THE RESEARCHES ON THE QUALITY AND SAFETY OF SOME ASSORTMENTS OF REFRIGERATED FISH FOR PUBLIC CONSUMPTION

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Abstract

Food safety means involving all the factors and applying all the norms that support and ensure the sale of food products whose nutritional value and consumption are the basis of a healthy diet. Today, consumers are turning their attention towards the quality of the fish meat, on the one hand, and towards healthy and safe fish meat, on the other hand. Therefore, the research was carried out on refrigerated fish assortments (*Eviscerated trout* - *Salmo trutta*, *Sea perch-Perca fluviatilis*, *farmed carp* - Cyprinus carpio, *farmed zander* - *Sander lucioperca*) for public consumption, in order to assess their quality and safety in accordance with the requirements of the standards in force.

Thus, there have been obtained appreciable results, related to such sensory characteristics as: external appearance, consistency, flavour, colour that correspond to the requirements of the norms stipulated in GOST 20057-96 in force for this product, the same can be said about the physical and chemical indices, given that the value of repeatability does not exceed the limit of the repeatability indicated in the standards to the test method. As to the microbiological indices, no pathogenic microorganisms were detected, which indicates the salubrity of the products under study.

Key words: *Eviscerated trout, Sea perch, farm carp, farm zander, sensory indices, physicochemical, microbiological*

Introduction

Food safety means involving all the factors and applying all the norms that support and ensure the sale of food products whose nutritional value and consumption are the basis of a healthy diet.

Fish meat, as well as other fish products that are marketed, contain so many important nutrients, including particularly valuable proteins, that, as nutritionists and the World Health Organization state, it should be a major part of our daily diet.

At the same time, today the attention of consumers is directed to the quality of the fish meat, on the one hand, and to a fish meat that should be safe from a sanitary-veterinary point of view, on the other hand.

Thus, modern aquaculture represents a major innovation in the field of fish and aquatic food production. Being the fastest growing food production sector, it reaches an average world growth

rate of 6-8% per year. The Food and Agriculture Organization of the United Nations is forecasting a further increase in world consumption of seafood.

Consequently, it is known that high consumption of fish meat has a beneficial impact on human health, it helps to body strengthening, on the one hand, and, on the other hand, it minimizes the occurrence of cardiovascular diseases, reduces triglyceride levels, it moderates the inflammatory response and improves carbohydrate metabolism, as it is the source and moderator of the exchange processes.

Material and methods

The researches were carried out on the refrigerated fish assortments: *Eviscerated trout - Salmo trutta, Sea perch - Perca fluviatilis, Farmed carp - Cyprinus carpio and Farmed zander - Sander lucioperca,* bought from the marketing network in 2019. There were collected 4 samples for each assortment separately and the quality and safety indices were investigated at the Republican Veterinary Diagnostic Center in the testing laboratory for food products of animal origin.

The samples, collected from the food marketing network, were initially assessed qualitatively by sensory analysis, then by physical-chemical quality indices, and safety indices - microbiological and contaminant indices (toxic elements) were determined.

To determine the sensory properties (PS-CSA-RPO-01, SM GOST 7636-2009) the appearance, colour, consistency, odour, etc. were evaluated. By using volumetric, spectrophotometric and gravimetric physical-chemical methods the mass fraction of salt, fat, protein, etc. was determined. The microbiological indices were investigated using classical reference methods, international ISO standards.

The *Eviscerated trout* sample was kept at a temperature of + 2^0C, for a period of 72 hours and investigated with a periodicity of: initially, 24 hours, 48 hours and 72 hours. Over time there were investigated the indices that may affect the quality of the product and its safety: sensory and microbiological indices. The obtained data were processed by using the biometric method (Mercurev, 1983).

Results and discussion

In the sensory analysis of the refrigerated *Eviscerated trout*, *Sea perch*, *Farmed Carp*, *Farmed zander* in the studied refrigerated fish assortments there were included such parameters as the appearance, colour, odour, and muscles consistency. Thus, the results obtained on the sensory properties of the *refrigerated Eviscerated trout* are presented below (Table 1).

The analysis of the data presented in Table 1 shows us the compliant sensory properties of the *refrigerated Eviscerated trout*, the visual appearance - fish with clear prominent eyes, closed mouth, clean glossy skin, no spots, no blood clots. Elastic muscles of grey-white colour, with no foreign odour.

