classified according to the level of variability in the respondents' answers. The k-means method identified three groups of factors: those with high variability (questionable freshness and low quality), medium variability (high price, product composition), and low variability (difficulty in preparation). Men more frequently refused purchases due to high price, questionable freshness, and low product quality, while women more often cited lack of information about expiration dates and product composition. Different age groups experienced different barriers: younger consumers focused on price and product origin, middle-aged consumers on freshness, and older consumers on difficulties in preparation. Residents of small towns and villages noted insufficient information about expiration dates and product composition. Retailers are recommended to enhance the quality of informational support for fish products by including detailed information on origin, methods of farming or catching, and expiration dates. Improving the appearance of fish and introducing quality standards is also necessary. Market policymakers and regulators are advised to monitor fish labelling and the reliability of the information provided. The findings are useful for developing marketing strategies tailored to different consumer groups, aimed at overcoming identified barriers – particularly by adjusting pricing policies, increasing product information transparency, and improving product quality.

Key Words: healthy eating, quality food products, purchasing power, price sensitivity, quality perception.

Introduction. Seafood products, including both marine and freshwater fish, remain an essential component of a balanced diet, being rich in easily digestible protein, omega-3 fatty acids, vitamins, and trace elements, especially compared with terrestrial meat products (Tacon et al 2020). The growing public interest in healthy eating, the increasing demand for high-quality food products, and greater attention to environmental sustainability have all contributed to renewed interest in fish and seafood among consumers. Indeed, European consumers overwhelmingly believe that eating fish is healthy (Pieniak et al 2010). This strong public perception underscores the positive health image of fish in the diet. However, despite the recognised health benefits of fish consumption and favourable attitudes towards healthy lifestyles, consumption in Poland remains significantly below the European average, suggesting the presence of multiple barriers that restrict broader market development (Utri-Khodadady et al 2024).

According to the European Market Observatory for Fisheries and Aquaculture Products (EUMOFA 2024), in 2022 the average annual consumption of fish and seafood in Poland amounted to 13.68 kg per capita (live weight equivalent), which marked a 5% decrease compared to 2021. For comparison, the EU-27 average was 23.51 kg per capita, showing only a 1% decline from the previous year. This continuing gap indicates

persistent structural, economic, and cultural limitations that affect Polish consumers more than their Western European counterparts. Notably, while the volume of consumption in Poland remains low, per capita expenditure on fish and seafood reached USD 74 in 2023, an increase of 13% year-on-year, suggesting that prices have risen disproportionately. The EU-27 average, by contrast, stood at USD 149 with a 6% increase. These figures suggest that the affordability of fish may be a major concern in Poland, particularly for price-sensitive groups.

Despite this increased expenditure, the actual consumption of the edible part of fish in Poland was only 7.43 kg per person per year (Stoś et al 2024). The structure of consumption further reinforces concerns about accessibility and variety: in 2022, frozen fish accounted for 79.5% of the products available on the Polish market. This segment experienced a 5% decline from the previous year, reflecting not only changing consumer preferences but also growing economic pressures. Meanwhile, interest in fresh and chilled fish is growing steadily, as consumers perceive it as a healthier and more premium option. Still, the dominance of frozen and processed products in the retail offer limits the availability of more appealing alternatives for quality-conscious consumers.

The range of fish consumed in Poland is heavily skewed toward imported species such as Alaska pollock (2.78 kg per capita on average in 2021-2023), herring (2.84 kg), mackerel (1.20 kg), salmon (0.79 kg), and saithe (0.76 kg). Among these, only salmon typically reaches consumers in a chilled form, while the others are mainly offered in frozen or canned formats. In contrast, locally produced freshwater fish, such as carp (0.52 kg) and trout (0.63 kg), are marketed primarily as fresh or chilled products but continue to represent a relatively small share of total consumption (Hryszko et al 2024). These figures reflect the limited year-round availability of domestic fish and entrenched consumer preferences for more widely available and economical imported species.

Recent studies underscore that high price sensitivity remains a primary factor limiting fish consumption in Poland. Szczepańska et al (2020) point out that many consumers refrain from regular purchases due to the cost barrier. For the Polish consumers the price of fish product is the second most important information cue checking on the product label (after the expiry date) (Pieniak et al 2011). These concerns are particularly visible in the context of inflationary pressure and rising food prices. Research by Frąckiewicz et al (2023) further demonstrates that younger consumers are more price-sensitive, whereas older consumers tend to place greater importance on quality and origin. This segmentation highlights the need to better understand the heterogeneous nature of the fish market in Poland and how economic constraints shape behaviour. In addition to price, product quality and freshness are crucial determinants of consumer decisions. Concerns about storage methods and the sensory quality of fish, especially in the frozen segment, often discourage purchases. The lack of accessible information on storage and preparation contributes to the perception that fish is less convenient than other protein sources. Hełdak et al (2020) observed that higher awareness of health benefits translates into increased fish consumption, yet this awareness does not always overcome scepticism about quality. Similarly, Rathod et al (2022) stressed the importance of seafood safety and called for enhanced quality control across the supply chain.

Consumer interest in environmentally sustainable and certified products is also increasing, offering an important opportunity to reposition fish as a high-quality and trustworthy food category. Research by Peiró-Signes et al (2022) showed that consumers seek environmental, social, and ethical information on seafood labels. Sacchettini et al (2021) found that consumers prefer products that are certified as safe and compliant with sustainability standards, underscoring the potential of traceability and eco-labelling in influencing consumer trust and behaviour. The demographic profile of consumers significantly affects their attitudes and behaviours in the fish and seafood market. Age, income, education level, and place of residence are among the most influential factors (Frąckiewicz et al 2023). Older consumers are more concerned with quality and health implications, while younger ones are often more price-oriented. Regional and cultural traditions also play a role, Różańska (2020) identified distinct differences in fish consumption across Polish regions, driven by habits, preferences, and local availability.