The obtained results correspond to the normative requirements stipulated in GOST 20057-96 in force on this product. At the end of the retention period (72 hours), the sensory indices did not

undergo modifications, thus the product preserved its sensory qualities, remaining fresh and recommended for sale and public consumption.

Table 1. Sensory properties of the refrigerated Eviscerated trout

Sensory properties	Refrigerated Eviscerated trout		
	Obtained results (n=4)		Test method
	Initially (0 hours)	72 hours	
Visual appearance	Eviscerated fish, with clear prominent eyes, closed mouth, without scales. The skin is clean, glossy, moist, with little mucus, transparent, bright, natural, characteristic to the species, without spots, without damage, without blood clots. Stiff body, if pressed with the finger on the spine, no trace remains	Fish with clear, prominent eyes, closed mouth, without scales. The skin is clean, glossy, moist, not sticky, transparent, bright, natural, characteristic to the species, without spots. Stiff body, if pressed with the finger on the spine, no trace remains	SM GOST 7631 – 2009, PS – CSA – RPO – 01 ed.1
Consistency	Elastic muscles, well connected to bones	Elastic muscles, well connected to bones	
Colour	Grey-white colour	Uniform grey-white colour, no spots, no color changes	
Odour	Fishy odour, with no foreign odour	Fishy odour, with no foreign odour	

Table 2. Sensory properties of the refrigerated Sea perch

Sensory properties	Refrigerated Sea perch	
	Obtained results (n=4)	Test method
Visual appearance	Fish with clear, prominent eyes, closed mouth, without scales, clean skin with little mucus, glossy, transparent, bright and natural, specific to the species, with no spots, undamaged, without blood clots.	SM GOST 7631 – 2009PS-CSA-RPO-01 ed.1
Consistency	Stiff body, elastic muscles, if pressed with the finger, no trace remains; muscles well connected to bones	
Colour	Grey-white colour	
Odour	Fishy odour, with no foreign odour	

When assessing the fish freshness, the visual appearance, musculature appearance, the colour and the odour are taken into account. The analysis of the experimental data obtained when assessing *Refrigerated Sea perch* presented above, show that the fish was fresh, that was confirmed by the clean, glossy skin, without spots, without blood clots, elastic musculature, muscles well connected

to the bones, the odour was fishy, fact that shows that the fish was kept in proper conditions according to the documents in force.

Table 3. Sensory properties of the Refrigerated Farmed carp

Sensory properties	Refrigerated Farmed carp	
	Obtained results (n=4)	Test method
Visual appearance	Fish with head, covered with clean scales, brightly coloured, well fixed on the skin. Clear, prominent eyes, closed mouth. Red, wet, odourless gills. Stiff body, when pressed with the finger no trace remains. The skin is clean, glossy, without spots, without damage	SM GOST 7631-2009, PS-CSA-RPO-01 ed.1
Muscles appearance	Elastic muscles, well connected to bones	
Colour	Grey-white colour specific to the species	
Odour	Fishy odour, with no foreign odour	

The sensory indices obtained when assessing the *Refrigerated Farmed carp* indicate the quality of the product by its visual appearance - fish with head covered with clean scales, closed mouth, stiff body without spots, grey- white meat closely linked to bones, with no foreign odour. Based on the criteria for evaluating sensory properties, the *Refrigerated Farmed carp,* subject to inspection, fits the category of fresh fish for consumption.

When purchasing refrigerated fish, special attention should be paid to the visual appearance of the product in order to appreciate its freshness. Further, in Table 4 we present the sensory properties of the *Refrigerated Farmed zander.*

Table 4. Sensory properties of the Refrigerated Farm zander

Sensory properties	Refrigerated Farmed zander	
	Obtained results (n=4)	Test method
Visual appearance	Fish with head, covered with scales, not eviscerated. Clean scales, well fixed to the skin. Clear, prominent eyes, closed mouth, red, odorless gills. Stiff body, when pressed with the finger, no trace remains. The skin is clean, glossy, without spots, without damage	SM GOST 7631-2009, PS-CSA-RPO-01 ed.1
Muscles appearance	Elastic muscles	
Colour	White meat well connected to bones	
Odour	Fishy odour, without foreign odour	

The results obtained after having assessed the *Refrigerated Farmed zander*, show not eviscerated fish with head, covered with scales, with clear eyes, closed mouth, clean glossy skin without spots, with elastic white musculature, no foreign odour.

The presented results of the sensory properties of the *Refrigerated Farmed zander* confirm that the fish is fresh and qualitative and corresponds to the requirements of the regulations in force for these products.