Cultural influences are also observed in younger populations. A nationwide study conducted in 2021 among people aged 14-22 revealed that the most popular species were salmon, cod, mackerel, herring, tuna, and pollock (Utri-Khodadady et al 2024). This relatively narrow range of preferred species points to the limited diversification of the fish offer and the dominance of popular, often imported, and processed types. Verza et al (2023) found that logistical barriers, including irregular deliveries and limited product assortments, reduce fish consumption. Even when consumers express interest in purchasing high-quality products, the lack of availability within the retail network limits follow-through. Vanhonacker et al (2013) noted that convenience-related concerns (e.g., preparation time, smell, or cooking skills) also deter consumers from choosing fish over other proteins. These aspects of availability and convenience are particularly relevant in Poland, where the market is dominated by frozen imports and the fresh fish segment remains underdeveloped. Many consumers hold positive attitudes towards fish and are aware of its health benefits. However, Pieniak et al (2010) found that while consumers firmly believe fish is healthy, this perception only weakly influences how often they actually eat it. Similarly, Verbeke & Vackier (2005) reported that general food-health awareness had no significant impact on fish consumption frequency. This suggests that simply knowing about fish's health benefits may not be sufficient to change consumption habits, highlighting the role of other factors in fish-eating behaviour.

Marketing plays an essential role in shaping consumer behaviour in the fish sector. Raftowicz et al (2020) observed that well-targeted marketing strategies, particularly those emphasising quality, sustainability, and health benefits, can significantly enhance consumption. The same view is supported by Nystrand & Olsen (2021), who showed that values such as personal health orientation and environmental concern often exert a stronger influence on purchase decisions than price or availability. Nystrand & Olsen demonstrated that these personal predispositions should be factored into segmentation strategies. Consumer segmentation studies confirm the value of tailored approaches. Armbrecht et al (2023), studying the Swedish market, found clear links between consumption volume, species preference, and sustainable behaviour. Similarly, Stancu et al (2022) showed that the willingness to try new products depends on openness to innovation, dietary preferences, and trust in food technology. These findings indicate that differentiated marketing and policy strategies are crucial for engaging diverse consumer segments.

Despite extensive prior research on consumer behaviour in the fish and seafood market, important knowledge gaps remain. While individual factors such as price, quality, and demographics have been analysed, there is insufficient attention paid to the interplay between these elements and how they affect different consumer segments. Particularly underexplored is how structural barriers – like logistics and marketing inefficiencies – interact with behavioural drivers and socio-demographic variables.

The present study seeks to address these gaps by analysing consumer attitudes and behaviour in the Polish fish and seafood market. Based on a representative survey of adult consumers, the study aimed to: (1) segment consumers according to socio-demographic characteristics and behavioural preferences; (2) analyse the main barriers and assess their impact on different consumer segments; and (3) develop recommendations for producers, retailers and policymakers aimed at effectively addressing consumer challenges and promoting sustainable development of the Polish fish and seafood market.

Material and Method. The study employed a representative survey method involving 1,003 respondents aged 18 to 60 and above, all of whom are residents of Poland and regular consumers of fish. Respondents completed the questionnaires during the first half of January 2025. The sample was formed using a random representative sampling method, ensuring an accurate reflection of the structure of the general population. Gender balance within the sample was maintained, with 523 women (52.1%) and 480 men (47.9%). Consumers were segmented based on socio-demographic characteristics and behavioural preferences. The socio-demographic segments identified included age, gender, place of residence, level of education, monthly income, and number of people in the household. The χ^2 (chi-square) test was employed to analyse the relationships

between respondents' socio-demographic characteristics. Consumer behavioural preferences regarding fish products were also identified. These included: a preference for cheaper fish products, even if of slightly lower quality; an expectation of a balance between low price and high quality; a focus on selecting only high-quality fish products, even at a higher cost; and a preference for fish products certified as sustainably sourced, even if more expensive.

The main barriers to purchasing fish and seafood were analysed to assess their impact across different consumer segments. The following barriers were examined: high price; unattractive appearance; questionable freshness or low quality; lack of information regarding product origin; lack of information on production method (wild-caught or farmed); lack of information on the type of fishing gear used; lack of information on the date of catch; lack of information on the expiration date; fish product composition (e.g. low fish content); presence of additives in the composition; difficulty in preparation; and lack of certification for sustainable fishing or responsible aquaculture. A full list of the questionnaire items, including response options, is provided in Table 1.

Table 1

List of questionnaire questions with answer options

<i>Question</i>	<i>Answer options</i>
Block 1. "Socio-demographic characteristics"	
Gender	Men Women
Age	18-29 30-44 45-59 60+
Place of residence	City with <100,000 inhabitants City of >100,000 inhabitants Village
Education	Primary Secondary Vocational Higher
Personal monthly income	<USD 266 or no income USD 266-798 USD 798-1,064 USD 1,064-1,596 >USD 1,596 Refused to answer
Monthly household income	<USD 798 or no income USD 798-1,596 USD 1,596-2,394 USD 2,394-3,192 USD 3,192-3,990 >USD 3,990 Refused to answer
Total number of people in the family	One Two Three Four Five Six and more
Block 2. "Consumer attitudes towards the price and quality of fish products"	
2.1. I prefer to buy cheap fish and fish products, even if their quality is slightly lower.	Completely disagree; Rather disagree;
2.2. I expect fish and fish products to be cheap and	Hard to say; Rather agree;

<i>Question</i>	<i>Answer options</i>
of high quality	Completely agree
2.3. I choose only high-quality fish products, even if they are more expensive	
2.4. I choose fish products with a sustainable fishing certificate, even if they are more expensive	
2.5. The health benefits of fish and fish products are more important to me than the price	
Block 3. "Have you ever refused to buy fish and fish products for the following reasons?"	
3.1. The price is too high	
3.2. Unattractive appearance	
3.3. Questionable freshness/low quality	
3.4. Lack of information about origin	
3.5. Lack of information about the production method	Never;
3.6. Lack of information about the fishing gear used	Rarely;
3.7. Lack of information on the date of catch	Neither rarely nor often;
3.8. Lack of expiration date information	Often;
3.9. Composition of fish product – too low fish content	Very often
3.10. Composition of the fish product – presence of additives	
3.11. Difficult to cook	

The study was conducted in accordance with the fundamental ethical principles outlined in the WMA Declaration of Helsinki (World Medical Association 2025), as well as relevant guidelines governing the ethical conduct of scientific research involving human participants. All respondents were informed of the study's purpose and objectives, as well as the conditions of participation, including their right to withdraw at any stage without negative consequences. Prior to participation, informed consent was obtained from each respondent for both participation in the study and the processing of personal data, in compliance with the Regulation (EU) No. 2016/679 of the European Parliament and of the Council on the Protection of Natural Persons with Regard to the Processing of Personal Data and on the Free Movement of Such Data, and Repealing Directive 95/46/EC (General Data Protection Regulation) (European Parliament 2016). Confidentiality and anonymity of responses were maintained through the coding of collected data, which was used solely in aggregated form for scientific purposes. The data were processed using Microsoft Excel, which was employed for the preliminary systematisation and visualisation of information. Statistical analysis was conducted using Statistica 13.3. Descriptive statistics, including mean values, standard deviation, and the coefficient of variation, were calculated. Analysis of variance (ANOVA) was performed to assess the significance of differences between respondent groups. Multiple linear regression was applied to identify relationships between the variables under study. The reliability of the results was assessed using the chi-square test. All statistical conclusions were considered significant at the level of $p < 0.05$.

To identify consumer segments oriented towards either price or quality in the fish product market, cluster analysis was performed using the K-means method. This approach enabled the classification of consumers into groups with similar preferences and characteristics, contributing to a deeper understanding of their needs and behaviours, and facilitating the identification of key factors influencing their choices in relation to fish products. The optimal number of clusters was determined using the elbow method. This method involves gradually increasing the number of clusters and analysing the corresponding change in within-cluster variance. The optimal cluster number is identified at the point where the rate of variance reduction declines sharply, forming an elbow shape on the graph.

In this study, the variance of response options for each of the factors of perception of barriers to the consumption of fish products was considered as a key indicator for assessing the variability of respondents' reactions. The use of the variance

indicator is methodologically justified in consumer behaviour studies, as it allows identifying factors with the highest level of disagreement in perception, which, as a rule, are the best predictors for segmentation (Wedel & Kamakura 2000). That is why segments were built on the basis of factors with high, medium and low variability, which made it possible to differentiate consumers by the degree of sensitivity to various barriers, and later to give these segments meaningful interpretive names, in particular, "price-oriented", "quality-oriented".

A Likert scale (ranging from 1 to 5 points for each response) was used to measure the degree of agreement or disagreement with a set of predefined statements: I prefer to buy cheap fish and fish products, even if their quality is slightly lower; I expect fish and fish products to be cheap and of high quality; I choose only high-quality fish products, even if they are more expensive; I choose fish products with a sustainable fishing certificate, even if they are more expensive; the health benefits of fish and fish products are more important to me than the price. The socio-demographic characteristics of the study group are presented in Table 2.

Table 2

Characteristics of the study group by socio-demographic factors

<i>Indicators</i>		<i>Number of respondents, people</i>	<i>Share in the total number of respondents, %</i>
Gender	Men	480	48
	Women	523	52
Age	18-29	185	18.4
	30-44	350	34.9
	45-59	287	28.6
	60+	181	18.1
Place of residence	City with <100,000 inhabitants	370	36.9
	City with >100,000 inhabitants	310	30.9
	Village	323	32.2
Education	Primary	27	2.6
	Secondary	417	41.6
	Vocational	134	13.4
	Higher	425	42.4
Personal monthly income	<USD 266 or no income	42	4.2
	USD 266-798	125	12.5
	USD 798-1,064	211	21.0
	USD 1,064-1,596	352	35.1
	>USD 1,596	196	19.5
Monthly household income	Refused to answer	77	7.7
	<USD 798 or no income	35	3.5
	USD 798-1,596	139	13.8
	USD 1,596-2,394	266	26.5
	USD 2,394-3,192	217	21.6
	USD 3,192-3,990	95	9.5
Total number of people in the family	>USD 3,990	58	5.8
	Refused to answer	78	7.8
	One	115	11.5
	Two	286	28.5
	Three	249	24.8
	Four	237	23.6
	Five	82	8.2
	Six and more	34	3.4

The study was conducted using a consumer panel. Based on population data for Poland, target sample sizes were determined for each level of the variables. By applying quotas,

the representativeness of the surveyed samples was ensured in terms of gender, age, size of locality, and region of residence.

According to the data presented in Table 2, the sociodemographic structure of the sample closely reflects that of the general population in Poland, including a nearly equal gender distribution. This indicates that gender, along with other key demographic variables, was proportionally represented and cannot be considered a factor influencing consumer preferences in this study. In terms of age groups, the largest proportion of respondents belonged to the 30-44 age category (34.9%), which reflects the current demographic structure of the Polish population. This age cohort represents the most numerous generations, followed by a decline in the size of younger generations as a result of ongoing demographic changes and the ageing of society. The distribution by place of residence showed that respondents from cities with populations of fewer than 100,000 inhabitants and those from rural areas constituted nearly equal shares (36.9% and 32.2%, respectively), whereas participation from larger cities with populations exceeding 100,000 was lower, at 30.9%. It is also noteworthy that the majority of respondents had attained either higher or secondary education (84%), which may reflect a relatively high level of awareness within this group. Regarding income, the largest proportion of respondents (35.1%) reported a monthly income ranging from USD 1 064 to 1 596, which may be indicative of an average economic standard of living among the participants. As for household size, the most common family structure was that of two people (28.5%), which is typical under modern conditions, where two-person households are increasingly prevalent.