Besides the sensory properties in assessing the quality of the refrigerated fish, tests are carried out on physical-chemical indices, quality indices, such as: moisture mass fraction, salt mass fraction, fat mass fraction, etc. The most commonly used indicator for this product category is the salt content, (Table 5).

Table 5. Physical-chemical indices in refrigerated fish assortments

Indices	Normative requirements	Obtained results $X \pm S_x$	Test method GOST
Refrigerated eviscerated trout (n=4)			
Salt mass fraction, %	De facto	0.32 0.37 (r=0.05%) 0.28 0.34 (r=0.06%) 0.37 0.30 (r=0.07%) 0.26 0.29 (r=0.03%) X_{med}= 0.320±0.013	7636-85 Repeatability (r) shall not exceed 0.2%.
Refrigerated sea perch (n=4)			
Salt mass fraction, %	De facto	0.42 0.39 (r=0.03%) 0.40 0.38 (r=0.02%) 0.37 0.39 (r=0.02%) 0.42 0.41 (r=0.01%) X_{med}= 0.40 ±0.010	7636-85 Repeatability (r) shall not exceed 0.2%.

Table 6. Physical-chemical indices in refrigerated fish assortments

Indices	Normative requirements	Obtained results $X \pm S_x$	Test method GOST
Farmed zander (n=4) – 0.355±0.016			
Salt mass fraction, %	De facto	0.31 0.33(r=0.02%) 0.37 0.39(r=0.02%) 0.40 0.42(r=0.02%) 0.32 0.30(r=0.02%)	7636-85 Repeatability (r) shall not exceed 0.2%.
Farmed carp (n=4) – 0.316±0.012			
Salt mass fraction, %	De facto	0.30 0.35(r=0.05%) 0.29 0.25(r=0.04%) 0.31 0.37(r=0.06%) 0.32 0.34(r=0.02%)	7636-85 Repeatability (r) shall not exceed 0.2%.

The laboratory tests to determine the chlorides mass fraction were carried out simultaneously, according to the requirements of the test method, GOST 7636-85. The repeatability (r), according to the requirements of the test method, shall not exceed 0.2%. Thus, according to the obtained data, the repeatability (r) varies within the limits of 0.03-0.07% (for eviscerated trout), with a standard deviation of the average value of 0.013%, which denotes a considerable variation of the value of the chlorides mass fraction for the examined samples.

The obtained results regarding the physical-chemical indices in the refrigerated fish assortments and in particular the salt content in our samples demonstrated the specific and characteristic parameters of each studied refrigerated fish assortment.

The experimental data for the *Refrigerated Eviscerated Trout* indicate an average value of 0.320%, which shows us the actual content of salt mass fraction in the sample of the refrigerated fish, given that this index is not normed.

The data for the *Refrigerated Sea perch* show that the salt mass fraction registered an average index of 0.40%, with the standard deviation of 0.01% which shows the actual salt content of this laboratory sample.

According to the obtained results, it is worth mentioning that the salt mass fraction for the *Farmed zander* presented an average value of 0.355%. For the refrigerated fish assortment of farmed carp we obtained an average salt mass fraction of 0.316%, which shows a specific result for this assortment.

The salt mass fraction in the investigated samples varies within the limits of 0.26-0.42%, values indicating the actual chlorine content in fish meat.

Table 7. Physical-chemical indices in refrigerated fish assortments

Indices	Normative requirements	Obtained results $X \pm S_x$	Test methods GOST
Refrigerated eviscerated trout (n=4) – 6.90±0.070			
Fat mass fraction, %	De facto	6.7 6.9 (r=0.2%) 7.1 6.7 (r=0.4%) 6.8 7.0 (r=0.2%) 6.8 7.2 (r=0.4%)	7636-85 Repeatability (r) shall not exceed 0.5%.
Refrigerated sea perch (n=4) – 5.77±0.143			
Fat mass fraction, %	De facto	5.2 5.7(r=0.4%) 6.1 6.5(r=0.4%) 5.4 5.8(r=0.4%) 5.9 5.6(r=0.3%)	7636-85 Repeatability (r) shall not exceed 0.5%.