To analyse the relationships between the socio-demographic characteristics of the respondents, the χ^2 (chi-square) test was employed (Table 3). The results of the χ^2 analysis revealed several statistically significant associations between socio-demographic variables. In particular, a significant relationship was observed between the level of education and personal monthly income ($\chi^2=15.87$; $df=3$; $p=0.002$), supporting the trend of higher income levels being associated with higher educational attainment. Respondents with higher education were more likely to report higher incomes, whereas those with secondary or primary education were more frequently found in lower income brackets. This finding aligns with general socio-economic trends and underscores the role of education in achieving financial stability.

Table 3

Results of χ^2 -analysis of the studied socio-demographic characteristics

<i>Pair of variables</i>	χ^2	<i>df</i>	<i>p-value</i>
Gender vs Age	10.32	3	0.015
Place of residence vs Education	4.25	2	0.053
Personal monthly income vs Monthly household income	12.76	5	0.025
Total number of people in the family vs Education	7.89	3	0.048
Age vs Place of residence	11.54	4	0.004
Education vs Personal monthly income	15.87	3	0.002
Age vs Total number of people in the family	8.63	3	0.035
Place of residence vs Monthly household income	5.92	4	0.205

The relationship between the age and place of residence of respondents ($\chi^2=11.54$; $df=4$; $p=0.004$) was statistically significant. This suggests differences in residential choices depending on age group. Younger respondents (18-29 years) were more likely to reside in cities with populations exceeding 100,000 inhabitants, whereas older respondents (45+ years) were more commonly found in rural areas or small towns. This may indicate a trend towards urbanisation among younger individuals and a preference for greater opportunities available in larger urban centres. The relationship between personal monthly income and monthly household income ($\chi^2=12.76$; $df=5$; $p=0.025$) demonstrated a close correlation between individual earnings and overall household income. Respondents from high-income households were also more likely to report higher personal incomes, reflecting financial stability and consistent employment levels.

Table 4 presents respondents' views on the importance of price and quality in fish products, as well as their preferences regarding additional factors such as sustainable fishing certification and perceived health benefits.

Table 4

Consumer attitudes towards the price and quality of fish products

<i>Answer option</i>	<i>Strongly disagree</i>	<i>Tend to disagree</i>	<i>Hard to say</i>	<i>Tend to agree</i>	<i>Strongly agree</i>	σ^2
<i>Likert scale score</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	
<i>Question</i>	<i>Share of those who chose, %</i>					
2.1. I prefer to buy cheap fish and fish products, even if their quality is slightly lower	31	24	23	13	9	1.67
2.2. I expect fish and fish products to be cheap and of high quality	5	7	29	30	28	1.21
2.3. I only choose quality fish products, even if they are more expensive	4	10	31	33	22	1.12
2.4. I choose fish products with a sustainable fishing certificate, even if they are more expensive	13	15	29	24	19	1.63
2.5. The health benefits of fish and fish products are more important to me than the price	4	9	30	32	25	1.15

Based on the results obtained, clustering was performed using the k-means method, which enabled the grouping of objects according to the principle of minimising the distance to the cluster centroid. As a result of the analysis, three clusters were identified (Figure 1). The first cluster comprised questions with high variance values (1.67 and 1.63), indicating a wide range of opinions regarding the price and quality of fish products. The second cluster grouped respondents with more uniform opinions (variance 1.21), while the third cluster included questions with the lowest variance values (1.12 and 1.15), suggesting a higher degree of similarity in the assessments provided by participants in this group.

To determine the optimal number of clusters, the elbow method was applied. As shown in Figure 1, the rate of decrease in internal variance slows significantly after three clusters, indicating that classifying consumers into three groups is appropriate.

The first group (cluster) – price-oriented (34%) – comprised respondents who more frequently choose inexpensive fish products, even at the expense of lower quality. This cluster was defined based on responses with the highest variance values (1.67 – question 2.1 and 1.63 – question 2.4 from Table 3), confirming the diversity of opinions regarding the price–quality ratio of fish products.

The second group – price–quality balance (41%) – included respondents who aim to strike a balance between an affordable price and satisfactory quality. The average variance value for this cluster was 1.21 (question 2.2), indicating a more unified position regarding expectations for fish products.

The third group – quality-oriented (25%) – consisted of consumers willing to pay a higher price for high-quality and certified products. Participants in this cluster exhibited the lowest score variability (1.12 – question 2.3 and 1.15 – question 2.5), reflecting a high degree of consensus among members of this group.

Table 5 presents the average response values for each cluster on a Likert scale (ranging from 1 to 5) across the analysed questions.

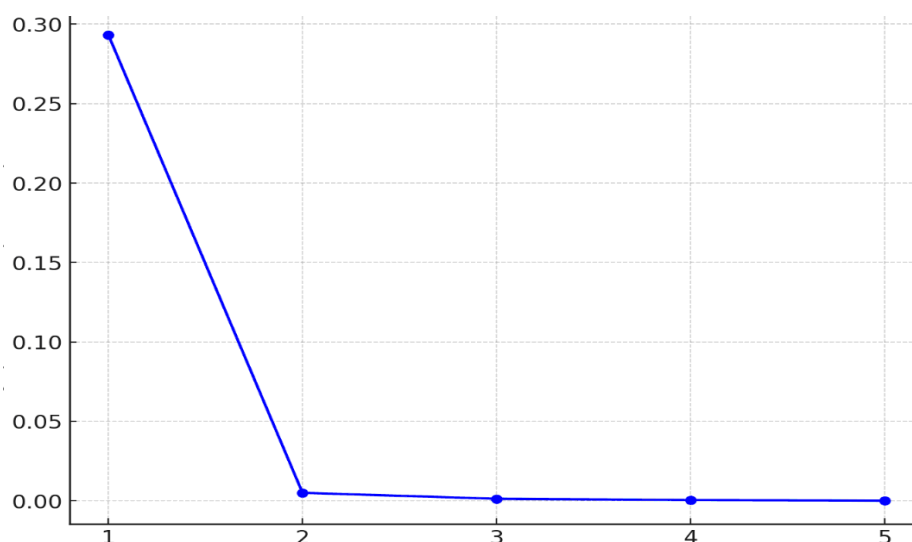


Figure 1. The determination of the optimal number of clusters using the elbow method.

Table 5

Average values of responses of each cluster on the Likert scale (from 1 to 5)

<i>Indicator</i>	<i>Price-oriented</i>	<i>Price-quality balance</i>	<i>Quality-oriented</i>
The advantage of cheap products	4.1	3.0	1.8
Expecting low prices	4.3	3.5	2.1
The advantage of quality products	2.2	3.4	4.6
Choosing certified products	2.0	3.1	4.3
The importance of health benefits	2.5	3.6	4.7

The analysis of the clustering data demonstrated a clear differentiation of consumers based on their preferences for the price and quality of fish products. The three identified clusters reflect significant differences in consumer priorities, enabling the identification of typical behavioural patterns. The first group comprised consumers for whom low cost is the decisive factor when purchasing fish products, even if this comes at the expense of quality. Representatives of this cluster are less inclined to pay more for certified products or those with proven health benefits. This group mainly includes respondents with middle or low incomes and an average level of education.

The second group consisted of consumers who seek a balance between price and quality. They attempt to find an optimal ratio between these characteristics and are partially willing to pay more for certified or higher-quality products, although they do not always view this as essential. This group is characterised by a degree of uncertainty in their priorities, as reflected in a significant proportion of responses indicating "Difficult to say". This cluster predominantly includes respondents with average incomes and varying levels of education.

The third group consisted of consumers who are willing to pay a premium for high-quality fish products, certification of sustainable fishing practices, and products with verified health benefits. For these consumers, trust in quality is a priority, even if it leads to a higher purchase cost. This cluster was primarily composed of respondents with higher education, residents of large cities, and individuals with high incomes.

For each cluster, an analysis of the socio-demographic characteristics of consumers was conducted, as presented in Table 1. Specifically, indicators such as gender, age, place of residence, level of education, personal and household income, and number of family members were examined. As a result, it was possible to determine the

dominant characteristics of each cluster, allowing for a clearer identification of the specific features of each consumer group.

Table 6 presents summarised data on the dominant socio-demographic characteristics of consumers in each of the identified clusters. It reflects the proportions or average values for each group across the corresponding indicators, thereby highlighting the distinctions between clusters. The results indicate that the price-oriented group of consumers is characterized by a predominance of younger respondents with an average income, while the quality-oriented cluster is dominated by older consumers with a higher level of education and income. The price-quality balance group was the most balanced on all the indicators studied.

Table 6

Dominant socio-demographic characteristics for each cluster

<i>Indicator</i>	<i>Price-oriented (%)</i>	<i>Price-quality balance (%)</i>	<i>Quality-oriented (%)</i>
Gender	Women (55%)	Women (53%)	Men (51%)
Age	18-29 years old (38%)	30-44 years old (35%)	45-59 years old (25%)
Residence	City <100,000 (40%)	Village (35%)	City >100,000 (38%)
Education	Secondary (45%)	Higher (48%)	Higher (50%)
Personal monthly income	USD 798-1,064 (25%)	USD 1,064-1,596 (38%)	USD >1,596 (30%)
Monthly household income	USD 1,596-2,396 (28%)	USD 2,396-3,192 (30%)	USD >3,990 (20%)
Number of people in the family	Two (30%)	Three (28%)	Four (27%)

The clustering results revealed differing approaches to the selection of fish products, which is essential for the development of targeted marketing strategies. Producers and retailers should take these differences into account when designing pricing policies, ensuring product quality, and planning advertising campaigns. For the first cluster, effective marketing strategies should focus on competitive pricing and clear communication of discounts or cost-saving benefits. Producers and retailers targeting this segment should carefully align their pricing policies and product positioning to meet the expectations of cost-conscious consumers. For the second cluster, emphasis should be placed on accessibility and a favourable price-quality ratio (value for money). The third cluster requires enhanced communication regarding the benefits of high-quality products in order to foster long-term consumer preferences. For further analysis of the barriers to purchasing fish and fish products, data on the frequency of refusals to follow through with planned purchases for various reasons were utilised. Table 7 presents the structure of respondents' answers using the Likert scale, which reflects the perceived influence of different factors on the decision to decline a purchase.

Table 7

Structure of responses to the question "Have you ever refused a planned purchase of fish and fish products for the following reasons?", %

<i>Factors</i>	<i>Never</i>	<i>Rarely</i>	<i>Neither rarely nor often</i>	<i>Often</i>	<i>Very often</i>	<i>Variance (σ^2)</i>
3.1. The price is too high	6	14	31	32	16	1.49
3.2. Unattractive appearance	6	13	29	28	25	1.72
3.3. Questionable freshness/low quality	6	13	28	26	27	1.78

<i>Factors</i>	<i>Never</i>	<i>Rarely</i>	<i>Neither rarely nor often</i>	<i>Often</i>	<i>Very often</i>	<i>Variance (σ^2)</i>
3.4. Lack of information about origin	15	21	34	21	9	1.34
3.5. Lack of information about the production method	16	23	35	19	8	1.26
3.6. Lack of information about the fishing gear used	24	23	33	14	6	1.04
3.7. Lack of information on the date of catch	16	20	34	19	11	1.18
3.8. Lack of expiration date information	11	16	26	25	22	1.63
3.9. Composition of fish product – too low fish content	9	16	32	25	19	1.55
3.10. Composition of the fish product – presence of additives	9	17	36	24	13	1.43
3.11. Difficult to cook	17	23	34	18	7	1.21