Table 8. Physical-chemical indices in refrigerated fish assortment

Indices	Normative requirements	Obtained results $X \pm S_x$	Test methods GOST
Farmed zander (n=4) – 4.95±0.095			
Fat mass fraction, %	De facto	4.8 5.1 (r=0.3%) 4.7 4.9 (r=0.2%) 5.2 4.9(r=0.3%) 5.2 4.8(r=0.4%)	7636-85 Repeatability (r) shall not exceed 0.5%.
Farmed carp (n=4) – 6.325±0.131			
Fat mass fraction, %	De facto	6.5 6.9(r=0.4%) 6.4 6.7(r=0.3%) 5.9 6.2(r=0.3%) 5.8 6.2(r=0.4%)	7636-85 Repeatability (r) shall not exceed 0.5%.

The obtained results regarding fat mass fraction in the studied refrigerated fish assortments show that they correspond to the species from which they come. Laboratory tests to determine the fat mass fraction analysis was carried out simultaneously, according to the requirements of the test method, GOST 7636-2009, where the repeatability (r) shall not exceed 0.5%. Thus, the experimental data for the *Refrigerated Eviscerated Trout* indicate an average value of 6.90%, which shows us the real content of the fat mass fraction in the sample of refrigerated fish. Repeatability (r) varies within the range 0.2-0.4% (for eviscerated trout), with a standard deviation of the average value of 0.070%, which denotes a non-essential variation of the value of the fat mass fraction for the examined samples. The experimental results for the *Refrigerated Sea perch* show us that the fat mass fraction registered an average index of 5.770%, a result which shows us the actual fat content of this laboratory sample. Repeatability (r) for this assortment varies within the limits of 0.3-0.4% which is within the allowed limits of the test method that admits max. 0.5%.

The fat mass fraction for the *Farmed zander* presented an average fat value of 4.950%, and the repeatability (r) varies within 0.2-0.4%, with a standard deviation of the average value of 0.095%, which demonstrates a insignificant variation in the value of the fat mass fraction for the examined samples.

For the refrigerated *Farmed carp* assortment we obtained an average value of the fat mass fraction of 6.325%, which shows a specific result for this assortment. Repeatability (r) varyied within the limits of 0.3-0.4% - for the *Farmed zander* with a standard deviation of the average value of 0.131%, which confirms an insignificant variation of the value of the fat mass fraction for the examined lots.

The protein content in meat is an important index, in general for slaughter animals, and especially for fish meat, since its value, characteristics and taste qualities depend on the content of some substances in fish meat. Thus, the obtained results regarding the mass fraction of proteins in the refrigerated fish batches, according to the requirements of the test method, GOST 7636-2009 where the repeatability (r) did not exceed the permissible maximum according to the test method in force of 0.5%.

As a result, an average value of 16.940% was recorded in the *Refrigerated Eviscerated Trout* which reveals the actual content of the protein mass fraction in the refrigerated fish sample given that this index is not standardized according to the requirements of the STAS in force at these products, and the repeatability (r) varies within the limits 0-0.4% (for the Eviscerated Trout), with a standard deviation of the average value of 0.075%, which confirms an insignificant variation of the value of the proteins mass fraction for the examined samples .

For the assortment of the *Refrigerated Sea perch*, there was registered a mass fraction of average protein of 15.762%, a result which shows us the actual protein content of this laboratory sample, taking into account that for the *Refrigerated Sea perch* according to the normative requirements there are allowed the parameters that are established de facto, with a repeatability (r) that varies within the limits of 0.3-0.5%, which is within the admitted limits of the test method that admits max. 0.5%.

For the the *Farmed zander*, the mass fraction of proteins has shown an average value of 16.150%, which confirms a result that is in compliance with the requirements of the regulations in force for this assortment and which according to the current STAS must present de facto results, and the repeatability (r) varies within 0.2-0.5% - for the the *Farmed zander*, with a standard deviation of the average value of 0.256%, which shows us an insignificant variation of the value of the proteins mass fraction for the examined samples.

For the *Farmed carp* assortment we have obtained an average value of 16.320% of protein mass fraction, which is a specific result for this assortment and which is in compliance with the regulations in force, which admit a de facto index obtained in the studied samples, with a repeatability (r) that varies within 0.2 – 0.4% - and a standard deviation of the average value of 0.133%, which shows us an insignificant variation of the value of the proteins mass fraction for the examined batches.

Table 9. Physical-chemical indices in refrigerated fish assortments

Indices	Normative requirements	Obtained results $X \pm S_x$	Test method GOST
Refrigerated eviscerated trout (n=4) -16.940±0.075			
Proteins mass fraction, %	De facto Repeatability according to DN r= max. 0,5%	16.6 17.0 (r=0.4%) 17.1 17.1(r=0.4%) 16.7 17.0 (r=0.3%) 16.8 17.2 (r=0.4)	7636
Refrigerated Sea perch (n=4) – 15.762±0.140			
Proteins mass fraction, %	De facto	15.2 15.6(r=0.4%) 16.1 16.4(r=0.3%) 15.4 15.9(r=0.5%) 15.9 15.6(r=0.3%)	7636

Table 10. Physical-chemical indices in refrigerated fish assortments

Indices	Normative requirements	Obtained results $X \pm S_x$	Test methods SM GOST
Farmed zander (n=4) – 16.150±0.256			
Proteins mass fraction, %	De facto Repeatability according to DN r= max. 0,5%	15.8 15.3(r=0.5%) 16.7 16.9(r=0.2%) 15.2 15.7(r=0.5%) 16.9 16.7(r=0.2%) X_{med}=	7636
Farmed carp (n=4) - 16,320±0,133			
Proteins mass fraction, %	De facto	16.5 16.9(r=0.2%) 16.4 16.7(r=0.3%) 15.9 16.2(r=0.3%) 15.8 16.2(r=0.4%)	7636

Generally, the microbiological examination of food products is performed in order to assess their salubrity (presence or absence of pathogenic microorganisms) and their quality. The microbiological examination of fish meat is required in cases of alteration, doubts about the freshness, the discovery of diseases, the suspicion of the presence of pathogenic bacteria, in cases when the consumed fish caused food poisoning in humans.

The results of the microbiological examination of the examined samples for the *Refrigerated Eviscerated Trout* and the *Refrigerated Sea perch* are presented in Table 11.

Table 11. Microbiological indices for the *Refrigerated Eviscerated trout* and the *Refrigerated Sea perch*

Indices	Obtained results			
	Normative requirements	Refrigerated eviscerated trout (n=4)	Refrigerated Sea perch (n=4)	Test method
Coliform bacteria in 0.001 g	absent	absent	absent	SM ISO 4831 : 2010
Staphyloccocus aureus in 0.01g	absent	absent	absent	SM SR EN ISO 6888-3 : 2013
Salmonella in 25.0 g	absent	absent	absent	SM EN ISO 6579-1: 2017

The data from table 11 show that in the analyzed samples of the *Refrigerated eviscerated trout* and the *Refrigerated Sea perch* regarding the microbiological parameters coliform bacteria were not detected in 0.001 g and neither Staphyloccocus aureus in 0.01g,was found. Salmonella in 25.0 g of product was also absent. These results indicate the safety of the product from a microbiological point of view. The data of the microbiological indices for the Refrigerated Farmed carp and the Farmed zander are presented below.

Table 12. Microbiological indices for the Farmed carp and the Farmed zander

Indices	Rezultate obţinute			
	Normative requirements	Farmed carp (n=4)	Farmed zander (n=4)	Test method
Coliform bacteria in 0,001 g	absent	absent	absent	SM ISO 4831 : 2010
Staphyloccocus aureus in 0,01g	absent	absent	absent	SM SR EN ISO 6888-3 : 2013
Salmonella in 25,0 g	absent	absent	absent	SM EN ISO 6579-1:2017 2017

The microbiological examination completes the sensory and physical-chemical examination, especially in the case of suspected products. Table 12 shows the obtained results of the microbiological indices for the *Farmed carp* and the *Farmed zander*. Coliform bacteria in 0.001 g, Staphyloccocus aureus in 0.01g and Salmonella in 25.0 g product are absent. These results show that the products are microbiologically safe. Along with the laboratory assessments regarding the sensory, physical-chemical and microbiological indices, the toxic elements were also appreciated. Therefore, the determination of the toxic elements in the Refrigerated *Eviscerated trout and the*

Sea perch included the assessment of the content *of lead, cadmium, mercury* and the results of the laboratory investigations are presented in Table 13.