Based on the data in Table 6, clustering was performed using the k-means method, which allowed us to identify three main groups of factors depending on the level of variance of the respondents' answers. The first group – factors with high variability of answers – included: "Doubtful freshness/low quality" (1.78), "Unattractive appearance" (1.72), "Lack of information about the expiration date" (1.63). The second group includes factors with medium variability: "Composition of the fish product – too low fish content" (1.55), "Price is too high" (1.49), "Composition of the fish product – presence of additives" (1.43), "Lack of information about the origin" (1.34). The third group – factors with low variability – includes: "Difficulties in preparation" (1.21), "Lack of information about the date of catch" (1.18), "Lack of information about the method of production" (1.26), "Lack of information about the fishing gear used" (1.04). This approach allowed us to clearly structure the factors according to the degree of disagreement of the respondents' opinions. Based on the results of clustering, the main socio-demographic characteristics of consumers within each cluster were investigated (Table 8).

Table 8

Dominant socio-demographic characteristics for each cluster

<i>Indicator</i>	<i>Factors with high variability of responses (3.2; 3.3; 3.8)</i>	<i>Factors with medium variability (3.1; 3.4; 3.9; 3.10)</i>	<i>Factors with low variability (3.5; 3.6; 3.7; 3.11)</i>
Gender	Women (60%)	Women (57%)	Men (53%)
Age	30-44 years old (39%)	45-59 years old (38%)	60+ years old (37%)
Residence	Cities >100,000 (52%)	Cities <100,000 (48%)	Villages (60%)
Education	Higher (47%)	Secondary special (46%)	Secondary (55%)
Personal monthly income	USD 798-1,064 (34%)	USD 266-798 (40%)	<USD 266 (42%)
Monthly household income	USD 1,596-2,394 (38%)	USD 798-1,596 (41%)	<USD 798 (41%)
Number of people in the family	3-4 people (43%)	2-3 people (34%)	1-2 people (55%)

According to the data in Table 8, the group of factors with high variability ($\sigma^2 \geq 1.6$) – which included reasons for refusing a planned purchase such as unattractive appearance,

questionable freshness or low product quality, and lack of information about the expiration date – was primarily composed of women (60% of respondents in this category). The age structure of this consumer group was predominantly individuals aged 30 to 44 (39%). A majority of respondents lived in large cities with populations exceeding 100,000 (52%) and held higher education qualifications (47%). In terms of financial characteristics, the average personal monthly income of respondents in this group ranged from USD 798 to USD 1,064 (34%), while household income was between USD 1,596 and USD 2,396 (38%). The most common family model in this group consisted of 3-4 members (43%).

Factors with medium variability ($1.3 \leq \sigma^2 < 1.6$) – including reasons for refusing a purchase such as high price, lack of information about product origin, and product composition (e.g., too low fish content or the presence of additives) – were also most significant for women (57%), though their proportion was slightly lower than in the previous group. In this category, respondents were mainly from the 45-59 age group (38%) and resided in cities with populations under 100,000 (48%). The most prevalent level of education was specialised secondary education (46%). The financial profile of this group indicated an average income level: the majority of respondents reported a personal monthly income of USD 266-798 (40%), while household income ranged from USD 798 to USD 1,596 (41%). This group was predominantly made up of families comprising 2-3 members (34%).

Factors with low variability ($\sigma^2 < 1.3$) – such as lack of information about the method of production, fishing gear used, date of catch, and difficulties in preparation – had the least influence on the decision to purchase fish products. These factors were most significant for men, who made up 53% of respondents in this group. The largest proportion of respondents in this category were aged 60 and above (37%). Most lived in rural areas (60%) and had attained secondary education (55%). This group had the lowest personal monthly income, with 42% earning less than USD 266. Additionally, in most households within this group, the total monthly income did not exceed USD 796 (41%). Regarding family composition, respondents in this category most commonly lived in small households consisting of 1-2 people (55%).

Given that consumers with high variability of responses (women aged 30-44, residents of large cities with medium to high incomes) demonstrated increased attention to product appearance, quality, freshness, and information on expiration dates, retailers should prioritise enhancing the visual appeal of fish products. It is recommended to improve product labelling systems by providing more detailed information regarding expiration dates, storage conditions, and product origin. Additionally, introducing high-quality packaging that highlights freshness and natural characteristics would be beneficial. In light of this group's high expectations, an effective strategy could include implementing product quality certification schemes, supported by independent expert evaluations.

For consumers with medium variability of responses (primarily women aged 45-59 with middle incomes, residing in medium-sized cities), retailers should focus on optimising pricing strategies. As the high cost of products was identified as a key deterrent for this group, it is advisable to expand the range of affordable options without compromising on quality. Simultaneously, clearer communication about product composition is needed – specifically, information on the percentage of fish content and the presence or absence of additives. Furthermore, retailers should consider implementing promotional and informational campaigns to build consumer trust and enhance product transparency.

For the group with low variability of responses (men aged 60 and above, residents of rural areas with low incomes), ensuring the availability of information on fish farming, catch methods, and preparation techniques is essential. Expanding the network of sales points in smaller communities – through field sales initiatives or partnerships with local food markets – can improve accessibility. Given the lower trust in conventional retail formats and the noted difficulties in preparing fish products, introducing simple culinary guides and recipes would support greater product adoption and contribute to increased popularity among this consumer segment.

Given that a significant proportion of consumers paid close attention to the quality and freshness of products, it is recommended that policymakers initiate the development and implementation of mandatory standards for providing information on expiration dates, storage conditions, product origin, and methods of fish capture. Particular emphasis should be placed on monitoring compliance with these requirements, which would contribute to strengthening consumer confidence in fish products. It is also advisable to implement policies aimed at improving the accessibility of fish products for low-income groups. As individuals in this category more frequently face financial constraints when purchasing fish, it is recommended to develop mechanisms for government subsidies or support schemes for producers and suppliers of fish products, thereby reducing the final cost to the consumer.

An additional area of regulatory focus should be enhancing transparency within the fish product market. It is proposed to introduce a unified electronic tracking system for the origin of fish, enabling consumers to access reliable information regarding the conditions of production, capture, and distribution. This measure would help reduce consumer distrust, particularly among those who place a high value on freshness and the environmental sustainability of products.

Given the important role of information in shaping consumer behaviour, government agencies should also promote educational campaigns to raise public awareness about the criteria for selecting high-quality fish products. This could involve the dissemination of informational materials through mass media, social networks, and consumer education programmes. The implementation of these recommendations would serve to increase trust in fish products across diverse consumer groups, optimise market structure, and ensure the sector's stable development in the long term.

Discussion. The results obtained indicate a close relationship between the level of consumer awareness and decision-making regarding the choice of fish products, a finding that is consistent with several previous scientific studies. This relationship is reflected in the work of Cusa et al (2021) and Costabile et al (2021), which emphasise that a lack of consumer awareness regarding the appearance of commercial fish species significantly affects their ability to correctly identify products. This, in turn, leads to a decline in trust towards certain categories of goods and limits consumer demand. These findings highlight the importance of information provision in shaping consumer preferences and point to the need for further research to identify effective strategies for increasing awareness.

Geographical factors also have a significant influence on consumer behaviour, as confirmed by the findings of Issifu et al (2022). In this context, it is important to note that regional variations in consumer preferences are often shaped by traditions, dietary habits, and product availability. An analysis of the key factors highlighted in Table 2 reveals that the most influential include product price (32% of respondents reported often and 16% very often refusing to purchase due to high cost), concerns over freshness and quality (26% and 27%, respectively), and unattractive appearance (28% and 25%). Informational factors also proved to be important: lack of data on expiration dates (25% and 22%) and the presence of additives in the composition of fish products (24% and 13%). Comparing these findings with the present study suggests that socio-cultural factors play a critical role in shaping demand – particularly in the context of globalisation and growing competition between local and international fish producers. Traditional dietary habits, especially in regions with a well-established culture of fish consumption, contribute to stable consumer demand. Conversely, in areas with limited access to high-quality fish products, a decline in purchasing activity is observed. The study by Krešić et al (2022) underscores the importance of product information and satisfaction with product characteristics as key factors influencing purchasing decisions. It was found that consumers with access to comprehensive information about the quality, origin, and production methods of fish are more likely to prefer certified products with verified environmental safety standards. This aligns with the present findings regarding the importance of information transparency, which directly impacts brand trust and consumers' willingness to pay a premium for products of proven quality.

The results of the initial cluster analysis identified three groups of consumers. The first group – price-oriented (34%) – comprised respondents who preferred cheaper fish products, even at the expense of lower quality. The second group – price-quality balance (41%) – included respondents seeking a compromise between affordability and acceptable quality. The third group – quality-oriented (25%) – consisted of consumers willing to pay more for high-quality and certified products. These findings partially correspond with the results of Kitano & Yamamoto (2020), who observed that prior experience with fish product consumption contributes to a more conscious approach to product selection. Similar to the third cluster in the present study, their research identified a group of consumers favouring certified and high-quality products. However, their study did not identify a group focused solely on price, which may be attributed to differences in the market samples analysed.

The second cluster analysis enabled the identification of three groups of factors influencing consumer decisions. The first group, characterised by high variability in responses, included the following factors: “Doubtful freshness/low quality” (1.78), “Unattractive appearance” (1.72), and “Lack of information about the expiration date” (1.63). The second group comprised factors with medium variability: “Composition of the fish product – too low fish content” (1.55), “Price is too high” (1.49), “Composition of the fish product – presence of additives” (1.43), and “Lack of information about the origin” (1.34). The third group included factors with low variability: “Difficulties in preparation” (1.21), “Lack of information about the date of catch” (1.18), “Lack of information about the production method” (1.26), and “Lack of information about the fishing gear used” (1.04). The data obtained confirm the conclusions of Peiró-Signes et al (2022) and Zhong et al (2020) concerning the influence of environmental labelling on consumer decisions. In particular, for respondents in the second and third groups of this cluster analysis, the presence of certification played a significant role in product choice – aligning with the concept of environmental awareness emphasised in the aforementioned studies. However, while Peiró-Signes et al and Zhong et al did not explore the role of informational barriers in decision-making, the present study identified the lack of information regarding expiration dates, product origins, and production methods as some of the most contentious factors affecting consumer behaviour.

The studies by Muhtar et al (2023) and Giosuè et al (2022) found that price considerations, product availability, and brand trust are decisive factors in the process of choosing fish products. This was also confirmed in the present analysis: respondents in the first group of the initial cluster analysis (price-oriented) were significantly more likely to be guided by value-based criteria, which aligns with the trends identified in the aforementioned studies. The results of the study by Rodriguez-Salvador & Dopico (2020) and Tani et al (2021) indicate the importance of market transparency and product traceability. Analysis of the responses also confirmed the relevance of these factors: respondents expressed interest in the origin of the product, its production methods and fishing conditions, which indicates a growing demand for reliable and accessible information on the quality and safety of fish products. Sigurdsson et al (2020) highlighted the importance of quality signals, such as labelling, certification, and positive reviews – findings that are consistent with the results of the second cluster analysis. Factors related to the lack of information (e.g., expiration date, harvest date, and production method) were perceived by consumers as barriers to decision-making, which supports the conclusions of the aforementioned study regarding the role of information provision in building trust in fish products.