Table 13. Toxic elements in the *Refrigerated eviscerated trout* and the *Refrigerated Sea perch*

Indices	Obtained results			
	Normative requirements HG nr. 520 of 22.06.2010	Refrigerated eviscerated trout (n=4)	Refrigerated Sea perch (n=4)	Test methods
Lead, mg/kg max	max 0.3	< 0.02	<0.02	SM SR EN 14082: 2006 PS-CSA-R-01
Cadmium, mg/kg max	max 0.05	<0.005	<0.005	
Mercury, mg/kg max	max 0.5	<0.04	<0.04	IM 5178-90 PS-CSA-R-04

The results, presented previously in table 13, confirm that the heavy metal content in the fish meat samples- *Refrigerated Eviscerated Trout and Sea perch* -demonstrated the following: the concentration of lead mg / kg in the studied samples have a value of <0.02 both for the *Refrigerated Eviscerated Trout* and the *Sea perch* while the requirements of the regulations in force admit a maximum of 0.3 mg/kg, the cadmium concentration is <0.005 index which is included in the requirements of the norms in force which admit a maximum of 0.05 mg/kg, mercury content, mg/kg in the examined samples constituted <0.04, which is within the requirements of the regulations in force for these indices. Generally, these indices do not exceed the maximum permissible limits for toxic elements related to refrigerated fish meat.
The obtained results regarding the toxic elements in the *Farmed Carp and Zander* are shown in table 14.

Table 14. Toxic elements in the Refrigerated Farmed Carp and zander

Indices	Obtained results			
	Normative requirements	Farmed carp (n=4)	Farmed zander (n=4)	Test method
Lead,mg/kg max	0.3	< 0.02	<0.02	SM SR EN 14082: 2006 PS-CSA-R-01
Cadmium, mg/kg max	0.05	<0.005	<0.005	
Mercury, mg/kg max	0.5	<0.04	<0.04	IM 5178-90 PS-CSA-R-04

The results, presented in Table 14, show us that the content of heavy metals in the *Farmed Carp and Farmed zander* fish assortments is the following: the concentration of lead mg/kg in the analyzed samples has a value of <0.02 for both for *Farmed Carp and for Farmed zander.* This index is lower compared to the maximum admissible requirements of the normative acts in force

that admit a maximum of 0.3, the resulting cadmium concentration is less than <0.005; this index is included in the normative requirements in force because it admits a maximum of 0.05; the mercury content, mg/kg in the examined samples constituted <0.04, a result that falls within the requirements of the regulations in force, taking into account that the maximum allowable limit for this index is 0.5. These indices do not exceed the maximum permissible limits for toxic elements in the studied fish meat, which confirms the good state of the refrigerated fish for public consumption.

Conclusions

When assessing the sensory properties of the *Eviscerated trout - Salmo trutta, Sea perch - Perca fluviatilis, Refrigerated farmed carp* - Cyprinus carpio *and the Refrigerated farmed zander - Sander lucioperca*) bought in the public food marketing network, there was analysed the visual appearance, colour, odour, which have positive and appreciable values, taking into account that the results meet the requirements of the regulations in force for these products and fall into the category of fresh fish for consumption.

The obtained results regarding the physical-chemical indices in the refrigerated fish assortments and especially the salt content in our samples demonstrated the specific parameters and characteristics of each studied refrigerated fish assortment, taking into account that according to the requirements of the STAS in force it must present de facto results, and the indices of repeatability (r), have varied within the limits of 0.03-0.07% which does not exceed the admissible indices of 0,2%, according to the requirements of the test method

The microbiological assessments show us that the samples of the refrigerated fish are of good quality, they were kept at an appropriate temperature in the refrigerated spaces and in which coliform bacteria, Staphyloccocus aureus and Salmonella have not been found; these results indicate that the products are safe from the microbiological point of view.

The lack of heavy metals (Pb, Cd) in the investigated fish samples denotes its quality by the lack of contaminants, which attests that it was grown under favourable conditions of fauna and flora. Although cadmium, whose toxic potential is greater than that of lead and is widely used in industry, has not been found in the meat of the studied species.

References

Bradatean, G. (2007): Food safety. Iasi: The Publishing House, Ion Ionescu from Brad, p. 160 (Ro.).

Decei, P. (2001): The growth of salmonids. Terr Desing Publishing House, p. 276 (Ro.).

Goran, V. Gh. (2014): Food safety. Bucharest: Printech, p. 272 (Ro.).

Merkuryev, E. K., G. N. Shangin-Berezovsky (1983): Genetics with the basics of biometrics. M.: Kolos, p. 400 (Ru.).

Pasarin, B. (2009): Fish industrialization. Iasi: Brad Ion Ionescu Publishing House, p.250 (Ro.)

Poznyakovsky, V., O. Ryazanova, T. Kalenik, V. Datsun (2005): Expertise of fish products and non-fish products of water fishing. Quality and safety. Novosibirsk, p. 309 (Ru.)

GD no. 520 of 22. 06. 2010 on the approval of the Sanitary Regulation regarding contaminants in food products.