The socio-economic differences in fish consumption discussed by Zhu et al (2024) and Landrigan et al (2020) were also confirmed in this study. The analysis revealed that respondents with higher income levels were more likely to prefer organic and certified products, whereas consumers with lower income levels tended to prioritise accessibility and price. While these findings align with those of the aforementioned studies, it is important to note that neither Zhu et al nor Landrigan et al provided a detailed analysis of the impact of information barriers on the decision-making process – an aspect that was central to the present research.

Particular attention should also be given to issues of traceability and sustainability, as emphasised by Fiorile et al (2023). The growing awareness among consumers regarding environmental responsibility and the production methods of fish products has led to increased demand for certified items that adhere to principles of sustainable development. This study similarly found that information concerning the environmental aspects of production significantly influences purchasing decisions – especially among consumers with higher levels of education and awareness.

Another important consideration is the demand for imported versus domestically produced fish, as explored in the study by Liverpool-Tasie et al (2021). Their findings indicate that national characteristics – particularly trust in local producers and perceptions of the quality of imported goods – play a key role in shaping consumer preferences. In this context, the results of the present study confirm that brand recognition, manufacturer reputation, and price affordability are decisive factors in demand formation.

One of the key differences in consumer preferences has been identified in the choice between farmed and wild fish, as highlighted by López-Mas et al (2021). According to their findings, consumer preferences are influenced not only by the quality characteristics of the product but also by the level of trust in its source of origin. Wild fish is traditionally associated with natural quality and the absence of artificial additives, whereas farmed fish is perceived as more affordable but potentially less environmentally friendly. These distinctions were also reflected in the present study, where a similar trend in the differentiation of consumer preferences was observed, particularly in relation to the lack of information regarding the production method (wild versus farmed fish).

The role of trust-related characteristics in the selection of sustainable products has been examined in detail by Maesano et al (2020) and Kobayashi et al (2020), whose findings are consistent with those of this study. These authors observed that consumers are more likely to favour products with demonstrated quality, as evidenced by appropriate certification and labelling. Trust-related attributes – such as information about origin, production methods, and adherence to environmental standards – play a critical role in shaping positive consumer attitudes. This study also confirmed that transparency in information provision and the availability of reliable product data significantly influence purchasing decisions.

The results obtained, in conjunction with findings from previous studies, support the conclusion that consumer decisions regarding the choice of fish products are shaped by a complex set of interrelated factors, each playing a significant role in the decision-making process. Notably, the type of product influences perceptions of quality: wild fish is often associated with naturalness and superior taste, whereas farmed fish is perceived as more accessible and offering a stable supply.

The level of consumer awareness regarding fish product types, production methods, and environmental considerations directly affects purchasing choices. Informed consumers are more likely to focus on quality attributes, product traceability, and certification of compliance. Of particular significance is the presence of environmental labelling, which is perceived as an assurance of quality, safety, and adherence to sustainable development principles. Transparency and traceability also emerge as critical factors, as consumers increasingly scrutinise the product's origin, production conditions, and supply chain. Trusted attributes, such as brand reputation, positive reviews, and independent certifications, further reinforce consumer confidence in their choices. Socio-demographic characteristics, including income level, education, age, and geographical location, also play a key role in shaping consumer preferences. For instance, individuals with higher income levels are more inclined to choose organic and certified products, while lower-income groups tend to prioritise affordability and pricing. This multifactorial interplay underscores the need for further research to deepen understanding of consumer motivations and to develop effective strategies for increasing awareness. Enhancing informational support, expanding the use of eco-labelling, and ensuring market transparency will contribute to fostering responsible consumption, improving product quality, and supporting the sustainable development of fisheries.

Conclusions. This study enabled a comprehensive analysis of the factors influencing consumer behaviour when selecting fish and fish products, as well as the identification of key barriers that hinder planned purchases. The clustering results revealed that the fish product market is segmented into three main consumer groups: price-oriented (34%), price-quality balance (41%), and quality-oriented (25%). Each of these groups exhibits distinct expectations and requirements in relation to fish products. Consumers in the first cluster prefer lower-cost options, even at the expense of quality. The second group seeks an optimal balance between price and quality, while the third is prepared to pay a premium for high-quality, certified products. Furthermore, cluster analysis of the barriers to purchasing fish products identified three groups of influencing factors based on the variability of respondents' answers. The first group, characterised by high variability ($\sigma^2 \geq 1.6$), included concerns about questionable freshness, unattractive appearance, and insufficient information on expiration dates. These factors were most significant for women (60%), primarily aged 30-44 (39%), residing in large cities (52%) and possessing higher education (47%). The second group, with medium variability ($1.3 \leq \sigma^2 < 1.6$), comprised high price, low fish content in products, presence of additives, and lack of information about product origin. These were particularly influential for women (57%) aged 45-59 (38%), mostly living in smaller cities (48%) and holding specialised secondary education (46%). The third group, with low variability ($\sigma^2 < 1.3$), included lack of information on production methods, date of catch, and difficulties in preparation. Although these factors had the least overall influence, they were most significant for men (53%), primarily aged 60 and over (37%), living in rural areas (60%) and having secondary education (55%). The findings are significant from both scientific and practical perspectives. They provide deeper insights into consumer behaviour and offer guidance for developing targeted marketing strategies. For price-oriented consumers, promotional offers and discounts are recommended. For consumers seeking a balance between price and quality, it is essential to ensure transparency regarding product attributes and quality assurance. For quality-oriented consumers, retailers should promote premium, certified products, emphasizing their benefits and safety. Practical recommendations for retailers include improving the quality of product information, particularly concerning origin, production methods, date of catch, and expiration date. Enhancing product appearance and introducing clear quality standards are also crucial. Policymakers and regulatory bodies should focus on strengthening control over labelling and ensuring that consumers have access to reliable and comprehensive product information.

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